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AIIC 2015 08-11 July, Azores Islands, Portugal

3rd Annual International Interdisciplinary Conference AIIC 2015



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PROCEEDINGS

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ABOUT HAZING IN HIGHER EDUCATION

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Abstract

Not a year goes by that we don't hear of another hazing scandal in a higher education institution. Many researchers took interest in this issue in order to understand its causes and consequences. They provided definitions and lead to prevent it. We found hazing in many social groups around the world, with different names, and under specific forms. This paper aims to better understand hazing and its actors, with a specific focus on hazing in higher education. We presented three definitions to offer several perspectives on hazing, and facilitate its apprehension. Our method was to analyze the relevant scientific literature with the intention of reflecting on its roots and representation among individuals. Results are an exposition of motivations from hazing's actors, recommendations about how to define it and how to prevent derivations. Our main conclusions assume hazing is usually depicted as a deviant behavior, but it would appear to be a norm. Also, its core purpose would be the progression from newcomer to a group member. A lack of structure or meaning could lead to its misuse and facilitate outrageous events. In higher education, hazing seems to be used as a tool to integrate freshmen in their new institutional world. Scandals including violence, sexual and alcohol abuse could be a symptom of something deeper from hazing's environment.

Keywords: Hazing, Higher education, Group Peers

Introduction

Hazing is a complex set of behaviors taking place during the integration process of newcomers in a coalitional group. Cimino (2013) defined the latter as a group where member generations overlap, have a past, and are expected to engage in cooperative actions for a long period of time. Several definitions relate to hazing. We present here three highlighted in the literature and which permit us to approach hazing with more than one point of view. The selection criteria were the size of samples of the studies and the purport of inclusivity in the definitions. In her national¹ investigation on initiation rites in the national college athletics association in United States, Hoover (1999) attempted to make a distinction between initiations rites and hazing. The researcher defined hazing as: *“any activity expected of someone joining a group that humiliates, degrades, abuses or endangers, regardless of the person’s willingness to participate. This does not include activities such as rookies carrying the balls, team parties with community games, or going out with your teammates, unless an atmosphere of humiliation, degradation, abuse or danger arises”*. This definition included several dimensions such as: what is expected from the individual trying to integrate the group, the abuse or danger that comes along, and the (un)willingness of the individual to participate. It also raises the challenge to establish the end of the initiation rite and the beginning of hazing. Later, Allan and Madden (2008) cropped Hoover's (1999) definition in their national² survey on student's hazing. In their proposal they avoided repetition and, we think, gained in definition inclusivity. According to those authors, more than half the population in higher education reported hazing experiences. These results suggest hazing should not be considered as a trivial matter. Other researchers gave definitions to the phenomenon. One of them was Nuwer (2001, quoted by Dias and Sá, 2012). He stated it as *“an activity that a high-status member orders other members to engage in or suggests that they engage in that in some way humbles a newcomer who lacks the power to resist, because he or she wants to gain admission into a group”*. These two definitions partly meet. However, Nuwer included additional notions in his definition, such as the status of the person involved, and the authority relationship shared between newcomers and high-status members of the group. Cimino (2011) attempted to define hazing as *“the generation of induction costs (i.e., part of the experiences necessary to be acknowledged as a “legitimate” group member) that appear unattributable to group-relevant assessments, preparations, or chance”*. This definition seemed to us to be the most inclusive one as it could be used in many hazing contexts. Nevertheless, this

1 This investigation took place in the United States of America.

2 This investigation took place in the United States of America.

definition considered hazing only when activities are non-relevant to the group's field. This assumption is a debatable topic. Hazing practices may vary and, depending on the group, could stand from personal servitude to sexual humiliation, including callisthenic exercises and binge drinking (Waldron, and Kowalski, 2009; Cimino, 2013; Mikell, 2014).

Most of these definitions were set against hazing. Hoover (1999), Allan and Madden (2008) even included advice to prevent it. This position against hazing makes sense, since we cannot go through half a decade without another scandal or death from hazing practices (Hollmann, 2002). Nevertheless, another strand of the literature tends to be less against hazing, and also compares it to ritual initiation (Dias and Sá, 2012; Frias, 2002). Hazing seems to fit Van Gennep's (1924) definition of ritual initiation in three phases, separation, marginalization, and aggregation³.

A part of the literature has been focusing on the devastating effects of hazing on hazingees. For instance, Castaldelli-Maia, Martins, Bhugra, Machado, Guerra de Andrade, Alexandrino-Silba, Baldassin, and Côrrea de Toledo Ferraz Alves (2012) found that cues of depression increase among medical student hazingees. Another wave has been centered on the group's adaptive dynamic (Tooby, Cosmides, and Price, 2006). In the same trend, Cimino (2013) understanding is to consider it as an adaptive mechanism aimed to ensure group survival.

Hazing is encountered in many parts of the world (Dias and Sá, 2013) and organizations, and is known under several terms. Each region and group has its own specificities but the main hazing dynamic remains the same, namely abusing the newcomers. Therefore, we assumed hazing from different groups and areas was comparable to some extent. Literature recorded hazing in many socialization groups, such as work place (Josefowitz and Gadon, 1989), primary and secondary school, higher education (Allan and Madden, 2008), and athletic groups (Johnson, 2011). Dias and Sá (2012) formulated a non-exhaustive list of the terms used to designate it in several languages. In this list we could find the following: ragging, fagging, fooling, bastardisation, badness, *baptême*, *doop*, *bizutage*, *ontgroening*, *mopokaste*, *iesvētības*, *novatada* or *rabnong*. It could be added *praxe* from continental Portuguese and *trote* from Brazilian Portuguese. These words are often used to refer at thematics such as religion, naivety, status, and initiation. However, the practice is way older than its wording. In fact, hazing could be as far back in history as the first coalitional groups (Delton and Cimino, 2013).

We also took interest in hazing's representation. We hear from hazing mostly when it goes wrong and gets highly publicized (Cokley, Miller,

3 Translated from French.

Cunningham, Motoike, King, and Awad, 2001). Hazing would be the visible part of a larger set of the group's activities (Frias, 2002). It could be interesting to look at hazing practices and processes without preconceived ideas. According to Cimino (2013), while studying introduction of a hypothetical hazing situation, 84%⁴ of participants from a representative sample of the population chose to haze at least a little.

This article focused on hazing in higher education. We described it and tried to integrate various perspectives on the topic. We emphasised by looking at the newcomer, the veteran, the group, and hazing's consequences for each of these instances. Finally, we discussed limits of our work and scientific literature.

Newcomer

Many reasons may explain newcomers' will to enter in a group. Along with the access of resources, protection (Cimino, 2013), and status (Johnson, 2011), one's needs to belong can be high (Baumeister and Leary, 1995). In his attempt to integrate the group, an individual could accept to achieve exhausting tasks to prove his commitment to the group (Cimino, 2013a), and feel pride through his ordeal achievement (Dias & Sá, 2013). Among youth, a will to enter rituals when integrating a group has been reported (Johnson, 2011). This will could be related to a lack of ritual initiation in our modern societies, their trend to emerge among groups⁵. Nowadays, without rituals of transition to mark each stage of life, it can be complex to define when adolescence ends and when adulthood starts. Dias and Sá (2012) hypothesized that hazing in higher education could assume this role. The same authors recorded that most of freshmen perceived hazing as some sort of obligation, specifically when entering the university world. Aside from brutal accident, violent behavior, and death, hazing reported as well some devastating effects on an individual's wellbeing and self-esteem (Mikell, 2014; Castaldelli-Maia et al., 2012). On the other hand, according to Dias and Sá, (2012) hazing could act as a catalyst to identity building, and ignite affiliation towards the group. The newcomer would conform himself to what appears to being the prototypical group member⁶ in order to reduce the stress of being a stranger to the university world (Dias and Sá, 2012).

Furthermore, hazing tended to label hazing as a positive experience and link it with feelings of enjoyment and pride (Dias and Sá, 2013), which could be to a cognitive dissonance. According to Festinger (1957, quoted by

4 This investigation took place in the United States of America.

5 See Pinnock, only available online: <http://tiger.uic.edu/~huk/Gang%20History/fightingfire.html>

6 See Burke and Stets, no date. Retrieved from: <http://wat2146.ucr.edu/papers/00a-alt.pdf>

Harmon-Jones and Harmon-Jones, 2007), when an individual holds elements of knowledge relevant but inconsistent to each other, it would induce a state of mental discomfort. The mind would then rationalize in order to avoid this discomfort. Harmon-Jones and Harmon-Jones (2007) listed three subcategories of cognitive dissonance that could explain in different ways what happens in a hazzee's mind when facing hazing.

In the first place, the induced compliance (Harmon-Jones and Harmon-Jones, 2007). Following Festinger and Carlsmith (1959), dissonance occurs when an individual acts not accordingly to his thoughts. In a hazzee's case, it would drive the newcomer to consider ordeals as less painful than they might seem. In the case of higher education the goal of a newcomer is the membership. We assume the hazzee keeps on in order to obtain access to the benefits of being a legit group member. Because the hazzee followed petty commands and coped with anxiety during the short integrative period, he could be tempted to consider this period to be less horrible, as he has been awarded for it. In terms of time, hazing period may vary from an organization to another. According to Cimino (2013a), it could be spread from weeks to years. In higher education, hazing is based on the institution's calendar. Thus, it would be fair to assume hazing ends before students need to focus for exams. Or, whether hazing is in several stages, the first part at least would end before the exams period. Induced compliance could explain why hazzees tended to understate negative aspects of hazing.

The second subcategory is the effort justification (Harmon-Jones and Harmon-Jones, 2007). Aronson and Mills (1958) suggested that the individual tends to give more value to a reward when it has been difficult to get. It is probably the reason for a recently joined member to value greatly his new status. If a hazzee feels he dedicated a lot of time and furnished serious effort in order to obtain his membership, it is logical he tends to value it more. It seems common sense to assume that hazing would differ among organizations. Indeed, according to Frias (1998b, quoted by Frias, 2002), the number of hazing groups in higher education tended to grow. This caused them to differentiate themselves from one another in order to keep their original identity. Some hazing group are known to be harsher than others. From Walker's (1968, quoted by Cimino's 2013a) work, it appears that it would be directly in relation to the group's prestige. The more prestigious they are, the more difficult they are to integrate. This information could contribute to the effort justification point, even if counter examples exist, such as Lodewijkx and Syroit's (1997), where the severity of hazing was positively linked to a feeling of loneliness, depressed mood and decrease of group liking among hazzees. The effort justification could explain hazzees' trend to describe hazing as positive and enjoyable.

The third subcategory Harmon-Jones and Harmon-Jones (2007) listed

was the free choice paradigm. According to Brehm (1956), when individuals were given a choice with similar outcomes, they tended to give higher rates to the outcome they had chosen, afterward. These results suggested that if a hazee stopped or never started the hazing period, he would tend to speak against the phenomenon. There is a lack of scientific work on this matter in the higher education hazing context.

Furthermore, the Stockholm syndrome could explain why a hazing's victim is eager to bond with his tormentor after becoming a legit group member. According to Baron (2001), in a coercive situation, individuals tend to identify and rely on any strong authority figure. The proposal of a hazee getting emotionally linked to his hazer makes sense. Especially if the hazer fits the prototype group member, since when depersonalization occurs in a group, an individual tends to behave as the salient group prototype⁷. Plus, according to Schachter (1959, quoted by Ellsworth, 2004), in a stressful situation, an individual often seeks the company of others. It is likely that the hazee would bind ties with his companions who have gone through the same ordeal. Since veterans were once newcomers, and veterans always remind newcomer hazing is not personal (Cimino, 2013a), it is slightly possible that after getting their memberships, individuals feel closer to their former tormentors. Some other confusing and stressful situations with strong authority figures met similar ends. As an example we could point the training of a pet, or even the relationship between parents and their children. Indeed, as stated by Keating, Pomerantz, Pommer, Ritt, Miller, McCormick (2005), when punishment and reward come from the same source, it facilitates social dependency. The authors gave examples, such as situations where fear and relief are involved, which tends to promote social compliance from the target (Dolinski, Ciszek, Godlewski, and Zawadzki, 2002), and to enhance conformity, because acceptance relieves from distress (Galanter, 1999).

From another perspective, the situation might explain the fact that a newcomer does not act against hazing practices. We know that in any given situation, social cues are crucial for an individual's behavior (Conger, Conger, Costanzo, Wright, and Matter, 1980). During a hazing activity, not noticing any rebellions from their social environment could induce a passive behavior among newcomers. Further, in the context of higher education, the newcomer does not only face a group but the history and traditions of said group (Ellsworth, 2004). If we refer to authority theories, the status of veteran and the – sometimes long – story of a group may cause compliance within the newcomer. Previous researches such as Milgram's (1974) remind us how eager to obey humans can be. As a reminder, Milgram proved that

7 See Burke and Stets, no date. Retrieved from: <http://wat2146.ucr.edu/papers/00a-alt.pdf>

under certain circumstances, most humans would comply with authority. In his settings, he was able to conduct several individuals to – falsely – electroshock innocent people. The importance of the situation appears then, highly relevant.

Veteran

After a certain amount of time, a group member will become a veteran. It seems logical that this status would be acquired through time and experience. In the context of higher education, the system sounds mostly based on time and will. For instance, in the Portuguese *praxe*, a member could become an initiator only on his third year (Frias, 1998). An individual's motivation to haze could come from various sources. According to Price, Cosmides, and Tooby (2002), group members have a punitive sentiment toward free riders in order to protect the group's interest. It meets Delton and Cimino's idea (2013), which suggested humans have adapted in a way that they have a concept of newcomers. It means they would perceive them differently than a fellow member, and treat them differently as well. Probably to ensure they are there to benefit the group and not to exploit it (Buss and Duntley, 2008).

In the context of higher education, a significant difference between group member and non-group member concerns authoritarianism (Drout and Corsoro, 2003). Hence, we could refer to Haney, Banks, and Zimbardo's prison experiment (1973), which reported that under certain conditions, humans tend to behave following their role. In their experiment, half of the participants assumed the role of fictional prison wardens, and the other half were fictional inmates. After a while, the fictional wardens started to behave dreadfully against the fictional inmates. We postulate that while the veteran performs the role of hazer, he feels he should act as one. This would imply that his representative prototype of hazer has, as principal features, to incline to abuse of his authority and, to some extent, to sadistic behavior. Another explanation could be that regardless of the prototype of hazer, when an individual has a position of power, he tends to behave sadistically. In the same line, Castaldelli-Maia et al. (2012) reported that hazing tends to become worse each year. An explanation could come from the work of Bandura, Underwood, and Fromson (1975). They gave individuals the opportunity to behave punitively against humanized, neutral or dehumanized groups, under diffused or personalized responsibility for their actions. Results were that individuals tended to act more aggressively against dehumanized groups, and when their responsibility was diffused. This fits the situation of hazing in higher education, where hazers act as a group and hazees are dehumanized through degrading name-calling and behaviors. Darley and Latané (1968) showed that individuals take more time to assist

someone in need when other observers are present. This could explain why hazers do not stop each other when one of them misbehave, leading sometimes to injuries or even death.

Higher education hazing could be a specific case of event, because the current hazer was until recently still a hazee. The work of Bandura, Ross, and Ross (1963) could provide hindsight. The researchers demonstrated that violence tended to be imitated by children, if they witnessed an adult performing it. Hazing in higher education is away from their paradigm. However, we could remodel it by looking at the hazer as being an authority figure or role model. Plus, in the same line, according to Baron (2001), in a situation of coercion, individuals could tend to identify and seek to rely on authority figures. Thus, if the hazer lived as a victim of hazing and then was the witness of several hazing periods, he could repeat the schemes as he is assuming the hazer role. The hazer could be traumatized by some hazing episode. The former hazee could find a cathartic opportunity once he becomes a hazer (Johnson, 2011). He would then express his former repressed feeling against his own former hazer and let it out on current hazees. A trend illustrated with Tolentino's poem (1895): "*I suffered insults and wrong turns, I kept everything handwritten, and over the next novices, I trumped with usury*"⁸.

Another idea was the apparent will from the hazer to conform the hazee (Klerk, 2013). And this, despite the fact that a newmember could have a beneficial impact on the group and stimulate creativity (Rink, Kane, Ellemers and van der Vegt, 2013). This phenomenon could emerge from various origins. Perhaps it is a side effect of the selection which occurs when individuals try to integrate a group. While trying to assess potential newmembers, the hazer would reject the deviant from his norm, without realizing it. In this context, the killer of non-normal could be tradition (Ferraz de Siqueira, Gondin da Fonseca, Bastos de Sá, and Moreira Lima, 2012), and its lowly questioned discourse. On the other hand, it appears that hazing takes its inspiration and originality from its direct environment. According to Frias (2002), higher education group tended to use academic symbols such as discipline and hierarchy, and aimed to mock them in an irreverent way. If it is true, it could be a lead to inspire new values in hazing group, in order to avoid injuries and deaths.

Group

According to Cimino (2013), as long as it is wealthy, a group will tend to grow. Logically, it could either produce members from the inside, or acquire them from the outside. In the context of higher education, the second

8 Translated from Portuguese.

modality prevails. Hence, several generations of members overlap in a coalitional group. The group would need new committed members to attend to its needs, and it would try to select among the prospective newcomers by hazing them. Traditionally, in higher education, the bidding period on hazing starts at the academic year. And, as previously stated, bears various time lengths. This fact makes the higher education hazing group some sort of particular case. For any coalitional group, it would be logical to wait for the need to arise in order to organize some kind of recruitment, where hazing would take place. In higher education, time is controlled by the academic year calendar and groups need to fit their integration process in this period, whether they need new members or not. This could explain some deviant behaviors, because there would be many newcomers at once, with limited initiators to handle them. Time pressure would lead to mistake, accident, and misbehavior through lack of control from the group peers.

According to Buss and Duntley (2008), humans tended to harvest resources by three great strategies: individually, cooperatively, and exploitatively. The first strategy appeared to be the riskiest one, and the second one seemed to be the most widely used by humanity. However, the last one illustrated the humans' will to avoid being exploited, while trying to exploit others. One could even argue that cooperation and exploitation are the same strategy, only unbalanced. In the specific context of higher education, main resources the group could offer are network and status (Dias and Sá, 2012), while allowing the newcomer to enter an entity with rich history and tradition (Honeycutt, 2005; Frias, 2002). The first one can be achieved without the group's help, and the second does not motivate everyone. Thus, it could mean there is something more, known only by group members. This last argument seems weak. According to Hoover and Milner (1998), farther than tradition, hazing binds through shared and secretive experiences. Then, perhaps the newly created intimacy among hazingees, that knits the group together, would be more relevant than the group history, or entry facts.

Before treating the third point, the history and tradition, it seems important to remind Van Gennep's (1924) three phases of the ritual initiation: separation, marginalization, and aggregation. During the first step, the newcomer is isolated from the rest of the world, sometimes physically (Essex, 2014). The aim is to draw symbolic separation from his former state (Van Gennep, 1924). In the marginalization step, initiators conform the initiated to the aimed status; in this case the ideal group member (Cimino, 2013). Finally, the aggregation step celebrates the acknowledgment of a new state. In this case, membership, by consolidating his new status (Van Gennep, 1924). An interesting parallel could be established between initiation and indoctrination. Schein, Schneier, and Barker (1961, quoted by

Baron, 2001), presented a three phase model of intense indoctrination, namely: unfreezing, changing, and refreezing. The first step consisted in physical and psychological stress in order to weaken the individual. The second was aimed to change attitudes and beliefs through guilt, cognitive dissonance, and peer pressure. The last step stabilized the operated changes. The context is not completely alike. In higher education, the protagonists are students welcoming peers. However, they could be playing with matches; and according to Nuwer (1999), such comparison could be relevant.

About the history and tradition, the point could seem weak. Hazing in higher education is conducted by students. Therefore, when they leave the institution, they leave with the knowledge of tradition they may have acquired. Many reasons could motive their leaving: getting a diploma, reorientation, abandonment. Educational reforms such as the Bologna decree from 2004 could have impacted the trend as well, at least in Europe. Master's degree veterans could be tempted to stop their contribution to initiation in order to focus on their last two years, including professional traineeships and master's degree thesis⁹. Thereby, if succeeding every year, the trajectory for a higher education hazing group member would be: first year, hazee; second year, watcher; third year, possible hazer. Then, fourth year would be an option, and fifth year appears to be out of the question, because of the master's thesis and the work it represents. Hence, it is possible that significant parts of the tradition and its meaning are lost every year. It could explain why the discourse in higher education hazing groups tended to remain old fashioned and anti-deviant (Ferraz de Siqueira et al., 2012). On the other hand, it could explain why hazing tended to become more and more cruel with time (Castaldelli-Maia et al., 2012). According to Loriers (2009), initiation ritual could lose its purposes and become an empty frame. Thus, in the case of higher education, while the initial intention was to facilitate integration, initiate and bind the newcomers, if the knowledge is lost its practice could shift to degrading behaviors, where hazers could free aggressive pulsions.

Limitations of the studies about hazing

Several limitations could be mentioned. The studies are based on witnesses, field observations and questionnaires. However, if we consider as true the fact that hazing is only a visible part of a larger set of the group's activities (Frias, 2002), it would mean we do not have all the information available in order to fully understand the phenomenon.

We used Cimino's (2011) definition in order to remain inclusive. However, the scientific literature has several ones, and it makes it even more

9 Retrieved from: <http://www.studyrama.be/spip.php?article1535>

difficult to know if we are talking about the same topic. Plus, hazing is often presented as a deviant behavior. Nevertheless, it has been recorded in many parts of the world (Dias and Sá, 2012), and bloomed in growing coalitional groups (Cimino, 2013a). According to Cimino's (2013) sample, 84%¹⁰ of participants chose to haze, even a little. Thus, it would be assumed as a normal behavior, which happens to have sporadic outrageous outcomes. The fact we usually hear about it when it goes wrong (Cokley et al., 2001) could alter our representation of the phenomenon.

The fact that every region and group type has its own specificities makes hazing even more difficult to understand and compare. Is it fully correct, for instance, to use the terms hazing and ragging indifferently? What about the *baptême* and the *praxe*? A lead for further researches could be to compare operationally behaviors occurring under one word and another, with a complete grid combining temporality, concrete content, and symbolic content for each activity taking place during the process' period. As stated, hazing is a complex set of behaviors. And its typicality from around the world, along with its relationship with cultural and traditional dimensions, makes it difficult to apprehend.

Conclusion

According to the scientific literature, individuals have a need to belong to groups (Baumeister and Leary, 1995) and in order to integrate the desired groups they would let themselves be hazed as a proof of their commitment to the aimed groups (Cimino, 2013). According to Johnson (2011), there is a will for an entry ritual, which may be explained by the lack of space for ritual initiation in our modern societies¹¹. For instance, there is no formal adulthood entrance ritual. According to Dias and Sá (2012), in the context of higher education, freshmen live hazing as inevitable. In addition, even if the same authors presented it as a catalyst in identity building, negative impacts on hazing are various (Mikell, 2014; Castaldelli-Maia et al., 2012). It appears to depend hugely on the situation and its actors. Harmon-Jones and Harmon-Jones (2007) provided elements to understand through cognitive dissonance the trend of hazing labelling hazing as a positive experience (Dias & Sá, 2012), despite its awful visible content. Baron (2001) added that, in a coercive situation, an individual will tend to identify and rely on any strong authority figure. This meets the Stockholm syndrome defined as when the victim bonds with its tormentor, which could explain the bond easily created between former hazing victims and former hazers. Another point of

10 This investigation took place in the United States of America.

11 See [Pinnock, only available online: http://tigger.uic.edu/~huk/Gang%20History/fightingfire.html](http://tigger.uic.edu/~huk/Gang%20History/fightingfire.html)

view to explain the reason for newcomers to comply with hazing is that social cues appeared to be strong determinants of individuals' behavior (Conger et al., 1980). Thus, being an individual among many passive ones could drive each hazee to remain passive. Plus, humans tend to obey to authority figures (Milgram, 1974), and in the context of higher education hazing, hazers could represent a traditional authority.

After some time, members become veterans and can take an active role in higher education hazing groups. According to Price et al. (2002), group members have a punitive sentiment toward newcomers in order to demotivate free riders. This concept meets Delton and Cimino's (2013), which stated that coalitional group members acquired a concept of newcomers. They would perceive them differently than fellow members, and haze them to ensure their commitment while protecting the group's interest. Another perspective comes from works on authority status. While in the hazer role, the veteran could think he has to act as one (Haney et al., 1973). Nonetheless, this would imply his hazer prototype is cruel. Also, it could simply be that while in authority position, an individual tends to abuse it. Furthermore, higher education hazing group are a specific case, because current hazers were until recently still hazees. Finally, their hazing behavior could be explained through Bandura et al.'s (1963) social learning theory, or through a cathartic motivation as well (Johnson, 2011).

Hazing would be a mechanism intended to dismiss free riders and mold newcomers to be the ideal group member (Cimino, 2013; Klerk, 2013). In higher education, tradition could be the reason why hazing seems legit, and the hazer has authority over the hazee (Honeycutt, 2005; Frias, 2002). The short period of every hazer's activity as initiator could induce a loss in meaning in the initiation process (Loriers, 2009). A comparison between Van Genep's (1924) three phase initiation process and Schein et al.'s (1961, quoted by Baron, 2001) three phase indoctrination process could lead to think it is the same tool, but defined by different words.

About scientific literature's limits, the data source is perhaps the weak spot. Ethical limitations would forbid operationalization in a laboratory, or field infiltration. These limitations are a break to understanding the phenomenon. Nonetheless, results such as Cimino's (2013) appeared trustworthy and generalizable to some extent. Comparing hazing from different countries, based on scientific literature, could be problematic. In cultural and traditional matters, words can signify different experiences and may mask what real experience really is in each country. Finally, hazing is usually pointed out as deviant behavior, nevertheless, according to Cimino's (2013) results, 84% of participants would wish to haze a little, and we know the practice is present in many parts of the world (Dias and Sá, 2012).

Hazing could be a human behavioral norm, acquired by social learning (Bandura et al., 1963) or as an adaptative mechanism (Delton and Cimino, 2013). Hazing could be a tool subject to (mis)use in order to protect a group's interest, which could have dreadful consequences over its target, the hazing. In order to avoid injuries and deaths, there are several dimensions to explain. First, forbidding it does not appear relevant, mostly because it would remain hidden and thus would be more difficult to follow. Second, it would probably increase group cohesion against hostility (Murphy, 1957), even if it is on a symbolical level, and even if the hostility comes from the law. Third, in the context of higher education, the actors are presumably intelligent, scholar and cultivated. Thereby, it could be profitable to inform them about matters of violence and alcohol, making sure hazers and hazingees understand they are responsible for their actions. Finally, if Frias (2002) was right, students tend to take their inspiration in their direct environment. Hence, the fact that students tend to use alcohol and violence during hazing (Waldron & Kowalski, 2009) could be taken as a symptom of our societies, and could invite us to rethink our values and educational habits.

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PERCEPTIONS OF THE PORTUGUESE COMMUNITY SCHOOL LEADERS IN THE UNITED STATES: A MULTIPLE CASE STUDY

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Abstract

Many ethnic communities in the United States have founded community schools to perpetuate in their new land their cultural “roots”, their own languages and their values. The Portuguese community in the United States is not exception and founded their first school almost one hundred years ago to promote the language and the culture of their ancestors. The purpose of this qualitative study, multiple case work, is to analyze the perceptions of six school community leaders about the context of the Portuguese community schools in the United States namely on the problems they face today, the type of leadership of the schools and the reasons of parents to place their children attending those schools. The narratives of the six leaders interviewed are consistent with common conclusions specifically that the schools face many problems nowadays related with lower enrollments and finances, lack of coordination, poor communication and collaboration among the Portuguese community schools although they benefit from a voluntary, dynamic and democratic type of leadership. These community schools are essential for the Portuguese communities in the United States. They represent the culture, the history and the special “link” to Portugal. For those reasons, these schools should be cared for and recognized by their efforts, leaderships and perpetuation of the national identity and values of our ancestors. It’s extremely important that these community schools be supported and cared for because they provide an important service to the Portuguese communities and to its students

Keywords: Portuguese community schools; leadership; Culture; Portuguese Language; United States

Introduction

Many ethnic communities in the United States have created and maintain heritage or community schools to preserve the language and culture of their ancestors. Thousands of such community schools exist today in the

United States. They provide alternative and/or supplementary educational resources as well as valuable cultural and social experiences for many American children (Fishman, 1999).

Among such schools are those of Portuguese origin. In fact, Portuguese-American communities have sponsored heritage schools in the United States for more than a hundred years.

For many Portuguese-Americans, Portuguese heritage or community schools represent “grass roots” commitment and community effort aimed at wakening the reasoning and sensibility of the young to the values of their culture (Bento, 2001). These schools also seek to perpetuate the community language, culture and identity in the United States of America. In light of that tradition, this qualitative study analyses the perceptions and opinions of the schools leaders about the role and specificities of those schools and the difficulties they face nowadays. In this context, we conducted semi structured interviews to six school leaders of Portuguese community schools in the east coast of the United States of America.

Community schools in the United States

Joshua Fishman relates that the United States, as the greater multilingual and multicultural nation cannot disdain the thousands of schools and the hundreds of thousands of children that the Ethnic or Community Schools serve. Fishman (1980) states:

These schools must be enclosed in the list of our educational, social and intellectual resources for national reasons given the fact that the United States cannot give itself the luxury to ignore six thousand schools attended by six hundred thousand children (p. 236)

The Ethnic or Community Schools are supplemental schools functioning between six and 10 hours per week and between three to five sessions of two hours each (Bradunas & Topping, 1988). According to Fishman (1989), linguistic education is only one of the multiple objectives of the ethnic schools. The education of traditions and history of ancestors, the wakening and the development of the ethnic identity, the improvement of communication between parents and children and the creation of chances for the members of the community to work and to socialize among them, are also essential objectives of great importance. In this way, Ethnic or Community Schools had given an important and independent contribution to the maintenance of ethnic languages and cultures. Bentley (1982) affirms:

For besides keeping the identity and increasing academic education, the proficiency in two languages is one advantage in a cosmopolitan world. Nine of ten Americans don't know how to speak, to read or to understand

another language for beyond the English. An education that leads to a high degree of bilingualism in English and a minority language is of great value for this country (p. 114).

Similarly to all the other ethnic or community schools, the Portuguese ones located in the areas of major Portuguese concentrations, transmit to its pupils significant levels of reading, writing and comprehension of the Portuguese language. Moreover, Portuguese Community schools give also emphasis to history, literature, customs and traditions to the Portuguese people.

During their research into heritage schools, Bradunas and Topping (1988) found the following similarities to be typical across ethnic groups:

- a) Emphasis on the importance of identity
- b) Acknowledgement of the significance of the native language
- c) Propensity to organize a school-type structure for their educational programs
- d) Similar problems with teachers and curriculum materials
- e) Identical headaches concerning enrollments and finances

The few differences they noted were related to language instruction. While more recently created schools such as Lithuanian, Polish, Hungarian, Turkish, Cambodian, Portuguese and Korean schools, seem to stress the importance of language above else, older schools, such as Japanese, Ukrainian, and Greek schools seem to place less emphasis on language instruction. To cite another contrast, the older Chinese schools seem to focus solely on a few ethnic arts while the oldest German-Russian and Dutch schools focus more on the social history of their community in its particular locale.

Portuguese Community schools in the United States

Five years ago, according to Castanho (2010) there were in the United States 65 Portuguese community schools distributed by 13 states with 3.286 pupils and 210 teachers. In the state of Massachusetts there were 9 schools and Rhode Island it had 5 schools a Portuguese population of 279.722 in Massachusetts and 91,445 in Rhode Island.

Fifteen years ago, Bento (2000) reported the existence of 62 schools serving 3,518 students and 195 teachers in the academic year of 1999-2000.

Nowadays, the state of **Massachusetts** has nine Portuguese community schools:

Portuguese Official school of Cambridge and Somerville

Portuguese school of Hudson

Portuguese school of Ludlow

Portuguese school of Milford

Portuguese Official school of Peabody

Portuguese United for Education (in New Bedford)
Portuguese school of Casa da Saudade (in New Bedford)
Portuguese Official school of Fall River
Portuguese school of Taunton

The state of **Rhode Island** has five schools:

Portuguese school of the Youth Lusitana Club (in Central Falls)
Portuguese school of Pawtucket
Portuguese Official school of East Providence
Portuguese Official school of Bristol
Portuguese school of Cranston

Methodology

For this qualitative study, we conducted six in-depth open ended semi structured interviews to the leaders of the Portuguese Community schools located in the east coast of the United States and used direct observation during the visits to the schools. Three schools were located in the state of Massachusetts and the other three in the state of Rhode Island. This is a case study, multiple in nature, as according to Best and Khan (1993)

The case study is a way of organizing social data for the purpose of viewing social reality. It examines a social unit as a whole. The unit may be a person, a family, a social group, a social institution, or a community. The purpose is to understand the life cycle or an important part of the life cycle or unit. The case study probes deeply and analyzes interactions between the factors that explain present status or that influence change or growth (p. 193).

Five participants, in this research study, were women and one was a man. All community school leaders have had experience in running the Portuguese community schools ranging from 4 years of experience to 15 years. All of them hold Bachelors' degrees either from Portugal either from the United States except one which has only the Basic educational level from Portugal. The number of students per school range from 20 to 40 students. Schools survive, financially, with the money coming from tuitions and fundraising.

Results

Content analysis of the six interviews as well as results of direct observations allowed us to arrive at the following conclusions in several categories:

a) Leadership and decision making:

The school leaders interviewed practice the following type of leadership: collegiate, collaborative, democratic, voluntary and based on personal values. It affirmed one school leader: *"the leader has to perceive that the others also are individual leaders; the school is not the school of Professor X, is our school, of all of us; it is the faculty, the totality that deserves the distinction, the recognition for the work that the school has made"* (I# 1). In the same direction, another school leader said: *"What I say to the teachers it is that here all of us are in "equal foot", to have availability, what I can do, I always ask for contributions of my colleagues; no decision is taken without being articulated among us and with the parents as well"* (I# 4). Another participant, stated: *"For me it is very important that the school functions with great success, or either, that the children are learning Portuguese, is for that, that they are here that feel protected are loved and, respected; and, not only the pupils but also the teachers and the school commission"* (I# 3).

b) Qualities that a Portuguese Community School leader must have:

The participants had related that a leader of a Portuguese community school must have certain attributes such as, sense of balance, being friend of the colleagues and pupils, capacity of initiative and organization, deep knowledge of the Portuguese language and culture and sensitivity for the necessities of the educational community and of the *"parents who are the pillars of the Portuguese schools"* (I#4).

Stated the first one interviewed (I#1) *"the Director it is a landmark, the fiduciary office of the scale, guarantees the cohesion and even the appropriate behavior, everything he makes in the school"*.

c) Support from the mother land (Portugal):

The participants interviewed related that the support from Portugal is nonexistent almost null financially. It has had some collaboration with the cession of some manuals to some schools although those materials are out of our context our reality in the present time; *The Coordination*, headquartered in Washington, is far away from the communities in such a way, geographic and pedagogically. It affirmed the participant (I#4): *"it does not have and we are not waiting to receive checks from Portugal but it there are other supports that do not demand great investments: curriculum development, , materials thought with our opinion, people who work here in the field, and to place all in the same page."*

It has been acknowledged that the support from Portugal to these community schools had been significant many years ago but nowadays is practically nonexistent. The community schools, according to Bento (2001), had had great influence in creating special links of students and communities to the mother land. **Parents' motivations**

Portuguese families want their children to learn the language and culture of their ancestors and for that reason place their children at the community schools. Stated one participant (I# 5), *“they want their children to learn Portuguese and they don’t want that the language dies”* Another participant had stated that *“They want to see their son or daughter to speak their own language and to learn the history and culture of Portugal”* (I# 6). Parents of students appreciate the language, culture and history of Portugal and intend to pass that on to the next generation. The community schools are the instrument used to accomplish that legacy (Fishman, 1999).

Conclusion

This research study, qualitative in nature, and multiple case, intended to assess the perceptions of the directors of six Portuguese schools in the United States (east coast) in several issues related to the Portuguese language, culture and traditions as well as the communication with the Portuguese government and its representatives in the area of education in the United States; for those purposes we conducted semi-structured open-ended interviews to six directors of the Portuguese schools in the east coast of the United States.

The ethnic minority groups in the United States and in other parts of the world tend to preserve and maintain their languages, cultures and their ethnicity through various means. One of the major instruments used are the ethnic or community schools which teach to the new generations the language, the values, the culture and the traditions of their ancestors. The Portuguese communities in the United States have been maintaining these ethnic schools for more than one hundred years. The Portuguese community schools are organizations rooted in its communities that are facing, on the present time, some challenges. Portuguese schools are led by people with great service spirit, deep cultural and language identity, and, devotion to the cause of the education of the Portuguese language and culture to the Portuguese descendants. They expect from Portugal and the Coordination Cabinet more support and orientation (and not so much financial support) in the elaboration of adequate materials appropriate to the reality of the learning public (they are now teaching the third generation no more the second) as well as orientation on audiovisual materials that represent the uses and customs of the several regions of Portugal (I#3).

It’s essential that these community schools be supported and cared for because they provide an important service to the Portuguese communities and to its students; Fifteen years ago, one researcher observed the effects of these schools: Bento (2001) found that the Portuguese community schools facilitate the following for students and communities: a) acquisition of the Portuguese language and culture; b) enhanced educational opportunities; c)

stronger links with Portugal; d) passing of a legacy to future generations; and, e) development of positive language and cultural attitudes. Although the schools face many challenges nowadays, they continue to provide great benefits to the Portuguese communities and their students. Therefore, they need more attention and support from the Portuguese government. Another researcher, had recognized the need of a closer connection between the Portuguese government and Portuguese community schools: "...it is a moral obligation of Portugal to support the teaching situations of integrated education, as well as the community schools with quality teaching, therefore we need everyone to dignify the Portuguese language in the foreign countries" (Castanho, 2010, p. 61).

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THE QUALITATIVE SYSTEMIC ANALYSIS IN THE CONTEXT OF QUALITATIVE RESEARCH METHODS

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Abstract

Alex Mucchielli in the University of Montpellier developed the qualitative systemic analysis. In this communication, we intend to present the principles of this methodological approach in human and social sciences. We believe that this qualitative approach is innovative in the context of qualitative methods and allows a new perspective in the analysis of the communication processes in social organizations. The main operations of the systemic qualitative method are the iterative definition of the framework, the identification of the recurrences and *circular causalities*, and the modeling of relations/social exchanges. These operations aim to find the sense/meaning of a social exchange system. The logic of the system, found by an approach that respects all the validation process in the qualitative methods, is important to clarify the specificity of the research in human and social sciences. In fact, qualitative research is one of the scientific achievements that are most relevant in the comprehension of the dynamics of human interaction.

Keywords: Qualitative systemic analysis, qualitative methods, qualitative modeling, circular causality, recurrence

Introduction

The qualitative methods in social research are multiple and, as they emerge from different epistemological paradigms, they have theoretical similitudes and differences. In the framework of the constructivist paradigm the qualitative systemic method of Alex Mucchielli adopts a methodological approach that leads to understanding the structure and functioning of social phenomena and human behaviour.

The main operations of the systemic qualitative method are the iterative definition of the framework, the identification of the recurrences and *circular causalities*, and the modeling of the relations/social exchanges. These operations aim to find the sense/meaning of a social exchange system.

The first operation in this systemic analysis is the building of a framework (*cadrage*), which corresponds to what is called "sampling" in other qualitative methods. The delimitation of the field of analysis is made from the point of view of the actors correlated with the observed relational networks.

The second operation consists in identifying the recurrences in the relations system. These recurrences are listed as a "form of exchange". (Mucchielli, Alex, 2006). This intellectual process combines the seeking of similarities with the categorization, despite not awarding meanings to the actions of the actors in the system¹² at this stage.

The third operation is based on seeking *circular causalities* and on the process of seeking totalities. The researcher must answer the question: "What is the collective concern shared by the actors that *builds* the relations system?" (Mucchielli, Alex, 2006)

This research, by comparison and by generalizing the induction of this *challenge* (*enjeu*), provides the key for the interpretation explained by modeling. The modeling of relations/exchanges (fourth operation) depicts a scheme of the significance of each *exchange* (formal categories) developed by the actors in a more global context.

By modeling relations/exchanges (fourth operation) we put, into an explicit scheme, the significance of each *exchange*. To do this, the investigator must make not only an intellectual work of *contextualization*, but also an interpretation of the emergent sense/meaning of the relations (Mucchielli, Alex, 2006).

For the qualitative systemic approach, the research of the *general framework* of significations system is the fundamental to a comprehensive understanding of human actions. This constructivist approach allows, by modeling the interactions and by the analysis of *circular causalities*, to open new perspectives for the analysis of relational and communicational systems.

A new approach to Palo Alto

To Alex Mucchielli, it is necessary to overcome the methodological framework of Palo Alto in the communications analysis: "*Watzlawick, Helmick-Beavin and Jackson did not develop an accurate method to build and then study the communications systems. The analysis that they propose is close to the text analysis.*" (Mucchielli, 2006:54).

The aim of the qualitative systemic approach is to develop an accurate procedure and method by modeling the significant exchange system

¹² A first version of this text was presented in the IX Conference of the European Sociological Association "European Societies or European Society", Lisbon, ISCTE-IUL, 02-05 September 2009.

between the actors of a social system (in micro, mezzo and macro levels). The systemic analysis emphasizes the shape of the exchanges that are generated by the participants in a communication system that allows putting into evidence the rules of the game that construct the system itself.

To Alex Mucchielli, Palo Alto's interaction analysis was not sufficient to define the implicit rules of the exchanges system and that is why he proposes a new approach that he named *qualitative systemic analysis*. This hybrid approach (phenomenological, grounded theoretical, structural, and systemic approach) is based on epistemological qualitative principles, explained in many texts and conferences by Alex Mucchielli.

The principles of the qualitative systemic analysis

To build a comprehensive model of reality, the qualitative systemic analysis adopts five (or seven) principles of the communications analysis principles: 1- the systemic postulate; 2- the principle of the levels in the observation and the frame working; 3- the primacy of the systemic context; 4- the principle of the circular causality; and 5- the principle of the homeostasis. In the communications field, there are two more principles. 6- the nature of the communications identifies the significant exchanges between the actors in a system. 7- the principle of the recurrence of the interactions emphasizes that we need to understand the origins of recursive interactions that generate structural games between the social actors.

The systemic postulate emphasizes that the phenomena don't exist alone and must be considered in interaction with other of the same nature. The principle of the levels and the frame analysis determine that the phenomena, in order to be understandable, must be observed in delimited frame. That frame defines the actors and the issues to consider. The primacy of the system context highlights that the meaning of a social action is given by the context formed by the system itself. The principle of circular causality states that a phenomenon is integrated in a complex system of mutual implications of actions and retroactions. The principle of homeostasis defines that all systems have their own rules and functions that generate a global logic that allows for its own reproduction. When the qualitative analysis is applied to the communication phenomena, we must also apply two other principles: first, the principle of the nature of the communication, which emphasizes that the communication must be presented in a category of significant exchange. This form must be put into the model by the generalization of the several concrete contents that were observed and that have the same meaning. Second, the principle of the recurrence of the interaction games that postulates that, in groups and organizations, the communicational phenomena can be presented as scenarios or as repetitive and recurrent *games*. (Mucchielli, A.2004: 44).

The method: the search for the global meaning of the system

The fundamental steps in the qualitative systemic analysis are linked with the main principles. The first step (linked with the second principle) leads to the definition, by the research problem, of a pertinent level of observation (the non-immediate level) (cf. Flick, Uwe 2005, 49-51). The second step (linked with the first principle) conducts to an identification of the elements of the system (actors). The first and the second steps allow for the construction of the framework analysis of the research to happen.

The third step (from the sixth principle) is developed in articulation with the previous step, and is related to the systemic modeling. The communications in the model are the recurrent and significant ones. The fourth step is integrated in the previous one. As we build the systemic modeling, we try to reconstruct the circular causalities and the determining “game rules” in these circular causalities. The fifth step (from the sixth principle) is the interpretation of the data organized in the systemic modeling, in order to find the global “game”, the logic of the system. The sixth and last step: through the modeling, the explanation of the circular causalities, the logic formulation of the game, we can discover the “issues” (profound problems of the actors and their implications in the system). This analysis permits to define the hypothesis for the intervention to change the system. This step is essentially inferential. It is here that we can understand the “issues” as well as the strategies of the actors. (Mucchielli, A.2004: 44-45).

The qualitative modeling

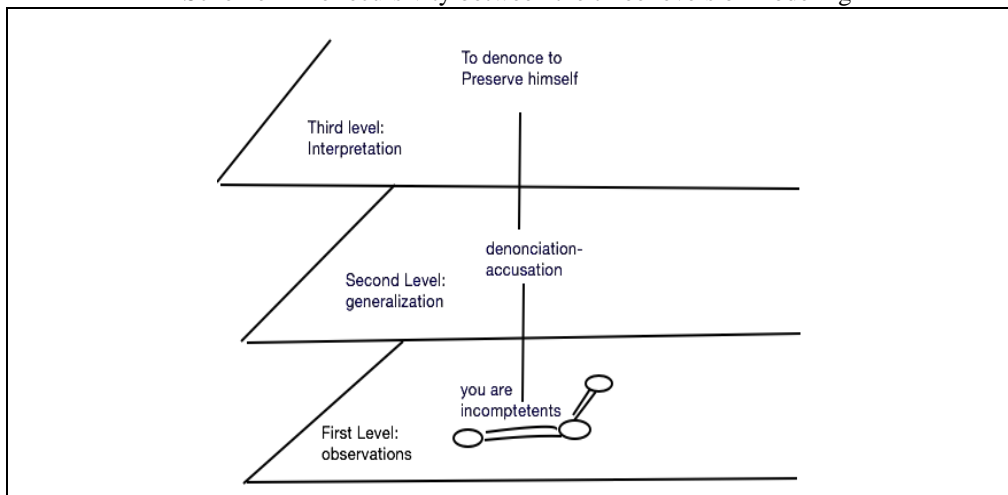
The qualitative modeling, in communication sciences, leads to the interpretation of the meanings of the interactions of the actors in a social system. To achieve the interpretation by the construction of a model, Mucchielli defines three levels of analysis, as explained in the introduction: the level of the concrete observation of the communications (where the facts are described); the level of the generalization of the communications (where the facts are put into categories) and the level of the interpretation of the meanings (where the implicit and explicit logic of the system is revealed). To go from one level to another, the researcher needs to go up and down because the reformulation of the exchanges in the superior level is done through the comprehension of multiple data of the inferior levels. These different epistemological levels lead to the inference of the global meaning of the system.

Mucchielli, in one of many examples of modeling, presents schemes of interactions that are linked by the logic of the interaction system. And he clarifies that the Palo Alto approach maintains the confusion between the social constructions made by the social actors (constructionism) and the

scientific methodology of the study of this constructions, which is constructivist. (Mucchielli, A., 2004:66-67)

One of the main examples of Mucchielli’s qualitative approach is present in the following scheme:

Scheme I The recursivity between the three levels of modeling



Source: Mucchielli, A. (2004:67)

In this scheme, we may see that the clause “you are incompetent”, in a context of the observation in the second level of generalization, fits the category of denunciation-accusation that is interpreted in the third level as a way to safeguard oneself in the context of the interaction. (Mucchielli, A. 2004:67)

The *logic of the system* found by the systemic qualitative approach is important to clarify the specificity of the research in human and social sciences. In fact, the qualitative research is one of the scientific achievements that is most important to comprehend the dynamics of human interaction and to interpret the meaning of human actions.

Conclusion

As a qualitative constructivist approach, the qualitative systemic analysis adopts a specific meaning of the *modeling* processes by defining formal categories and their meaning, in order to reveal the logic of the system (rules). In this process, we have an important dual epistemological rupture between the meaning for the actors and the meaning for the researcher. For Mucchielli, the Palo Alto approach needs to reach another level of interpretation and that is why he proposes the qualitative systemic analysis.

The validation of the results in this method is the same as with other qualitative methods: internal acceptance (the research and the results must be

accepted by the actors); completeness (one of the methods to achieve the completeness is the triangulation of the techniques and of the theories. The writing of the research diary is also important for reaching the completeness); saturation (the phenomenon that appears during a certain moment of a qualitative research, when the data that we have collected is not new); internal coherence (appeals for the research to be coherent and comprehensible by any researcher); and external confirmation (the acceptance of the research findings by the scientific personalities, experts and others researchers) (Mucchielli, A.1991:111-118).

This process of validation of the findings in qualitative research must be emphasized in the dialogue with the so-called positive sciences. As Alex Mucchielli says, “*the development of the qualitative research is the achievement of the fundamental progress in the definition of the specificity of the research in human sciences*”(Mucchielli, A.1991: 19).

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SUSTAINABILITY OF RESEARCH CENTRES IN RELATION TO GENERAL AND ACTUAL RISKS

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Abstract

Direct application of University Science Parks and Research Centres operational models for the needs of sustainability of their research and development activities in the period after completion of their financial support from structural funds (e.g. after 2015) represents one of the important issues for their direct leader employees. The definition and ways of implementing said models cause enormous discussions already nowadays in science and research environment. Time lead of such discussion shows that the issue is not really solved and represents a serious risk for projects' sustainability, which is so vital not just in the decisive monitored period of 5 years after the project completion, but mainly in mid-term and long-term horizon. It is necessary to connect sustainability assurance with an active approach within the frame of the assembly regulation process of both the actual and predictor risk by following the most important goal - the competitiveness within European research area and all-society contribution of its actual activities.

Keywords: Sustainability, Research Centres, Risks

Introduction:

I. WHAT IS THE RESEARCH CENTRE OF THE UNIVERSITY OF ŽILINA?

During the course of years 2013 and 2014 thirteen university science parks and research centres (USP and RC) were created in Slovakia with financial support from European Union. EU support reached more than 410 million € and was aimed to create excellent background for research activities in academic and academic collaborating with private sector.

One of newly created centres is Research Centre of the University of Žilina (Research Centre; RC ZU). After its completion it will be a unique

workplace for research and development established by the University of Žilina. Its function is to operate as a regional centre of applied research integrating decisive research activities and thus reaching synergistic effect in application and increase of research potential of the University of Žilina. At the same time the prime social commitment will be assured, which is the research implementation with direct impact on everyday life. Research centre aims to conduct research for people. For fulfilling this message and function, it connects activities of several science-and-research working units. It involves the 5 crucial faculties of the University of Žilina, 13 departments and institutions included. There is also a strong connection to industrial partner – Transportation Research Institute, which with its 60-years history represents one of the crucial elements in frame of private activities in chosen segments of transport research.

The main research areas the RC ZU is focused on are the areas where the University of Žilina is established at an excellent level within the frame of EU and plays an important role on a world-wide scale.

Keys activities can be described as follows:

- 1) Research and development in the area of control and evaluation of transportation infrastructure condition.
- 2) Research and development in the area of progressive materials for building the transport infrastructure and production of the means of transport.
- 3) Research and development in the area of design, construction and control of intelligent buildings and renewable energy sources.

There are more than 110 employees participating in these activities, including 9 professors, 13 docents and 48 post graduates (PhD.). To boost the educational process, various activities and actions are performed for an even more intensive involvement of students on all levels (including PhD. Students) during their studies.

Research Centre of the University of Žilina also supports clever people with good ideas and is building its own incubator for spin-off and start-up projects. This enables a simpler and much faster commercialization of research results and developments; an active look-up for potential spin-off and start-up projects as well as it supports the creation of new innovative business companies.

Another part of Research Centre, Regional Centre for Knowledge and Technology Transfer and Science Popularization is engaged in popularization of research results in laic and professional community. Its aim is to acquire customers for research and development activities at national and international level, to identify potential application of the results reached in research and development, to enhance their transfer to praxis and to build up the system for effective commercialization of reached results. There is

also a department for dealing with regulation and active protection of spiritual property in relation to actual output.

In June 2014 a construction of so called „intelligent building“ started, using the low-energy construction methodology (with thermal energy consumption under 15 kWh/(m².year)), applying the higher standard of the building equipment concerning a variety of thermal, cold and energy sources, from the point of view of energy demands regulation, safety and services in the building.

The building itself and its integral technological environment in combination with its real use, will provide preconditions for research activities in area of energy demand, control of heat gain, operating algorithms optimization or for example settings of the optimal heat comfort for the users.

In frame of common research activities, the Research Centre of the University of Žilina organizes events, such as „Research Forum“ or „Research star“ for fellow scientists and researchers.

I.

II. SUSTAINABILITY = DEMAND

Every subject not managed by adequate grant (either on regional, national or higher level) has to come up with additional means of funding to become self-sufficient for operation and further development. Financial mechanism for newly created university science parks and research centres is based primarily on idea of zero or minimal dependency on founder (universities or Slovak academy of sciences). Based on these premises, question of sustainability is much more than relevant.

The basic element of sustainability is demand for ones services and products, which directly influences viability and determinates the role of the subject in frame of research-and-development as well as all-society environment. Although we primary consider the demand in relation to its satisfaction from the point of view of financial incomes for relevant research-and-development subject, the social demand occurs more and more often, which we can define for example by:

- Interest to cooperate from top-level professionals,
- Need of existence of such subjects that are able to efficiently interlinks educational and research activities in academic area or
- In the form of all-society commissions that do not generate financial income and do not thus contribute to direct financial sustainability of existing subjects.

When the forms of demand are known, it is possible to start focusing on relevant risk factors and to create tools to regulate them.

III. RISK FACTORS FROM THE RC ZU POINT OF VIEW

Risks in relation to specific organizations of research and development such as USP and RC can be divided into 2 basic groups: general and specific.

General risks represent a group of circumstances, which influence the very existence, operational capability, financial independence and competitiveness of all subjects (all newly created USP and RC) without exception. We can include here:

- existence of national forms of support for USP and RC (direct grants and stimuli),
- legislative and programme barriers and arrangements disabling an active entry into the economic market conditions,
- all-society attitude to further support for USP and RC in relation to the state and prediction of development of national and European economics.

Specific risks are unique influencing factors related individually to each one of USP and RC. It is a group of factors that arise for example from:

- Reallocation of research-development capacities in the frame of professional fixation and relevant region (amount and quality of competitive subjects),
- Existence of mid-term and long-term demand partners (regular customers),
- Access to high-quality supraregional basis of human resources,
- Efficiency of using own unique infrastructure,
- Possibilities for active and stable binding to important research organizations on international level and engaging in common activities of R&D,
- Efficiency of integrating other R&D subjects under its own regulation.
- Range and quality of actual activities aiming to financial sustainability (indirect grant schemes for USP and RC, for example Slovak Research and Development Agency, local grants and amount of irregular income, for example in form of contractual research), including the questions of founding and operating the start-ups and spin-offs.

It is necessary to mention here that even though both risk groups act externally as separate factors on USP and RC projects' sustainability, it is not possible or right to compare their importance, separate them completely from each other and approach them without solving the secondary risks caused by them.

A. Control of General Risks by RC ZU

It is not possible to create and apply tools for managing general risks by an individual subject like RC ZU, considering the volume and character of the factors entering their development process. From the projects' sustainability point of view, USP and RC identify the primary problem as the missing definition of any further support from initiating subject (in this case the Ministry of Education). There is a serious assumption that after the 2013-2015 period (period with financial support from initiating subject), a new period will follow where USP and RC will have to redirect from activities for stabilization in economic environment and demand base creation to „lifesaving activities“. It is highly possible that some of USP and RC will not be able to find sufficient tools to survive until the new supporting systems are defined and will have to cease to exist or will need considerable help from founder institutions. Then the questions of efficiency of investing the financial resources for their creation occur, which will logically cause scepticism for future support.

USP and RC also have to directly confront legislative and programme barriers. These on one hand „dictate“ duties in form of activities for its sustainability, but on the other hand they limit the forms of financial support in the frame of monitored period (by the year 2020) to minimum and thus limit the possibilities of equalization with market subjects. The sooner suitable legislative precautions come, not just in form of internal (institutional regulations of the University of Žilina) and national legislation, but mainly on the part of programme adaptation (Operational Programme Research and Development and Operational Programme Research and Innovation), the sooner it will be possible to find an optimal model of its own functioning in relation to the question of sustainability.

The last mentioned general risk is the amount of public acceptance of ongoing and future support for USP and RC projects considering the economic situation and direct impact of actual R&D activities for public benefit. This risk factor is generated through the whole society and even though it acts externally like some unimportant factor of sustainability, when considered in detail its role is extremely important. The reason is its ability to accelerate or completely stop the sustainability of these projects. Considering creation of 13 USP and RC subjects, there were more than 400 million € allocated for the 2013-2015 period. This amount represents an extreme expense for economy and a massive obligation to final recipients of services and products of actual R&D activities (the society), while their amount and quality is directly transformed in form of feedback into one of the indicators reflecting the need of sustainability of USP and RC. In case that society will not create demand for provided products and services, it will be necessary to reconsider tools applied for preserving sustainability and to redirect financial

help to other economy sectors outside research and development. From the economic contribution point of view, it is possible to discuss the subject of USP and RC sustainability and their influence on economy, while declaring that R&D sector contributed to economic growth. Thus the expended financial means will prove to create benefits (both financial profits and social benefits) and a direct motivator to provide tools for preserving sustainability of USP and RC in future period will occur.

B. Managing Specific (Individual) Risks of RC ZU

This group of risks is characteristic by quite open possibilities of direct risk management by applying the right tools at the right time.

The idea of RC ZU was drafted in form of a subject that disposes of certain elements of uniqueness and competitiveness in order to simplify implementation of sustainability tools. Areas of research and development originate from historic background so they are focused on transportation and related topics. The University of Žilina as the founding institution profiles itself in a long-term horizon as a centre of transportation research in Slovakia, with stable position in European area. RC ZU project realization contributes to this profiling.

Meanwhile the competitive advantage occurs in form of favourable regional and supraregional localization in comparison to other research-and-development subjects, that could directly threaten (or weaken) demand for RC ZU's services and products completed with very specific acquired and used infrastructure.

Great deal of attention according to RC ZU management model is dedicated to activities concerning acquiring and preserving the strong partnerships with demand entities from industry or society (including the environment providing educational process). With industrial partners it means to conduct such research activities that are interesting for their own applicability into praxis. Reaching this goal will help not only to create higher level of demand from said partners but will also lead to much required financial stability for further innovations and operation. One of the examples is signing several general contracts of cooperation even before finishing the actual building of RC ZU own research facility.

In second case, where the attention is concerned with society interests, the goal of RC ZU is to transform its own activities into the form that brings direct effect to society, for example connecting research activities with educational process. Direct use of gained knowledge is meant here, in frame of actual R&D activities included into educational process, mainly at the University of Žilina.

Another decisive element that directly influences the RC ZU sustainability is ensuring the available basis of employees who dispose of

relevant professional and managerial abilities. That is the reason why we approach creation of research teams in a highly professional manner, choosing people by committees, while the innovation and competitiveness of approach of the person is emphasised. This system is partly supported by strengthening the teams with post docs. Right now there are taken steps to integrate the students of bachelor and engineering degrees into the actual research-and-development process of RC ZU as well. The goal is not just to enhance their knowledge basis but also to determine their innovation potential.

A clear, well established system greatly eliminates personal risks and uniquely determinates the position and duties of each member of research groups and managerial teams, which reflects itself in efficiency of decisive and specific R&D activities.

Research-and-development environment is quite often confronted with insufficient level of using one's own infrastructure. This level is mainly influenced by the correct prediction of demanded services and products in combination with operational costs and personal capacities needed for the direct R&D activities. When the idea of RC ZU was forming, the emphasis has been put on unique equipment, thus preventing the impact of aforementioned risk. At the same time, modularity and compatibility of some parts of infrastructure have been taken into consideration. It means the efficiency in cooperation with already existing infrastructure of University of Žilina, especially already existing excellence centres of research and development and the ones that the RC ZU will probably cover in the future. Even in spite of the system adaptation, the risk is connected mainly with preserving its operational ability after completing the direct funding schemes and possible growth of competitive subjects, which may dispose of similar equipment.

Strong institutional partner support from important research-and-development organizations in Slovakia as well as Europe creates preconditions for participating in common activities that bring important and wanted effects, including the financial gains. RC ZU integrates activities consisting of regulating such relations and makes an effort to increase their benefits for the needs of actual sustainability. It acts as an active partner for international initiatives like HORIZON 2020, COST, EEAGRANTS, Visegrad FUND or direct notices on the part of regional partners (Danube Region). At the same time it supports widening of researchers database by activities in the frame of Marie Curie models.

RC ZU also takes adequate steps in order to achieve financial sustainability. It mainly concerns of the active approach for receiving grants from Slovak Research and Development Agency, Research Grant Agency, subsidies from the Ministry of Economy SR, etc. At the same time it forms

specific Regional Centre and Incubator, e.g. organizations that are supposed to help in an active way by gaining customers, protecting and spreading intellectual property and support the innovative ideas in form of spin-off projects.

Conclusion:

It is not possible to leave sustainability of such important and specific projects like USP and RC (with their huge infrastructure and personnel) up just to themselves. Not even in spite of ambition to apply such managerial models that aim mainly for financial stability in mid-term and long-term horizon without being dependent on other forms of direct or indirect support (grants, subsidies, stimuli, etc.). This statement is based mainly on a short-time period needed for building the USP and RC facilities as well as implementing specific research-and-development activities, where the elements of unique services and products are formed and the position in frame of open market economy is stabilized. It is necessary to realize that until given time period expires (the end of year 2015), there will be 13 unique research-and-development institutions in Slovakia, but most of them will be only in its initiatory stage. That means at a zero point or in its proximity. There is an assumption that without more of the direct support from the founding institutions, these new USP and RC projects will end in similar scenarios of development that happened in last seven years, when the excellence centres of research and development have been built from the infrastructural and personal aspect, while the need of their short-term sustainability was not reflected in implementation of specific stabilization activities at research and economy space. That has been transformed afterwards into undesirable pattern and one of the goals for newly established USP and RC is the use of their potential, which will directly contribute to increase their competitiveness.

It is possible to directly apply the aforementioned statements to Research Centre of the University of Žilina. The managerial model tries to approach each of the risks, which can influence the efforts to provide actual sustainability, in a way that establishes Žilina as a science city in mid-term to long-term horizon. An important precondition to reach this goal is following the basic pillars of success: to conduct a unique, specific research and development activities, to follow trends in demand and to conduct the research for society, the research for people.

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STUDENT'S STRESS IN HIGHER EDUCATION INSTITUTIONS: A CRITICAL REVIEW OF FOREIGN LITERATURES AND THE ONES IN ALBANIA

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Abstract

This aim of this paper is to establish a theoretical approach of student's stress issue. This article provides an overview of the literature regarding the definition of stress, the sources of student's stress, and a summary of the main academic stress. This theoretical article also highlights and explains the importance of the studies undertaken in this area with the aim of obtaining a better knowledge of the sources of stress among students and the strategies to counter-attack it. This paper explains some theoretical models that analyze stress in terms of resources conservation and recovery of the individual. It presents some of the main instruments that are used to measure the degree of student's stress. Also, this paper studies the issue of stress in the context of academic performance. The novelty that this article brings consists of the emphasis on the importance of increasing the focus of the study of student's stress on the students in our country (Albania). Hence, this is a starting point for developing policies and coping strategies to reduce stress on students. Also, this is in a view of increasing student's performance and their academic achievements. This type of approach has many benefits, especially in research, with the possibility of finding new ways to explain these psychological issues. However, I discover this theoretical approach to be useful, by combining the resources on stress from foreign literatures and literatures in our country, Albania.

Keywords: Student's stress, sources of stress, academic performance

Introduction

Complete and convincing data from various studies show that high levels of stress among students can affect their memory, concentration, and their ability to solve problems thus reducing their learning abilities and their academic performance (Al-Kandari & Vidal, 2007; Dixon & Robinson

Kurpius, 2008; Dyson & Renk, 2006; Misra, McKean, West, & Russo, 2000; Wells, 2007).

Consequently, numerous quantitative research which are mainly focused on students who are enrolled full time, or who are living in dormitories or not, shows that stress takes a significant part of a student's life (Pascarella & Terenzini, 1991, 2005; Robotham & Julian, 2006). Thus, studies show an increase in stress for students, especially in recent years. This growth is associated with a decrease in the student's progress; thus, women are the ones who experiences higher levels of stress (Akgun, 2004; Dixon & Robinson Kurpius, 2008; Gadzella, 1994b; Gadzella & Carvalho, 2006).

Moreover, higher education is one of the main factors that enable individuals to become successful in obtaining a profession in order to face the different challenges of life. College life can be challenging and difficult for a new student. However, it requires a higher degree of student initiative, determination, and self-monitoring. A huge amount of research has attempted to identify important factors of student's success by assessing the relations among many psychological and academic variables. Few studies have used different methods to propose and test models that can be used to understand the relations among factors that influence student's academic success (Momanyi, Ogoma, Misigo, 2010; Peterson, Milstein, Chen & Nakazawa, 2011). Furthermore, an important part of the mission statement of most universities is the education of students to prepare them for a lifelong learning. According to Mbathia (2005), education supplies people with specific skills and enables them to perform their tasks effectively. Therefore, the better the performance of an individual, the more competitive and rewarded the individual will be. Nevertheless, many factors have an impact on student's academic performance. Owiti (2001) describes that attitude leads to achievement and abilities are needed for successful performance. In addition, Bandura (1997) confirmed that intellectual capability and motivation are significant factors on academic performance.

Theoretical Approaches to Stress

Consequently, stress is a major theme in the literature used in social sciences, behavioral studies, and those who focus on the study of life. According to Cohen, S, Karmack, T & Mermelstein, R. (1983), stress is defined as a process in which demands that comes from the environment or threaten the adaptive abilities of the individual organism, derive psychological and biological changes, which may cause the individual to be infected with various diseases. Stress is defined as a special relationship between the person and the environment being evaluated by the individual due to lack or excess of his/her inputs, which endangers his/her welfare

(Lazarus & Folkman, 1984). Hans Selye (1974, 1976) and the coping model (Lazarus & Folkman, 1984), focus on the interaction between people and their external environment and defined stress as an imbalance between requirements, external sources, and the individual. However, stress is present when the pressure exceeds the perceived ability to confront it.

The notion of “stress” has entered the current language along with the studies of the famous biochemist Hans Selye. The idea of “stress” has bothered Hans Selye in his entire life. However, this famous scientist dedicated his life to study “stress” which brought about a revolutionary concept in the field of medicine and humanities. Selye’s work (1976) on general adaptation syndrome (GAS) is considered nowadays as a highly important research made on stress description.

Hans Selye (1976) reminds us that there can be two different reactions to stress: a positive reaction and a negative reaction. Therefore, a particular level of stress is necessary to help being more motivated. This kind of stress is called Eustress. Subsequently, the genesis of the thought of studying stress in the context of medicine and biology represented by Selye (1976), consisted of the use of the term “Eustress” referring to curative stress and the term “distress” referring to unpleasant situations that produce stress.

Furthermore, the study of Lazarus & Cohen (1999) and Lazarus (1966: 25) on psychological stress and enduring process began to shift the focus from stress to endurance. Without doubt, the most influential theoretical perspectives about psychological stress and endurance were directed by Lazarus and his colleagues (Lazarus, 1966; Lazarus & Folkman, 1984; Lazarus & Launier, 1978). This perspective explicitly grew from the need to understand individual differences that characterize an individual in stressful situations to the way they handle these situations (Lazarus & Folkman, 1984). Therefore, stress is regarded as an incentive, as a response, and as a process (Baum, 1990; Cooper, deWe & O’Driscoll, 2001; Lazarus & Cohen, 1999).

Seeing it as a stimulus, stress is focused on environmental factors that threaten our internal balance. In addition, seeing it as a response, it refers to the way someone reacts to a particular stressed situation. Stress as a process involves a series of interactions and adaptation of the individual with the environment where he lives. It is considered as a transition, which means an exchange between the resources that an individual possesses and the demands that comes from the environment.

Sources of Student’s Stress

University students are subject to several types of stressors, mainly related to the entrance into a new developmental stage, i.e. young adulthood (e.g., Pillow, Lovett, & Hill, 2008). At this stage according to Erikson

(1968), young adults are faced with issues such as intimate relationships, choice of a career, moving away from home, getting a first job etc. Therefore, the transition from high school to college or university is often accompanied by efforts to cope with the high stress levels in adaptive or maladaptive ways (e.g., alcohol drugs) (Millstein & Halpern-Felsher, 2002; Webb, Bray, Getz, & Adams, 2002; Young, Morales, McCabe, Boyd, & D'Arcy, 2005).

Furthermore, studies have demonstrated that stress is noticed not only in major life events (e.g., beginning of studies at the university, starting a new job etc.), but also, daily hassles (e.g., time pressure, arguments with colleagues etc.) are important stressors among university students (Goff, 2009; Le May, 2011; Ong & Cheong, 2009; Ross et al., 1999).

Numerous studies (Lindsey, Lionit, Hendricks, Butler, 2011; Matheny, Ashby & Cupp, 2005; Misra, McKean, West & Russo, 2000; Ukeh, Aloh & Kwahar, 2011) have ranked in the category of academic stress. Hence, this includes overload through tests, exams, challenging courses, the different educational system, and the making of decisions about future career plans. In addition, difficult courses are referred to as demanding programs. In these programs, students are unable to understand and apply the concepts they have learned; and are unable to obtain good grades. Students were also under constant pressure between the self-imposed expectations for higher grades and lower results than they expected.

Several efforts have been made to identify the types of stress most often experienced by college and university students (Abouserie, 1994; Dill & Henley, 1998; Edwards, Hershberger, Russell, & Markert, 2001; Hudd, 2000; Pengilly & Dowd, 2000; Ross, Niebling, & Heckert, 1999). However, factors that stresses students should be evaluated and identified continuously and competently, to explore the patterns of the stress at students referring to the social trends and cultural norms of the country. Stress is a part of students' existence and can impact how students cope with the demands of college life. Unfortunately, very few studies on stress in general and the student's stress in particular have been taken so far in our country. This raises the urgent need to develop studies in this direction in order to recognize the sources of stress specifically in Albanian students and to design programs for the management of stress. Thus, the application of these programs in practice will lead to a higher student academic performance.

Stress Impact on Student Academic Performance

Stress is the foremost impediment to academic performance. Thus, it outranks the other top 10 impediments to learning which include cold, flu, sore throat, sleeping difficulties, concern for a troubled friend or family member, and relationship difficulties (Abid, H. C. 2006).

However, research as shown that there is a relationship between stressful life events and poor health-related quality of life among college students. In the spring of 2003, the NCHA showed that respondents identified stress as the highest impediment to academic performance for the past school year. Thus, this can be attributed to many of the emotional and physical symptoms common in the college population, such as fatigue, hypertension, headaches, depression, anxiety, and the inability to cope with stress. Furthermore, excessive stress reduces work effectiveness, contributes to bad habits, and results in negative long term consequences including addictions, crime, absenteeism, poor academic performance, school dropout, professional burnout, and ultimately, career failure (Kuhn, 2005).

Academic performance is the only indicator of the quality of time that a student spends in college. Over the years, academic performance at different levels of study is measured by the results of their exams (Kyoshiba, 2009). Various studies have highlighted the fact that good average grades always serves as an important indicator to open a new window in life for a better job opportunity, better pay, and more educational attainment (Ang & Huan, 2006). In addition, college students experience higher stress in predictable time each semester due to academic commitments, financial pressures, and management capabilities due to lack of time. When stress is perceived in a negative way or becomes excessive, it can affect the student's academic performance and state of health (Campbell & Svenson, 1992).

Students also face emotional problems, physical, and family issues, that may affect their learning ability and their academic performance. Excessive stress can cause mental and physical health problems, can reduce self-esteem, and can affect students' academic achievements.

Several studies examine academic performance in the general population of students at the university using their average grades to measure their academic performance (Mani V., 2010; McKenzie, K & Schweitzer R., 2001; McNabb, R, Pal, S & Sloane P., 2002).

In general, stress regarding university has been revealed to be connected in reverse to student's academic performance at their first year in particular (Krause, K, Hartley, R, James, R & McInnes, C. 2005).

Furthermore, reducing stress is a goal for many persons. This is because stress can either hinder or motivate one's performance. The direction of its effect depends on the perception of the individual. When stress is perceived negatively or becomes excessive, it may become linked to physical and mental illness. The process of university education evaluates the student constantly and causes a reevaluation of their self-image. However, as the session progresses, stress rises with every paper and examination. Stress can affect both health and academic performance. Among other health

risks, it may result in increased blood pressure, a stress-related condition leading to an elevated risk of disease (Talib, N & Zia-ur-Rehman, M. 2012).

Conclusion

The aim of this paper was to establish a theoretical approach of the student's stress issue and to provide an overview of the literature regarding the definition of stress and the sources of student's stress. It summarizes the main specific academic stress. Till this present-day, stress remains a topic which requires more attention. However, some studies underlines that the lack of satisfaction and fulfillment leads to increased distress (Vasile & Albu, 2011). Consequently, the sources of student's stress that comes from literature can serve as a starting point for conducting important studies focusing on the stress of Albanian students, specifically analyzing what is stressing them. Likewise, the presentation of data coming from different studies on the impact of stress on academic performance, serves as a greater awareness of the leading actors of higher education in the development of programs to manage stress in students with the main purpose of improving student's academic performance. Through this knowledge and by spreading this information about stress, we can contribute to a healthier and balanced society.

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MATHEMATICAL EDUCATION AND INTERDISCIPLINARITY: PROMOTING PUBLIC AWARENESS OF MATHEMATICS IN THE AZORES

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Abstract:

Mathematical literacy in Portugal is very unsatisfactory in what concerns international standards. Even more disturbingly, the Azores archipelago ranks as one of the worst regions of Portugal in this respect. We reason that the popularisation of Mathematics through interactive exhibitions and activities can contribute actively to disseminate mathematical knowledge, increase awareness of the importance of Mathematics in today's world and change its negative perception by the majority of the citizens. Although a significant investment has been undertaken by the local regional government in creating several science centres for the popularisation of Science, there is no centre for the popularisation of Mathematics. We present our first steps towards bringing Mathematics to unconventional settings by means of hands-on activities. We describe in some detail three activities. One activity has to do with applying trigonometry to measure distances in Astronomy, which can also be applied to Earth objects. Another activity concerns the presence of numerical patterns in the Azorean flora. The third activity explores geometrical patterns in the Azorean cultural heritage. It is our understanding that the implementation of these and other easy-to-follow and challenging activities will contribute to the awareness of the importance and beauty of Mathematics.

Keywords: Recreational Mathematics, Interdisciplinarity, Astronomy, Biology, Cultural heritage

Introduction

Mathematics is present in our daily life, even in the lives of those suffering from *math*-related phobias. However, too many people are unaware of this, which may be both a consequence and a cause of a poor mathematical literacy. Therefore, it is crucial to raise public interest towards Mathematics. We suggest that this goal can be achieved partly through an investment in the popularization of Mathematics so that a broad cross-section of the public can have contact with mathematical ideas and concepts and realise that Mathematics is present in our daily life.

The results obtained by the Portuguese students, and particularly the Azorean students, in Mathematics are unsatisfactory (Mullis *et al.*, 2012; OECD, 2014; Soares, 2015). These results are a reflection of the mathematical illiteracy and of the little importance the society as a whole gives to Mathematics. Too often there is a vicious cycle in which parents pay little attention to their children lack of success because they had a similar experience as students. The changes, therefore, must occur across the society.

Flewelling and Higginson (2001) suggest that students can overcome math anxiety and find learning mathematics to be a rewarding and successful experience when teachers change the typical classroom culture by having students experience rich learning tasks. Also, in *How the Brain Learns Mathematics*, Sousa (2008) argues “Information is most likely to get stored if it makes sense and has meaning”. Thus, we contend that activities related with popularization of Mathematics can also contribute to the mathematical education of students.

Here, we present very preliminary ideas of how popularization of Mathematics can be achieved in the Azores.

Popularization of Science and Mathematics

The popularization of Mathematics has a very long history and we shall only mention a few important contributions. The very famous mathematician David Hilbert gave popular lectures in 1921 for students returning to the university after the war and continued the series through the 1920's (Reid, 1970). Lucas' Tower of Hanoi game is an example with a much broader impact (Hinz, 1989). Many other examples throughout history can be given. A particularly relevant example is the work of a lifetime of Martin Gardner. Gardner wrote the famous “Mathematical Games and Recreations” column for *Scientific American* magazine for more than 25 years. This work has inspired hundreds of readers to delve more deeply into the large world of Mathematics.

Even though popularization has a long tradition, it is a relatively recent topic that motivated the fifth international study of the International

Commission on Mathematical Instruction (Howson & Kahane, 1990), and had seen important developments after the World Mathematical Year 2000.

Worldwide there are hundreds of science museums and science centres that provide interactive exhibitions, in many different fields of Science. A visit to these centres does not replace the formal instruction in school, but it can be extremely inspiring and engage a child or an adult in the process of discovery. Until recently there was a lack of evidence supporting the general view that these visits play an important role in promoting the science learning of the public. The International Science Centre Impact Study, a consortium of 17 science centres in 13 countries (including Portugal) addressed this question and its results strongly support the contention that individuals who used science centres were significantly more likely to be science and technology literate and engaged citizens (Falk *et al.*, 2014).

Unfortunately, there are very few museums or centres dedicated to the popularization of Mathematics. There are a few exceptions, like *Mathematikum*, in Gießen (Germany), or the recent *MoMath*, in New York (USA). Some large science museums have permanent or regular mathematics exhibitions, like the *Cité de Sciences et L'industries*, in Paris (France), the *Pavilhão do Conhecimento*, in Lisbon (Portugal), or the announced new mathematics gallery in the London Science museum (UK), due to open in 2016. Popularization of Mathematics, like the popularization of Science, is in the razor's edge: the difficult balance between the rigorous language of Mathematics and the need to make the message accessible to a large audience.

Popularization of Science and Mathematics in Portugal

In the last two decades there has been a boom of science centres in Portugal¹³. Also, the involvement of scientists and academics in activities dedicated to the popularization of Science is now extremely common (e.g. Russo & Christensen, 2010). Yet, there is still no museum or centre specifically dedicated to Mathematics. Also, it is relevant to notice that in 1185 science news published in one of the most respected national newspapers, *Público*, in the year 2005, Mathematics was the area of knowledge least present, in 23rd place with only 11 articles (Mourão, 2007).

Fortunately, things appear to be slowly improving. The *Ludus Association*, created less than a decade ago, has given a seminal contribution to the popularization of Mathematics in Portugal. This association aims the promotion and dissemination of Mathematics, particularly Recreational Mathematics and Abstract Games in its various forms, such as educational,

¹³ Ciência Viva Centres Network's website: <http://www.cienciaviva.pt/centroscv/rede>.

cultural, historical and competitive. Another important example is the *Atractor Association* (Arala Chaves, 2006). The television series *Isto é Matemática*, that consisted in short episodes dedicated to the popularization of Mathematics, promoted by the Portuguese Mathematical Society, achieved a considerable success in recent years. For other examples, see Eiró *et al.* (2012).

This important work of the last years must be adapted and reproduced to reach the different parts of the country and the widest possible audience in a regular and consistent way, so that there is a positive change in the society towards Mathematics.

Popularization of Science and Mathematics in the Azores

Presently, the Azores archipelago has six science centres. Four of these centres are located in the main island of S. Miguel and are dedicated to Astronomy, Geoscience and Volcanology, Microorganisms, and to the Natural Sciences and Technology. The others are located in the islands of Terceira and Faial and are dedicated to the Environment and Climate, and to Marine Life, respectively. The other six islands, although only representing 15% of the population, have no centre or museum dedicated to Science. Again, there is no centre or museum dedicated to the popularization of Mathematics in the archipelago, nor there are plans in this direction.

Although there is no centre for promoting Mathematics in the Azores, in the recent past there have been several initiatives dedicated to this purpose organised by the Department of Mathematics of the University of the Azores. Some of the most relevant initiatives were two series of talks *A walk through science: Mathematics in or lives*¹⁴ and *Mathematics in the Afternoon – Azores*¹⁵. In 2013, in collaboration with the *Ludus Association*, this department organised two international meetings: *Board Game Studies Colloquium XVI*¹⁶ and *Recreational Mathematics Colloquium III*¹⁷. Also, there have been frequent presences in the local television and articles in the local newspapers aiming to promote Mathematics¹⁸.

Before considering how to develop further the popularization of Mathematics in the region, let us first mention one particular difficulty the Azorean science centres face in trying to achieve their goals successfully. If a school or a family want to learn about Astronomy or Volcanism and they do not live in S. Miguel Island they cannot realistically have access to the science centres created for these purposes – the geography and the cost of

¹⁴ See <http://www.ciencia.uac.pt>.

¹⁵ See <http://www.tmacores.uac.pt>.

¹⁶ See <http://ludicum.org/ev/bgs/13>.

¹⁷ See <http://ludicum.org/ev/rm/13>.

¹⁸ See <http://sites.uac.pt/rteixeira/divulgacao>.

traveling are very real obstacles. It is true that the astronomy centre, OASA, does occasionally visit schools in other islands with their portable planetarium and telescopes, and this somewhat minimizes the problem, but this is not the case for the other science centres. What this implies is that the creation of another centre, in this case for the popularization of Mathematics, is probably not the best option as our goal is to reach most of the population. Also, the economic difficulties the country and the region are presently facing also contribute to make this option unviable. We therefore propose to popularize Mathematics based on the following ideas:

- Conceive and build interactive activities and portable exhibitions;
- Present some of these activities in a “mathematical corner” in the different science centres. If possible, some of the activities should be related with Mathematics that is relevant to the particular area of knowledge of that centre. Those islands that do not have a science centre could receive these activities in a local public library, museum or school;
- Develop contents that reach a large audience, which is not limited to schools and to those that visit museums, science centres and other institutions alike. One possibility is to present mathematical concepts and ideas in guided tours around towns (see Sections 4 and 5). Another possibility is to offer games and activities, where Mathematics is actively present, in local fairs or festivities.

Next, we present some activities to be implemented in this context.

Exploring methods to measure distances

One of the most important problems in Astronomy is the measurement of distances to other celestial bodies. This question arises in determining the distance to the Sun or the Moon but also in determining the distance to a nearby star or a very distant galaxy. There are many different methods in Astronomy to measure distances and, in general, each method is limited to a particular range of distances, originating the concept of a cosmic distance ladder: one method can be used to measure nearby distances, a second can be used to measure nearby to intermediate distances, and so on. At the base of this ladder is the method of parallax that gives a direct distance measurement to nearby stars.

The method of parallax is based on simple trigonometry and, because it can also be used to determine terrestrial distances, we propose an activity to experimentally determine distances, which perhaps could be implemented in the OASA centre for Astronomy. This aims to illustrate concepts of high school mathematics in real life problems and also contribute to a better understanding of this important method in Astronomy.

The different steps required to implement this activity can be summarized as:

- One starts by understanding the parallax concept by closing one eye and moving one's head until obtaining an alignment of two objects at different distances. After switching the closed eye with the open eye, one observes the effect of parallax – the two objects are no longer aligned.
- One observes that to detect this effect the closer object cannot be too distant – for very distant objects the distance between our eyes is not enough for the parallax to be noticeable.
- One finds a target object for which one wants to measure the distance, call it D, like a tree or a cross in a church. One must make sure there are other objects in the background at a much larger distance.
- One observes the target object from some place A so that the object is aligned with a background object referred as X. One moves in a perpendicular direction to the object a sufficient distance so that the object is now aligned with another background object Y and refer to this place as B (cf. Figure 1).

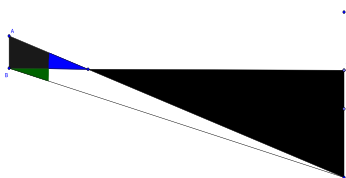


Figure 1: A schematic representation of how to use parallax to measure distances.

- With an appropriate device, to be described ahead, one measures the angle between the direction B to Y and B to X and denote it by α . With a tape measure the distance between A and B, call it d. Notice that this angle is small and it gets smaller and harder to measure as the chosen target object is further away.
 - All the necessary information to determine the distance is now in your hands! As the distance to the target object is much smaller than the distance to the background objects we have $\tan \alpha \approx \tan \beta = d/D$, or $D \approx d \cot \alpha$.
 - After one or several measurements, the application of this method in Astronomy becomes easier to explain and understand.
- To measure the angle we propose a simple although not very rigorous method using a protractor (obviously if a theodolite is available it can be

used with much better results). An image of a protractor can be printed and glued on cardboard or templex and the angles can be marked on this surface using pins.

Exploring numerical patterns in the Azorean flora

The cultivation of pineapple (*Ananas comosus*, Cayenne variety) is a tradition on the island of S. Miguel. Originating in South America, pineapples reached the Azores in mid-nineteenth century. Initially no more than an ornamental plant, it became an industry after some years. With time, and due to their unique aroma and flavour, pineapples ended up being an emblematic product of the Azores.

There are also other ways of looking at pineapples and these are connected with an interesting mathematical pattern. To better understand the connection between pineapples and Mathematics, let us call to mind Leonardo of Pisa (circa 1170-1240). Known as Fibonacci, Leonardo of Pisa was an important medieval mathematician. In 1202, Fibonacci wrote a treaty called *Liber Abaci*. One of the chapters dwelled on problem solving; there, Fibonacci presented the problem: “A man placed a pair of rabbits, male and female, in a place with walls all around. How many pairs can be bred in one year, bearing in mind that, every month, each pair generates another one, which from the second month becomes productive?”

Let's try and solve this problem. In order to do that, we need to analyse what happens at the beginning of each month. Let's start with a pair of newborn rabbits. In the second month, this pair becomes adult, so in the following month they give birth to the first pair of rabbits. Thus, in the third month there are already two pairs. In the fourth month, the initial pair gives birth to another pair, while the first pair becomes adult. On the whole, there are three pairs of rabbits. In the fifth month, both the initial pair and their first offspring, now adults, have new descendants. If to these we add the pair of bunnies from the previous month, there is a total of five pairs of rabbits. If one carries on with the problem, the numbers obtained shall be 1, 1, 2, 3, 5, 8, 13, 21, ... The series of numbers obtained is known as the *Fibonacci sequence* and obeys to a most interesting pattern: each number is the result of the addition of the two previous ones (for example, $8=5+3$ and $13=8+5$).

But what is the connection between these numbers and pineapples? If we really look at a pineapple, we notice that the diamond-shaped markings that make up its skin (called bracts) are organized in spirals (cf. Figure 2). A closer look allows us to conclude that there are two families of parallel spirals, some whirling to the right and others to the left. What is astonishing is that if we count the total number of spirals of each family, we always get the same numbers: 8 and 13! What an amazing mathematical pattern! In the

hustle and bustle of every day life we sometimes do not realise that Nature is full of numerical patterns, and pineapples are no exception.

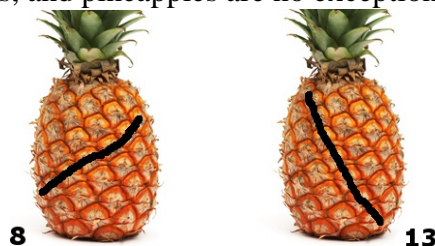


Figure 2: The numerical patterns of the Azorean pineapple.

There are many other captivating ways of exploring the Fibonacci sequence. Next, we propose exploring this sequence in an itinerary on the island of Faial.

Stop One: the Capelo Park. The Natural Forest Reserve of the Capelo Park has an area of 96 hectares and a significant diversity of endemic plants. The Maritime Pine (*Pinus pinaster*) can also be found there. Given the abundance in pines, it is quite easy to find pine cones.

Figures 3A and 3B show a common pine cone photographed from the base up, with the connecting stem in the middle. A closer look reveals that there are two sets of spirals: one whirls to the left (counter-clockwise) and the other to the right (clockwise). One of the sets has 8 spirals and the other has 13, two consecutive Fibonacci numbers.

Stop Two: the Seaside Avenue of Horta. It is possible to find several palm trees in the green areas of the avenue, namely Canary Island Date Palms (*Phoenix canariensis*).

In Figure 3C we can see the trunk of one of these palm trees. Again we can find two families of spirals: one whirling to the left, the other to the right. In the image only one spiral of each family is identified. The spirals that whirl clockwise had a steeper climb than the others (looking at the photo we can see that those spirals do not whirl around the trunk completely, though the counter-clockwise spirals whirl around more than twice). If we count the number of spirals in each family, we come up again with the numbers 8 and 13!

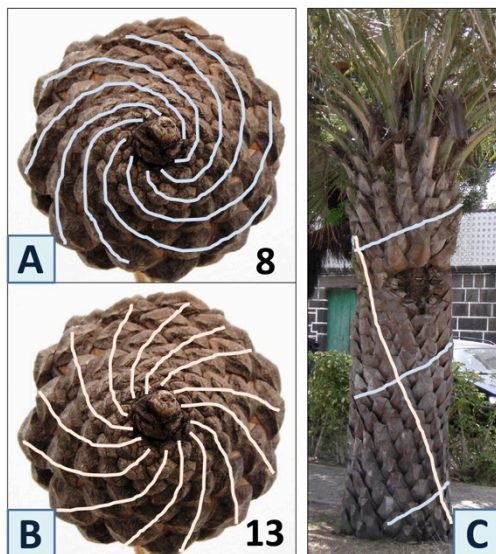


Figure 3: The numerical patterns of a pine cone and of a palm tree.

But why can we frequently find Fibonacci numbers in plants?

The answer lies in the way they grow. If we look at the tip of an offshoot, we can see little bumps, called *primordia*, from which all the plants characteristics are going to evolve. The general disposition of the leaves and petals is defined right at the beginning, when the primordia are being formed. Thus, we just have to study the way the primordia appear (Stewart, 1995).

What we can observe is that the consecutive primordia are distributed along a spiral, called the generating spiral. The significant quantitative characteristic is the existence of a single angle between the consecutive primordia that are, thus, equally spaced along the generating spiral. The angle's amplitude, called the golden angle, generally has 137.5 degrees. In the nineties of the twentieth century, Stephane Douady and Yves Couder identified a possible physical cause for this phenomenon (Douady & Couder, 1992). The physical systems evolve normally to states that minimise energy. What the experience by the two physicists suggests is that the golden angle that characterises plants growth represents simply a minimum energy state for a sprout system mutually repelled.

But what connection is there between the golden angle and Fibonacci's sequence? If we take pairs of consecutive numbers of the sequence and divide each number by the previous one, we get $1/1=1$; $2/1=2$; $3/2=1.5$; $5/3=1.666\dots$; $8/5=1.6$; $13/8=1.625$; $21/13=1.615\dots$; $34/21=1.619\dots$. As we continue with this calculation, the results approach a specific value, sometimes by default, others by excess. This value is a non-periodic infinite title, approximately equal to 1.618, represented by the Greek letter *phi* (Φ) and also known as the *golden number*. By dividing 360 degrees by *phi* we

get an angle of approximately 222.5 degrees. Since this is a value higher than 180 degrees, we should consider the corresponding convex angle and, then, subtract from 360 degrees the value obtained. The result is 137.5 degrees!

In 1907 the mathematician Iterson proved that by joining consecutively a set of dots separated by 136.5 degrees along a generating spiral, it is possible to identify two families of spirals, some whirling clockwise, others counter-clockwise. In the overwhelming majority of the times, the total number of spirals in each family is a Fibonacci number (Livio, 2012). Even more, the values are two consecutive Fibonacci numbers, this is so because the ratio between these numbers is close to the golden number.

Stop Three: Faial's Botanical Garden. The Botanical Garden covers an area of 8000 square meters and plays an important scientific and educational role, mainly due to its considerable plant collection, mostly endemic.

The growth of the stem and the branches of a plant produces leaves with a regular spacing between them. Yet, the leaves do not overlap when growing, for that would deprive the bottom ones from the sun light and humidity needed. Hence the reason the leaves tend to grow in positions that allow them to get both sun and rain. Many times, the leaves disposition is characterised by a spiral growth, which allows this type of optimising (cf. Figure 4A). *Phyllotaxis*, from the Greek and meaning “arrangement of leaves”, studies precisely the distribution patterns of the leaves along the plants stem.

Let's have a look at the leaf distribution of some of the plants of the Botanical Garden. In the case of the *Viburnum treleasei* (Figure 4B), the *Hypericum foliosum*, the *Picconia azorica* and the *Veronica Dabneyi*, the leaves are in opposite pairs. Since the pairs of leaves present themselves in alternate 90 degrees angles (perpendicular planes), this is called decussate. And although 2 is a Fibonacci number, there is more to it.

Many of the plants at the Botanical Garden have alternate spiral leaves, and the distribution of this kind of leaves along the stem presents an interesting and easy way to spot the pattern (cf. Figure 4A). In order to do that, we should choose as reference a leaf located in the lower part of the stem or of a branch (marked by an X in the figure). Then we should count the following leaves until we reach a leaf with the same orientation as the reference leaf. We should also count the number of whirls around the stem resulting from the plant's growth. In the vast majority of times, the two values are alternate Fibonacci numbers (which means that there is one single Fibonacci number between them). In the example shown in Figure 4A, the values are 8 (the number of leaves) and 3 (the number of whirls). Remember that 3 and 8 are alternate Fibonacci numbers, for they have 5 in between

them in the Fibonacci sequence. By knowing this, we also know the angle that separates two consecutive leaves. In this case, the angle is $3/8$ of a complete whirl, that is, $3/8 \times 360 = 135$ degrees (an approximate value of the golden angle: 137.5 degrees). Then we can say the plant has a *phyllotactic fraction* of $3/8$, a value that characterises the angular separation of two consecutive leaves along the stem.

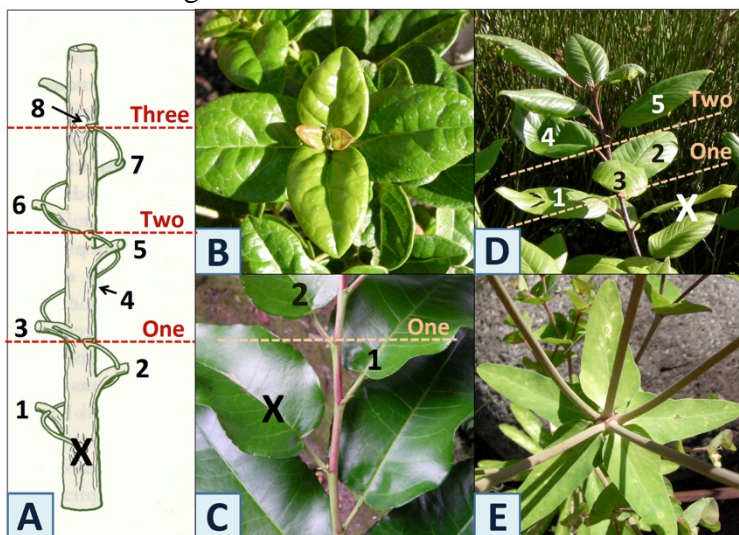


Figure 4: Examples of numerical patterns that can be found in Azorean flora.

Considering some examples together with their phyllotactic fractions, we have: *Prunus azorica* (Figure 4C), *Semele androgyna* and *Holcus rigidus* ($1/2$); *Ilex perado*, *Rumex azoricus*, *Frangula azorica* (Figure 4D) and the flower stems of *Azorina vidalii* ($2/5$); *Pericallis malvifolia*, *Myrica faya*, *Laurus azorica*, *Myrsine retusa* and *Vaccinium cylindraceum* ($3/8$); *Euphorbia azorica*, *Solidago sempervirens* and *Persea indica* ($5/13$).

Besides these, there are other interesting patterns: the 5 flower stems of the *Euphorbia azorica* based on a 5 leaf set (Figure 4E); the flowers of the *Ranunculus cortusifolius*, *Pericallis malvifolia*, *Viburnum treleasei*, *Myosotis azorica*, *Daucus carota*, *Rubus hochstetterorum*, *Angelica lignescens*, *Lysimachia azorica* and *Spergularia azorica* all have 5 petals. Thus, one can conclude that many of the flowers of endemic plants of the Azores have 5 petals.

An interesting challenge would be to visit the Botanical garden and observe these properties *in loco*. Another possibility would be to find the phyllotactic fractions of other plants present in our daily lives.

Exploring geometrical patterns in the Azorean cultural heritage

The relationship between Mathematics and Art has deep roots in many cultures (Washburn & Crowe, 1988). Ornamental patterns, namely

those existing in Azorean sidewalks and traditional crafts, can be studied from a mathematical point of view. The mathematical classification is based on the concept of symmetry, a unifying principle that involves regularity, equality, order and repetition, some important aspects of structure and form in Art. Mathematicians apply the Theory of Groups to study the ways that a motif repeats and the manner in which one part of a pattern relates to the others.

The possibilities turn out to be quite limited: there are only four types of symmetries (*reflections, translations, rotations and glide reflections*). We can systematically identify all symmetries of a given plane figure, and so establish a classification for that figure. There are three types of figures: *rosettes* (figures with rotational symmetries and, in some cases, mirror symmetries), *frieze patterns* (figures with translational symmetries in one direction), and *wallpaper patterns* (figures with translation symmetries in more than one direction, which leads to the paving of the whole plane). Quite surprisingly, there are exactly seven types of frieze patterns and seventeen types of wallpaper patterns. Although there are infinitely many types of rosettes, their symmetry is simple and quite easy to understand. For more details, see Martin (1982) or Teixeira (2015).

The sidewalks and squares paved in Portuguese Pavement are one of the most characteristic aspects of the heritage of many Portuguese towns. In the Azores, artistic paving dates from mid-twentieth-century. It is present in sidewalks, squares and private atriums and gardens, bearing different artistic patterns where the black basalt contrasts with the white limestone.

Figure 5A shows a rosette from Campo de S. Francisco, in S. Miguel. We immediately find rotational symmetries: if we rotate the figure around its center by a given amplitude, the figure obtained totally overlaps the initial figure. The amplitude to be used depends on the number of the motif's repetitions. In this case, we have 8 repetitions, for which the rotation angle should have an amplitude of $360/8=45$ degrees (or any of its multiples) as to obtain a symmetry of that figure. We can also find mirror symmetries (a total of 8 axes of symmetry that pass through the rotation center; 4 of them cut in half opposite petals and the remaining 4 separate consecutive petals).

In Figures 5B to 5D, it is shown three examples of friezes from Horta, in Faial island. One should bear in mind that all friezes have a common property: the translational symmetries in one direction, which implies precisely the repetition of a motif along a strip. The frieze of Figure 5B also has vertical reflection symmetries. On the other hand, the friezes of Figures 5C and 5D share one common property: the half-turn symmetries. If one imagines each of these upside down, the result is that the configuration does not change. Besides the translational and half-turn symmetries, the first

does not possess other symmetries; the second has horizontal and vertical reflection symmetries.

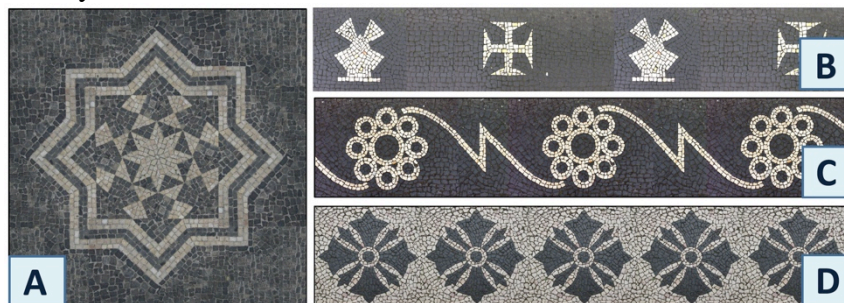


Figure 5: Examples of geometrical patterns that can be found in Azorean sidewalks.

Weaving is one of the first and oldest traditional industries of the archipelago of the Azores. The art of weaving, using wool, linen or cotton, demands accuracy, time and perseverance. But the beautiful works are a living proof of all the craft and art of the Azorean weavers¹⁹. We shall now analyse the symmetries found in some works created by Joana Dias, an artisan from Santa Maria island. We begin by presenting the friezes printed in two bookmarks, both inspired by motifs that can be found in many traditional skirts of the Azorean culture (cf. Figures 6A and 6B).

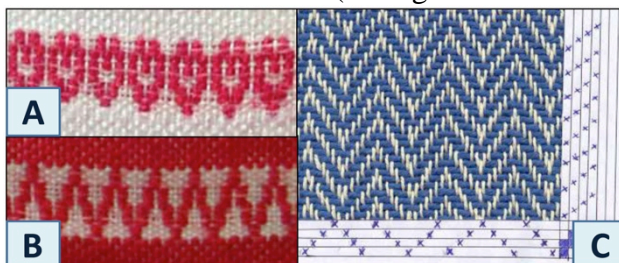


Figure 6: Some geometrical patterns that we can find in weaving works.

In the first, it is possible to identify translational symmetries in one direction and vertical reflections. In the second, we have the following types of symmetries: translational symmetries in one direction, half-turn symmetries ($360/2 = 180$ degrees rotations; if we imagine the strip upside down, its configuration is not altered); vertical reflections (the axes of symmetry are perpendicular to the frieze); and glide reflections (following the same direction as the frieze, these symmetries produce an effect similar to our footprints when walking barefoot on the sand). In Figure 6C, we have a 2-dimensional pattern (a wallpaper), with translational symmetries in more than one direction, half-turn symmetries, vertical reflections and horizontal glide reflections.

¹⁹ The Regional Centre for Handicrafts's website: <http://www.artesanato.azores.gov.pt>.

This theme can be pursued by using symmetry itineraries for the pavements or by visiting local arts & crafts centres²⁰.

Another idea would be to implement an exhibition at a Science centre in which, for example, the photo of a frieze (from a pavement or a handcrafted object) would challenge visitors to go on an exploratory journey: each station would present a question, and the answer would lead to another station and another question, and so on; by answering correctly, the visitors in the end would be able to characterize the symmetries of the frieze and to classify it.

Conclusion

Mathematical literacy is important not only to produce better scientists and engineers but also to form better citizens – Mathematics is more than a body of knowledge, it is a way of thinking. There is an urgent need to change the perception of the relevance of Mathematics in the Azorean society. The purpose of popularization is to raise awareness, not just to educate, and the criterion of success is not only an increase of knowledge, but also a change of attitude (Howson and Kahane, 1990).

In this work we describe our initial efforts to develop interactive activities that can transmit the relevance and beauty of mathematical concepts and also their importance in science and in everyday life. Here we present in some detail two activities related with geometrical and numerical patterns in things that surround us and one activity addressing the use of trigonometry in Astronomy. These connections of Mathematics with Astronomy, Nature and Art can promote the awareness of Mathematics among young people and the general public.

Although the activities proposed here are almost cost-free, there will be other ones addressing other mathematical ideas that will inevitably be more elaborate and require substantial financial resources. Our plans are to first test and implement low cost activities and, after that, obtain financial support to develop more ambitious interactive exhibitions.

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²⁰ At <http://sites.uac.pt/rteixeira/simetrias> there are several symmetry itineraries available, as well as texts and media clippings on the subject.

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THE ROLE OF EUROPEAN INTELLECTUALS IN THE PUBLIC SPHERE

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Abstract

This paper tries to understand – throughout a comparative social, historical and political analysis – if there is any continuity in the *modus operandi* of intellectuals in contemporary public arena. Thus, the main purpose of this paper is to identify, if the European public intellectual of the 21st century has recovered his/her active role and legitimacy in the public domain such as the one he/she already experienced in the mid-sixties and seventies. Having in mind the contradictory discourses around the role and representation of the intellectual, it seems, nevertheless, crucial to keep hold of E. Said’s argument about intellectuals as “representative figures” (E. Saïd, 1993), who through responsible action, creativity, courage (B. Misztal, 2007) and an “avantgardistic instinct for relevance’s” (Habermas, 2009) should be endorsed with the values of a free and deliberative democracy. In a nutshell, this paper enables us to understand that the resurgence of critical intervention and political engagement of civic-minded intellectuals in the public arena has been contributing to a greater vitality and re-politicization of European public sphere.

Keywords: European Intellectuals, Public Sphere, Resistance, Social movements.

This paper about “European Public Intellectuals and Social Movements” tries to understand – throughout a comparative social, historical and political analysis – if there is any continuity in the *modus operandi* of intellectuals in contemporary public arena. Thus, the main purpose of this paper is to identify, if the European public intellectual of the 21st century has recovered his/her active role and legitimacy in the public domain such as the one he/she already experienced in the mid-sixties and seventies. Nevertheless, to establish a comparative analysis between public European intellectuals and social movements it is helpful to revisit the contemporary debate around of the transformation of the role of intellectuals.

At a time, when some see intellectuals as an endangered species (eg. Steve Fuller, 2004, T. Judt, 2008 and R. Posner, 2001), and others stress their betrayal (J. Benda, 1927; Chomsky, 1969; Jacoby, 1987; Johnson, 1988 and Grass, 2000²¹), there is still who persist on their involvement in the social and political spectrum. The discussion about the role of contemporary public intellectuals has been highly controversial. While some defend a clear rupture with the tradition of intellectuals from Zola to Sartre, others continue to admit their commitment with universal values. Hence, while M. Foucault replaces the traditional intellectual by the expert specialist, who engages in and articulates the interest within his or her field of specialization (Misztal, 2007) - and Z. Bauman (1987) admits that as a result of the end of meta-narratives and grand-ideologies (J-F. Lyotard, 1979) intellectuals have lost their charismatic role as a public legislators and their role now “is [...] to mediate the communication between ‘finite provinces’ of ‘communities of meaning’”²². E. Said (1993)²³, on the other hand, while criticizing the functionalist-bureaucratic²⁴ view of intellectuals as policy-makers, who gravitate towards centers of power, asserts that they role “is essentially that of [...] heightening consciousness, becoming aware of tensions, complexities, and taking on oneself responsibility for one’s community. [...]”. In other words, “they are the ones [...] who provoke difference and change” (2001: 385-386). J. Habermas (1985) also regards the intellectual as a politically engaged citizen, as “the medium and intensifier of a democratic

²¹ In a interview about the intellectual’s role with P. Bourdieu, G. Grass claims the different connotation between a French and a German Intellectual: “In France, it seems to me, one speaks always, without hesitation, of “the intellectuals,” but my experiences in Germany have shown me that it’s a mistake to believe that all intellectuals are on the left. You can find proof to the contrary throughout the history of the twentieth century, the Nazi era included: A man like Goebbels was an intellectual” (2000).

²² Compare Z. Bauman (1987: 197): “[...] the strategy of interpretation does differ form all strategies of legislation in one fundamental way: it does abandon overtly, or put aside as irrelevant to the task at hand, the assumption of the universality of truth, judgement or taste; it refuses to differentiate between communities which produce meanings; it accepts those communities’ ownership rights, and the ownership rights as the only formation the communally grounded meanings may need. What remains for the intellectuals to do, is to interpret such meanings for the benefit of those who are not of the community which stands behind the meanings; to mediate the communication between ‘finite provinces’ or ‘communities of meaning’.”

²³ Compare A. Melzer: “The public intellectual [...] self-consciously rejects the contemplative ideal of withdrawal and detachment, and is vitally concerned to ‘make a difference’, ‘to take a stand’, to ‘help society’” (2003: 5)

²⁴ See Brym’s definition of the functionalist view of intellectuals, “who pointed to the absorption of intellectuals by expanding government bureaucracies, university systems, business corporations, broadcasting networks [...]” (Brym, 1980: 20)

will” (1985:51) that contributes - along with his/her critical reasoning and civic participation - to a pluralistic and deliberative public sphere.

Meanwhile, and more recently, the eruption of the global economic crisis there has been a resurgence of European intellectual’s social and political commitment. Together with other differentiated social groups of activists, they are now challenging the *status quo*, i.e. the ‘permissive consensus’, the social “(...) retreat into conformism” (Castoriadis, 1997, p. 36), the political deficit and scarce civil involvement (which puts in check the accountability of the EU council) the excessive bureaucratic instruments and the imperatives of the economic system. Their oppositional stance against political power is, meanwhile, gaining a greater visibility in both domestic and in the European public sphere. According to Justine Lacroix and Kalypso Nicolaidis (2010: 17-18) in their recent book *European Stories: Intellectual Debates on Europe in National Contexts*, “concepts such as democracy, citizenship, or the republic as well as values, ethics, or norms are now at the core of debates that inextricably link the ‘national’ and the ‘European.’”

Even though the idea of a European public sphere, of a sense of a common identity is controversial, Europeans have - over the years – tried to grow a shared cultural and political imaginary. The way the ‘Peoples of Europe’ imagine their social existence is influenced by their, nevertheless inconsistent and paradoxical, common historical past. Terror, horror and crime, stresses G. Steiner (2005) are some of the expressions employed in “Europe’s self-definition as a *lieu de la mémoire*”. He points out the irrationality of a *locus*, where “Goethe’s garden almost borders on Buchenwald, where the house of Corneille abuts on the market-place in which Joan of Arc was hideously done to death” (Steiner, 2004: 22). Meanwhile, J. Derrida (2004: 410) upholds that the Europeans, while not leaving the memories aside, must “[...] fight for what of Europe remains irreplaceable for the world to come, for it to become more than a market or a single currency, more than a neo-nationalist conglomerate, more than a new armed force”.

Although there are various skeptical views on a EU and European public sphere (Philip Schlesinger (1995), Peter Graf Kielmansegg, 1994; Dieter Grimm, 1995), there are others who cultivate the idea of common ground for public communication and intervention that transcends the level of nation-state. Aligned with J. Habermas and J. Derrida, Outhwaite and K. Eder assume that “[a] transnational public ... exists in Europe as a cross-cutting of elite publics, citizens’ publics and popular publics, related to each other by some supranational institutional environment...A European public is not a chimere but a thing that already turns up in critical times ... A transnational public sphere ... is one which is no longer tied to a reified body

of people such as the nation, but to a latent demos that can be there when time requires it” (Eder cited in Outhwaite, 2009: 64).

During the last two decades, prominent European intellectuals: Z. Bauman, P. Bourdieu, J. Derrida, U. Eco, A. Giddens, J. Habermas, S. Zizek have explored this transnational public sphere, primarily through privileged sites of resistance, for instance, through printed media²⁵: *Le Monde*²⁶, *The Guardian*, *Die Zeit*, among others, in order to create a European sense of citizenry. One of the key moments of resistance towards the EU political pragmatism occurred in May, 2003 when J. Habermas with the co-signature of J. Derrida published an article entitled “February 15’ or what binds Europeans together: A plea for a common foreign policy, beginning in the core of Europe” in the *Frankfurter Allgemeine Zeitung* against the US invasion in Iraq. These two politically active and responsible intellectuals (in E. Said’s definition of a true intellectual’s role) were here “able to sift, to judge, to criticize” (Said, 2003: 98-99)²⁷ and influence the millions of Europeans, who rallied (in London and Rome, Madrid and Barcelona, Berlin and Paris) against the US invasion of Iraq, while upholding the values of freedom and justice. Yet, other civic-minded and engaged intellectuals such as Umberto Eco (Italian), Adolf Muschg (Swiss), Gianni Vattimo (Italian), Fernando Savater (Spanish) also endorsed in this resistance movement.

It is interesting to notice that public European intellectuals took once again “the role of ‘democracy’s helpers’” (Misztal, 2007: 1). This “call to resist”, call for a renewed EU public sphere, with critical, free and politically reflexive individuals was certainly an example of a progressive and enlightened European citizenship and a sign of a deliberative democracy. The struggle towards the emergence of a European deliberative democracy, i.e., a democracy that “focuses on social movements, and on the civil, cultural, religious, artistic, and political associations of the unofficial public sphere, as well” (Benhabib, 2002: 21) has certainly prompted a debate from

²⁵ See D. della Porta et al. research work’s results: “[...], we assume that the printed media are one of the most important arenas of public claim-making, and that most actors will, at one stage or another, try to make their views public.” (della Porta & Caiani, 2009: 30)

²⁶ According with a recent case study about “French Sociologist and the Public Space of the Press” by Laurent Jeanpierre and Sébastien Mosbah-Natanson (2009:179; 185), *Le Monde* journalists tend to favour sociology over economics and humanities. Sociology consider as a counterweight to the “hegemony of economics as a mode for problematizing and constructing public issues”

²⁷ They shared in this article the following premises: “the determination of a European political responsibilities beyond any Eurocentrism; the call for a renewed confirmation and effective transformation of international law and its institutions, in particular the UN; a new conception and a new praxis for the distribution of state authority, etc., according to the spirit, if not the precise sense, that refers back to the Kantian tradition” (Habermas, Derrida, 2003: 1).

below between the voices of EU civil society actors. Since 2002 activists have, as well, come together in European Social Forums. Some persist that the growing relevance of social movements²⁸ in Europe is a consequence of the encroaching capital-market liberalization. The Lisbon Treaty, for instance, which dismantled the welfare state in the name of free competition, and the current economic instability in Europe have stimulated new transnational social movements that contest, challenge and call into question the dominance of what J. Stiglitz calls the market fundamentalism. The recent marches in Europe (e.g. Indignant demonstrations), especially in the southern countries, against a self-regulating market, against the austerity measures, high unemployment rate, precariousness and exclusion, present a common framework of action and resistance. Such wave of a generalized societal discontent in Europe has intensified alliances between NGOs, Unions, Parties and European citizens. Moreover, and even though the “conditions of plurality of values, repertoires, traditions and political cultures, where people have different perspectives” D. della Porta (2005: 340f) suggests that they now face common problems.

The recent protests in Europe, especially in southern Europe, involve a strong socio-economic orientation and agenda and are highly motivated by a collective common goal: social self-protection. Similar to the old, classical social movements (labour struggle), and differently from the ones of the mid-60s headed by the sons and daughters of the Welfare state (Rootes, 1995), in which all demanded recognition of all kinds of rights – cultural, economic, national, generational and sexual rights (Touraine, [2005] 2007). The current social movements fight back against the implementation, in the name of integration, of restrictive EU’s economic and political policies. Europeans symptomatic felling of *Unsicherheit* and the global awareness of the failings of free market liberalization has, however, strengthened the affiliation of an intellectual elite with other networks of resistance and solidarity. These intellectuals are not really engaged in the classical role of organizer, on centralizing for her/himself the decision-making and division of labour, rather they have developed new intervention strategies. In a glance, from S. Hessel *Indignez-vous* (2010)’ slogan “create is to resist, resist is to create”, to J. Habermas²⁹, J. Derrida, S. Zizek’s media strategy

²⁸ “Social movements are conceptualized as dense informal networks of collective actors involved in conflictual relations with clearly identified opponents, which share a distinct collective identity, using mainly protests as their modus operandi. In this sense, they tend to overlap, at least in part, with civil society actors, usually identified with a set of voluntary associations, distinct from both the state and the market and sharing some common, civic values” (Della Porta and Caiani, 2009: 6)

²⁹ See for instance Habermas’ article “Rendons l’Europe plus démocratique ! La crise européenne”, published in *Le Monde*, 25.10.11

and Fernando Savater's involvement in virtual forums of activists - there is a clear commitment with society and social justice.

Yet, these intellectuals do no longer present solutions. P. Bourdieu (1998: 58) emphasizes the *modus operandi* of intellectuals in a context of neo-liberalism and in a global risk society "is not only to invent responses, but to invent a way of inventing responses, to invent a new form of organization of the work of contestation and of organization of contestation, of the task of activism." For J. Habermas, their "[...] sense for what is lacking and 'could be otherwise' [...] spark of imagination in conceiving of alternatives; and a modicum of the courage required for polarizing, provoking, and pamphleteering (Habermas, 2009)³⁰ makes them privileged players that animate the *civitas*, forge synergies and inspire new forms of reflection and demands.³¹ In the meantime, F. Savater responded in an interview of *El País* last February (25th, 2012) [Cultura, 25 Feb. 2012] that intellectuals should not only bring to the public debate proposals that transcend the usual political pragmatism, but as well they should enrich the comprehension, instead of the confusion or the simplification of these themes.³² In short, we can conclude these intellectuals remind the "Peoples of Europe" the need of a participatory European citizenry based on critical thinking, political reasoning and free discussion. According to them, to create a "social Europe" and restore our utopias, "[...] we must create",

³⁰ Compare B. A. Misztal (2007: 36-37) "Creativity is a means that enables intellectuals to participate in the realm of knowledge and to transcend their professional specializations into critical sensitivity, and by this process to ensure their authority as critic-specialists. By emphasizing creativity as one of the main characteristics of the intellectual role, we can hold that the creative achievements of intellectuals, while taking place against a background of specialist knowledge, also refers to the movement from specialized domains of scholarship into domains of public debate and back. The courage of conviction, as the necessary precondition for speaking in defiance of the established powers and the public, also contributes to public intellectuals' special authority."

³¹ Compare Morris et al. (2004: 171), "Leaders are critical to social movements: they inspire commitment, mobilize resources, create and recognize opportunities, devise strategies, frame demands, and influence outcomes". Aldon Morris and Suzanne Staggborg (2004: 175) conclude in their study "Leadership in Social Movements" that leaders usually possess a greater cultural and educational capital than other activists. They stress that "[t]o be successful, social movements require that a myriad of intellectual tasks be performed extremely well. A host of social movement activities – framing, interfacing with media, writing, orating, devising strategies and tactics, creatively synthesizing information gleaned from local, national, and international venues, dialoguing with internal and external elites, improvising and innovating, developing rationales for coalition building and channeling emotions – are primarily intellectual tasks."

³² ["Los intelectuales son escritores, profesores y artistas que quieren hacerse oír fuera de sus áreas de trabajo sobre cuestiones políticas y sociales. Deberían aportar al debate público argumentos o propuestas que trascendiesen las cautelas del pragmatismo político habitual, para así enriquecer la comprensión y no la confusión o la simplificación de esos temas"].

emphasizes P. Bourdieu, a European social movement.” (2000). In other words, to recover the founding values of Europe, citizens must revitalize the EU’s public sphere now strongly-bureaucratized, “colonized” by the economic imperatives of the “System” and by a top-down political model (Habermas [1981], Benhabib, [2002]). Thus, explains J. Habermas, “[a] public sphere that functions politically requires more than the institutional guarantees of the constitutional state; it also needs the supportive spirit of cultural traditions and patterns of socialization, of the political culture, of a populace accustomed to freedom” (1992: 453).

In a nutshell, this paper suggests that the resurgence of critical intervention and political engagement of civic-minded intellectuals in the public arena has been contributing to a greater vitality and re-politicization of public sphere. In this dramatic moment of the European history, the responsibility to speak truth to society (Melzer, 2003, p. 11) becomes once again the fundamental task of contemporary intellectuals. Such commitment with “transparency and justice [...] requires the active public participation of public intellectuals in expanding the democratic imagination and civic sensitivity of citizens and their leaders alike” (Misztal, 2007, p. 4).

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PSYCHOHISTORY OF THE 2012 QUÉBEC STUDENT REVOLT

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Abstract

This paper examines the psychohistory and consequences of the massive student demonstrations, often featuring mass erotic displays, which erupted in Montréal, Québec, in 2012. These marches, to protest an increase in university fees proposed by the education ministry as an austerity measure, provoked a political crisis that brought down the democratically-elected government of the province. The crisis reflected the historical isolation of Québec, the socioeconomic structure which has emerged there as a substitute for organized religion, and the psychological dependency fostered by a utopian political system, which have all fed a strong sense of entitlement in many citizens, enabled by a benevolent mother-state. This cultural pattern encouraged students to make 'impossible' financial demands, while resenting the state as an insufficiently-indulgent parent who was hindering their wish-fulfillment fantasies. These unprecedented events, which carry serious implications for the future of welfare-state liberal democracy, can best be understood by examining the history, culture, and family dynamics of the distinctive society of Québec.

Keywords: Political demonstrations, university fees, Québec.

Psychohistory of the 2012 Québec Student Revolt

Introduction

For seven months in 2012, a series of major student demonstrations and riots suddenly erupted in the streets of Montréal in order to protest a modest proposed increase in Québec university fees, although at about \$2200 per year they are by far the lowest in Canada or North America (Statistics Canada: Undergraduate tuition fees, 2015). These massive protests often involved 150,000 - 200,000 students marching through the streets of Montreal, sometimes nearly naked, and convulsed the province so as to bring down and triumphantly replace the government (Wikipedia: Quebec Student Protests, 2015). What caused this massive and violent emotional reaction, so disproportionate to the small sums involved? (And so incongruous in

Canada, the fifth most prosperous country in the world; Macias, 2015).

Outside of Québec these events are less well-known than the Paris riots of 1968, or the US civil-rights marches and anti-Vietnam war protests of the sixties, which also involved students, but demonstrating for the rights of others rather than themselves. They have historical importance since, remarkably, they succeeded in their aims and showed for the first time how a determined, self-interested clique (representing at most about 3% of the population) may override the other 97%, paralyze the political system, and forcibly divert the resources of society to their own unearned benefit. For the mob to bring down a democratically-elected government in this way is unparalleled in North America for nearly two centuries, and in Canada only the anti-conscription riots of 1918 have come close, although in that case the government prevailed. We must examine the historical and psychological forces that led to this sudden eruption of seemingly irrational protest on the part of young people who are mostly privileged rather than downtrodden.

These events can only be understood as the *combined* effect of history, politics, economics, psychology, sociology and religion. They make no sense if viewed from the perspective of a single discipline, e.g., exchange theory and classical economics would predict that the students of Québec, being wealthier, would be more satisfied than those of other provinces, not less. Nor can the 'pure joy of rioting' (Dalrymple, 2015) explain these prolonged demonstrations, which are still occurring intermittently three years later.

The roots of French Canada

The primal trauma for French Canadians remains the British military invasion of Québec in 1759 (Wikipedia: Canada, 2015) which suddenly turned their flourishing pioneer settlement, founded in 1608, into a colony ruled by Great Britain, the detested enemy that was carrying out ethnic cleansing in French Acadia to the east. French Canadians were abandoned by France to survive alone in the new world, and the half-hearted union of English-speaking colonies with Québec to form the federal nation of Canada in 1867, a classic bad marriage, did not relieve this sense of orphanhood. Although the Québec population, mostly French-speaking and Catholic, has grown from 60,000 at the time of the conquest to eight millions today, due to church dogma making fecundity and motherhood sacred, indeed almost obligatory (Bélanger, 2000), its unique situation in North America leaves it today as an ethnic enclave, more populous than Denmark or Finland, but hemmed in by three hundred million anglophones. Quebecers turned to nationalism to survive psychologically as francophones linked in one big family, *maîtres chez nous*. The symbols of this 'nation', venerated to the bounds of reason, include the French language, poutine, ice hockey, and the

singer Céline Dion. *Nous ne sommes pas comme les autres!*

The death of religion

The authoritarian hierarchy of the Catholic church which for centuries ruled strictly over this society was composed of traditional symbols of the family: 'sister' nuns, 'brother' monks, and 'father' priests, all united in the mother church under the ultimate maternal symbol, the sacred Virgin Mary. To be a Catholic was to find a secure place within this family when there was no other national sanctuary. Québec was conquered in the religion-dominated era of Louis XV, and for long was unaffected by the Enlightenment ideas of the French and American revolutions, so that Protestants and anglophones within living memory could still be described literally as agents of the devil. Jews were regarded similarly (Gladstone, 2011).

Massive, financially burdensome religious organizations abounded, and held society in an authoritarian embrace. There was much poverty, save among the wealthy elite, with little economic development, and true democracy was unknown for centuries, as shown by the rule of the dictator Maurice Duplessis as late as 1959. Contraception, abortion and divorce were illegal only a few decades ago, while women's suffrage came in 1940 (Kalbfleisch, 2012). Strict sexual repression was the norm, combined with extreme political conservatism.

However, starting around 1960 this system rapidly collapsed under the influence of consumerism, industrialization and education, and the overthrow of religious authority figures soon followed as their roles were transferred to the political leaders of the Quiet Revolution (Canadian Encyclopedia, 2015). Within a generation, the culture changed from ultra-traditional to ultra-'progressive' and highly permissive, as families of nearly seven children on average were replaced by one of the world's lowest birth rates, while cohabitation, illegitimacy, abortion and divorce flourished. Atheism, hedonism, and promiscuity have largely become the norms, while measures of social pathology are rising, such as crime, suicide and substance abuse (Langlois et al., 1992). Most laws are lax, and are barely enforced. The great empty monasteries, convents and churches have been converted to restaurants or colleges today, with the Catholic religion almost non-existent. As is common when strict parental control is suddenly lifted, the people swung to the opposite extreme of uncontrolled, libidinal behavior - a process that also occurred, in more catastrophic form, in the liberated former African colonies of France and Great Britain. As family breakdown is common in Québec today, and above the level of the other provinces, at least one third of children have neither a real father in the home to provide a role model (Employment and Social Development Canada, 2015), nor even a surrogate

Christian one that they can internalize. This is a classic post-modern dilemma, taken to extremes.

Rise of the Québec mother-state

In Freudian terms, when the adult finally confronts his father, he wishes to destroy him and to possess the mother, yet also to imitate the father in replacing him. In the politics of Québec, this meant that massive new institutions of civil society, the benevolent government agencies, hospitals, and universities eagerly replaced the all-powerful Church, authoritarian yet benevolent and forgiving. This transformation was similar to what was then occurring in France, and in some ways it has succeeded, so that Québec today qualifies as a tolerant and humane society; but without the emotional force of religion and its taboos, there is little profound motive for obedience to the restrictive rules of civil society. Consequently corruption on a heroic scale is ubiquitous in both business and politics, as is being shown today in the numerous billion-dollar scandals revealed by the Charbonneau Commission (CBC, 2015).

Another fundamental problem is that while the Church preaches unconditional love, in fact its charity is limited and carefully measured out to the faithful, with some obligations implied on the recipient. But when society relies upon on a civil society with utopian aims, run by a privileged elite whose role is to hand out as much of other people's money as possible, an infantilizing culture of mass dependency is created that is open-ended and crushingly expensive.

Despite having some of the highest tax rates in the world, so that many middle-class citizens pay over half their income in taxes (Kozhaya, 2004), Québec's public debt of over \$68,000 per taxpayer is the worst in Canada, drawing comparisons with Greece and Portugal (MEI, 2015). Individual rights and entitlements are almost unlimited, and the corresponding obligations on the all-providing state know no bounds. Thus the citizen of Québec is born in a government-run hospital, to parents who receive paid leave, and will then attend daycare, primary school, high school, junior college, and university, all provided largely by the government. He very often works for the government, directly or indirectly. He also receives lifelong medicare, and enjoys unemployment and disability protection. His tattoos can be removed for free. He is compensated if he is injured in an accident or during a crime, even one that he is committing, and when he retires he will receive a state pension. When he dies his family will receive funeral expenses. Business corporations receive billions in subsidies, often specious and nepotistic, and the government runs hundreds of money-losing state corporations. Every member of the family is served double helpings of dessert under this system.

Child-citizens?

The traditional church, like the state, had the roles of both a nurturant mother and a more restrictive father. But as the state took over in Québec, with seemingly unlimited resources to bestow, the former role came to predominate, as almost nothing could now be forbidden for fear of alienating voters or special interest groups. This mother-state resembles an indulgent mom rather than a strict nanny, and people speak scornfully of anyone (except themselves) who is receiving this largesse as "sucking on the government teat". The more that is given the more is demanded, and the less autonomy is shown, leading in turn to still greater demands by the child-citizens. Tough love is nowhere to be seen. To 'enable' this psychological dependency, and to generate revenue, the almighty state through its lavish advertising campaigns endlessly urges the public to gamble away even *more* money in its ubiquitous casinos, online gaming sites, and corner-store lottery outlets, and to consume *more* alcohol through its aggressive promotions in state liquor stores (Kucharsky, 2006).

The psychological result is a pervasive state of dependency in the population and a general sense of entitlement: what will the all-powerful state do for me, in its role as surrogate parent? Where is my free lunch (and breakfast, and supper)? This is a system literally of 'bread and circuses', as seen in the government-sponsored Cirque du Soleil and the many lavish street festivals that are provided by cities to entertain the masses even as potholes go unattended and bridges collapse (Peritz, 2011).

This situation is parallel to Québec's relationship with the federal government based in Ottawa, which functions as a surrogate grandfather figure in that it reproaches Québec for its profligate spending, but continues to enable this behavior by pouring large sums of money into the province: some \$8 billion annually that is taken from the wealthier provinces (Wikipedia: Equalization payments, 2015). This aid, much more than other regions of Canada receive, is met with resentment on the part of Quebecers instead of gratitude. As parents know, no good deed goes unpunished, and there is an active separatist movement which commands about 40% support currently.

The fees crisis of 2012

Québec has of course shared in the global economic woes of the great recession, and its public debt has become ever more uncontrollable. Thus in 2012, among other austerity measures aimed at controlling the debt crisis, the Liberal government of Jean Charest was forced to announce that it would raise university fees modestly. In this statist system all the fees are set by the provincial government (private universities are outlawed) and at about \$2200 per year for an undergraduate in a non-professional program are remarkably

low - often a tenth or a twentieth of the fees at comparable US universities, and less than a third of the fees in other Canadian provinces (Bishop's University, 2015). By contrast, a student from Alberta, coming from 'outside the family', must pay \$7800 in order to study in Québec, even though his wealthy province props up Québec with billions of dollars.

Fees have been frozen for twenty years, steadily shrinking in real terms with inflation, and now cover only a tenth of the actual tuition cost per student. In addition, both the government and individual universities provide an extensive program of scholarships, loans and bursaries to benefit those students who come from poorer backgrounds.

One might expect that a proposed increase of about \$1600, introduced gradually over a six-year time period, would be accepted as a reasonable contribution to the financial health of the province (Serebrin, 2011). A hike of \$325 in the first year is the price of a cell phone; or consider the student automobiles which proliferate on campus so as to cause major parking problems. But this proposal was rejected by many francophone students, perhaps a third of the total. Although students in professional programs, graduate studies, or the anglophone universities showed no interest in protests, large crowds of francophones from general education and liberal arts programs immediately started spontaneously to assemble and to march in the streets, mostly in Montréal. Many classes were subjected to a comprehensive boycott, intended to be universal across the province. Disruptive sit-ins took place in government offices, causing some injuries and damage (CTV News, 2012).

The long "strike"

This intransigence was maintained over the next seven months as large crowds, sometimes extending over 50 blocks, showed their outrage over the proposed fee increase. Although most marches were peaceful, even as the numbers swelled towards 200,000, some ugly incidents occurred, particularly when other students who did not wish to participate were forcibly prevented from entering their classrooms to attend their courses. The police on occasion responded violently to incidents of vandalism, and one student suffered a concussion and lost an eye. Others were injured, and at least 2,500 students were arrested, often paying fines of \$500 each (Wikipedia: Quebec Student Protests, 2015).

The protesters misrepresented their actions as a "strike", but in fact it was a boycott. Rather than withdrawing paid labor to obtain higher pay, they were essentially saying that the considerable financial *gift* bestowed in them by society, equivalent to about \$30,000 annually per student (Corbeil, 2012) was not large enough and they wanted more, even as the rest of society was tightening its belt. Responding to a gift by angrily demanding a larger one is

a reaction seldom found outside of the nursery.

The government soon showed that it was unwilling to confront the marchers, or even to ignore them. Rather than standing its ground as a legitimate authority, it first attempted to appease them by offering to spread out the fee hike and to increase the bursary program. The total amount would now come to \$1,778 in 2018-2019, after seven annual increases of \$254. Education minister Line Beauchamp told reporters that after including the income-tax credit on tuition fees, the proposed increase would be \$177 a year, or 50 cents a day! (Dougherty, 2012).

This reasonable offer was contemptuously rejected, and some student leaders demanded *zero* fees as their goal (as they still do). Soon the minister of education resigned in despair from her post and left politics, observing that the students neither wished to resolve the dispute nor to respect democracy. Since this minister happened to be female, and as the mother is expected to bestow gifts unstintingly on the children even as the father counts the costs, this unconscious gender association perhaps aggravated the underlying psychic tension already present in the negotiations. Panicking, the political leaders hastily brought in unworkable emergency laws intended to control street demonstrations, such as forbidding the wearing of masks (Wikipedia: Bill 78, 2015). Clearly they were no longer in control. The winter semester was suspended at over twenty campuses (Bell, 2012).

The government was thus in the position of parents whose unemployed son, living in the basement on a good allowance, replies to requests that he should contribute a little to the family budget by angrily demanding a larger allowance. Although its case in terms of economics, political legitimacy, and ethics was self-evident, the state could deny nothing to its offspring, psychologically mired as it was in enabling a mutual-dependency relationship with them. This craving of the students for more money in essence represents an unfulfillable quest for boundless love.

A children's crusade?

The most startling feature of the protests was that the marchers on some days were almost naked, both males and females wearing just underwear - or even less, such as a mere penis-sheath (Figure 1), with the women's breasts often bare save for the nipples (see Figures 2, 3 and 4). Eros ruled, and the marchers seemed to revel in flaunting their sexuality and child-like status, explicitly repudiating patriarchy (Figure 5). The marchers all wore a small red oblong of felt as their key symbol, the *carré rouge*, resembling a sacred heart or a bloodied tampon, surely in unconscious ritual tribute to the life-giving mother figure of the state, or Marianne in Gallic terms (Figure 6). The symbol also evokes 'flying the red flag', the local euphemism for menstruation. The color red here was not a communist

symbol: there was no sign of the hammer and sickle, nor of Marxist ideology, and many of the marchers were clearly petit-bourgeois. (Their figurehead leader was the multi-millionaire politician Pauline Marois, who drove a Ferrari). Other student leaders were the privileged products of private schools.

Despite occasional violence and vandalism, an atmosphere of saturnalia prevailed overall, with gaiety and colorful costumes. The marchers also carried saucepans, hammering on them with spoons to create an overwhelming din. Marois, then the leader of the official opposition in the Québec parliament, gleefully marched with the students, likewise beating on a pot like a hungry child who pounds her spoon impatiently on the dinner-table (Barron, 2015).

These events often evoke aspects of the French Revolution, and observing these joyous scenes might once have evoked Wordsworth's happy reaction (1805) to its early stages: "Bliss was it in that dawn to be alive, but to be young was very Heaven." Today, however, we might echo Albin Lentz, the college president in Philip Roth's novel *Indignation*, who dismisses the students taking part in a panty-raid riot as "A mob of disobedient children. Kiddies in diapers unconstrained". "An army of hoodlums," Lentz calls the rioting students, "imagining, apparently, that they were emancipating themselves." (Roth, 2008).

The implications of these events are troubling, as the rioters were not just engaged in erotic adolescent fun, but sincerely believed that they were promoting a worthy social cause to improve society. Some marchers carried signs saying "Democracy", although their actions in fact destroyed the democratic process to serve their own ends. *It's all about me!* Other signs read "Free Education", meaning that other people, some of them not well off, must pay for the entire education of mostly middle class students. Education that is 93% free (the current figure) is not enough, it must be 100% "free" (Corbeil, 2012).

"Victory"

After seven months in which the demonstrations were growing rather than declining, to the dismay of the public, the Liberal government admitted defeat and stepped down prematurely, triggering a general election. Even though the public was split over the protest movement, the failure of a parent to control a misbehaving child often annoys the onlookers more than does the child itself, and so the formerly popular Premier Jean Charest was crushingly defeated at the polls, losing power and even his own seat in the legislature (National Post, 2012). Marois thereby rose overnight from leading the marchers in the streets to become the first female Premier of Québec. But only two years later she was in turn humiliatingly ejected from power in

another general election, also losing her own seat (Coorsh, 2014). The two major student protest leaders were likewise elected to the legislature in 2012, but then defeated in 2014, again showing the turbulent emotions aroused in the electorate by the protests.

The Liberal Party has thus returned to power, but, emotionally scarred, it now does not dare even to *discuss* university fees, which with inflation continue to decrease. It has been thoroughly intimidated and is in effect forbidden from governing. Student power has triumphed.

Ironically, if we ignore the budget deficit, then in terms of simple logic, the students might appear to have a case, as zero tuition fees for universities are found in Scandinavia, Germany and Scotland, for example. But such a context involves a sound economy and a mature acceptance of student responsibilities that is quite different from the cultural and historical pattern of Québec. Today, US Senator Bernie Sanders has introduced a utopian bill that would provide free tuition at all 4-year colleges in the United States (Thomason, 2015), although there is no chance of it passing. The likely costs over ten years would total \$470 billion.

It is also undeniable that ongoing looting of the public purse by various other privileged sectors of society is comparably egregious, yet unpunished. And as some student leaders remarked, all the \$400 million cost of the fee increases could have been met if Canada had bought just one less F-35 fighter jet in its current defense procurement, since these ultimately may cost approximately two billion dollars apiece to buy and maintain (Pugliese, 2014).

This argument uses the metaphor of relying upon a rich grandfather, although in fact defense is not a provincial responsibility. However, the craving to acquire such insane weapons of death and destruction, driven ultimately as it is by Thanatos, cannot compete in intensity with the unrestrained urgings of Eros; no one marches for more jet fighters. And the joyous mob could even be seen as celebrating a victory over feelings of death, according to the theory of terror management (Parry, 2015).

The future for Québec

We see that an isolated group whose identity, beyond language, was largely based on the parental symbols of organized religion, turned massively to the state as their nurturing and forgiving mother figure when the church declined and family ties fragmented. Any child's mother is the most important figure in their early life, but today the all-bestowing welfare state will rapidly supplant her. And since this mother state, while utopian in theory, is a financial disaster in practice, the offspring will demand more money at the very point where its financial resources are becoming less. The aboriginal reservations within the province illustrate the results of total

dependency on the state, with extreme levels today of substance abuse, smoking, violence, child abuse, suicide, homicide, destitution (Curtis & Ayala, 2014), and drastically shortened life expectancy (Statistics Canada: Life expectancy, 2015), although in precolonial times these tribes were well able to survive the rigors of living in tents at temperatures of thirty or forty below zero.

All universities in the province are now in debt, and trying to cope with large deficits by using underpaid part-time instructors to teach enormous classes, cancelling smaller programs, and admitting unqualified entrants. The quality of education is suffering and gloom prevails in academe (Samoisette & Zizian, 2013). As additional government funding is unlikely when the province is financially squeezed, this creates a lose-lose situation for all concerned, except perhaps the students in a narrow financial sense, although the education of many was disrupted by their boycott of seven months of classes.

These universities are now in a desperate situation, awash with red ink while paying tenured professors salaries of up to \$150,000 and rectors up to \$400,000 per annum. They must admit more and more students, setting up a vicious cycle, so that about half the population now enters higher education programs (Statistics Canada: Postsecondary participation rates, 2008). These are of dubious value, and are taken for reasons that outside of the professional and scientific courses are often unclear, beyond providing three or four enjoyable years of beer, sex, drugs, and sport. These programs are ruled over, and mainly paid for, by the aptly titled Québec Ministry of Education, Leisure and Sport. About a third of entering students soon become bored, and drop out of their studies within a year or so (Aubin, 2012).

This make-believe scenario is paid for by a government that is trapped in credit-card debt: the parents have no more pocket money to hand out. A parallel is seen in the destructive youth riots in Paris during 2010 that successfully blocked the French government, which likewise was presiding over a financially parlous mother-state, from modestly reforming the nation's labor laws and retirement age in order to match economic reality (Wikipedia: 2010 French pension reform strikes, 2015). By contrast, the less indulgent society of England experienced only minor student demonstrations when in 2010 it abruptly raised university fees from \$5,000 to \$15,000 (Wikipedia: 2010 United Kingdom student protests, 2015). In Québec the future for universities and other institutions of civil society appears bleak, as the psychological issue of dependency versus autonomy remains unresolved, and dependency is typically a progressive condition.

Conclusion: Whither democracy?

The worst result is that the fundamental processes of liberal democracy are unravelling. We are forced to confront what we knew all along, that a spoiled child will howl when asked to behave properly, and that it is almost impossible to control a screaming infant. "To be a customer without the responsibility of paying for goods or benefits received is to be an egotist permanently resentful at not getting what you want immediately, which becomes the only criterion of satisfaction", as observed by Theodore Dalrymple (2004).

Other interest groups are now following this pattern, the students' decisive victory providing a tempting model for any interest group hoping to overthrow or suspend legitimate authority. Thus the Montréal firefighters on August 18, 2014, invaded the City Hall council chamber during a council meeting and thoroughly trashed it, aiming to block pension plan reforms. The councilors fled the chamber in alarm as the police stood by, gloating happily, since they too have lately been engaging in theatrical and disruptive public protests for more money. Some 2320 city workers left their posts during this event. These firefighters, like other public employees, enjoy rights that most taxpayers would envy, as they retire on average at 53, with a full pension.

Similarly, in spring 2015, violent demonstrations have again erupted, this time in an ugly form at Université du Québec à Montreal, in which buildings were damaged, classes disrupted, and non-striking students were forcibly prevented from attending their classes (Charnalia, 2015). Therefore de facto, if not de jure, the mob now rules, as laws may be introduced only with their consent. Anarchy spreads sporadically while the economy of Québec flounders. Smash the system! (Figure 7). Another related but distinct trend is the emergence of the FEMEN protest organization: multinational, exclusively female, and concerned with a wide range of causes undertaken for reasons of altruism rather than personal gain (Figure 8).

Although the 40% of Québec citizens who pay no income tax may not see a need for change, this developing malaise could ultimately cause working citizens to look for a strongman leader who promises to fulfil the paternal disciplinary role, as the political situation slowly comes to resemble the crises during the nineteen-thirties that led to fascist regimes in many European countries. The various thugs who then emerged as national father-figures, promising forcibly to clean up the "scum" in the streets, to echo President Sarkozy (Samuel, 2014), came to power enjoying great popularity, as a family will often prefer a ruffian father to having none at all. Disciplined, authoritarian followers convey an image of internalized paternal power and authority instead of infantile dependency, a message which might offer some members of the weary public an attractive antidote to the

tantrums of the students who took over the streets to flaunt their dependency with such devastating success.

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Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Eugène Delacroix, *July 28: Liberty Leading the People*, 1830, oil on canvas, approximately 11.8 x 8.2 feet.
(Louvre, Paris)

Figure 6



Figure 7



Figure 8

MATHEMATICAL CONTENTS THROUGH TALES

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Abstract

This work is about the contest “A tale that accounts” which is promoted by an organizing committee with the collaboration of Regional Delegation of South and Islands of the Portuguese Mathematical Society. This contest is open to all students of public and private schools of all country and consists of writing and illustrating a tale involving mathematical contents. The contest, which is now in its third edition, began in the school year of 2012/2013. The experience allows us to point out that it promotes the interdisciplinary between different contents and revealed to be a captivating initiative that has been well accepted by a growing number of students and teachers.

Keywords: Interdisciplinary, Mathematics, Imagination, Knowledge

Introduction

The contest “A tale that accounts” (Concurso “Um conto que contas”, in Portuguese language) is open to all students of public and private schools of all country, from the first level of first cycle to the last level of secondary. In Portugal, the basic education is consisted of nine years of schooling, divided into three sequential cycles of four, two and three years, respectively, and the secondary education which is consisted of three years of schooling.

The competition consists of writing and illustrating a tale involving mathematical contents and it has as main objectives to promote habits of reading and writing in students and to promote coordination between various disciplines, stimulating the imagination.

The participants can compete in one of eight categories, according to their level of education, in individual modality or in team, with a maximum of four elements.

The eight categories that participants can compete, four in individual modality or in team, are:

- a) 1st category or category A1 – a competitor of the 1st, 2nd, 3rd or 4th year;
- b) 2nd category or category A2 – a competitor of the 5th or 6th year;
- c) 3rd category or category A3 – a competitor of the 7th, 8th or 9th year;
- d) 4th category or category A4 – a competitor of the 10th, 11th or 12th year;
- e) 5th category or category B1 – two to four competitors of the 1st, 2nd, 3rd or 4th year;
- f) 6th category or category B2 – two to four competitors of the 5th or 6th year;
- g) 7th category or category B3 – two to four competitors of the 7th, 8th or 9th year;
- h) 8th category or category B4 – two to four competitors of the 10th, 11th or 12th year.

Each tale must be accompanied by the title, the name of the author(s), the name of the responsible teacher by the participation of student(s), the name of the school and an illustrative design. The illustrative design should allow perceiving the central idea of the story.

The tales was assessed by a jury, which includes specialists from mathematics and Portuguese language. In this evaluation are valued mathematical contents (corresponding to the educational level of the participants and according to the official programs – see [5-8]), the domain of language, originality, creativity, logical narrative, among others.

The areas of the responsible teacher by the participation of students are mathematics, Portuguese language, English language, natural sciences, citizenship, art and visual technology, and also attended librarian teachers and teachers of first cycle.

Until now, there were three editions of the contest, the first of which in the school year 2012/13. The texts of the three tales highest rated in each of the eight categories were published annually in a book (see [1-3]).

The first edition – 2012/13:

In addition, the participants had to present the tales with the following specificities, namely the number of characters of each category, including blank spaces:

- a) categories A1 and B1 – between 5000 and 7500 characters;
- b) categories A2 and B2 – between 7500 and 10000 characters;
- c) categories A3 and B3 – between 10000 and 12500 characters;
- d) categories A4 and B4 – between 12500 and 15000 characters.

In this edition were not proposed any themes to the students, so that they could write about anything, since mathematical contents were included.

In the first edition of the contest were submitted 118 tales, 48 in individual modality and 70 in team (more specifically, 14 tales to the category A1, 14 tales to the category B1, 13 tales to the category A2, 21 tales to the category B2, 13 tales to the category A3, 25 tales to the category B3, 8 tales to the category A4 and 10 tales to the category B4). This contest was attended by 278 students, but it involved about 2100 students.



Figure 1. Image of the first edition of the contest “A tale that accounts”

The second edition – 2013/14:

In this edition the number of characters of each category, including blank spaces, was changed for:

- a) categories A1 and B1 – between 4000 and 6000 characters;
- b) categories A2 and B2 – between 6000 and 8000 characters;
- c) categories A3 and B3 – between 8000 and 10000 characters;
- d) categories A4 and B4 – between 10000 and 12000 characters.

In this year was proposed Mathematics of Planet Earth as general theme, in particular for each category were proposed the following themes:

- a) categories A1 and B1 – a planet to discover: oceans, meteorology and climate, mantle processes, natural resources, solar systems;
- b) categories A2 and B2 – a planet at risk: climate change, sustainable development, epidemics, invasive species, natural disasters;
- c) categories A3 and B3 – a planet organized by humans: political, economic, social systems and financial services, transport organization and communication networks, management of resources, energy;

d) categories A4 and B4 – a planet supported by life: Ecology, Biodiversity, evolution.

In the second edition of the contest were submitted 99 tales, 42 in individual modality and 57 in team (more specifically, 10 tales to the category A1, 11 tales to the category B1, 10 tales to the category A2, 18 tales to the category B2, 17 tales to the category A3, 26 tales to the category B3, 5 tales to the category A4 and 2 tales to the category B4). This contest was attended by 213 students, but it involved about 1063 students.



Figure 2. Image of the second edition of the contest “A tale that accounts”

The third edition - 2014/15:

In the last edition of the contest, the number of characters was the same of the second edition and were proposed the following themes:

- a) categories A1 and B1 – Mathematics and Nature;
- b) categories A2 and B2 – Mathematics and Sport;
- c) categories A3 and B3 – Mathematics and Magic;
- d) categories A4 and B4 – Mathematics and Art.

In the third edition of the contest were submitted 151 tales, 74 in individual modality and 77 in team (more specifically, 9 tales to the category A1, 16 tales to the category B1, 26 tales to the category A2, 20 tales to the category B2, 27 tales to the category A3, 35 tales to the category B3, 12 tales to the category A4 and 6 tales to the category B4). This contest was attended by 301 students, but it involved about 2920 students.

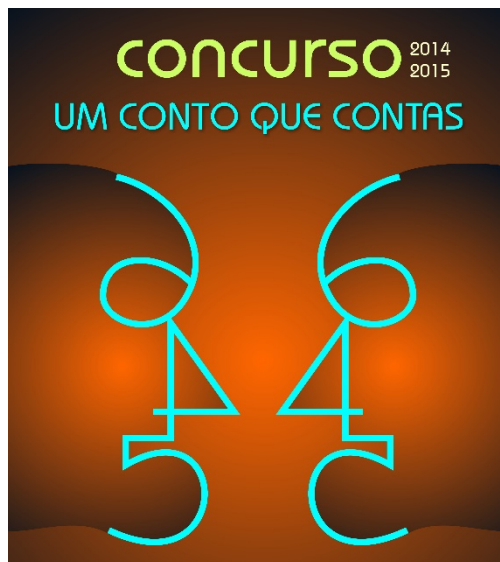


Figure 3. Image of the third edition of the contest “A tale that accounts”

Conclusion

The contest, during these three first editions, comes involving teachers of Mathematics, Portuguese language, and even other educational areas, as well as all students in an exploratory trip using creativity and imagination, applying the mathematical concepts as a common basis in the creation of the tales, and the interdisciplinary of various topics considered over the period of the student's learning from a very early age until the degree in high school.

In Table 1 we present the data of the three editions of competition, namely the number of tales submitted and the number of students involved.

	First edition 2012/13	Second edition 2013/14	Third edition 2014/15
Tales of category A1	14	10	9
Tales of category A2	13	10	26
Tales of category A3	13	17	27
Tales of category A4	8	5	12
Total of the individual tales	48	42	74
Tales of category B1	14	11	16
Tales of category B2	21	18	20
Tales of category B3	25	26	35
Tales of category B4	10	2	6
Total of the team tales	70	57	77
Total of the tales submitted	118	99	151
Attended students	278	213	301
Involving students	2100	1063	2920

Table 1. Data of the first three editions of contest “A tale that accounts”.

The Figures 4 and 5 show the evolution of the number of stories presented in eight categories. We can observe that the second and third categories, either individually or in teams, have more participation, wherein the category B3 is the more participated and the category B4 is the less participated.

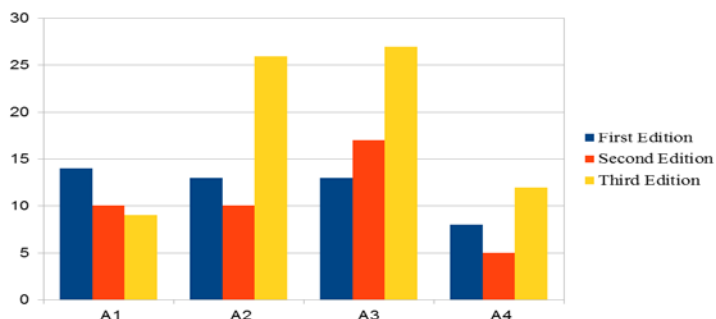


Figure 4. Graph with the number of tales in individual modality by category.

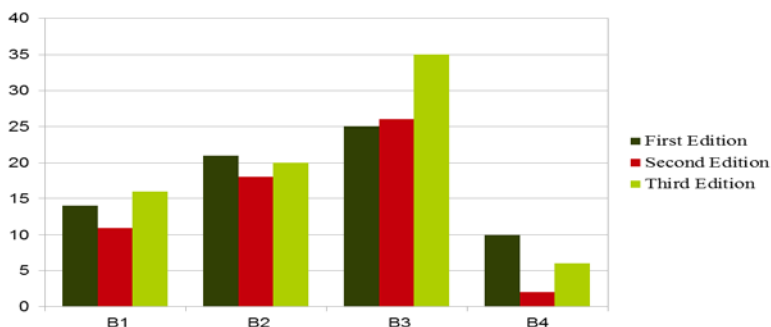


Figure 5. Graph with the number of tales in team modality by category.

In Figures 6, 7 and 8 we present pie charts with the data of all categories in each edition of the competition.

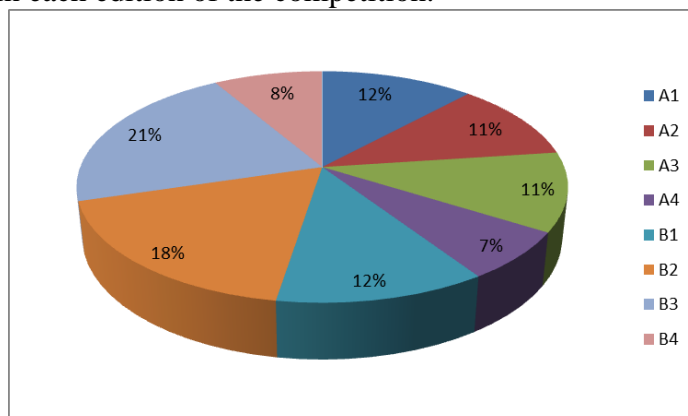


Figure 6. Graph with the percentage of tales by category in first edition.

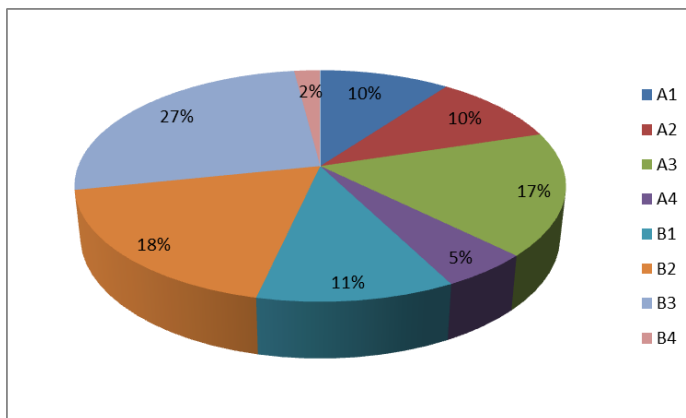


Figure 7. Graph with the percentage of tales by category in second edition.

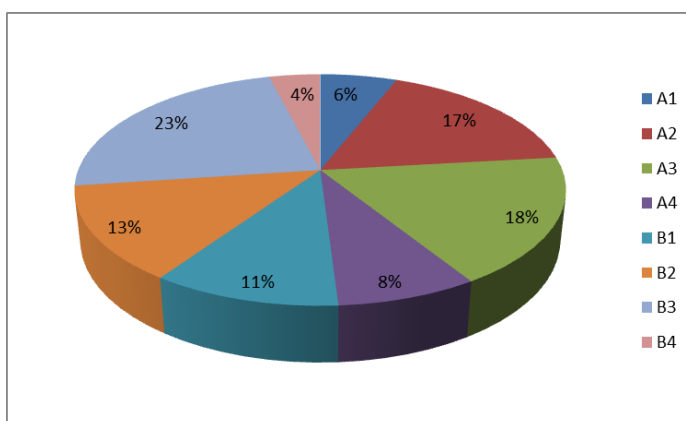


Figure 8. Graph with the percentage of tales by category in third edition.

This activity promotes an exchange of interdisciplinary experiences combining, as already mentioned, several areas of knowledge, in particular the Portuguese language and Mathematics. This promotes the enrichment of the relationship between students and teachers. For the student is a peculiar and interesting way to consolidate knowledge and for the teacher an effective and attractive way to promote the interdisciplinary between different contents.

Some teachers have referred that this creative process has been important in motivating all students, and not only students with better classification in Mathematics.

It should be noted that in this competition there is no prize money. In addition to the experience gained, the prize is a book with the compilation of the 24 winning tales, including the tales from first to third place in each of the eight categories.

Given the information from the first three editions, the good experiences are always contagious. We believe that the contest is a true stimulus among all students.

The sponsors of the contest have been the University of Évora, the Luís de Molina Foundation, the Research Centre in Mathematics and Applications of University of Évora, the Research Centre in Applied Mathematics and Technologies of Information of University of Azores, the Delta Cafés and the AMIL – Association of Interactive and Ludic Mathematics.

Acknowledgements:

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BEHAVIORS AND ATTITUDES IN THE TEACHING AND LEARNING OF GEOMETRY

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Abstract

This paper presents a case study about teaching and learning topics of Geometry that are part of the syllabus of high school courses. Internationally the teaching of Geometry has been the subject of several studies. Nevertheless, research continues to reveal that Geometry is still quite absent from the classrooms, especially in the early years; Geometry is disliked by most students, is misunderstood, and its notation is totally ignored. One of the reasons for this failure is that these issues are addressed superficially in the curriculum of the training teachers of Geometry. This paper describes the experience of teaching Geometry to a class with 90 students in academic year 2014-2015, enumerates some difficulties and behaviors faced by students and teachers, and exposes the results of the academic success.

Keywords: Geometry, teaching, learning, difficulties

Introduction

According to Isaac J. Schwatt “The average student seems to have less understanding of Geometry than of any other of the elementary mathematical disciplines. Even calculus is not excepted. This is in part due to the extreme difficulty of the subject of Geometry, the age at which the study of it is usually attempted, and the relatively small amount of time allotted to it” [4].

Given that the development of students’ capabilities in geometrical reasoning continues to be an issue of considerable international concern, this paper reports on an academic experiment in a Curricular Unit involving Geometry.

The Geometry topics taught in the degree of *Educação Básica*, from the University of Azores, present a low success rate. Moreover, failed students are put together in the same class as the students that are going to attend it for the first time. During seven years, the number of students in the class increased from 20 (the number of new enrollments per year) to 90. In

the academic year of 2014-2015 we split the class in three according to the students' knowledge. We based it on the outcome of a diagnostic test that assessed elementary notions on Geometry, for instance, the classification of triangles and quadrilaterals, the designation of angles as well as the incidence of point, line, and plane. The course Director timely informed students that a diagnostic test was going to take place. Despite that, only 70 students took the test. Based on the test results, the first class got 28 students enrolled, while the second and the third got 31 students.

We believe we set the conditions so that all students could attend classes. Week lectures are organized as follows: 2 hours for theoretical grounds, illustrated with application examples; 2 practical hours where students are motivated to solve problems and issues related to the theoretical content of that week; and 1 tutorial hour. Sadly, the number of students attending tutorial classes was only of 2 per week (on average) during the period of class. In addition, there is 1 office hour to answer to individual questions.

The goals of this subject are: develop Mathematics capabilities to be used as an instrument of interpretation and intervention in the society; develop the capacity to formulate and solve problems, as well as to train memory, to reason formally about problems, and to promote creativity; develop research, creativity, and autonomy capacity; establish a link between course contents and the curricular program of “Ensino Básico”; articulate the topics studied with the mathematical topics of the programs and curriculum guidelines for preschool, first and second cycles of basic education; and consolidate scientific knowledge in Geometry, in particular, plane and space geometry [2].

The Syllabus of the subject is: plane and space Geometry – basic concepts, definitions, and properties; polygons – general definitions, classification, and properties; polygons composition; relationship between triangle elements; congruence and similarity criteria; circumference – relative position between two circumferences and between a straight line and a circumference; relationship between polygons and the circumference; Analytical Geometry in the plane and in the space – coordinated system vectors, straight-line equations in the plane and space, plane equations; Topological Geometry in the space – relative positions between planes, relative positions of straight lines, relative positions between straight lines and planes, three-dimensional polyhedrons and curves; representation and planning of some solids; measure and base units – international system of units; measurement of base units length; plane figure area; prism volume; volume of cylinders, cones and spheres; area of a surface; time units [2].

The subject of this course is presented both in theoretical and practical lectures using computer-aided contents whenever needed. The

adopted methodology stimulates and privileges the active participation of students. The subjects are presented, discussed, and developed using problems and real situations. In order to consolidate the learning of the concepts, students are provided with exercise sheets on each course topic, as well as all additional material to support lectures [2].

The final grade is computed as the weighted average of two midterm written tests or, alternatively, a final-term written exam. The first written test assesses the skills required to Plane Geometry, while the second written test evaluates the skills required to Space Geometry.

Development

After reviewing several basic Geometry concepts, such as the notation of point, line, line segment, half-line, angle, perimeter, area and volume, and respective units of measurement, we still noticed a difficulty in the geometrical expressions of such concepts. The gaps make it difficult for students to acquire the desired knowledge as well as for teachers to devise methods to present the subjects in an understandable way. As an immediate consequence, students make a great number of mistakes and fail to acquire ground concepts that form building blocks for more advanced notions.

It was notorious the resistance to use an accurate notation. In addition to the notations presented, each student has a tendency to create his or her own notation, using various symbols for the same geometric element. The inconsistency and the notation abuse obstruct the students to understand his or her acquisition of knowledge and hinder the teacher in the correction, either in verbal form, whether in written form.

The weak or reduced concentration, the lack of motivation, the lack of language fastidiousness, the incomplete sentences, the immediate and hasty conclusions when they are not, the use of the design that does not correspond to the actual data assumed to be true, for instance, a draft of an isosceles triangle when it is scalene, the dependence on use of the calculator to perform basic operations, the lack of critical spirit, the wish of getting approved without knowledge, the use of a tutor rather than prompting the teacher, the gasp of inappropriate behavior in the classroom (cell phone, tablets, computers and side-by-side conversations unrelated to the matter under study), the entrance and exit of the classroom without proper teaching authorization restrict any kind of effort and strategy used by the teacher.

Without pretending to ridicule the students' answers, but showing the geometric immaturity of answers, we present two examples where there is a clear confusion between geometric figures in the plane and geometric figures in the space. It was observed in the 2nd written test, a true false question, that 11 of the 33 evaluated students responded, "the square is a polyhedron" (Figure 1). In another question, a student responds correctly that the sentence

"the base of a cone is a polygon" is false, correcting it and saying that "the base of a cone is a polyhedron" (Figure 2).

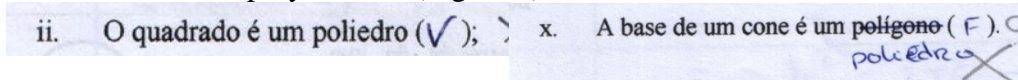


Figure 1. Example of mistake

Figure 2. Misconception

A fact that makes us always surprised is the confusion between the perimeter, the area, and the volume, and, specially, the use of measurement units.

It was asked in a written test, to compute the edge of the base of a quadrangular prism given its volume and height, expressed in different measurement units. We have witnessed two failures: (1) many of the students were not able to detect that the units of measure were different, so proceeded to normal division operation, interpreting the result as the desired answer; (2) others divided the volume by the height of the prism and interpreted the results of this operation as the desired edge length of prism. In fact, in these conditions when divided the volume by the height we get the area of the base of the prism. It was evident the exchange of measurement units. The worst confusion was the use of the squared measurement unit of the area for the length measurement unit of the base edge. Notice that the Units of Measure topic is introduced in elementary school, being constantly used throughout the academic path.

The teachers must use different strategies to fill such gaps. They must insist that students need to always keep in mind the unit of measure used, in particular, the use of linear units for lengths, quadratic units for areas, and cubic units for volumes.

According to our experience in teaching in different courses, we notice that in certain classes not directed to Mathematics there is a greater difficulty in abstracting Geometry problems. We reinforce at an early stage that the appropriate path must be from the concrete to the abstract. Another difficulty we noticed in teaching and learning Geometry is that a problem can be solved in several ways. So, there is not a single solution pattern that the students "memorize" and then "reply".

Below we present the graphics with our evaluation results. Figure 3 shows the evaluation results of the first written test, where from 90 students enrolled only 62 attended. From these 62 students, 8 got a positive grade, with values ranging from 9.5 to 14.1 out of 20. Only two students achieved the highest score. The lowest grade was 0. Under these conditions, the percentage of success in the first written test was 13%.

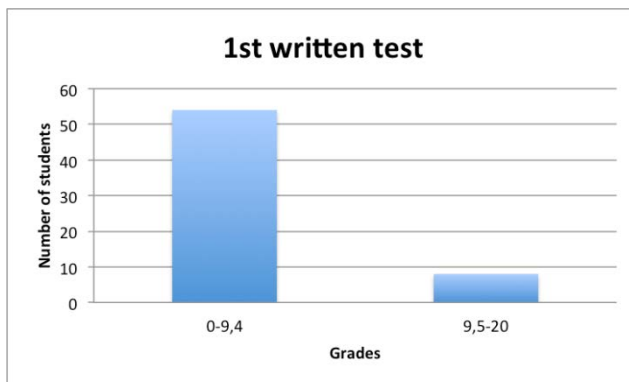


Figure 3. Results of 1st written test

In Figure 4 we observe the evaluation of the second written test. Of the 62 students who attend the first written test only 32 made the second written test. From these 32 students, 14 students got a positive grade, with values ranging from 9.5 to 19.2 out of 20. Only one student achieved the highest score. The lowest grade was 1.6. Under these conditions, the percentage of success in the second written test was 44%.

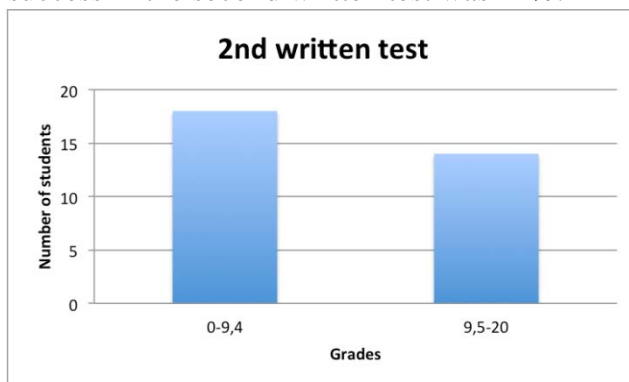


Figure 4. Results of 2nd written test

In order to give an overview of the general behavior, the Figure 5 depicts the evolution of the class. The columns represent: (a) the number of all students enrolled; (b) the average of the students who attended the geometry classes in the plane; (c) the number of students who carried out the first written test; (d) the student average that attended the geometry classes in space; (e) the number of students who made the second written test; and finally (f) the number of students that have achieved success in the Curricular Unit with the two written tests.

At the time of writing, it is impossible to inform the final performance of the class, since the exams period is still to come (from June, 15th to July, 17th of 2015).

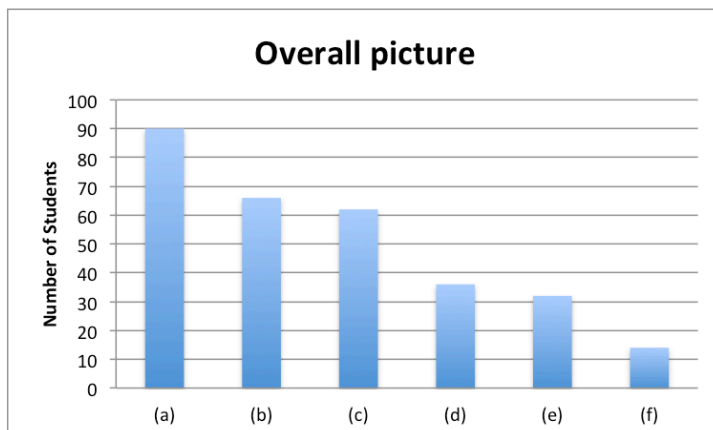


Figure 5. Evaluation of the class

With the help of the diagnostic test we were able to get a clear picture about the knowledge and skills degree of the class. Notice that only 12% of the group was in a position to be successful. Upon this background, some strategies have been applied to improve the knowledge. In the end, we achieved a success rate of 23%, which shows some improvement and a certain efficacy in the strategy we followed. Nevertheless, we are aware that there is still much work to be done.

Conclusion

Despite all efforts and exceptionally created conditions, the results were no better than in previous editions of the class. One of the reasons for the failure is the high degree of student absenteeism. From 90 students enrolled, 23 never attended any class.

We present the comments of Diana Lewis [1] on the causes for students not to like Geometry.

It goes without saying that students typically tend to dislike (or hate) Math more than other subjects.

As we know, many subjects fall under the Math umbrella, e.g., Algebra, Geometry, Trigonometry, Pre-Calculus, Calculus, and Statistics. But have you ever stopped to wonder why many students tend to struggle so much in Math?

Some answers:

1) Many students simply do not understand Geometry: while most subjects have something that students can relate to or find interesting, Geometry is conceptually difficult for some learners. Aside from not understanding it, most often they do not see why it is important for them to learn.

2) Geometry is not interactive: many subjects, like Language Arts, writing, and even Science can be very exciting for students because they get to actively take part in the learning process. Geometry may seem boring to them because they have to memorize and follow sets of rules, many of which do not have exceptions.

3) Poor relationship between student-teacher: If a student feels that she does not have a pleasant relationship with the Geometry teacher, the student may be more likely to do poorly in the class. When the class size is too big, the student can easily begin to feel lost and overlooked.

4) Negative experiences in previous Math classes: every student that has had at least one negative learning experience in her educational history, whether it was in elementary school, middle school, high school, college, or a trade school. Sometimes, all it takes is one negative experience to take the fun out of a subject forever. If this has happened to a student, it is important for them to try to reverse that process. Geometry can be very fun for students, but if they start in a state of mind that they hate Geometry, it would be very unfortunate and hinder their success.

To guarantee the success of the Geometry, either in teaching or in learning, its concepts must be explained and understood, never memorized by the use of its formulae. We cannot forget that we learn by doing!

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ONLINE SOCIAL NETWORKS AND WORKPLACES: NEW AND OLD CHALLENGES

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Abstract

Abstract text, In recent years the growth in the use of new technologies, especially the internet, has given birth to new problems that deserve to be evaluated. The use of technologies of Web 2.0 poses new challenges as to the powers of employers in using the information disclosed by the employees. The new web phase in which we live today offered an active role to the user, removing him from the shade of a passive position. This mutation of borders created new interaction paradigms insofar as the notion of time and space was altered, which could lead to serious consequences as far as the utilization of online social networks is concerned as well as its impact on the employment relationship. The boundary between what may or may not be published by the employee on online social networks like facebook, twitter or blogs is not always clear. But, the employee's privacy concerning information available in online social networks which can be used by the employer within the employment relationship, also deserves protection. In this article, we intend to analyze the characterization of online social network on the web 2.0 in order to better understand, at a second stage, the effects of its use in the working relationship.

Keywords: Online Social Networks, Web 2.0, employer power, privacy

Introduction

The study of human relations in workplace is a continuous challenge that could benefit from the new technologies of communication. In fact, internet has become a fundamental support of contemporary culture, causing changes in the economy, society, culture and in the way human beings relate to each other. It is beyond doubt that, in the last decade, our society has been strongly influenced by the internet with all the ensuing consequences for man and society. And, invariably, this has results in one of the most

important dimensions of human life, ie, working life. Indeed, the entire context in which the person-employee moves has been undergoing progressive changes related to the use of new information and communication technologies in the workplace. In the context of this new reality, we are faced with problems as to the processing of data belonging to the employee's private life and that, by integrating the sphere of privacy, should somehow be the subject of protection.

The new frontiers of Web 2.0

The present problems grew alongside with the growth of the Web 2.0 applications. We are talking about the second generation of the World Wide Web, where there is an area for collaboration, interaction and information sharing. The simplicity of publication and the quick storage of information in online social networks, enabling each individual to create a space where each person filters and controls the information, are seen as the strong points of the Web 2.0.

The idea is that the user no longer has a passive attitude towards information but has also become its producer underlies the new paradigm. The term Web 2.0 is, in fact, used to describe the progress on the Internet where the user produces, manages, organizes and publishes information. The web 2.0 applications, which allow the user to post and exchange information online include blogs, wikis, RSS, podcastings and online social networks (Grabner-Kräuter 2009, 505). With the aforementioned applications it is possible to customize the contents that each user publishes enabling the information considered to be relevant, to be filtered on each personal page.

“The essential difference between Web 2.0 and the traditional Web is that the content is user-generated, and there is considerably more collaboration amongst Internet users. The most interesting Web 2.0 application in recent years in the emergence of online social networks or virtual communities which have opened up possibilities for rich, online human-to-human interaction unprecedented in the history of Internet communication.” (Grabner-Kräuter 2009, 505-506)

As it is mentioned by Fumero (Fumero and Roca 2007, 13), Web 2.0 is characterized for being the web of people as opposed to the web of data, in which the social and the technological interact, producing changes on one another. Indeed, the use of these new technologies of web 2.0 has sparked three major changes: on one hand the critical capacity of users, who now have new tools to communicate with the world, was enhanced; on the other hand the facility in the publishing of information led to the creation of communities around common interests, which in turn led to the strengthening of interpersonal relationships of a community; ultimately, the

validation of content is more reliable, due to the greater number of individuals involved in the production of information (Simão 2006, 14-15).

The user's initiative in disclosing information

As we have seen, nowadays user is not limited to adopting a passive attitude of consulting information but he is its producer, building its contents. Thus, the words of McLuhan, 1967, are extremely up to date "we shape our tools and they in turn shape us" (McLuhan 1967, 294), stressing that man cannot be limited to a passive attitude but must build and share knowledge.

But in fact, nowadays, the stronghold of privacy is an increasingly expanded concept, given the amount of information available online pertaining to the private life of each individual. The most curious thing to note is that much of the information made available on online social networks was placed by the user who thereby gives his/her consent to the disclosure of personal data. Moreover, as Grabner-Kräuter wrote the common profile of the online social network user discloses information about address, pet name, surname, which school is he/she attending and other details of family life that are often fundamental data to, for example, retrieve a password (Grabner-Kräuter 2009, 505). In fact, that is "the kind of information used for security or 'lost password' questions for online banking and other confidential services" (Grabner-Kräuter 2009, 505).

To that extent, when it is the user who voluntarily enters the information, updates the data, creates profiles and interest groups, various issues have risen as to the access and use of the aforementioned information.

The problem in question gains an even greater relevance if we think that the user / employee is extremely exposed when allowing "friends of friends ..." to have access to personal information available on online social networks when a study shows that as far as the average user is concerned, 55% of the friends are colleagues, 16% hierarchical superiors, 13% clients, 11% suppliers and 5% others (Ray 2011, 128).

Personal information available on online social networks in the employment context

Online social networks have placed new challenges in the context of employment relationships that go beyond productivity problems due to improper use of these tools during working hours. The new problems include, for instance, negative comments about the employer or colleagues or questions on the use that the employer can make of such data.

Registration in online social networks is often associated with reference to the company or institution where one works. This information although seemingly harmless, could have serious consequences on the employment relationship. In outlining that relationship between a person and

a given company, voluntarily or not, a bond between the image of the organization and the contents disclosed by the employee is created. On other occasions, the publication of images or comments regarding the individual's private life can not only affect the corporate image which the employer intends to protect but also the employment relationship.

Another relevant aspect in this context concerns the publication of information relating to internal and confidential matters of the company that may lead to causing damage and sever the trust established in the employment contract.

It appears then to be clear that the use of online social networks by employees is a source of conflict. However, nowadays, we cannot limit this question to the misuse that the employee can make of this tool once the employer may, as well, misuse the contents available therein.

This latter hypothesis concerns cases where, in the recruitment process, the employer decides to investigate the candidate's profile on online social networks. Thus, though, for example, facebook or twitter he can have access to very personal information that is in no way related to the skills required for the job but may have a lot of weight at the time of the selection process.

“The use of new technologies of the Web 2.0, and most of all the use of online social networks led to the user to have a positive and active attitude interacting with others, abolishing the notions of time and space, and changed the Labour landscape. The internet and the e-mail, the use of online social networks like Facebook or Twitter, Orkut, Friendster, or Linkedin, the blogs, the forums, turned the control of the employer to a more and more present and intrusive one, affecting the workers' privacy.” (Moreira 2013, 76)

We are hence before a double problem once the misuse of online social networks can be seen both on the employees as well as on the employers side, which only highlights the fact of this being an issue with an enormous study potential.

On one hand, with regard to the use of online social networks by the employee there should be a greater awareness of the impact of their respective conduct. This due to the fact that employees must refrain from posting messages that could affect the company's image, always taking into account the criteria of proportionality and reasonableness. Ideally, the internal regulations of a company should alert for this type of cases without forgetting the entire regulatory framework, including constitutional, applicable to it.

On the other hand, regarding the use of social networks by the employer to find out information about the private life of the employee, the solution will depend on the scope of the privacy concept to be adopted. In

this case the ratio of the intensity of privacy proposed by Moreira should be adopted. If the user's profile (employee or applicant) is a private one, and in case of private online social networks there is a legitimate expectation of respect for his/her privacy (Moreira 2013, 79). In the case of the privacy settings being configured to allow other users to access the employee's profile his/her expectation of privacy will be reduced but, even in that case, the employer may not use such information if it is not directly related to one's suitability for the job.

In analyzing these issues, one should also take into account the type of online social networks: in case of a private online social network, the employer won't gain access to the information but may limit its use in the workplace; in case of a free access professional online social network or a network whose access was supplied by the employer, the employee can access the information therein offered (Moreira 2013, 78).

Future perspective: the point of no return

In terms of future perspectives, it could be said that the use of online social networks introduced by Web 2.0 has dramatically altered the way in which people relate to each other, and this requires new solutions for a new process of interaction that will not stop growing. Despite all this, the answer to the various questions that the use of online social networks brings to the employment relationship should not be the same.

The availability of online contents seriously interferes with the privacy of every individual and therefore it also interferes with the employee's privacy before the power of the employer. In face of this scenario one must be careful with the fact that "in our own day scientific and technological advances have raised the spectre of new and frightening invasions of privacy." (Bloustein 1964, 963).

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A SURVEY ABOUT EXPERIMENTS ON NOTIONS OF TIME IN CHILDREN K-1 AND K-2

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Abstract

In this paper we explore the importance of analyzing the exercises that the manuals have in Mathematics study, because the difficulty of identifying some errors on them can interfere with the capabilities of children. We work with some exercises related to the theme of temporal notions, based on a survey of textbooks from the 1st and 2nd grade (K-1 and K-2). Our concern is to alert about the importance of reflecting on the content of the books, in order to promote a teaching-learning process tailored to the needs of children. The activities present in the manuals should allow children to develop their logical- mathematical reasoning, for later be able to understand and apply mathematics. To this end, we present some reflection about the exercises of manuals, and we give our opinion about what is the correct and incorrect. Also, some activities are suggested, among which were implemented with children of the 2nd grade, K- 2, along the experiments that support our work.

Keywords: Reflection; children; logical- mathematical reasoning and temporal notions

Introduction

The study in question focuses on the analysis and reflection of present exercises in textbooks of the 1st cycle of basic education. It has been proposed as part of the course Fundamentals and Applications of Elementary Mathematics, belonging to the master's Pre-School Education and Training of the 1st Cycle of Basic Education of the University of the Azores, Portugal, orientated by João Cabral, PhD. The importance of this study takes place in the context of learning to be critical, to doubt that not everything that is exposed in textbooks is quite correct, because some failures can emerge in

edition process due to the author's interpretation of a certain topic or printing process.

Our experiments, about the temporal notions, targeted the K-1 and K-2 level, based in manuals used on the years from 1995 to 1996 in Portuguese schools. Our goal was to explore the concept of time, evaluating the temporal notion that children can have. So, with the presentation of various exercises, we analyze some textbooks.

The temporal notion is difficult to define because it is related to something abstract where the child cannot manipulate, observe and verify. "The time is not perceptible as such, unlike the space or the speed, since it is not perceptible by the senses. Only takes perception of the consequences of its action, its speed and its results." (Piaget, 1963, cited by Sousa, 2012). For example, a child who in the course of a race know who was in 1st or 2nd initially did not have the notion that the first took less time than the others, only you realize that was the first to arrive.

Also for adults the time accuracy it is not always easy, if it was not the aid of the clock hardly humans know how many seconds, minutes or hours passed. Note that when love is an activity looks like the "Time Flies" and when you do not like it seems that time "Takes Forever". Now, the same happens to children, the only difference is that they do not already have responsibilities and so do not care about the passing hours. Hence it is important to explore the temporal notions with children, so that in the near future they learn to value time. They must realize that time does not stop, or go back in order to get the most out of life and know how to live.

Notes about notions of time

In figure 1 and figure 2, are presented some exercises associated to temporal notions that we can find usually on textbooks of K-1 and K-2 levels.



Figure 1: page 87 of K-1 (Monteiro,1995)



Figure 2: page 88 of K-1 book (Monteiro,1995)

From the five exercises presented in Figure 1 and Figure 2, in our view, two of them are well achieved: the first of page 88, asking to see a picture of the day and one of the night and compare, and the exercise of "Ana went to Lisbon." In the first, it is important that children realize that in the morning until dusk there is a timeline. In the second exercise, the child must realize that the use of transportations can decrease or increase travel time.

The remaining exercises, in our view, have some mistakes that can induce the child in error. In the first exercise, we start by criticizing the order of the days of the week, Figure 1. If in fact the first day of the week is Sunday, the exercise should start on Sunday. The child must associate second to second day because the truth is that this is the first exercise associated to time and it is intended that the child realizes how many and what day of the week. After at least until Wednesday, the tasks that are presented are tasks that occur every day. We think it would be more interesting if each student at the end of the class write about the events that they liked on that day. Starting to apply and explain to the day of Sunday - "What else do you liked to do yesterday?" - And end what they liked to do on Saturday.

The following exercise, on the same page, can also confuse the child, because imagine that, for example, during the week it rained every day. The child believes in what they see and the exercise would not make sense. One solution would be to explain that that year was a weather forecast for next

week - interdisciplinary talking about the weather - and later in the week indicated review and correct exercise.

The last exercise was well done, if the day "today" had not represented in order to student complete the correct day.

Overall, since this is the first time that the temporal notion is presented, we find that the exercises are not well achieved on quality, quantity and if there were any children with special educational needs would be difficult for them to solve the problem. The child begins to learn through body movement, handling objects and only later through the written representation and abstract. Therefore, none of these exercises is interconnected with practice and much less with the five basic senses to the learning process.

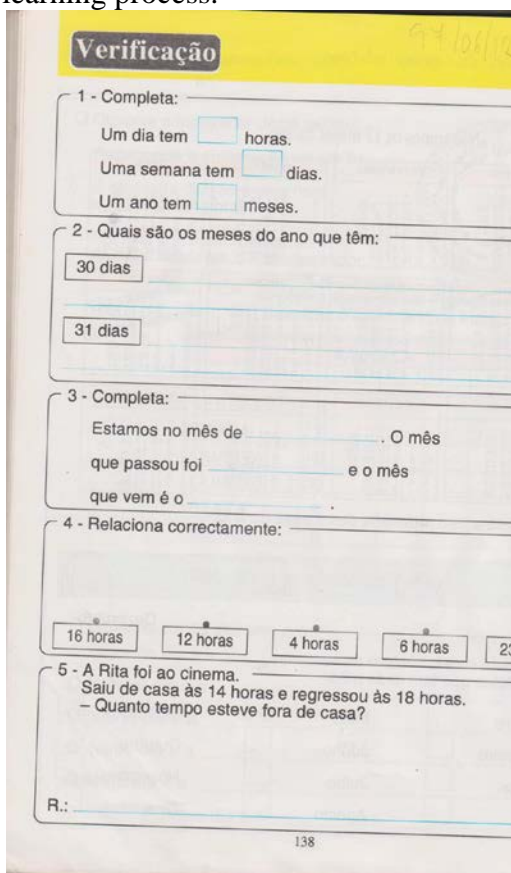


Figure 3: page 138 of K-2 (Freitas, 1996)

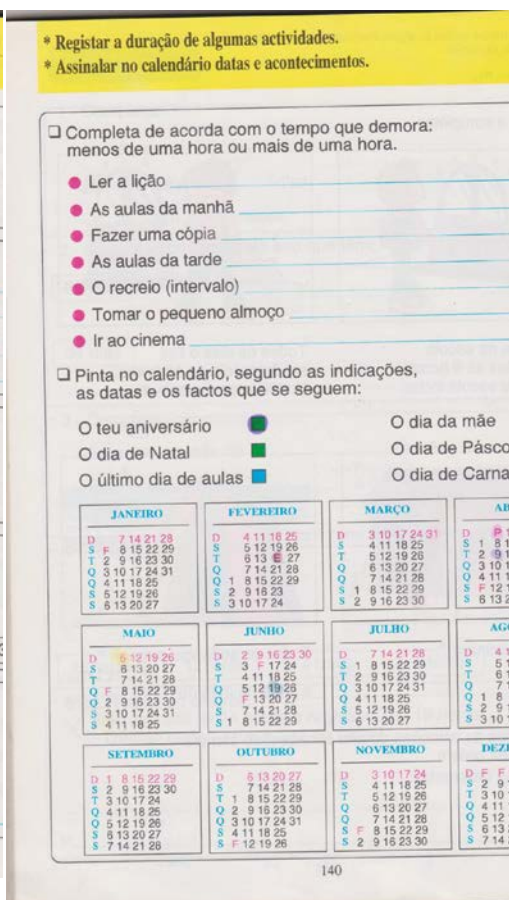


Figure 4: page 140 of K-2 (Freitas, 1996)

In the 2nd year, K-2, we observe an increase of exercises in order to relate the hours, days, weeks and months. In our view, the activities are accessible, at least on the manuals that we checked, very similar to (Freitas,

1996), but nevertheless, they are all mixed. The teacher should respect an order of learning teaching the child in very well organized step by step activities. For example, first the clock should have been presented and then the activities related thereto; then the days of the week and so consequently.

The first exercise of page 140, figure 4, in our view, is not well explored. Each child may interpret the exercise in a different way and in addition each has its rhythm. "Read the lesson"; "Make a copy" and "Take breakfast" are activities whose time have various duration from child to child. "The morning classes" and "Afternoon classes" will certainly be the points whose answer is unique (over an hour). This criticism arises because as we all remember, the exercises are done and corrected at once, and usually teachers only accept one answer. As for the other points, "Recess" and "Go to the movies," are poorly formulated, because if we consider the time-break in their entirety certainly goes beyond an hour and a trip to the movies as a child may consider the total time or just the time the film occurs.

Activity implementation

To better understand the child's perspective, various activities was been implemented with two children of level K-2. First, we applied the verification form that we can see in figure 3 (summary of all the matter present in manual) to try understand what the child knows or does not know. In our opinion, the children will have difficulty answering the questions of form, because we think the exercises are associated with memory and not the reasoning and understanding. Then an exercise of the same manual will be implemented (1st exercise on page 140, see figure 4) which we think is not well managed. It is intended, therefore, to understand whether children's responses are consistent and if the exercise is explicit. Finally, it will be implemented some activities that, in our opinion, are accessible to all children, especially for children with special educational needs. These activities are not associated with time, whereas in K-2 only is worked the notion of "hour" and not the minute, but we think at this stage tasks using minute and second are already accessible to children (should be explored on the order second, minute, hour and not backward). The practical activities are not limited to the use of pen and paper, but the exploitation of one's body and dramatic expression. With these activities, described below, it is intended that the child has the perception of the length of certain tasks and develop his mathematical logical reasoning.

So, using the structure proposed by (Sousa, 2012) we propose the following practical activities to work the notion of time:

- 1- Ask students to imitate: the walk of a baby, a young and an old person;
- 2- Imitate an ice cream melting in the sun and then melting on the shade;
- 3- To imitate a stone falling and then a feather;

- 4- Replicate the water coming out of a faucet and then the water to evaporate;
- 5- Ask a child (without having with no clock) to leave the room and, after 1 minute, re-enter. Those in the room register time to check if the time elapsed are larger or smaller than anticipated;
- 6- Request to build paper airplanes or teach how to build and ask to throw us into the air, all at once, to see what is what remains in the air longer.

Implementation results

The implementation was held on 02/02/2015 with 2 children and these are presented throughout the work as a child A (6 years old) and the child B (7 years), both girls, and attending the 2nd year of primary education, but revealed that not worked the theme of hours. In figure 5, figure 6, figure 7 and figure 8, we present the resolution of the exercises taken from the manual. The practical activities, proposed in the previous section, were observed and filmed for a better reflection.

1 - Completa:
Um dia tem 4 horas.
Uma semana tem 7 dias.
Um ano tem 12 meses.

2 - Quais são os meses do ano que têm:
30 dias
31 dias Janeiro

3 - Completa:
Estamos no mês de Fevereiro. O mês que passou foi Janeiro e o mês que vem é o Março.

4 - Relaciona correctamente:
16 horas 12 horas 4 horas 6 horas 23 h

5 - A Rita foi ao cinema.
Saiu de casa às 14 horas e regressou às 18 horas.
- Quanto tempo esteve fora de casa?
R.: 5 horas

Figure 5: Resolution page 138 – Child A

1 - Completa:
Um dia tem 24 horas.
Uma semana tem 7 dias.
Um ano tem 12 meses.

2 - Quais são os meses do ano que têm:
30 dias Novembro Abril Junho Setembro
31 dias Janeiro Março Maio Julho Outubro Dezembro

3 - Completa:
Estamos no mês de Fevereiro. O mês que passou foi Janeiro e o mês que vem é o Março.

4 - Relaciona correctamente:
16 horas 12 horas 4 horas 6 horas 23 h

5 - A Rita foi ao cinema.
Saiu de casa às 14 horas e regressou às 18 horas.
- Quanto tempo esteve fora de casa?
 $18 - 14 = 4$
R.: Ficou fora de casa 4 horas

Figure 6: Resolution page 138 – Child B

* Registrar a duração de algumas actividades.
* Assinalar no calendário datas e acontecimentos.

Completa de acordo com o tempo que demora: menos de uma hora ou mais de uma hora.

- Ler a lição menos de uma hora
- As aulas da manhã menos de uma hora
- Fazer uma cópia menos de uma hora
- As aulas da tarde mais de uma hora
- O recreio (intervalo) menos de uma hora
- Tomar o pequeno almoço menos de uma hora
- Ir ao cinema mais de uma hora

Figure 7: Resolution page 140 – Child A

* Registrar a duração de algumas actividades.
* Assinalar no calendário datas e acontecimentos.

Completa de acordo com o tempo que demora: menos de uma hora ou mais de uma hora.

- Ler a lição mais de uma hora
- As aulas da manhã mais de uma hora
- Fazer uma cópia menos de uma hora
- As aulas da tarde mais de uma hora
- O recreio (intervalo) mais de uma hora
- Tomar o pequeno almoço mais de uma hora
- Ir ao cinema mais de uma hora

Figure 8: Resolution page 140 – Child B

In the check form, figure 5 or figure 6, with 5 exercises, according to our interpretation both children have not mastered the hours. In addition, exercises that are correct are most associated with memory than to the application of logical-mathematical reasoning. The maturity of the older child, child B, stands out along the work, it responds correctly to the first 3 exercises. The child A, do not have the notion of time and replies that the day has 4 hours. However, we believe that answers to four hours because the "resort to memory" should remember that you've heard anything that ends in 4 (24 hours). In the 2nd exercise, this child only identifies the month of January, certainly because it was the month that just passed and still remembers. Both children respond correctly the exercise 3.

In the following exercise, the child A said she did not know how to draw the clock, so voluntarily we drew the first two, and after the drawing was asked if she knew represent the required hours, but she did not. The other child managed to draw the clock format, but did not know how to represent the hours. Because we were busy with the child A, child B called for help and the teacher did not hesitate to go help and give answers to it. Because we were near, we realize that the child did not know how to place the hours.

In the last exercise, both children had immense difficulties. Without counting the child A, automatically answered that they were 5 hours (wrong answer). The child B, once again, got help from the teacher who was still at his side and said "then you do not know which is $18 - 14$?". We did not want to ask to the teacher to leave or wanted to pry, but we tried to be attentive to the child's reaction and noticed she stared at the exercise without realizing it because of that account and no realize the final result.

Therefore, it was found that both children are unaware of the clock and the representation of hours. In addition, the last 2 exercises should not arise in page 138, because the clock is only explained in detail in next year's primary and these are not the appropriate exercises to work the time. So the manual of the K-2 level explores something that only is explored in K-3

level in Portugal, giving some wrong directions to the teacher that only follows the manual blindly.

Next we talk about the exercise that we considered wrong, figure 8 or figure 9. On this was asked the children to identify the tasks that lasted about an hour. As we expected, the responses were not consistent and these differ in the following paragraphs:

"Read the lesson"; "The morning classes"; "Recess" (the child B associated time the total recreational time, as said "When I go out to the three I'm still in school!");

"Making breakfast" (child B said it took a long time to eat). That is, there are activities that allow the child to distinguish over 1 hour, example, when your child says it takes a long time to eat does not mean that exceed 1 hour.

However, three of the points were marked with the same answer: "Make a copy"; "The afternoon classes" and "Go to the movies." A child who does not yet realize the temporal notion has difficulty identifying the duration of one hour. By asking to differentiate more or less time than an hour, the child only associated with the activity that takes more or less time. So, we, therefore, consider that this activity is dispensable. The child does not learn anything new and exposes only on paper their ideas because exercise does not create any rational problem. Even after correcting the exercise, for example the teacher says: "Note that breakfast lasts always less than a hour." we believed that the child got confused as it is something abstract.

Finally, a number of practical activities, which we believe allows the development of logical-mathematical reasoning, were presented. They allow the child to explore the space around her and have free body movements. The video was used as observation instrument, allowing a better reflection of what happened.

The first activity was merely exploratory and enabled children be themselves for a while, but on the following activities has always asked something about the exercise.

The children joined very well to exercise and they were educational. We realized that we should have had more attention in the formulation of questions and they should already be outlined as the way the question is raised is very important and can induce the child in error. After the observation of the video, we noticed that we kept too focused approach in diagnostic evaluation. One of our goals was to understand what the children knew or not, and tried not to provide answers, not to influence the results. However, if you opt for an interactive assessment, exploration of practical activities, we believe we would have achieved better results.

We consider that practical activities allow teaching-learning process and will take advantage of these in the near future: the kids loved; allow develop reasoning; explore the dramatic and body language and are accessible to all children (can easily be adapted to children with special educational needs).

In order to improve the practical activities: removed the point that asked to mimic the water to evaporate; add more activities appropriate to the level of education concerned and would be more careful in formulating the questions, trying that were already planned.

Conclusion

According to (Sousa, 1996), "The teacher does not teach; motivates, encourages and stimulates the student to self-discover, to search, to experiment, to invent and create. ". It is therefore important to bring the child's reality and present exercises that have some relation with their day-to-day. Know how to identify what is the time pointed by the pointer is important, but children have a lifetime to be able to tell what time it is. In primary education, it implement activities that somehow "unlock" the reasoning of the child, so that later help in learning and understanding mathematics.

More than decorate, the child must learn to reason. For example, in the future should have the concept of the day of the week for reasoning and not by walking constantly consult a calendar. It is important to live and learn to respect the time because this is always present in life and is untouchable.

In our opinion, on the books that supports the 1st cycle of basic education: the exercises do not differ much from each other; do not allow the child to explore, search and create. They are not dynamic and are not accessible to all children. We can found on them boring and repetitive exercises that do not allow a gradual evolution, or the development of logical-mathematical reasoning.

We are human and so we all falter, therefore, teachers should have a large capacity and at ease to criticize and revise the exercises presented to them. If focus is only on what's on paper surely that much of the information is missing in the teaching and student learning process.

In short, those who work day to day with children learn to identify the best method and rate to be used for these, hence it is necessary that the teachers themselves create and adapt exercises to their needs and difficulties.

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LIFE CYCLE COSTING MODEL BASED ON TARGET COSTING AND ACTIVITY-BASED COSTING METHOD AND A MODEL PROPOSAL

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Abstract

Excessive levels of competition with globalization has forced businesses to differentiate into products and prices. Differentiation in price is only possible with lowest price. Businesses can create differentiation in products by increasing quality of the products and after sales services. To provide these, businesses have to know exact cost of the products and services and they need to design their products and services based on their costs. At this point, conventional cost systems become insufficient and businesses need strategic cost management systems. One of these strategic cost management tools is the target costing method. Target costing method focuses on design stage of the product and aims to control and reduce the costs before they emerge. Conventional cost systems become insufficient in providing accurate data to target costing. At this point, activity based costing method provides more accurate data to target costing especially in indirect costs of products. After sales services which create differentiation in products have some costs and these costs need to be considered as costs of the products. In this study, a model is proposed for target life cycle costing based on activity based costing. In this model, all costs from design stage to after sales support in product life cycle are considered as product costs and target cost is calculated using activity based costing method. Finally, the model is explained using an example.

Keywords: Life Cycle Costing, Activity Based Costing, Target Costing

Introduction

Businesses need to keep lower prices from competitors in market in order to survive in competitive environment. To achieve this, they have to detect costs in the best way. At this point, the cost of the system used by the businesses to provide accurate information is very important.

Target costing, which is the one of these method aims to determine the cost of prod-uct at the design stage and reduce cost of the products before they emerge. The pur-pose of target costing is to manage costs before they emerge.

The activity-based costing which differs from conventional costing methods with the distribution of indirect cost method focuses on the activities. In this method, re-sources are consumed by activities and activities are consumed by products.

Businesses try to differentiate their products with after sales services in competitive environment. After sales services include warranty or installation of the product. Thus, these costs are need to be calculated in the cost of the product.

The purpose of this study is creating a model for target costing based on Activity based costing including whole life cycle costs of a product. The basis assumption of this study is target costing and activity based costing mutually complementary meth-ods. Featured aspect of this study is target cost includes the cost of all stages of product life cycle (from designing to after sales services) based on ABC.

Activity Based Costing

With the increase in competition it has become necessary to calculate the cost of produced goods and services more accurately. Conventional costing methods are insufficient to provide efficient cost information. Therefore, activity-based costing method has come into question.

Although activity based costing method initially considered for detecting and controlling the indirect costs, its coverage expanded in the coming period. (Bengu, 2005).

In general, the activity based costing system can be defined as an accounting technology that calculates the cost of activities and reflects this costs to products and customers. Basic logic of this method is that activities are obtained from a certain cost and it is based on the products and customers consuming activities at different percentage. (Alkan, 2005, s. 43).

Conceptual Framework of Activity-Based Costing

For a better understanding of the activity based costing process some of the basic concepts should be well known. These concepts are, resources, activities, cost factors and activity center:

Resources: Resources are managed or referenced economic factors to perform activities (Unutkan, 2010, s. 90). Resources are the elements that make up costs for a business. Examples of resources can be lease costs, labor costs, depreciation expenses, electricity, water and etc. expenses. In addition, some of the resources are directly related to the product (like direct labor,

direct materials), some of the products are not directly related to the product (like rent, general and administrative expenses). While the resources are consumed by products in the conventional cost management system, activities consume resources in activity-based costing system.

Resources are the elements that are the first financial inputs of activity based costing system. It is an important step which categories business resources will be collected. In this point of view when deciding what the system's resources are and determining the costs the reference must be firstly the business ledger records (Alkan, 2005, s. 44).

Activities: Activities are actions that are performed during the production of a company's products and services (Unutkan, 2010, s. 91). The first step of the implementation of the activity based costing system is to determine the activities of the business. The basic function of an activity is to convert inputs (resources) to output (products). During this conversion activities consume resources. In other words, activities are the process that producing goods by consuming resources (Alkan, 2005).

Cost Driver: Cost drivers are factors that determine required the effort or workload to perform an activity (Unutkan, 2010, s. 91). In other words, cost driver is a factor that causes a change in the cost of activities (Bengu, 2005). When the number of activities increases, the number of cost driver is also increases. One of the main points of activity-based costing system to decompose the conventional costing system is the concept of cost drivers. While in ABC different cost drivers for each activity are used, in the conventional system it is used a single distribution key. This causes to produce erroneous report of the conventional cost system.

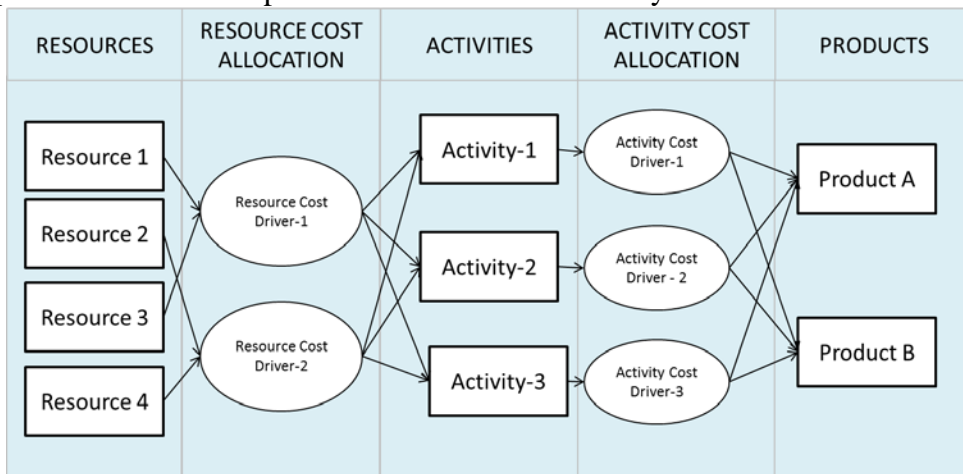


Figure 1. Cost Drivers in ABC (Pazarceviren, 2004)

There are two different cost drivers in activity based costing system. One of them is used for carrying resource costs to activities and the other one

is used for carrying activity costs to the products (Pazarceviren & Celayir, 2013).

Application of Activity Based Costing

Specific steps for the establishment of activity-based costing system must be followed. These steps consist of two stages. The first stage is the stage of costing activities. The second stage is the stage of the installation of the activity costs to the products. The basic assumption of this system is that the activities consume resources and the products consume the activities.

This two-stage consists of five steps (Bekcioğlu, Gurel, & Kizilyalcin, 2014):

- **Identifying activities:** It is the most important step in application of the activity based costing system. In this step all business activities should be analyzed in detail.
- **Classifying activities:** In a business many activities of a product come out during the ABC application. Because monitoring these activities separately is not applicable and economic, activities are grouped according to a certain criteria. In this stage similar activities can be combined and grouped. The costs of these grouped activities are distributed to products by a single carrier.
- **Costing activities:** After finding activities and activity centers, cost of the activities process needs to be done. The first step is to calculate the cost factors. The next step is to distribute the costs to activities according to cost factors. Cost factor (supply factor) is the measure that define the relationship between activity and resource costs. These are the measures like volume, weight, number of workers, man-hours, the number of bulbs, the number of equipment and etc.
- **Selecting accurate cost factors for allocating costs to the products:**

The production process must be examined carefully for determining used cost factors for allocating activity costs to products. Cost factors should be determined in accordance with cause-and-effect relationship at this stage. Three points are important during the selection of cost drivers (Bekcioğlu, Gurel, & Kizilyalcin, 2014, s. 24):

- ✓ Ease in providing the necessary data for cost factor (measuring cost),
 - ✓ The relationship between selected cost factor and the actual consumption of activities (the degree of correlation),
 - ✓ Behavior demonstrated by cost factors (behavioral factors).
- **Charging activity costs to products:** In the stage of charging activity costs to products, first, unit cost of cost drivers. Then how many units consumed from these factors by products are calculated. Finally, unit

cost of factors and unit consumption of products is multiplied and product allocation cost is calculated. When the same process is applied to all activities belonging to a product, the activity-based cost of a product is calculated.

Target Costing

It's become an obligation for businesses to estimate the price paid in the market accurately, calculate the product costs accurately and assign an accurate price. At this point, target costing is getting important.

Although the target costing method is expressed firstly by Henry Ford, it is a concept that is developed by Toyota in the 1960s, used by many Japanese businesses and conferred in the literature by the Japanese. (Aksoylu & Dursun, 2001).

Target costing method is used in the first stages before the design and create a new product's production methods. In this method, the process is directed by customers, is focused on designing products and is spread over the entire life cycle. (Coşkun, 2002, s. 25). Target costing is a strategic profit and cost management process to reduce product costs throughout the course of the product life (Alagoz, Yilmaz, & Ay, 2005).

Due to the occurrence and development of target costing in Japan it is defined by Japanese researchers in different ways. The prominent names are Hiromoto, Sakurai and Monden. Target costing is defined as the main function of market orientation and dynamic cost management by Hiromoto where as it is defined as effective cost management tool in reducing product costs through other departments by Sakurai and Monden. According to Peter Horvarth and Werner Seidenschwarz target costing is a strategic cost management method that converts information about the product, market and resources to a quantitative measure based on the strategic foundation (Pazarceviren & Celayir, 2013).

The main purpose of target costing could be specified like this: (Alagoz & Ceran, 2006, p. 66):

- ✓ Consolidate being market-oriented; product planning within the framework of activity planning area; customer, competition and supplier oriented.
- ✓ In conjunction with with the Value Engineering, in reducing costs based on customers and competition correcting designs and forcing improvements
- ✓ At all levels of production forcing to a full-time control for specific and / or external development and specific and / or external production,
- ✓ In conjunction with capacity utilization planning and capacity planning forcing a Simultaneous Engineering.

Target Price, Target Profit and Target Cost

Target costing concept has emerged as the result of two important factors related to cost and market. One of them is the price determined by the market. Nowadays as a result of increasing competition businesses have lost the control over determining the price of products. Therefore, the price is determined by the market. The other cause that has an influence on the emergence of target costing is that determining the large part of the products' costs at the product design stage (Pazarceviren & Celayir, 2013).

Target cost simply is the cost of resources consumed in producing the product to sell a product at an targeted profit (Coşkun, 2002).

Target costing has quite a simple formulation and calculated as follows (Alagoz, Yilmaz, & Ay, 2005):

- The product sale price on the market is determined.
- Targeted profit margin deducted from the sales price.
- The remaining figure is the cost required to produce the product. This cost is the product of target cost.

$$\text{Target Cost} = \text{Target Price} - \text{Target Profit}$$

Target sales price and sales volume is determined by the information obtained from customers. The target profit, concerning the desired rate of profit in all product life cycle is found by the result of long-term profitability analysis. Target cost is the difference between the two (Coşkun, 2002).

Basic Principles of Target Costing Method

There are six basic principles of target costing. Because these principles take a different approach in terms of the cost management they reveals completely different approach than conventional systems in terms of cost and profit planning. These six key principles are (Swenson, Ansari, Bell, & Kim, 2003):

- **Costing in accordance with the price:** Market prices are used to determine the target cost. The target cost is calculated using the following formula. $\text{Market Price} - \text{Needed Profit} = \text{Target Cost}$
- **Concentrating on customer:** Considering and analysing the customers needs and expectations on the quality, cost and time for product design and process decisions.
- **Concentrating on product design:** Cost control starts at the stage of the product design. Therefore, engineering changes must be made before production begins. Target costing aims to make cost savings before the product produced. 80-85% of the cost of the product arises in the product design process. Therefore, the design stage is the most important principle of target costing (Hacirustemoğlu & Sakrak, 2002).

- **Extensive involvement:** Participation in the whole process from the design of the product to final state with cross-functional product and process team.
- **Paying attention to value chain:** All members of the value chain (such as suppliers, distributors, customers) are included in the target costing process.
- **Costreduction during whole product life cycle** (A life-cycle orientation): Costs that are over the entire life cycle of the product should be reduced. Costs include purchasing costs, operating costs, maintenance costs, a distribution and service costs.

Target Costing Process

Target costing is composed of the following three processes simultaneously or sequentially with each other:

- **Market level costing:** Starting point of target costing is the costing at market level. Due to the market level costing the information is collected about customer needs and prices they are willing to pay for their needs (Cooper & Slagmulder, 1999). By conducting the market analysis in this stage new products' position in the market could be detected and also products' costs at an acceptable level could be detected. The information taken from there will be transferred to the product level.
- **Product-level costing:** Acceptable costs detected in the stage of costing at market level acceptable costs of target costing are transferred to the product level. At this stage working on product design and production process starts. Designers work with the cost pressure. The purpose of the costing at product level is to provide designers focus on the cost of the product and discipline the costs.
- **Unit- level costing:** After the target cost at product level is determined target costs received from product level are transferred to the components of product. Thus for the unit that will be purchased to the suppliers target cost is indicated. Suppliers are obliged to produce the units assigned to them in the framework of target costs. By this way according to the target cost obtained at market level suppliers must discipline their costs.

Relation Between Target Costing and Activity-Based Costing

Target costing is related to the activity-based costing on three points. The first one is determining the estimated cost. Activities that are used on the indirect areas depending on the product, can be analyzed by original activity costs. The second, activity-based costing can determine the cost drive of the product planning and the design offer. Subjects such as product diversification, usage of standard parts, chain of distribution, purchasing and

production, has to be compatible with market requirements. While target costing provides information for market requirements and cost goals, activity based costing can present cost structures of design alternatives. The third, activity-based costing can be used as a tool for achieving target cost. Activity-based costing which identifies the activities required to realize specific product functions and related to this, determines the cost allocation keys, assists to determine the optimal value area by transferring activity costs to product (Horvath, Gleich, & Schmidt, 1998).

Product Life-Cycle Costs

With the increasing competition suppliers whose profit margin has been shrunk must determine the prices in a more clear way. Therefore, they need to calculate the endured costs throughout product's all life stages from the product's research and development stage to the after sales costs.

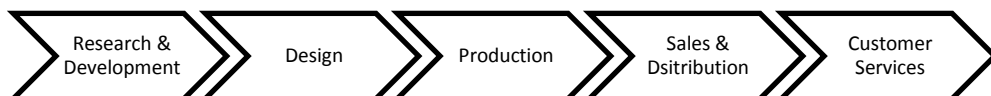


Figure 2. Life Cycle of A Product (Blocker, vd., 1999, p.134)

Product life cycle of a new product to be introduced to the market can be determined as before market and after market at two stages. Market entry stages are defined as the process from the idea stage to the commercialization stage. After market entry stages are development, maturity and decline stages. During each stage of the product life of the product should be evaluated according to different criteria.

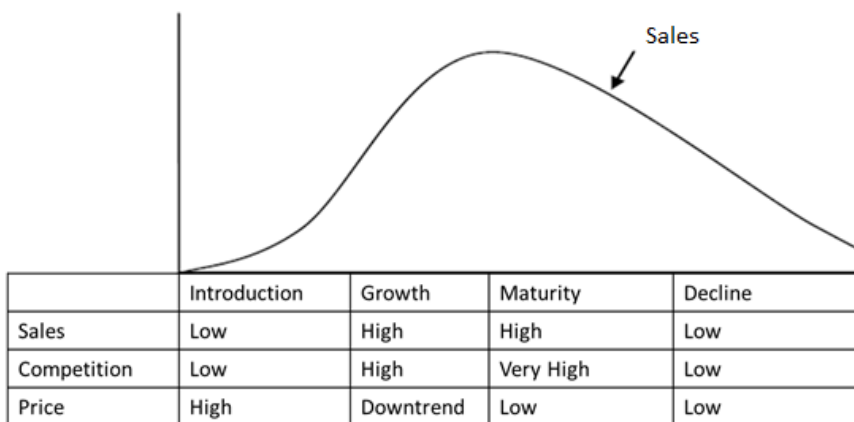


Figure 3. Product Life Cycle Stages (Kaygusuz, 2011)

In Figure 3 changes that occurs during the product life of a product take part. Whereas sales volume is low in the entry stage, it increases in the development stage, slows down in maturity stage and quite decreases in

decline stage. In contrast, whereas prices are high in entry stage, they decrease at later stages.

As shown in Figure 3, it is the product price that set by the market and is the main issue of target costing. Because price of the product is determined by the market and a profit determined based on this price and target cost of a product calculated according to this.

Due to the cost of the product during product life cost occurs in three stages:

✓ Activity costs came forward to place on the market until the commercialization stage of product (Kaygusuz, 2011). Market research costs, research and development activity costs, design and testing costs are included at this stage.

✓ Production and activity costs occurred after the product commercialization (Kaygusuz, 2011). Production and distribution costs occur at this stage.

✓ Activity costs occurred after the sale of the product. Technical service, return etc. costs are included in this group.

The difference introduced in this study is that in target costing method it is considered the whole life cycle of the product and activity-based costing system is used in calculation of the target cost.

A Model Proposition For Determining Product Life-Cycle Cost

Effective and consistent target costing process requires the activity based costing model. Thus, value obtained from the model will be much. During the application of activity based costing method whole life cycle of the product must be considered. Because the purpose of the activity based costing is revealing the product costs in the best way.

In this study the whole life cycle of the product is considered and then a target costing model is set out. Data used in target costing obtained from the activity based budgets in our model. The costs incurred in the life cycle of the product is handled in three periods:

- ✓ Costs incurred before production
- ✓ Costs incurred during the production and sales,
- ✓ Costs incurred after sales

Difference presented in this study is that costs occurred during the life time of the product are included target cost by activity cost method.

Costs incurred before production are costs like research and development costs, market research costs, general and administrative costs and financial costs. These costs are generally indirect fixed activity costs.

The costs incurred during the production and sale are fixed / variable and direct / indirect resource and activity costs.

Costs incurred after the sale are distribution costs and after sales support costs. After sales support costs are included technical support costs as well as costs of collected, repaired or exchanged and re-delivered to customers of returned products from customers. In the meantime businesses have to consider the activity costs of maintenance and spare parts for a certain proportion of products sold and include in their budgets. Because these costs are proportional with the amount of sales they are defined as direct variable costs. On the other hand it must be considered that technical support also has a fixed cost. This cost is assessed as indirect fixed resource cost.

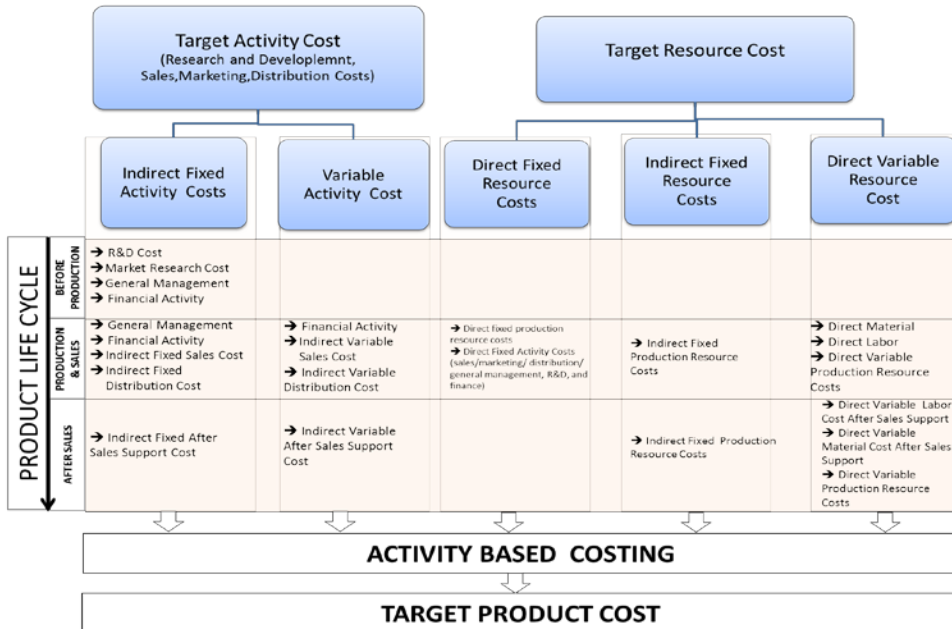


Figure 4. Life Cycle Costing Model Based on Target Costing and Activity-Based Costing Method

Costs that will occur throughout the product life cycle (before production, during production, sales and after-sales period) are included into the target costs according to the activity based costing system.

Table 1. Life Cycle Costing Model Based on Target Costing and Activity-Based Costing Method

Res. / Act.	Fixed / Variable	Life Cycle	Cost Elements	Cost Accounts	Data Source			
Activity Costs	Indirect Fixed Activity Costs	Before Production	Indirect fixed R&D activity costs of the products in R&D departments	R&D Cost	Activity Cost Budget System Of The Business			
			Indirect fixed market research activity costs of the products in R&D departments	Market Research Cost	Activity Cost Budget System Of The Business			
			Indirect fixed general management activity cost before production	General Management Cost	Activity Cost Budget System Of The Business			
			Indirect fixed Financial Activity Cost before production	Financial Activity Cost	Activity Cost Budget System Of The Business			
	Production & Sales			general management budgeted activity costs during production and sales	General Management Cost	Activity Cost Budget System Of The Business		
				Finance departments budgeted activity costs during production and sales	Financial Activity Cost	Activity Cost Budget System Of The Business		
				Indirect fixed expenses during production and sales	Indirect Fixed Sales Cost	Activity Cost Budget System Of The Business		
				After Sales	Indirect fixed expenses of distribution	Indirect Fixed Distribution Cost	Activity Cost Budget System Of The Business	
					Indirect fixed expenses of after sales support	Indirect Fixed After Sales Support Cost	Activity Cost Budget System Of The Business	
				Total Indirect Fixed Activity Costs				
	Variable Activity Cost	Production & Sales		Financial cost of production and sales activities	Financial Activity Cost	Activity Cost Budget System Of The Business		
				Indirect variable costs of the products in sales & marketing departments	Indirect Variable Sales Cost	Activity Cost Budget System Of The Business		
				Total Production & Sales				
				After Sales	Indirect variable costs of the products in sales & marketing departments	Indirect Variable Distribution Cost	Activity Cost Budget System Of The Business	
			Indirect variable resource costs of the products in after sale support departments	Indirect Variable After Sales Support Cost	Activity Cost Budget System Of The Business			
Total Variable Activity Cost								
Total Activity Costs (Fixed + Variable)								
Resource Cost	Direct Fixed	Production & Sales	Direct Fixed Production Resource	Direct fixed production	Activity Cost Budget System Of The			

Res. / Act.	Fixed / Variable	Life Cycle	Cost Elements	Cost Accounts	Data Source
	Resource Costs		Costs Of The Products in Departments	resource costs	Business
			Direct Fixed Activity Costs Of The Products in Departments	Direct Fixed Activity Costs	Activity Cost Budget System Of The Business
Total Direct Fixed Resource Costs					
	Indirect Fixed Resource Costs	Production & Sales	Indirect Fixed Production Resource Costs Of The Products in Departments	Indirect Fixed Production Resource Costs	Activity Cost Budget System Of The Business
Total Production & Sales					
		After Sales	Indirect Fixed After Sale Resource Costs Of The Products in Departments	Indirect Fixed Production Resource Costs	Activity Cost Budget System Of The Business
Total Indirect Fixed Resource Costs					
Total Fixed Cost (Direkt+Indirect)					
	Direct Variable Resource Cost	Production & Sales	Direct Labor Expenses	Direct Labor Cost	Direct Labor Time And Pay Sets Of The Products Based On Direct Labor Operation List
			Direct Material Expenses	Direct Material Cost	Standard material quantity and price sets of the products based on product tree
			Energy Expenses	Direct Variable Production Resource Costs	Resource consumption amount and price sets of the products
			Other Direct variable Expenses	Direct Variable Production Resource Costs	Resource consumption amount and price sets of the products
		After Sales	Direct after sales support labor expenses	Direct Variable Labor Cost After Sales Support	Direct labor consumption amount and price sets of the products based on saled products
			Spare parts and other material expenses after sale	Direct Variable Material Cost After Sales Support	Standard material quantity and price sets of the products based on product tree
			Electricity and other Direct variable Expenses	Direct Variable Production Resource Costs	Resource consumption amount and price sets of the products based on saled products
Total Direct Variable Resource Cost					
Total Resource Cost (Fixed + Variable)					
PRODUCT COST (Total Activity Cost + Total Resource Cost)					

In this model cost of the product that will produce is obtained in two stages:

- ✓ Calculating the production cost of products to be produced.
- ✓ Calculating the activity costs (non-production costs)

Another discrepancy in this model is including the costs occurred after sales into the target product cost. Costs incurred after the sale are as follows:

- ✓ **Distribution costs:** Logistics and distribution costs incurred to deliver the product to the customer after the sale of the product
- ✓ **Technical support costs:** Technical support costs provided to customers to use the product after reaching to customer. After the product has been sold it is important to include offered as free technical support costs into the product.
- ✓ **Repair and maintenance costs within the Warranty Period:** To include warranty costs within the warranty period for the product into the product is important. In this part variable direct labor, direct variable material costs and indirect fixed costs are used. In the target costing process, it must be budgeted that this cost has a certain percentage in the sold product.
- ✓ **Return Product Cost:** After the product reached to customer sometime it may be returned for some reason. At this time return product costs are occurred. Costs incurred in this case they are reverse logistic costs. In the target costing process, it must be budgeted that this cost has a certain percentage in the sold product.

The following example is used to illustrate the above.

In the sample target cost of a product is calculated as of year. It has been a R&D study for the product for a year. The product is planned to be sold throughout 5 years.

In addition because of having a warranty period of two years costs that occur after sales are also considered. In other words, after the product sold throughout 6 years the cost of after sales will occur for two years. Although product remains on the market throughout five years business will bear a cost for 9 years.

Target costs over the life cycle of products is summarized in the Table 2.

Table 2. Cost of the Products in Life Cycle

Period/Years	Before Production	Production & Sale	After Sale
1st	R&D Costs		
2nd		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
3rd		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
4th		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
5th		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
6th		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
7th		Direct/Indirect Resource / Activity Costs	After Sales Support Costs
8th			After Sales Support Costs
9th			After Sales Support Costs

Target costs of the products is calculated by using activity based costing method over the years. Activity based costing method provides more accurate cost information to target costing. In the calculation of unit costs, costs are classified into two parts as resource costs and activity costs. Resource costs are classified into two parts as fixed costs and variable costs. In addition, all costs in whole life cycle of the product (before production and after sales support costs) are included in the target cost products.

Table 3. Unit Direct Variable Resource Costs

Direct Variable Resource Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Direct Material Costs	150.000	309.000	353.496	297.901	202.572	170.499				1.483.468
Direct Labour Costs	200.000	420.000	480.480	412.776	280.688	240.924				2.034.867
Direct Var. Prod. Res. Costs	125.000	257.500	294.580	248.251	168.810	142.082				1.236.223
Direct Variable Finance Costs	8.000	16.480	18.853	15.888	10.804	9.093				79.118
Direct Variable Sales Costs	50.000	103.000	117.832	99.300	67.524	56.833				494.489
Total	533.000	1.105.980	1.265.241	1.074.116	730.399	619.430				5.328.166
Budgeted Sales Amount	100.000	200.000	220.000	180.000	120.000	100.000				920.000
Unit Direct Variable Cost (TL/unit)	5,33	5,53	5,75	5,97	6,09	6,19				5,79

Direct variable resource costs are shown on Table 3. Direct variable resource costs include direct material costs, direct labour costs, direct variable production resource costs, direct variable finance costs and direct variable sales costs. Unit direct variable resource costs is calculated by dividing direct variable resource costs to total quantity in every year.

Table 4. Unit Direct Fixed Resource Costs

Direct Fixed Resource Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Direct Fixed Production Resource Costs	20.000	20.000	20.000	20.000	20.000	20.000	20.000			120.000
Direct Fixed Marketing Resource Costs	40.000	41.200	42.848	44.133	45.016	45.466				258.664
Direct Fixed Sales Resource Costs	50.000	52.500	54.600	57.330	58.477	60.231				333.137
Direct Fixed Distribution Resource Costs	40.000	41.200	42.848	44.133	45.016	45.466				258.664
Direct Fixed Finance Resource Costs	6.000	6.180	6.427	6.620	6.752	6.820				38.800
Direct Fixed GM Resource Cost	40.000	42.000	43.680	45.864	46.781	48.185				266.510
Total	196.000	203.080	210.403	218.081	222.043	226.168				1.275.775
Budgeted Sales Amount	100.000	200.000	220.000	180.000	120.000	100.000				920.000
Unit Direct Fixed Resource Cost (TL/unit)	1,96	1,02	0,96	1,21	1,85	2,26				1,39

Table 4 shows the unit direct fixed resource cost of the product. Direct fixed resource costs include direct fixed production resource costs, direct fixed marketing resource costs, direct fixed sales resource costs, direct fixed distribution resource costs, direct fixed finance resource costs and direct fixed general management resource costs. The unit direct fixed cost is calculated by dividing total direct fixed resource cost to total quantity in every year.

Table 5. Unit Indirect Fixed Resource Costs

Indirect Fixed Resource Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Indirect Fixed Production Resource Costs		20.000	20.000	20.000	20.000	20.000	20.000			120.000
Indirect Fixed Marketing Resource Costs										
Indirect Fixed Sales Resource Costs										
Indirect Fixed Distribution Resource Costs										
Indirect Fixed Finance Resource Costs										
Indirect Fixed GM Resource Cost										
Total		20.000	20.000	20.000	20.000	20.000	20.000			120.000
Budgeted Sales Amount		40.000	42.000	43.680	45.864	46.781	48.185			266.510
Unit Indirect Fixed Resource Cost (TL/unit)		0,50	0,48	0,46	0,44	0,43	0,42			0,45

Table 5 shows the unit indirect fixed resource cost of the product. Indirect fixed resource costs include indirect fixed production resource costs, indirect fixed marketing resource costs, indirect fixed sales resource costs, indirect fixed distribution resource costs, indirect fixed finance resource costs, indirect fixed general management resource cost. The unit indirect fixed cost is calculated by dividing total direct fixed resource cost to total quantity in every year.

Table 6. Unit Indirect Fixed Activity Cost

Indirect Fixed Activity Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Indirect Fixed Production Activity Costs		20.000	20.600	21.218	22.067	22.729	23.183			129.797
Indirect Fixed Marketing Activity Costs		3.500	3.605	3.713	3.825	3.939	4.057			22.639
Indirect Fixed sales Activity Costs		45.000	46.350	47.741	49.173	50.648	52.167			291.078
Indirect Fixed Distribution Activity Costs		12.000	12.360	12.731	13.113	13.506	13.911			77.621
Indirect Fixed Finance Activity Costs		5.000	5.150	5.305	5.464	5.628	5.796			32.342
Indirect Fixed GM Activity Costs		9.500	9.785	10.079	10.381	10.692	11.013			61.450
Total		95.000	97.850	100.786	104.021	107.142	110.129			614.927
Budgeted Sales Amount		100.000	200.000	220.000	180.000	120.000	100.000			920.000
Unit Indirect Fixed Activity Cost (TL/unit)		0,95	0,49	0,46	0,58	0,89	1,10			0,67

Table 6 shows the unit indirect fixed Activity cost of the product. Indirect fixed activity costs include indirect fixed production activity costs, indirect fixed marketing activity costs, indirect fixed sales activity costs, indirect fixed distribution activity costs, indirect fixed finance activity costs and indirect fixed gm activity costs. Unit indirect fixed Activity costs are calculated by dividing total indirect fixed Activity cost to total quantity in every year.

Table 7. Unit Fixed Life Cycle Cost

Fixed Life Cycle Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Direct Fixed R&D Resource Cost	20.000									20.000
Indirect Fixed R&D Resource Cost	15.000									15.000
Indirect Fixed R&D Activity Cost	30.000									30.000
Indirect Fixed After Sales Support Cost		30.000	30.900	32.136	33.100	33.762	34.100	34.100	34.100	262.197
Direct Fixed After Sales Support Cost		31.000	31.930	33.207	34.203	34.887	35.236	35.236	35.236	270.937
Indirect Fixed GM Activity Costs	5.000	5.000	5.150	5.356	5.517	5.627	5.683	5.683	5.683	48.700
Total	70.000	66.000	67.980	70.699	72.820	74.277	75.019	75.019	75.019	646.834
Budgeted Sales Amount		100.000	200.000	220.000	180.000	120.000	100.000			920.000
Unit Fixed Life Cycle Cost (TL/unit)										0,70

Table 7 shows the unit fixed life cycle costs of the product. Fixed life cycle costs include direct fixed R&D resource cost, indirect fixed R&D resource cost, indirect fixed R&D activity cost, indirect fixed after sales support cost, direct fixed after sales support cost and indirect fixed gm activity costs. unit fixed life cycle costs of the product are calculated by division of total fixed life cycle costs to total budgeted quantity in every year. Unit fixed life cycle costs of the product are put as same value in each year.

Table 8. Unit Variable Life Cycle Cost

Variable Life Cycle Cost	1.year (TL)	2.year (TL)	3.year (TL)	4.year (TL)	5.year (TL)	6.year (TL)	7.year (TL)	8.year (TL)	9.year (TL)	Total (TL)
Direct Variable After Sales Support Material Cost		5.791	21.718	30.405	28.957	21.718	15.927	14.479	5.791	144.787
Direct Variable After Sales Support Labor Cost		4.000	4.200	4.368	4.586	4.678	4.818	4.818	4.818	36.288
Total		9.791	25.918	34.773	33.544	26.396	20.745	19.297	10.610	181.075
Budgeted Sales Amount		100.000	200.000	220.000	180.000	120.000	100.000			920.000
Unit Variable Life Cycle Cost (TL/unit)										0,20

Table 8 shows the unit variable cost of the product. The unit variable costs of the product include direct material and labor cost of the after sales service. These costs occur during after sales services during warranty period of the product. Thus, it's assumed to be continued for two years after last sold product.

Table 9. Unit Target Cost

Unit Target Cost (TL/unit)	1.year (TL/unit)	2.year (TL/unit)	3.year (TL/unit)	4.year (TL/unit)	5.year (TL/unit)	6.year (TL/unit)	7.year (TL/unit)	8.year (TL/unit)	9.year (TL/unit)	Average (TL/unit)
Unit Direct Variable Cost		5,33	5,53	5,75	5,97	6,09	6,19			5,79
Unit Direct Fixed Resource Cost		1,96	1,02	0,96	1,21	1,85	2,26			1,39
Unit Indirect Fixed Resource Cost		0,50	0,48	0,46	0,44	0,43	0,42			0,45
Unit Indirect Fixed Activity Cost		0,95	0,49	0,46	0,58	0,89	1,10			0,67
Unit Fixed Life Cycle Cost		0,70	0,70	0,70	0,70	0,70	0,70			0,70
Unit Variable Life Cycle Cost		0,20	0,20	0,20	0,20	0,20	0,20			0,20
Unit Target Cost		9,64	8,41	8,52	9,09	10,16	10,87			9,20

Unit target costs are calculated in Table 9 year by year. It shows the target costs in each year and average cost of the product. Life cycle costs are put as same value in each year.

Activity based costing method is used in this model to get target cost in whole product life cycle. This model provides more accurate cost information than conventional cost models to get target costs.

Conclusion

With the increasing in competition, the cost calculation of the products has become more important for businesses. Businesses needs more accurate cost information in order to right pricing and compete in the market. Thus, they have to know costs of the products before production or design. Target costing provides this information but in order to get right cost information from target costing, target costing method should be based on activity based costing method. Another point is the life cycle costs of the products. These costs should be placed into Activity costing method to get right cost information.

In this study a model is proposed for target costing. In this model, all costs from des-ing stage to after sales support stage is taken into consideration. In addition, activity based costing method is used for target costing. Activity based costing is important for allocation of indirect costs to products. By this model, the more accurate product costs are calculated.

Using activity based costing method which is improved as an alternative of the con-ventional costing in target costing including product life cycle costs give right cost information of products.

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SOCIAL MEDIA STRATEGIES FOR ORGANIZATIONS USING INFLUENCERS' POWER

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Abstract

Social media is a big part of our life nowadays and organizations' managers should use this fact in order to bring their products and services closer to potential customers via online social networks. Social media represents an almost free tool to simulate the word of mouth discussion on a brand, in this way the information getting to customers that would be hard to get to in other ways. The objective of this paper is to analyze the influence certain people can have in social networks and how these social network influence ranks are calculated. Social media is more than just counting likes and shares; it is about taking into consideration all components that might increase the conversion rate. In this paper, there are presented some techniques that might be used to increase the awareness for the brand, creating a powerful community around the brand's page, raise the interest of potential customers so that in the end, the sales will grow as well. Another important aspect of the influence in social networks, which is analyzed in this paper, refers to the trust that some influencers might use to promote certain brands. This trust was built usually in several years and the influencer has a considerable number of fans on the personal page, so using social media, this large amount of potential customers might be informed about some products or services, considering that with the trust the fans have in the influencer, the conversion rate will be high. The results and conclusions presented in the paper show why managers should take into consideration persons with high social networks influence ranks when planning a marketing campaign for their brands and how online influence might transform into positive business outcome.

Keywords: Social networks, influence marketing, social media management, entrepreneurship

Social media represents a great opportunity for managers to grow their customer number almost for free using the influence power of the opinion leaders. The paper presents the two-step flow of communication that fits perfectly online social media communication and shows how Cialdini's principles of influence can be applied in social networks as well.

The importance of social media has increased dramatically in the last years. In Romania it made the difference in the presidential elections and got the second favorite to convince three millions and a half citizens to vote for him, only through social media campaigns. So with almost half of the Romanian population having a Facebook account, the engagement and the conversion rate of social campaigns is higher than ever. These figures should not be ignore by managers who should realize that if they don't tread seriously their online presence on social networks and their online branding, not only that competitors will attract their customers, but they risk to become invisible for potential customers who look mostly online for information when they want to buy something.

The two-step flow of communication

Ideas and messages from mass-media are taken by influencers and transmitted forward to the population. The two-step flow of communication developed by Lazarsfeld considers that in its way to the public, the message is filtered by the influencer, which plays an intermediary role. The influencer explains the message transmitted in order to make sure will be understood by its community. The influencer is at same time innovator, because transmits in his group new information, and conservatory factor, because he is filtering the information, transmitting forward only what is needed in his group.

The two-step flow of communication has two steps in transmitting the information. The first step represents the information transmission from mass-media to the opinion leaders or to those persons that pay more attention to mass-media communications and then indirectly, from the opinion leaders to the persons that follow less the messages sent by mass-media. Usually, the opinion leaders do not just transmit the information forward, but they offer explanations for the members in their group. So, the personal influence comes between the message originally transmitted by mass-media and the reactions to that message. The personal influence can be encountered when dealing with buying a new product or service, as the opinion of close friends and family and of the opinion leaders make the difference when choosing between several companies offering similar quality. This process is defined best when talking about the adoption of innovation, when influencers are hired to recommend to their followers to try a particular product or technology.

So, with the two-step flow of communication, the messages are not transmitted directly, they are filtered by the opinion leaders, mass-media influence becoming an indirect one, passing through interpersonal relations. (DeFleur, 1999)

The main characteristics of opinion leaders are:

- Credibility- represented by the positive capital image
- Being active in relation with other groups and in his own group
- Great exposure in mass-media due to previous success

When choosing the influencer who will promote their brand in social networks managers should take into consideration the credibility of the influencer and then analyze the conversion rates off previous campaigns developed on his social network page.

Cialdini's influence principles application is social networks

Cialdini's principles can be used as starting point for marketing strategies in online social networks as influence is an important part in any marketing campaign. The six principles of persuasion mentioned by Cialdini, reciprocity, consistency, social proof, authority, scarcity and liking, if used correctly are boosting conversions in online marketing.

- Reciprocity

After a company offers quality content on a web-site or on the Facebook page, it is more likely that the follower that found useful that content to feel obligated to acquire a product or a service from that web-site or will become members of the online community (by following the Facebook page, for example) just to receive useful information later.

The conversion rate usually grows if there is quality content offered. In Inbound Marketing there are many companies offering at the beginning free quality content and then informing their clients that if they want more detailed reports they can collaborate.

Companies like Klout and HubSpot find their customers on social media among those managers who want to develop successful online marketing strategies, by choosing the influencer that best fits their needs as all these companies calculate the power of influence of different opinion leaders in a certain community.

- Consistency

This principle is encountered in online marketing as offering for free a course in PDF form and if the customer is satisfied with the quality of that free course sample will contract the services of the company. The e-mail address of a potential customer is the most valuable for the company, so it is willing to offer free samples or prizes just to obtain the contact details of interested customers.

- **Social proof**

The social proof principle in online social media can be proved by the number of fans/ followers in networks like Facebook or Twitter, by the number of visualization of YouTube videos or simply, by the number of likes and shares of posts.

Another way in which this principle is used is by informing potential customers about best sold products, which might convince the customers to make a decision based on the number of other customers that made the same decision in the past.

- **Authority**

Cialdini explains that people follow the advice of those with authority and expertise in a certain area. This is why even is a person with a high capital image tends to create more conversion, in the field they are expert in. For example, a singer can represent very well in social media platforms the interests of a Fashion Store, because the fans of that singer might want to copy its style.

- **Liking**

As people tend to trust more the ones who are similar to them, by giving enough details about the brand history and the team that is behind the brand, can make potential customers identify with them and grow the conversion rate.

Liking principle can be found in social networks by uploading appealing video content or by having an attracting design of the web-site.

- **Scarcity**

This principle is meant to show customers that offers posted on Facebook for example are valid only for a limited amount of time and that the quantity is also limited.

Department stores use this principle when promoting Black Friday offers, making customers desire to catch some product sold only in few pieces.

Conclusion

Managers should be aware of how Cialdini's persuasion principles can be applied successfully in social media marketing campaigns and of how influencers can help grow brand awareness and increase conversion rate.

The personal brand, as well as the online brand is essential when talking about influence. Online influence has three components: trust, brand and expertise. It is possible to built a brand by interacting only in one social networks but it is recommended to be active in several networks to acquire influence. Many scholars consider influence to be synonym with power, so if a power increases its influence using the principles mentioned above, automatically will have more power to attract clients towards the brand, to raise sales or share market.

This study is part of a larger PhD study and will be developed in the future.

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SYSTEM OF PREVOCATIONAL REHABILITATION IN THE CZECH REPUBLIC

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Abstract

Prevocational rehabilitation is performed by members of the rehabilitation team to get a functional assessment of the psychosensomotor potential for employment purposes for people with disabilities (patients/clients). Standard methodologies were divided into basic, recommended and special methods for determining the psychosensomotor potential for employment. The functional basic methodologies include: Barthel Index, Instrumental routine daily activities test, Daily structure, Interest questionnaire, Self-assessment of pain, Sensory examination, Work curve by Emil Kraepelin and Richard Pauli, Jebsen-Taylor Test, Purdue-Pegboard test - model 320 20, Jamar Dynamometer, Isernhagen Work System, Loewenstein Occupational Therapy Cognitive Assessment, Activity Matching Ability System, WHO DAS II. The recommended methodologies include examinations by experts that each facility is obliged to ensure, if necessary, for example, targeted and comprehensive assessment, spiroergometry, speech examination, psychological, psychiatric examination, hearing examination, visual examination. Special methodologies are according specialization of rehabilitation facilities. Our Department of Rehabilitation Medicine is focused on patients with brain damage, therefore we use Rivermead Behaviour Memory Test, Mini Mental State Examination, The Middlesex Elderly Assessment of Mental State, Prevocational assessment according to Jacobs, Canadian model of employment, General office test Functional, Independence Measure etc. The prevocational evaluation result is sending to Labour Offices and should not contain any confidential medical information. This report may contain recommendations for further education or retraining. Physician completes the discharge paper and he summarizes the evaluation of the rehabilitation team members. This report includes positive employment recommendations and work restrictions.

Keywords: Prevocational rehabilitation, disability, functional assessment, abilities to work

Introduction

The definition of a disability according to the International Classification of Functioning, Disability and Health is: a disability is a decrement in the functioning of the body on an individual or social level that arises when an individual with a health condition encounters barriers in the environment. This definition is the result of a consensus of a general discussion in Prague in the framework of the 6th programme of the European Union; Measuring Health and Disability in Europe; supporting policy development (MHADIE) and this was published in the Lancet journal in 2006 [6].

According to the WHO, disability is the “loss or abnormality of body structure or a physiological and psychological function”. Disease, injury or an inborn defect can lead to activity restriction, and can cause also the restriction of participation. Participation is the performance of people with a disability and is closely connected to environmental factors, facilitating or creating a barrier. When facilitating factors are applied, performance is improved and also quality of life is maximally improved. The estimate of people with a disability in the European Union (EU) is different – from 8 to 14%. It means that in a person’s productive age in the EU; approximately 26 million people have a disability. In April 2014, the Czech Statistics Office first published the number of people with a disability in the Czech Republic. The figure is 1,077,673 persons with a disability, 10.2% from the whole population in the Czech Republic [3, 5].

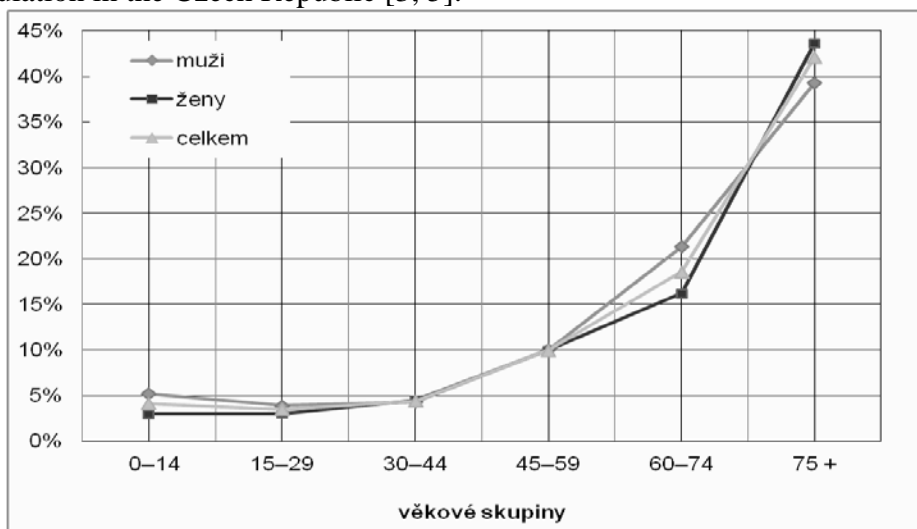


Figure 1: The number of people with a disability in the Czech Republic (Czech Statistics Office, April 2014)

Based on the initiative and methodological guidance of the Department of Rehabilitation Medicine of The First Medical Faculty, Charles University, and in cooperation with the educational company Edost Chomutov, a project was established which was funded by the European Social Fund and from the state budget of the Czech Republic entitled “Initiative of the EQUAL Association – Rehabilitation – Activity – Work (RAW)”. This project was conducted from 2005 until 2008. A total of six inpatient rehabilitation departments in 6 regions participated in this project in cooperation with Labour offices. In the Czech Republic, vocational rehabilitation is under the responsibility of the labour offices in accordance with the Employment Act [4]. As part of this project, personnel, material and supply standards of rehabilitation departments have been developed for prevocational rehabilitation. We have divided prevocational rehabilitation into the first and second tier methodologies.

The EQUAL project was continued by a Systemic Individual Project of Regional Networks cooperating in vocational rehabilitation (PREGNET). A tender was announced by the Ministry of Labour and Social Affairs (MLSA), virtually as a continuation of the RAW project provided that this project will be spread around national regions that were not involved in the RAW project, with the objective to create prevocational rehabilitation facilities in each region (the Czech Republic has 13 regions) with standards of methodology, personnel, material and the supply of equipment. The PREGNET project started in 2012 and ended in 2014. At the end of the project, we proposed that the MLSA issue accreditations for facilities that will perform prevocational rehabilitation, based on the standardization of prevocational rehabilitation procedures, and that prevocational rehabilitation should be reimbursed from the resources in the employment area.

I.

The priority of the PREGNET project was to create new prevocational centres in the rest of the seven regions in the Czech Republic (other regions participated in RAW). Methodology created in RAW was innovative. The goal of the PREGNET project was the methodological standardization of vocational and prevocational rehabilitation, creating a network of all bodies cooperating in the prevocational and vocational rehabilitation of people with a disability in the Czech Republic, and using the International Classification of Functioning, Disability and Health WHO [12].

Centres with accreditation can evaluate the potential to work, education and re-training [2, 8]. The project solved methodology, a part of the complex rehabilitation process. A prevocational rehabilitation process must begin in an acute process in the health care system and also in emergency units. Rehabilitation is necessary for patients with motor,

internal, oncological, visual, auditory, mental and psychological impairment. Patients with a long-term or permanent impact of injury, disease or inborn defect also need other means of rehabilitation (medical, social, educational prevocational and vocational), according to individual needs of the people with a disability [10].



Figure 2: Prevocational Rehabilitation Centres in the Czech Republic

In the prevocational rehabilitation process, the members of an inter-professional rehabilitation team – physicians, physiotherapists, occupational therapists, psychologists, speech therapists, special teachers, nutritive therapists, nurses, social workers, also prosthetics and biomedical engineers must participate, and it is necessary to cooperate closely with family members and patients’ friends.

In patients with a disability, it is necessary to provide continuity of all rehabilitation means – accessibility and the complexity of rehabilitation are crucial, and rehabilitation must start early. The short-term and long-term rehabilitation plans help reach an optimal effect in a short time and is maximally cost effective. In the rehabilitation process, it is important that an individual functional assessment of the psycho-sensory motor potential of people with a disability is the result of an individual inter-professional evaluation. It is important for rehabilitation team members to cooperate closely with family members and also to motivate patients with a disability [6]. The basis for successful integration of the patients/clients with a disability into society is to find a new sense of life, to use their abilities, to find new activities for the early return to work. Methodology uses the term patient/client. A patient is a person who is examined and cured, and is a “part” of the healthcare system. A client is a person who lives his/her life at

own home or in a residential home, e.g. a client of the Labour Office, to use social benefits, is a “part” of the social care system, it is their participation in society.

The initial medical examination contains information about vocational and school case history, and is a complete objective examination. A detailed case history is focused on the objective testing of the psycho-sensory motor potential of the patients for possible working positions. Physicians in a prevocational centre have to study all the health documentation and their own initial examination, and after that, indicate special examinations by other inter-professional team members. During a rehabilitation conference, the rehabilitation healthcare team members evaluate the psycho-sensory motor potential for employment, for education of the patients with a severe disability [7].

Methodologies of Prevocational Rehabilitation

As part of the PREGNET project, standard methodologies for determining the psycho-sensory motor working potential were divided into **basic, recommended and special**.

The basic methodology has been selected so that the prevocational rehabilitation centres in the Czech Republic are uniformly equipped, and that these methodologies require a one-time investment (financed from the project). Methodologies were selected so that they are sufficiently broad and cover most of the work activities. They included tests to evaluate physical exercise, balance, dexterity, orientation in unfamiliar situations, cognitive functions, working position and working equipment. The basic methodologies are: simple; short; time saving (up to 3 hours in a single day); financially and personally less demanding, and suitable for clients with a mild and/or moderate disability. The functional basic methodologies include the Barthel Index; the instrumental routine daily activities test; a daily structure; an interest questionnaire; a self-assessment of pain; a sensory examination, and Work Curve by Emil Kraepelin and Richard Pauli; the Jebsen-Taylor test, the Purdue-Pegboard test (model 320 20); the Jamar Dynamometer, the Loewenstein Occupational Therapy Cognitive Assessment; the Activity Matching Ability System, WHODAS II (World Health Organization Disability Assessment Schedule) and the Isernhagen Work System. The innovative approach in the area of functional assessment is provided by the Isernhagen Work System, a functional diagnostics system intended to test the working and functional potential of individuals which was purchased within the project. This functional diagnostics is intended for people with a disability, without education or with primary education who are capable of performing physical work.

The prevocational rehabilitation centres need not own the recommended methodologies, but if necessary, they should ensure their availability [1, 2, 7].

The recommended methodologies include examinations by experts that each facility is obliged to ensure, if necessary and for example, a targeted and comprehensive assessment; spiroergometry; a speech examination; a psychiatric examination; a hearing examination, sight examination, etc.

The methodologies used to evaluate the functional psycho-sensory motor potential will be complemented based on the professional specialization of the facilities, and according to the rehabilitation goals, including retraining or further education and individual possibilities for professional inclusion of the patient/client [1, 11].

The special methodology is among the optional equipment of the prevocational rehabilitation centres according to their specialization. They are used only by selected facilities based on their experience and focus on the age groups of patients with a disability or for various functional diagnoses. These methodologies are more variable, more detailed, more time consuming and intended for more complex cases in patients/clients with severe and very severe disabilities. Of special methodologies, we use for example, the Functional Independence Measure; the Rivermead Behaviour Memory Test; the prevocational assessment according to Jacobs; a Canadian model of employment and general office test [2, 8].

Conclusion:

Physicians who engage in prevocational rehabilitation initial/baseline medical examinations may prescribe additional functional tests by an inter-professional rehabilitation team. After having finished all the examinations, we discuss each patient/client in a rehabilitation conference. The final report – a summary and assessment – is prepared according to the results obtained by each expert in the team, positive and negative recommendations for healthcare professionals, for labour offices, for social services and support for education.

We send the final report on prevocational rehabilitation to the general practitioner. The final report is also sent to the employment offices and as a standard, is drawn in accordance with the PREGNET project (based on the final report prepared for the employment agencies in the RAW Project). This report should not contain any confidential information. It may also contain recommendations for further education or re-training of the patient/client, as re-training falls within the jurisdiction of the employment office [6].

The employment offices follow the conclusions of the prevocational rehabilitation, and recommended vocational rehabilitation that is focused on

particular work activities and particular job positions. If the prevocational rehabilitation facility recommends further long-term education, a special education teacher will contact the appropriate school.

The final report is sent to the selected school to the attention of the teacher who is responsible for teaching people with special needs. The final report also recommends, on an individual basis, the necessary and appropriate long-term social support (allowances) and services that are processed by the social worker based of functional diagnostics provided by the inter-professional rehabilitation team. The final reports are processed by a physician who will summarize the assessments of experts from the inter-professional rehabilitation team, and should include positive recommendations and recommended work restrictions [3, 4].

Job opportunities for people with a disability:

1. Open labour market:

- a) the first goal is, if possible, to rejoin the previous job
- b) the same employer but a different job position
- c) another employer

2. **Supported employment** – time limited service (only for 2 years) for people with a disability who find a paid job in a common working environment – this means a job in the open labour market. Patients/clients with limited abilities to work need individual, long-term continuous support before and after returning to work.

3. **Sheltered workshop** is an individual job position established by an employer for client with a disability by written consensus with the Labour Office. The Labour Office can provide an allowance for the establishment of a sheltered workshop to employers. Persons with a disability who want to work as self-employed can make an agreement with Labour Office about the establishment of a sheltered workshop and begin to use the allowance for the administration and organization of this sheltered workshop.

The part of supported employment: **A Job assistant** is a person who helps clients directly in their new job to find the optimal kind of communication; discover new abilities and habits necessary for the job. **A Job consultant** is a person who gives the clients support and help to find working positions, to cooperate with employers who want to engage people with a disability [1, 2, 8].

Important Proposals of the Change in the Employment System of People with Disabilities in the Czech Republic

- The necessity of an approved law about coordinating rehabilitation in the health care system, the social care system with an educational system and the system of employment. People with a disability have to start work as

soon as possible with all possible technical aids, with long-term social supports, social benefits and social services in a working environment without barriers.

- The duty of employees in labour offices to inform applicants about the possibility to participate in prevocational and vocational rehabilitation.
- The possibility for the applicants with severe and very severe disabilities to work at home or to use e-work.
- Cooperation with a non-profit organization (non-governmental organization (NGO), is an example of “good practice” e.g. massage courses for the Czech Blind Union organized with Labour Offices in the Czech Republic.
- The necessity to create a new non-medical health profession, an “advisor for employment for people with a disability”. This type of education does not exist in the Czech Republic. Graduates of this study branch would be able to work with people who suffer a disability, have knowledge of functional abilities of these people and an integrated system of typical positions. It is the Czech acronym for Integrated System of Typical Positions, a set of information about the world of labour and methods of using the information to facilitate communication on the labour market and make it more effective.
- It is designed to help people with a finding an optimum employment by means of:
 - maintaining up-to-date databases of occupations and typical positions
 - describing the aspects and requirements of different jobs in a Registry of Typical Positions
 - offering tools for vocational counselling and career guidance, as well as
 - job mediation (placement) instruments
 - referring to other labour market, education and training information systems
 - matching vocational training with the requirements of the labour market
 - offering background material for companies to make their practice of human resource management more effective
 - presenting recommendations for personal growth of individuals and improvement of their skills.
- They could consult individually with employers of the possibility how to use technical aids in work situations and to create a working environment without barriers and with the opportunity of transport from work to home.

We have to prepare education of children, youth and adults with disabilities to reach the highest level of education. Cooperation between education and actual regional need of employees' positions for people with a disability is necessary.

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ECONOMY-MIGRATION, CAUSE AND CONSEQUENCE WHICH INCREASES THE NUMBER OF DIVORCES

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Abstract

The Albanian economy during these 25 years of transition is accompanied by changes. It is true that during this period, has undergone positive changes, but it does not bring any significant improvement in terms of employment growth in the country. Most Albanians, again see immigration as an opportunity for employment, since the country has not been able to find a job, that to provide sufficient income for their families. Youth, the most vital part of society, are the ones who make up the majority of immigrants. The majority of them, once they have a family, and others are parents who want to provide income to raise their children. Immigration contributes positively to the economy of these families, but also has its negative side, in terms of the impact that it has on the relationship between partners in a couple. Living divided between partners, it has created problems in this relationship, being dogged by divorce. So, as a result of a high level of emigration, we have also increased the number of divorces in the country. Low economy brings a host of social problems, which generate from it. These problems lead to an increase in the number of divorces, where most of them make up the pairs, who had only one of the partners or both in emigration.

This study was conducted in the region of Elbasan. The data were taken from interviews conducted with partners that have made themselves a request for divorce. For this study also used data from studies carried out by various state institutions, INSTAT and NGOs operating in Albania.

Keywords: Divorce, immigration, the economy, marital relations, social problem.

Introduction

Divorce is a difficult moment in the life of a couple, not only for the problems that lead to his marriage but also the consequences which followed

it especially for children. A very important factor that affects the growth of divorces is immigration. Albanian emigration to other countries is mainly for economic reasons, which are directly related to economic conditions in which our country is. As a former communist regime inherited from a backward economy and rundown. During the transition, Albania was an improvement but we are left again a country with a weak economy which does not meet the needs for jobs. Facing this economic state with a high unemployment rate have highlighted the emergence of a new phenomenon of economic migration. Economic emigration got a widespread especially after the 90's with the change of political system. This phenomenon continues to exist even today. Initially emigration ranged mostly young people and mostly men, while women stay at home with children waiting for men to bring in money. Over time the situation has changed as part of immigration are also women and children.

The purpose of this study

Divorce is a phenomenon that plagues every day society. This concern comes not only because if there is increased but also because he has social as well as economic cost (psychological consequences of partners but also the children, economic conditions after divorce, etc.).

The purpose of the study is:

The impact of economic immigration, because that leads to the increasing number of divorces.

Making more specifically on the problems that lead a couple to divorce, in terms of relations between spouses and their character. The distance for a long period, has also brought a cooling, to keep peace in the couple. Couples who previously had their contradictions between the departure of migrant husband, were added still more these contradictions. Another fact is that the spouse in migration creates a new connection where. Social and economic changes can influence the improvement of conditions in many families. This could possibly bring the curb immigration as a phenomenon, and therefore curbing divorce due to immigration.

Hypothesis and research questions

The hypothesis is cast in this study it is:

- Increasing the number of divorces as a result of immigration and the opening of the company

Questions raised in this study are:

- What couples go to divorce?
- How many of these couples have had one of the partners in emigration?

- How has the distance for a long time affect the relations between them?
- What changes in social, cultural and economic policies will help these couples not to go in divorce?

Research methods and methodology

To make this study were used primary data (interviews of divorced people) and secondary (data taken from the literature). In reviewing the literature gathered data pertaining to divorce, which was due to the departure for a long time one of the partners in emigration.

I conducted this study based on a representative model of study with qualitative data collected from the literature. Also in the study included primary data from semi-structured interviews and unstructured that were conducted with participants in the study.

The sample: is using non-probability approach. Select the champion is aiming to give answers to the survey questions. Participants in the study were men and women who have made themselves a request for divorce. Interviews were conducted with persons having stayed away divorced partner for a long time as a result of immigration. The purpose of these interviews is to see how it has impacted the distance in relationships, the couple stay for a long time in a country with different culture.

Data processing is count taken through thematic analysis starting with unprocessed data, interpreting, summarized and categorized them. The conclusions were drawn using interpretive approach

Analysis

Immigration of Albanians to neighboring countries, generally has been illegal. He has never been directed or organized by the state authorities. As a result of massive and uncontrolled immigration for many years, Albanian citizens successfully worked without a residence permit, without being registered in the relevant state bodies. Thus, they did not have a safe place to stay. Precisely this was the reason why mostly men migrate, leaving women and children in Albania. Migrants return to the country and emigrate again illegally, for more than a decade, a period that is relatively long in terms of family life and couple relationship. They were almost out of family troubles and problems during its migration where trying to secure money for their families. Almost throughout the year were away from your family and wife. They stood with their families just a few days a year and mainly during the holidays.

Over the last decade, Albanian immigrants were granted legal residence in the respective countries where they emigrated. Most of them made family reunification by pulling the migrant family. Referring to

research conducted by INSTAT (INSTAT 2014); It indicated that spouses or partners and children left behind by migrants during their migration up about 60%. Specifically 54% of them have left his / her spouse and more than half have left the children in the family unit of origin. Almost a third of the immigrants claim that partners of them have gone out to join them, while one in four have their children along. (INSTAT 2014). Most of the immigrants have left children in Albania. This fact constitutes a very worrying and complex problem.

Where these children are staying and with whom? From the analysis of the social status of children in all institutions of social problems handling, about 80% are children who come from families with divorced parents with social problems, imprisoned, in emigration (SOS Children's Villages Albania 2012). Many parents divorced, and then remarried, leaving their children in these institutions, as partners do not accept them. Remarriage of parents, has been a problem for children who are not welcomed by the new partner of a parent. Some parents in emigration, send their children in these institutions. Some of the immigrants leave their children in the care of parents or their relatives, because they have no opportunity to take with them into emigration. Immigration is not easy for parents as well as children.

Generally, men constitute the largest number of immigrants, but the difference with women is not very great. (INSTAT 2014) 34% of men aged 25-34 years old have immigrated. This age group constitutes the largest number of migrants, followed by the age group of 20-24 years, which constitutes 23% of men who have emigrated. (INSTAT 2014) These are the most active age for work, also have worked. Their essentials of life are at the stage when they have a family and need to provide for its maintenance. Albanians have had various destinations where most favorite emigration were Italy a place where there are 47% of emigrants, followed by Greece with 43% of immigrants. In third place rank the United States of America with the difference compared with the first two places (INSTAT 2014). Historically Albanians have been more inclined to migrate towards neighbors compared to remote sites even though their economy has been more developed.

Marital relations during the reunification of spouses in emigration. Reunification emigration has not been easy, not only in terms of difficulties in accommodating family, but also in the adaptation of lifestyle in a foreign country. Each of the partners had been his way of living. Immigrant men were separated from family problems which mainly resolved by women. During the union they are caught unprepared before a situation where they seem to take part in solving these problems. This is often accompanied by disagreements between partners, passing unpleasant situation for their

children. Interviews with partners who have made a request for a divorce after he returned from abroad, the difficulty emerges that they have to remake their lives in pairs after a long period of separation. Living share has established a cooling of relations between the partners although their marriage still existed. Most marriages among immigrants have had such a history, after the crowning, the husband is in emigration and stayed there almost all the time. During this period one of the partners is dealing with raising children, while the other partner has provided income for the family emigrated. Up to this stage everything goes well in terms of their marriage and relationships. Couple problems arise with their union in emigration. During the union they understand that marriage has problems which had not noticed before, but that added over time. Disputes have been eclipsed by the conflicts which add even more cooling of relations between the partners. Divorces cases included in the study 58% say that marriage has come to an end as a result of the cooling of relations in pairs. Spouses leaving blame each other for the situation in which is their marriage. They often justified by the fact that they have not well known partner before marriage, or that are inconsistent character. These problems emerge after several years of marriage, where most of the time, the partners have lived separately. Thus marriage comes to an end, although the partners have not previously thought of such a thing. Quite evident in couples with a partner in migration are even extramarital relations. Living away from the spouse, it has contributed to the creation of these connections, which have had a negative impact on marriage. Such examples have not only the partners in migration, but also the partners who have resided in the country. Allegations of adultery are common in-demand claims for divorce. 45% of the cases included in the study exhibited partner's betrayal as a problem that has led to the recent marriage. One problem may be less evident if the spouses would live near each other as all normal couples.

Although state intervention is crucial in terms of reducing the scale of immigration?

Couples who have emigrated partners, are at higher risk for divorce, referring to data arising from the study. It relates not only to the way of life that make these partners, but also the problems faced by them. For any of the partners is not an easy life, for those who are living in emigration and separated from family, as well as to other partner should only handle family problems. Certainly one of the families that have emigrated partners have better living conditions, are in a better economic condition, compared to households without migrants. Such a finding would not mean that their problems are solved. Social problems that carries emigration, mostly to reflect this social group compared with the other group. It also noted the high number of divorces performed. Immigration is a factor that strongly affects

the increasing number of divorces. The data of the study it appears that 65% of divorce cases were included in the study had one or two partners in emigration. To avoid this phenomenon and to reduce as much as the number of divorces caused as a result of immigration, state intervention is crucial. Enterprise and realization of economic and social policies, would have a very positive impact in terms of reducing the scale of Albanian emigration to other countries. Consequently spouses will make a more consolidated, so the family will be demonstrated fewer social problems, and consequently divorces would be fewer in number.

Economy a key factor in the increase of divorce. Although at first glance seem somewhat paradoxical, low domestic economy indirectly affects, therefore, not directly in the growth of divorce. The weak economy appeared phenomenon of economic migration, because of unemployment, which in turn shows social problems that directly affect the increasing number of divorces. A weak economy appeared mostly social problems, which adversely affect relations between the partners.

What are the measures taken by the state to curb immigration and boost employment?

The biggest influx of migrants coming from rural areas and most of them are young. (Officials Journal 2014 / No. 169) These young if they were in Albania to work in agriculture. This referred to the current situation in rural areas which are based mainly in the agricultural sector in terms of employment. Their migration makes to decrease the availability to work in these areas. This adversely affects agriculture and rural development. The economic crisis in countries where Albanians have emigrated has forced many of them to return. To mitigate unemployment is first priority of state institutions development of the agricultural sector (Officials Journal 2014 / No. 169) after 52% of full-time employees in the country belong to this sector. (INSTAT 2013) are employed in agriculture, the largest number of women, reducing inequality in employment gap between men and women. (Officials Journal 2014 / No. 169). And investments in this sector and its development can positively affect the reduction of immigration as a major part of immigrants will have employment opportunities. They will not be interested to emigrate if employment in this sector will be profitable for them. Reduce the rate of emigration in turn will enhance the mitigation of social problems and reducing divorces caused by the latter.

Conclusion

Of course the economic situation of our country's economy is also reflected in our families. When in place it is very difficult to find work, immigration is seen as the ability to provide from the unemployed category. This really is a good solution of economic problems, but that is often

associated with social consequences. One of the most worrying problems is the divorce as a result of immigration. If employment opportunities in the country would be higher then the number of immigrant Albanian it would be reduced. As a result of inhibition of mass immigration would decrease significantly the number of divorces caused by him. State intervention to boost employment is very important because it will reduce the number of immigrants by reducing the social problems caused by it.

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MACROECONOMIC IMBALANCE PROCEDURE IN THE EURO AREA – EX POST ANALYSIS

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Abstract

Macroeconomic imbalances increase the probability of economic crisis, even more so in a monetary union with limited economic policy tools available. In the Economic and Monetary Union (EMU, euro area or eurozone), macroeconomic imbalances have accumulated since the euro introduction and they have significantly contributed to the emergence of the recent crisis with serious impacts on several Member States and hereby on the whole euro area. In order to improve the proper functioning of the EMU and prevent possible future crisis, a governance reform has been undertaken in the European Union (EU) in 2011, including introduction of a new procedure for preventing and correcting macroeconomic imbalances - the Macroeconomic Imbalance Procedure (MIP). It starts with an alert mechanism based on a set of eleven macroeconomic indicators with their threshold values (the so-called scoreboard), which this paper mainly focuses on. The first part of the paper provides an overview on the functioning of the preventive and corrective arm of the new procedure within the EU. The second part deals with the economic reasons for establishing respective MIP indicators. Finally, the third part aims to test appropriateness of the composition of the scoreboard for anticipation of the recent crisis by analysing the development of the indicators in the twelve euro area countries in period 2004-2007, i.e. prior to the outbreak of the crisis.

Keywords: Euro area, Macroeconomic Imbalance Procedure, scoreboard of indicators, crisis

Introduction

In a monetary union such as the EMU, the Member States abandon their autonomous monetary policy as well as exchange rate policy tools. Hence, in the event that asymmetric shocks occur, the Member States have to use their fiscal policy tools and/or flexible labour markets (i.e. labour mobility or wage flexibility) for adjustments after shocks. However, within the euro area labour mobility is rather limited and wage flexibility is not

particularly high. In a period of difficult economic developments, room for fiscal policy measures is also limited. Another possible solution to face asymmetric shocks would be fiscal transfers, which, although discussed at the European level, are politically not feasible at present. In such conditions, it is very important to prevent occurrence of asymmetric shocks in the EMU by early identifying macroeconomic imbalances that could lead to these shocks and by adopting necessary measures in respective economies to reduce or eliminate the existing imbalances (Essl and Stiglbauer, 2012). This has become even more important after the outbreak of the current economic and financial crisis, followed by the debt crisis in the euro area.

The heterogeneity of the economies participating in the eurozone has made the area as a whole vulnerable to external shocks such as the recent crisis which revealed weaknesses in the governance framework underlying the functioning of the EMU. So in order to prevent possible future crisis, a governance reform has been undertaken in the European Union (EU), including introduction of a new procedure within the EU's annual cycle of economic policy guidance and surveillance (the European Semester) for preventing and correcting macroeconomic imbalances in the euro area - the Macroeconomic Imbalance Procedure (MIP). It is a surveillance mechanism that aims to identify potential risks early on, correct the imbalances that are already in place and prevent them from re-emerging. The MIP represents an integral part of economic policy coordination within the EU and in particular within the EMU, where the need for such policy coordination is even stronger.

In September 2010, the European Commission (subsequently referred to as "Commission") adopted a legislative package consisting of six proposals, the so called *six-pack* legislation, which aims to reinforce the monitoring and surveillance of fiscal, macroeconomic and structural reform policies in the EU and the euro area compared to previously applied legislation. The Ecofin Council and European Council reached an agreement on the six-pack legislation to improve EU economic governance in March 2011. As a result of discussion on economic indicators to detect macroeconomic imbalances, Ecofin/Eurogroup adopted resolution on the design of the scoreboard of indicators in November 2011. The legislation on the MIP entered into force in December that year, so it could become a part of the 2012 European semester. The MIP legislation consists of two regulations included in the six-pack: *Regulation (EU) No 1176/2011 of the European Parliament and of the Council of 16 November 2011 on the prevention and correction of macroeconomic imbalances* and *Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011 on enforcement measures to correct excessive macroeconomic imbalances in the euro area*. Regulation 1176/2011 covers

all EU Member States and lays out the details of the surveillance procedure, while Regulation 1174/2011 applies only to euro area Member States and focuses on enforcement, including the possibility of sanctions.

Preventive and Corrective arm of the MIP

As the Stability and Growth Pact (SGP)³³, also the MIP consists of the preventive and corrective arm. Within the preventive arm of the procedure potential macroeconomic problems have to be identified and regularly analysed in order to detect the emergence of imbalances early-on. The corrective arm will come into effect if macroeconomic imbalances in a particular Member State prove to be serious, i.e. “excessive”.³⁴ Consequently, this Member State will be required to submit a plan for corrective measures. The corrective arm provides means to effectively enforce correction of imbalances. In case the Member State concerned fails to comply with the recommended corrective actions, sanction may be imposed.

The MIP is built as a “two-step approach”. The first step is represented by an alert mechanism which works as a filter. The objective of the alert mechanism is to focus attention on observed risks early on and identify the Member States for which, in the second step, more in-depth analysis appears warranted so as to assess their vulnerability and substantiate policy recommendations if appropriate (European Commission, 2012b). So it is in-depth analysis, and not the alert mechanism, which provides the basis for any recommendations to be addressed to the Member State under the preventive or corrective arm of the MIP.

The MIP starts with the Alert Mechanism Report (AMR), prepared by the Commission in November each year since 2012. The alert mechanism is based on the so-called scoreboard, i.e. a set of eleven (previously ten) macroeconomic indicators of external imbalances, competitiveness and internal imbalances with their threshold values established by the Commission. The threshold values are not interpreted mechanically, but in conjunction with the accompanying qualitative analysis. This approach gives the Commission both flexibility and a high degree of discretion in

³³ SGP is a set of rules designed to ensure that countries in the EU pursue sound public finances and coordinate their fiscal policies.

³⁴ According to the Regulation 1176/2011, a macroeconomic imbalance means “*any trend giving rise to macroeconomic developments which are adversely affecting, or have the potential adversely to affect, the proper functioning of the economy of a Member State or of the Economic and Monetary Union, or of the Union as a whole*”, while the excessive imbalances are defined as “*severe imbalances, including imbalances that jeopardise or risks jeopardising the proper functioning of the economic and monetary union*”.

interpreting the data (Moschella, 2014). The overall number of breaches of thresholds, the severity of individual breaches as well as the combination of breaches, potentially signalling broad based problems, is also taken into account (European Commission, 2011).

Based on the results of the scoreboard and the qualitative analysis, as well as taking into account relevant data beyond the scope of the scoreboard (additional indicators) in order to get a more complete picture, the Commission identifies the Member States that face risk of excessive imbalances. In these countries a closer analysis (in-depth review) is being carried out by the Commission in collaboration with the affected Member State. The in-depth review focuses on causes and potential effects of existing macroeconomic imbalances.

Following the in-debt reviews the Commission determines whether imbalances exist and what their nature is. Depending on the severity of the imbalances the Commission proposes policy recommendation either under the preventive or under the corrective arm of the MIP. Strictly speaking, the in-depth review can lead to three different results: 1. the Commission does not detect any macroeconomic imbalances and consequently does not take any further steps; 2. the Commission detects macroeconomic imbalances and advises the Council of the EU (the Council) to issue recommendations for preventive action to the affected Member State or 3. the Commission detects excessive imbalances which could jeopardize the functioning of monetary union and advises the Council to issue recommendations for corrective action to the affected Member State.

The Excessive Imbalance Procedure (EIP) would be initiated only in cases where the in-depth review leads to the third conclusion above. This would mean starting the corrective arm of the MIP, potentially leading to sanctions for euro area Member States. If the in-depth review leads to the second point above, the European Council issues recommendations on the correction of the macroeconomic imbalances to the Member State. These recommendations are only of preventive nature and represent a part of the proposals for country-specific recommendations, which provide guidance for national policy making.

After starting an EIP under the corrective arm of the MIP, the Member State concerned must submit a corrective action plan (CAP), based on a Council recommendation. The plan must contain adequate measures for the correction of the imbalances detected and specify the implementation timetable. In case the plan is considered inadequate, the Council will issue another recommendation, based on a proposal from the Commission. Then the Member State must submit a new CAP. On the other hand, if the plan is considered adequate, the Member State will be asked to implement the corrective actions defined in the plan within the timetable. If a Member State

fails to implement the defined corrective measures adequately, the Council will issue a recommendation setting new deadlines for implementation.

The enforcement of the EIP is backed by sanctions. In the event of contraventions financial sanctions may be imposed for the euro area Member States (but not for the other EU Member States). In case of an inadequate implementation of a CAP, an interest-bearing deposit equal to 0.1% of the country's GDP will be imposed. Moreover, two consecutive negative evaluations with regard to the CAP or the implementation of corrective measures will entail an annual fine equal to 0.1% of the country's GDP. This fine will be applied until the CAP has been accepted or the implementation of the corrective measures considered being adequate. If an interest-bearing deposit with the Commission has already been imposed on the Member State, the deposit will be transformed into an annual fine. The penalties will be used for the financing of the European Stability Mechanism (ESM). The EIP will be terminated once the Council, based on a recommendation from the Commission, determines that the imbalances have been effectively eliminated.

One of the major innovations of the procedure is the use of a reverse qualified majority voting (RQMV), under which a Council decision on a Commission recommendation regarding the activation of sanctions against euro area Member States is deemed to be adopted by the Council unless it decides, by qualified majority, to reject the recommendation within ten days. Thus, RQMV enhances the likelihood that the surveillance process will proceed as planned rather than being blocked by political considerations (Moschella, 2014).

Indicators of the scoreboard

In November 2011 the Commission published a Staff Working Paper presenting envisaged initial design of the scoreboard of early-warning indicators for the surveillance of macroeconomic imbalances (European Commission, 2011). The proposal contained ten indicators and considered an additional indicator on the banking/financial sector that would be developed by the end of 2012. The design of the scoreboard is based on a set of four principles: 1. The choice of indicators focuses on the most relevant dimensions of macroeconomic imbalances and competitiveness losses, with a particular emphasis on the smooth functioning of the euro area. 2. The scoreboard indicators and thresholds should provide a reliable signalling device for potentially harmful imbalances and competitiveness losses at an early stage of their emergence (thresholds established with a statistical approach based on the distributions of the indicators' values identifying the thresholds as the lower and/or upper quartiles of the distributions; such thresholds are consistent with the values found in some empirical studies in

the available economic literature). 3. The scoreboard has an important communication role. 4. Indicators are of high statistical quality in terms of timeliness and comparability across countries.

Nowadays the scoreboard used for AMRs consists of eleven indicators (including indicator on the financial sector) with their indicative thresholds. The indicators include both stock and flow indicators which can capture shorter-term deteriorations as well as the longer-term accumulation of imbalances. The economic rationale behind the inclusion of individual indicators into the scoreboard, the transformations used and the determination of threshold values is in short as follows (European Commission, 2012b):

Current account balance

- 3 year backward moving average of the current account balance as percentage of GDP, with indicative thresholds of +6% and -4%

The current account balance is one of the most significant indicators in explaining crisis incidence. The economy with a high current account deficit is borrowing and importing in excess of its exports. Surveillance under the MIP covers also current account surpluses; however, a greater degree of urgency is required in economies with large current account deficits and competitiveness losses. Hence the need for policy action is strong in economies with large deficits of the current account; however, also the Member States with large current account surpluses should implement the reforms focusing on strengthening their domestic demand. The average over three years is used in calculation in order to provide indications of the persistence of a potential imbalance. The indicative threshold for current account deficits of -4% was derived from the historical data for the EU Member States, using a simple statistical distribution analysis. The upper value of the threshold is set at +6%.³⁵

Net international investment position (NIIP)

- NIIP as percentage of GDP, with an indicative threshold of -35%

The NIIP as the net financial position (assets minus liabilities) of the domestic sectors of the economy versus the rest of the world is the stock counterpart to the current account balance. Persistently high current account deficit leads to highly negative NIIP. Calculation as a share of GDP allows for cross-country comparability. Value for the last available year is used and the indicative threshold is -35% of GDP. However, besides the level also

³⁵ The initial scoreboard used by the Commission had the same 4% trigger point for the current account imbalance, whether this was a surplus or a deficit. However, this was later changed into an asymmetric trigger: +6% for surplus countries and 4% for deficit countries (De Grauwe, 2012).

composition of assets and liabilities in terms of maturities is an important factor when assessing the overall vulnerability of the external position of a Member State.

Real effective exchange rates (REER)

- 3 years percentage change of the REER based on HICP/CPI deflators, relative to 41 other industrial countries, with indicative thresholds of $-/+5\%$ for euro area countries and $-/+11\%$ for non-euro area countries

The indicator of the REER is based on consumer prices in order to capture the drivers of persistent changes in price and cost competitiveness of each Member State relative to its major trading partners. The REER is frequently considered among early warning indicators. It assesses price and cost competitiveness developments and not some other aspects of competitiveness like product quality or overhead costs, so it is complemented by other scoreboard indicators such as export market shares. Symmetric indicative thresholds are used and they differ between the euro-area ($-/+5\%$) and non-euro-area Member States ($-/+11\%$).

Export market shares

- 5 years percentage change of export market shares measured in values, with an indicative threshold of -6%

This indicator aims at capturing structural losses in competitiveness. Changes in export market shares can be driven by the increase/decrease of a country's export volume (numerator effect) but also by the growth of total world exports in goods and services (denominator effect). So countries can lose market shares because their exports grow more slowly than total world exports. The percentage change over five years of exports for each country as share of the world exports allows for measuring long-term competitiveness development. The indicative threshold of the export market share indicator corresponds to cumulative losses of 6% over a period of five years.

Nominal unit labour cost (ULC)

- 3 years percentage change in ULC, with indicative thresholds of $+9\%$ for euro area countries and $+12\%$ for non-euro area countries

The indicator of nominal ULC monitors developments in price and cost competitiveness across the EU Member States. A rise in an economy's nominal ULC corresponds to a rise in labour costs that exceeds the increase in labour productivity. If other costs are not adjusted in compensation, economy's cost competitiveness can be threatened. The three-year percentage change is used in order to capture the medium term developments of labour costs. The indicative threshold for the euro area countries is 9% , for non-euro-area countries 12% . Together with the REER indicator, the ULC

indicator allows a comprehensive assessment of the cost/price competitiveness developments in the Member States.

House price index

- year-on-year changes in house prices relative to a Eurostat consumption deflator, with an indicative threshold of 6%

Large movements in housing markets can be an important source of macroeconomic imbalances and have been associated with several economic crises. The consumption deflator is used in calculation to reflect the value of house prices relative to the whole consumption basket.

Private sector debt

- private sector debt (consolidated) as a percentage of GDP with an indicative threshold of 133% (previously 160%)

Excessively high private sector debt increases the vulnerability to economic shocks. The indicative threshold of private sector debt is 133% GDP; however, there is no firm evidence from the literature on an optimal level of debt in the economy.

Private sector credit flow

- private sector credit flow as a percentage of GDP with an indicative threshold of 14% (previously 15%)

Private sector credit flow includes loans and securities other than shares. This indicator is the flow counterpart of private sector debt (a stock indicator). Quickly expanding credit is considered as one of the best predictors of financial or banking crises. Credit growth is also a good early warning indicator for house price booms and there is a potentially important link between credit growth and external imbalances.

General government sector debt

- general government sector debt as a percentage of GDP with an indicative threshold of 60%

A high level of general government debt increases the vulnerability of a Member State, weakens its room of manoeuvre to deal with crisis situations and is even more worrying when it is accompanied by large private sector debt. The indicator for general government debt is therefore included in the scoreboard to provide a broader picture of Member States' indebtedness, not to monitor risks of unsustainable public finances, which are covered by the SGP. The Treaty reference value of 60% of GDP is used as the indicative threshold for this indicator, as a separate threshold under the MIP would be confusing.

Unemployment rate

- 3-year backward moving average of unemployment rate, with an indicative threshold of 10%

The indicator of unemployment rate helps to better understand the potential severity of macroeconomic imbalances in terms of their likely persistence and the capacity of the economy to adjust. The indicator is defined as the 3-year backward average of the unemployment rate which was preferred to yearly figures, strongly influenced by short term volatility.

Financial sector liabilities

- year-on-year percentage change in total financial sector liabilities, with an indicative threshold of 16.5%

This indicator has become the eleventh indicator of the scoreboard (European Commission, 2012a) and was included in the scoreboard for the second AMR published in November 2012. It aims at better capturing the interlinkages between the real economy and the financial sector. Experience has shown that a fast expansion of the financial sector has often preceded financial crises. While the European Systemic Risk board (ESRB) monitors financial stability risks, the MIP looks at the financial sector from the point of view of macroeconomic imbalances.

The appropriateness of the scoreboard of indicators is regularly reviewed by the Commission from the view of the composition of indicators, the methodology used and the indicative thresholds established. In line with the MIP legislation, it is possible to add new or better-quality indicators to the scoreboard or replace some of the existing indicators. Besides the scoreboard results, the economic reading takes into account other relevant information and the broad economic context using complementary additional indicators which are also reported in the AMRs. This includes growth and employment developments, nominal and real convergence, as well as productivity developments.

Four AMRs have been already published and few modifications have been made. However, according to some authors, the MIP still suffers from severe shortcomings, e.g. with respect to the surveillance of competitiveness divergences and current account imbalances (Hallwirth, 2014) or due to its predominant single-country focus (Moschella, 2014; Ederer, 2015), and the limited integration of macroeconomic and financial analyses, which may lead to missing important systemic developments. In addition, the MIP regulations remain relatively vague on the criteria to establish “excessive imbalances” in a country (Kamps et al, 2013).

Development of the MIP indicators in selected EMU Member States before the recent crisis

We have analysed available data for the indicators of the MIP scoreboard in the period 2004 – 2007, i. e. prior to the outbreak of the global financial and economic crisis, in order to test whether the indicators and thresholds established would have allowed to identify macroeconomic imbalances early on and thus anticipated the crisis. We have chosen twelve EU Member States using euro as the official currency in the period analysed, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal and Spain.³⁶ Hence, table 1 with indicator values for 2004 – 2007 contains only indicative thresholds for the euro area Member States for REER and ULC. Figures falling outside the thresholds established by the Commission in the AMR are highlighted in grey.

As seen in the table, the countries analysed can be divided into two groups with different characteristics. For the first group, the group of countries more or less belonging to the so called core of the EMU (or the North eurozone): Germany, Austria, Luxembourg, Netherlands, Finland, Belgium, France, current account surpluses (in several countries large)³⁷, positive or only moderately negative NIIPs, modestly growing ULC, real exchange rate depreciation (apart from Belgium and Luxembourg), relatively lower indebtedness of the private sector in most countries and government debts below or slightly over the threshold (apart from Belgium), slower growing private credit flows and only moderately expanding financial sectors were typical in the period analysed.

On the other hand, the second group consisting of euro area periphery economies (South eurozone, apart from Ireland; sometimes called GIIPS: Greece, Ireland, Italy, Portugal, Spain), was characterised by relatively large current account deficits (apart from Italy), highly negative NIIPs (apart from Ireland and again Italy), a significant rise in nominal ULC, real exchange rate appreciation, quickly expanding private sector credit flows (apart from Italy), high overall indebtedness as well as a fast expansion of the financial sector (apart from Italy and Portugal) and increase of real estate prices (in particular in Spain, Ireland).³⁸

³⁶ A similar analysis has been conducted by Essl and Stiglbauer (2012) who used a smaller sample of countries, ten indicators and data for a shorter period.

³⁷ Gross (2012), in his analysis, left France out of as its current account behaviour exhibits a mixed feature, surplus until 2006 and deficit afterwards.

³⁸ According to Gross (2012), Italy is in a position similar to the one of France (i.e. not sharing clearly the features of either group).

Table 1

The indicators of the scoreboard in selected euro area Member States in the pre-crisis period (2004 – 2007; figures highlighted are the ones falling outside the thresholds established by the AMR)

Indicator		External Imbalances and Competitiveness					Internal Imbalances					
		Current account balance as % of GDP	investment position as % of GDP	Real effective exchange rate	Export market shares	Nominal ULC	% y-o-y change in deflated house prices	Private sector debt as % of GDP, consolidated	as % of GDP, consolidated	General government sector debt as % of GDP	Unemployment rate	% y-o-y change in total financial sector liabilities
		3 year average		% change (3 years)	% change (5 years)	% change (3 years)					3 year average	
Thresholds		4%/6%	-35%	±5%	-6%	9%	6%	133%	14%	60%	10%	16.5%
Austria	2004	2,2	-17,3	4,5	5,2	1,9	-3,6e	124,5	4,1	64,8	4,5	11,0
	2005	2,0	-21,7	2,6	12,6	2,8	2,5e	124,0	6,8	68,3	4,8	22,4
	2006	2,4	-12,9	-1,7	1,3	2,6	2,0e	126,1	5,4	67,0	5,0	9,2
	2007	2,8	-9,8	-1,8	0,7	3,8	2,0e	127,2	8,1	64,8	4,8	11,0
Belgium	2004	3,7	28,4	6,2	na	2,5	6,3	120,4	9,4	96,6	8,0	14,2
	2005	2,9	33,5	5,0	-7,4	1,7	9,7	121,9	6,3	94,8	8,4	15,7
	2006	2,3	29,4	0,5	-15,8	2,8	6,5	120,3	6,5	90,8	8,4	10,8
	2007	1,9	28,9	0,2	-10,3	5,8	4,7	133,9	18,0	86,9	8,1	15,5
Finland	2004	6,2	-9,3	6,7	-2,2	1,6	7,7	106,0	6,5	42,7	9,0	13,4
	2005	4,5	-14,0	1,6	-6,3	2,8	7,1	114,7	12,7	40,0	8,7	13,9
	2006	4,2	-12,4	-5,5	-8,0	3,7	5,6	117,9	8,8	38,2	8,3	12,6
	2007	3,6	-25,9	-4,9	-5,9	3,8	3,9	122,3	13,0	34,0	7,7	10,2
France	2004	0,8	-4,7	9,3	-13,4	5,8	12,7	104,8e	5,7e	65,5	8,7i	9,8
	2005	0,4	1,1	6,0	-7,4	5,1	13,2	109,2e	8,2e	67,0	8,8	15,1
	2006	0,2	1,1	-0,5	-14,9	4,8	9,8	112,6e	9,2e	64,2	8,9	15,1
	2007	-0,1	-1,5	-1,5	-18,1	5,7	3,6	115,6e	11,2e	64,2	8,6	12,6
Germany	2004	2,6	10,7	7,4	5,0	1,3	-2,6	119,0p	-1,7p	64,6	9,7	3,9p
	2005	3,5	21,0	4,6	9,5	0,0	-0,3	117,1p	0,3p	66,8	10,5	6,3p
	2006	5,0	27,9	-1,5	2,0	-2,9	-1,5	114,1p	1,3p	66,3	10,7	4,8p
	2007	5,8	26,5	-1,5	0,6	-2,9	-3,7	111,0p	2,0p	63,5	10,1	8,1p
Luxemburg	2004	9,5	116,1	6,5	14,6	7,3	11,7	na	na	6,5	3,8	14,8
	2005	10,2	133,5	6,6	15,5	5,6	8,1	na	na	6,3	4,5	31,4
	2006	11,3	140,5	3,3	18,4	6,9	8,3	na	na	7,0	4,7	16,1
	2007	10,7	105,0	2,4	23,0	8,4	4,8	na	na	7,2	4,5	12,2
Netherlands	2004	5,3	3,7	7,9	-2,4	7,4	2,2	214,1	5,1	50,0	4,1	5,9
	2005	6,9	-2,6	3,2	1,7	1,9	3,3	217,7	12,3	49,4	4,9	16,4
	2006	8,1	3,2	-2,1	-4,4	-0,5	1,8	217,7	13,6	44,9	4,9	12,4
	2007	7,8	-6,0	-2,1	-2,7	1,5	2,5	216,8	13,1	42,7	4,4	15,0
Greece	2004	-6,3	-67,0	10,4	21,6	12,8	-0,5e	74,4	11,4	98,9	10,2	8,9
	2005	-6,7	-77,3	6,4	6,3	12,1	7,8e	86,2	14,3	101,2	10,1	16,8
	2006	-8,3	-85,4	0,3	-4,8	9,6	9,6e	93,0	16,3	103,4	9,9	14,1
	2007	-11,2	-96,1	-0,4	3,8	10,6	2,5e	101,9	16,2	103,1	9,1	22,0
Ireland	2004	-0,6	-17,9	18,4	12,6	10,7	9,3	150,1	23,7	28,3	4,5	20,0
	2005	-2,1	-24,5	12,1	5,9	14,8	6,5	171,2	33,8	26,2	4,5	35,1
	2006	-4,2	-5,3	2,7	-12,5	12,8	11,9	191,7	41,0	23,8	4,5	21,3
	2007	-6,7	-19,5	3,1	-15,4	14,3	4,3	198,1	24,9	24,0	4,5	9,6
Italy	2004	-0,6	-16,7	11,0	-6,8	11,0	3,6	89,7	7,5	100,0	8,3	7,2
	2005	-0,8	-17,7	6,8	-5,0	9,2	5,4	95,9	9,6	101,9	8,0	12,1
	2006	-1,0	-22,8	-0,5	-12,6	7,0	3,1	102,2	10,4	102,5	7,5	10,5
	2007	-1,3	-24,1	-1,2	-10,0	6,5	2,6	109,6	11,9	99,7	6,9	0,6
Portugal	2004	-8,0	-66,8	9,0	-4,1	7,1	-1,6	165,8	13,0	62,0	6,8e	6,4

	2005	-8,5	-69,9	5,3	-3,5	7,4	-1,4	171,4	12,0	67,4	7,7e	10,7
	2006	-9,6	-79,3	0,7	-4,4	4,3	-1,5	176,5	12,6	69,2	8,2e	13,8
	2007	-10,1	-88,8	0,6	-4,5	5,1	-1,9	185,0	18,2	68,4	8,7e	10,2
Spain	2004	-4,0	-51,9	10,8	2,5	9,4	13,0e	137,8	19,5	45,3	11,3	16,3
	2005	-5,4	-55,6	7,8	5,5	9,6	8,0e	154,9	26,9	42,3	10,6	25,3
	2006	-7,2	-65,8	3,1	-3,2	10,0	11,2e	177,8	35,2	38,9	9,6	20,0
	2007	-8,8	-78,1	2,7	-3,2	11,3	6,3	191,9	26,0	35,5	8,6	16,8

Flags: e – estimated, na – not available, p – provisional.

Source: European Commission (2014).

Current account balances across the euro area countries have developed very differently over the first ten years of the euro. The Southern European economies built up large current account deficits vis-à-vis the Northern euro area countries and experienced a massive loss of competitiveness. Data for current account balance in 2004 – 2007 in Table 1 provide evidence of this development. Current account imbalances derived both from structural competitiveness factors (different countries' restructuring and outsourcing of production) and from the asymmetric macroeconomic effects of the EMU on creditor and debtor countries (sharing a common currency) (Guerrieri, 2012). By removing exchange rate risk, the introduction of the euro encouraged massive capital flows to, and large current account deficits in the South eurozone. Meanwhile, there have been large current account surpluses in Northern countries. To some extent, these deficits may reflect the higher investment needs in the lower-income countries in Southern Europe as they lag behind in terms of economic development. But sustaining such imbalances has serious consequences for the economy and the euro. The excessive demand boom in the peripheral countries was promoted by private and public consumption and residential investment spending.³⁹ This led to persistent inflation, strong increase of ULC, loss of competitiveness, and asset price inflation – notably in the housing market, so gaps in competitive positions widened in the two groups of countries. These developments were not sustainable.

While little attention was paid to these imbalances for many years, the recent crisis has shed more light on them and revealed many weaknesses in the euro zone architecture. Since the start of the crisis and in particular after 2009, the large capital flows from the Northern countries have suddenly stopped, creating severe adjustment pressures. However, to correct existing imbalances in a sustainable way, both deficit (debtor) and surplus (creditor) countries have to pursue appropriate policies. According to De Grauwe (2012) as well as Ederer (2015), adjustments in surplus and deficit countries

³⁹ In Spain and Ireland, foreign capital was used to sustain massive construction booms. In Greece, Portugal and to a lesser extent Italy, foreign capital was used to finance consumption (Gross, 2012).

need to be symmetric and coordinated to prevent further destabilising developments in the EMU.

Running continued current-account deficits also adds to the national debts, whether it is in the form of government debt or private debt. There were countries in both analysed groups highly exceeding the reference value of 60% GDP for government debt (Greece, Italy, and Belgium). In contrast, Luxembourg (first group) and Ireland (second group) recorded very low general government debt ratio in the analysed period. However, while in Luxembourg government indebtedness has stayed at a low level during the crisis, in Ireland the development has rapidly changed since the outbreak of the crisis, reaching more than 120% GDP in 2012, mainly due to rescuing its insolvent banking system by the government. A significant rise in government debt ratio has been recorded also in Spain since 2008. This supports the statement that high public debts can be more the effect than the cause of the EMU crisis.

Private sector debt as percentage of GDP exceeded the indicative threshold in three economies from the second group (Ireland, Portugal, and Spain) and in two countries from the first group (Belgium and Netherlands)⁴⁰. What can be considered as crucial is the fact that the overall indebtedness of both private and government sector was higher than 200% of GDP in all countries belonging to the second group in 2007. This, combined with other macroeconomic imbalances, contributed to negative development in the next years.

As regards other two indicators, export market shares and unemployment rates, the picture is mixed. From the view of changes in export market shares, France seems to be even more problematic than Italy or Ireland and in the analysed period unemployment rates only slightly exceeded the threshold in Germany, Greece and Spain.

As development after 2007 shows, it was economies from the second group that have experienced the most serious economic difficulties - recession, increase in overall indebtedness and rapid deterioration of labour market situation. Finally, financial assistance from the EU⁴¹ and International Monetary Fund (IMF) has been provided to Greece (2010, 2012), Ireland (2010), and Portugal (2011) as well as to the Spanish banking sector (2012). In return they committed to implement austerity measures aimed at reducing their budget deficits and agreed to implement structural reforms in order to improve their competitiveness.

⁴⁰ And probably also in Luxembourg, where data are not available for this indicator until 2008.

⁴¹ The European Financial Stability Facility (EFSF), the European Financial Stabilisation Mechanism (EFSM), the European Stability Mechanism (ESM), bilateral loans from euro area Member States.

Conclusion

As the development of the scoreboard indicators in twelve euro area Member States in 2004 – 2007 shows, a combination of several macroeconomic imbalances was present in this period. So the MIP scoreboard would have anticipated a high risk of the emergence of the crisis. The macroeconomic imbalances proved to be unsustainable, and in worsening global economic environment, they led to serious crisis which required providing financial assistance to economies concerned.

Large macroeconomic imbalances may also undermine the stability and functioning of the whole EMU and affect confidence in the euro. Thus, for the solution of the crisis and successful functioning of the euro area in the long term, it is of utmost importance to eliminate or reduce the existing imbalances within the monetary union, using the appropriate governance and policy mix. The new procedure for preventing and correcting macroeconomic imbalances in the euro area could facilitate such adjustments, prevent macroeconomic imbalances from re-emerging and contribute to sustainability of the EMU, provided that the new governance framework is used effectively and takes into account the real causes of the eurozone crisis, i.e. understands the imbalances as a symmetric phenomenon requiring a coordinated cross-country approach.

Note

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EXPERIMENTAL INVESTIGATION OF COORDINATION AT AGGREGATE VERSUS INDIVIDUAL LEVEL

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Abstract

We argue that the ability to coordinate under strategic complementarity is substantially affected by mutual interactive development at the individual and aggregate level. Optimal strategy which is followed by each player does not only depend upon strategy of the other player but also on conditions prevailed at the aggregate level. Results of our laboratory experiment suggest that certain type of player might be or might be not awarded depending on type of the economy, which has important implications at the aggregate level with respect to the speed of the convergence.

Keywords: Coordination, convergence, nominal inertia, expectations

Introduction

Keynesian coordination problems have received considerable attention in many studies, among others Ball, Romer, (1991), Cooper, John (1988), Ochs (1995), Cooper, and Haltiwanger, (1993), Oh, Waldmann (1994), Haltiwanger, and Waldman, (1989). These studies argue that an environment described by strategic complementarity with heterogeneous agents might have important implications at the aggregate level. In a nutshell, the presence of strategic complements causes that rational agents have a tendency to imitate the behavior of naive agents and through that multiply the effect of non-equilibrium behavior at the aggregate level. As a result the mix of sophisticated and naive agents in the economy in case of one time shock will result in an adjustment path similar to pure naive case adjustment with only slow movement to equilibrium in an environment of strategic complementarity. This mechanism is enabled by the presence of a small number of naive agents, whose effect on the adjustment process is disproportionately important for the first few periods after the shock. The first order effect of small fraction of naive agents at the aggregate level is

documented by many studies such as Akerlof and Yellen (1985) or Blanchard, Kiyotaki (1987).

Coordination issues were also investigated on experimental basis by Fehr and Tyran (2007), (2008), Van Huyck et. al (1990), (1991), Russell, Thaler (1985). Research of Fehr and Tyran (2007), (2008) suggests that the slow adjustment of nominal prices after a fully anticipated monetary shock is the case under conditions of strategic complementarity and coordination represents a problem. With help of experimental framework similar to Fehr and Tyran (2001) we aim to extend the latest research. We argue that the ability to coordinate under strategic complementarity is substantially affected by mutual interactive development at the individual and aggregate level. Optimal strategy which is followed by each player does not only depend upon strategy of the other player but also on conditions prevailed at the aggregate level. As a result coordination of individual player and coordination at the aggregate level has to be distinguished for our purpose. Our results suggest that certain type of player might be or might be not awarded depending on type of the economy, which has important implications at the aggregate level with respect to the speed of the convergence. Our conclusions will differ with respect to whether players face an environment of real or nominal values.

In the next section we introduce experimental design. The following section provides us with basic simulations related to the aggregate and individual level development. Presentation of the main results of the experiment and its comparison with simulations is the content of the next section. Summarization of our main findings follows.

Experimental design

The following section describes the nature of experimental design together with the character of experimental procedures and parameters

General description of Experimental Design

Experimental design inspired by Fehr and Tyran (2001) is based on n-player pricing game with strategic complementarity and unique equilibrium. All n subjects in the role of firms have to set simultaneously their nominal prices in each period of the game, but at no cost in any period. The experimental game is divided into a pre-shock and post-shock phase, with 2T length periods each. The pre-shock phase, which lasts T periods serves the purpose of equilibrating the system and is given by M_0 . Afterwards, a fully anticipated negative monetary shock is implemented, where money supply is reduced to M_1 . The post-shock phase then lasts an additional T periods. We need to emphasize that the shock was fully anticipated and was therefore common knowledge to participants, together

with the length of the post-shock phase. Post-shock phase enables to observe the character coordination to equilibrium at the aggregate level and also at the individual level. In other words we may observe how nominal prices adjust in response to the shock in various treatment conditions.

The subject's pricing behavior is governed by the size of pay-offs.

The *real payoff* of subject i , π_i , is given by

$$\pi_i = \pi_i(P_i, \bar{P}_{-i}, M) \quad i=1, \dots, n \quad (2)$$

Where P_i stands for i 's nominal price, \bar{P}_{-i} is the average price of the other $n-1$ group members and M denotes a nominal shock variable (money supply). The *nominal payoff* is expressed as $\bar{P}_{-i}\pi_i$.

We use the aforementioned payoff function Fehr and Tyran (2001) in our experimental setting with treatment condition, which relates to the form in which payoffs are expressed. The payoff can be either real or nominal. The real treatment (RH) marks the situation, where subjects receive the payoff information for their decision making in real terms. In the nominal treatment (NH), subjects receive the payoff information for their decision making in nominal terms. In order to compute their real payoffs, subjects in the nominal treatment have to divide their nominal payoffs by the average price of the other $n-1$ group members, i.e. $\bar{P}_{-i}\pi_i/\bar{P}_{-i}$.

Additionally, experimental subjects are in a group with other $n-1$ human subjects. The aggregate response rule is not known in advance, which implies that the subject has to form expectations about price choices of the other $n-1$ human opponents in his group. This induces uncertainty, which is substantially higher under nominal frame. As a result we may expect that character of coordination may differ depending on the type of frame with which subjects have to cope with.

Experimental parameters

In our experiment, group size of $n=4$ is set and remains constant for the whole period before and after the shock. Each group has two types of subjects, subject of type x and subject of type y , equally distributed within the group. The payoff function differs among the players, where x types have to select a relatively low price in equilibrium, whereas y types have to choose a relatively high price. The money supply before the shock in each treatment was given by $M_0=42$, while in the post-shock phase it was given by $M_1=M_0/3=14$. The average equilibrium price over all n group members in the pre-shock phase is given by $\bar{P}_0^*=18$, whereas in the post-shock equilibrium $\bar{P}_1^*=6$. The length of the pre-shock and the post-shock phase is $T=20$. Experimental subjects interact via computer terminals and have to select in each period an integer price P_i in interval from 1 to 30. They also have to form an expectation P_{-i}^e about \bar{P}_{-i} . In order to make the appropriate

aforementioned decisions the subjects receive information about their payoffs in a matrix form (See pay off tables of Fehr and Tyran (2001) for more details). The payoff matrices are designed for x and y-types of players for all treatment conditions. Either the real or the nominal payoff is present in the matrix for each feasible combination of (P_i, \bar{P}_{-i}) .

In total, 80 subjects participated in the experiment. 40 subjects participated in the nominal treatment NH, 40 subjects participated in the real treatment RH. Subjects were paid a show-up fee of 150 CZK. This was also the minimum amount, which they could win during the game. The total earnings of the subjects in the experiment were approximately 450 CZK on average. The experimental session lasted 90 minutes on average. The experiment was conducted in the Laboratory of Experimental Economics, Prague, in June 2011. In order to experimentally test the subjects' behavior through computers, the Java program was used to set-up the experiment.

Aforementioned experiment is not macroeconomic in Walrasian sense and rather concentrates on single market. However, this is not a problem since temporary macroeconomic models rest on microeconomic foundations. Thereby, laboratory experimentation is in line with current macroeconomic modelling and the size of experimental sample might be considered as a sufficient in order to form relevant conclusions at aggregate level. Exactly because macroeconomic models are based on individual behaviour, experiments might provide guidance for how subjects perceive examined phenomenon. For instance, in the economy with multiple equilibriums it might indicate what equilibrium subjects consider as more relevant, (Duffy, 1998, 2008).

Simulations of Coordination Issues at the Aggregate and Individual Level

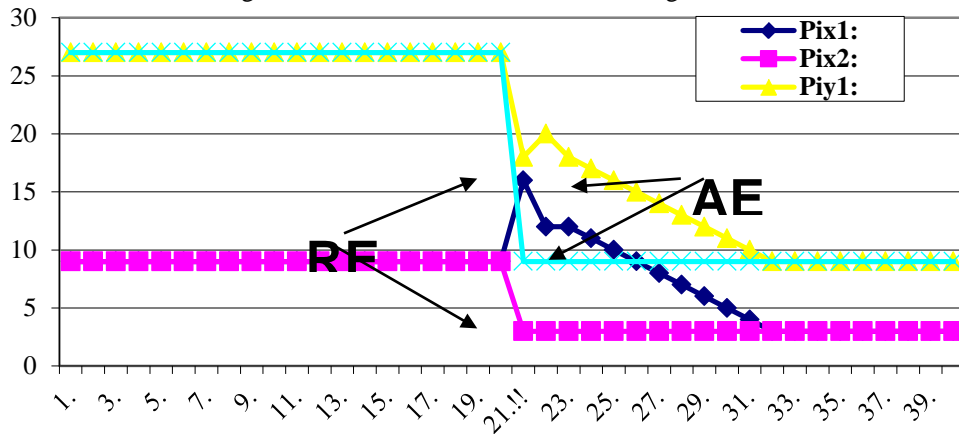
The so-called coordination problem appears to be a crucial factor which may affect the speed of adjustment in the economy after the shock. However, coordination as an effort to move quickly towards equilibrium with high expectation correction and immediate adjustment is not sufficient delineation as emerged during the course of research. In order to explain properly this phenomenon we need to distinguish coordination problem at the aggregate and individual level for our purpose. Our statements are underpinned by simulations based on aforementioned experimental design.

2.1 Coordination at Individual Level

Coordination at the individual level is understood as a strategy used by each player. Our simulations based on experimental design proved that mostly two basic types of players were responsible for the final development at aggregate level. Firstly, an adaptive player (AE) is present as a type of

player who does not coordinate at all, i.e. “no coordination is present”, and his behavior is dependent on past price development. His expected price is usually above the actual price, which means delayed expectations. As a result he expects the average price close to the pre-shock price development. Secondly, the rational player (RE) is present as a type of player, who offers coordination with respect to his strategy of immediate movement to the equilibrium. His expectations are in line with price development. Figure 1 shows individual pricing behavior of rational and adaptive players according to type of the player.

Figure 1: Simulations of Individual Pricing Behavior



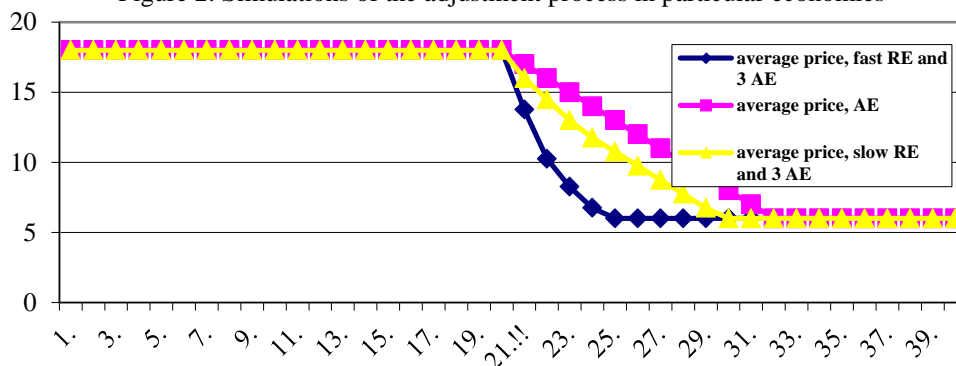
Also note the presence of two type of players x and y mentioned in experimental design. Later, results of the laboratory experiment will show that behavior of rational player may change if the rest of the individuals are not willing to coordinate. In that case rational player is persecuted by lower income. As a result, he stops to coordinate and switch to behavior closer to the adaptive one. He slows down his adjustment to the equilibrium because of his unconfirmed expectations, thereby causing nominal inertia. Although the player remains fully rational, the best way for him is to behave in an adaptive way in order to maximize pay-offs. His behavior therefore might be described as adaptively-rational and will be close to the behavior of adaptive player.

2.2 Coordination at the Aggregate Level

Various cases may arise from the combination of the aggregate versus individual level. In the economy, there may appear players who will be willing to coordinate, but might be outweighed by subjects who are not willing to coordinate or do not coordinate (i.e. adaptive players), which leads to no coordination or even discoordination at the aggregate level.

The character of coordination at the aggregate level has to be distinguished according to the type of economy present. Results show that a purely adaptive economy is considered an economy where no coordination is present after the negative shock because price adjustment together with formation of expectations is restricted purely to past development. This economy consists only of adaptive players. An economy where coordination takes place after the negative shock in a more or less successful way consists primarily of rational players willing to coordinate. Lastly, an economy with negligible coordination or even discoordination consists primarily of players, which are not able to cope with the character of an environment or adaptive players are present. Simulations in Figure 2 below show how the speed of convergence in the economy might be affected by the presence of particular players. If the economy is purely adaptive, the development after the shock follows backward-looking character. This is depicted by the line with slowest adjustment. On the other hand the presence of rational player in the economy, who is willing to coordinate, significantly fastens the adjustment to equilibrium after the shock. The adjustment to equilibrium is fastest. If rational player does not want to coordinate in the economy anymore because of his upset expectations, he will follow behavior close to adaptive player. This will substantially slow down the speed of adjustment and the performance of the economy is represented by the line which lies in the middle.

Figure 2: Simulations of the adjustment process in particular economies



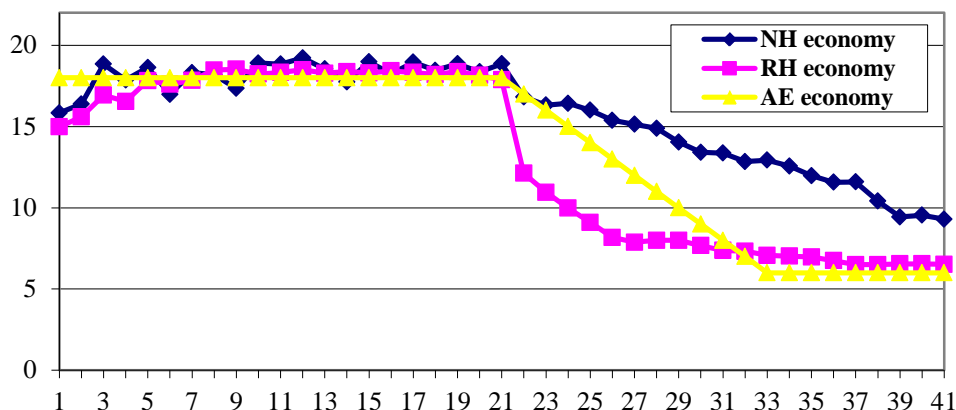
Results

The following section will reveal the main results of experiment and compare them to basic simulations mentioned above.

3.1 Results at Aggregate level

Figure 3 describes experimental results gained at the aggregate level. In order to compare the performance in the economy of the real (RH) and nominal treatment (NH), simulated case of purely adaptive economy (AE) with no coordination at aggregate level was added.

Figure 3: Development of the average price in the economy of NH, RH and AE.



Directly after the monetary shock is imposed, the tendency for inertial pricing is significantly lower for players in the real treatment. This indicates that sufficient coordination is the case due to frequent presence of rational players, who contribute to faster convergence to equilibrium as proved by simulations. The tendency of rational player to behave in complementary way is very low in this economy. The speed of adjustment of this economy is close to the simulated case of highly coordinated economy as suggested by Figure 2.

In contrast, the nominal treatment exhibits characteristics of no coordination or even discordination at the aggregate level, since its performance is even lower than that of adaptive economy. The speed of adjustment to the equilibrium is rather slow. We may presume frequent presence of players, who are defeated by the nominal frame or the presence of rational players who behave in complementary way since it is profitable for them. The performance of this treatment is in line with simulated case of the economy with rational player who behaves in complementary way to players, which are not willing to coordinate.

If expectations are to be evaluated, the nominal treatment expects price $\bar{P}^e=18$ directly after the shock, whereas the real treatment expects $\bar{P}^e=12$. This again confirms that the nominal treatment is more inertial in the period after the shock compared to the real treatment.

Development at the aggregate level raises the question, to what extent it is desirable to behave in the economy in a rational or adaptive way.

3.2 Results of Coordination at Individual Level

The following section provides closer look on the frequency of particular types of players with respect to the type of treatment.

The real treatment

Fast adjustment to equilibrium of the real treatment at the aggregate level is given by composition of players within the groups. Representative group RH 5 (where RH stands for the real human treatment and number of group), documents that it takes only 5 periods till the price will adjust to equilibrium after the shock, (See Figure 4). Results confirm the presence of rational players who speed-up the process of equilibrating. However, sometimes also the presence of adaptive players is the case, which is in line with the speed of the convergence of group which was not immediate. This composition of groups with mix of rational and adaptive players was mostly the case of all groups within the real treatment.

Figure 4: Average price development in Group RH 5

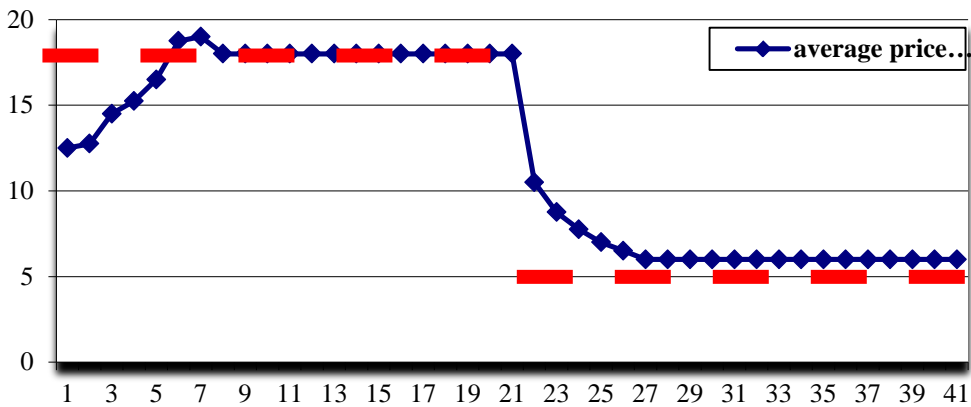
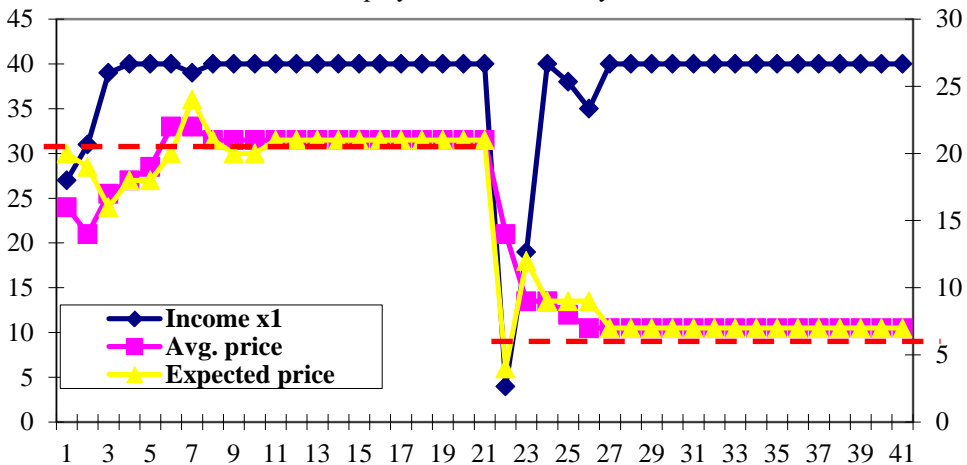


Figure 5 below documents the performance of player x_1 from representative group, whose pricing strategy definitely reflects rationality. Based on his coordination effort, he significantly reduces his price directly after the shock.

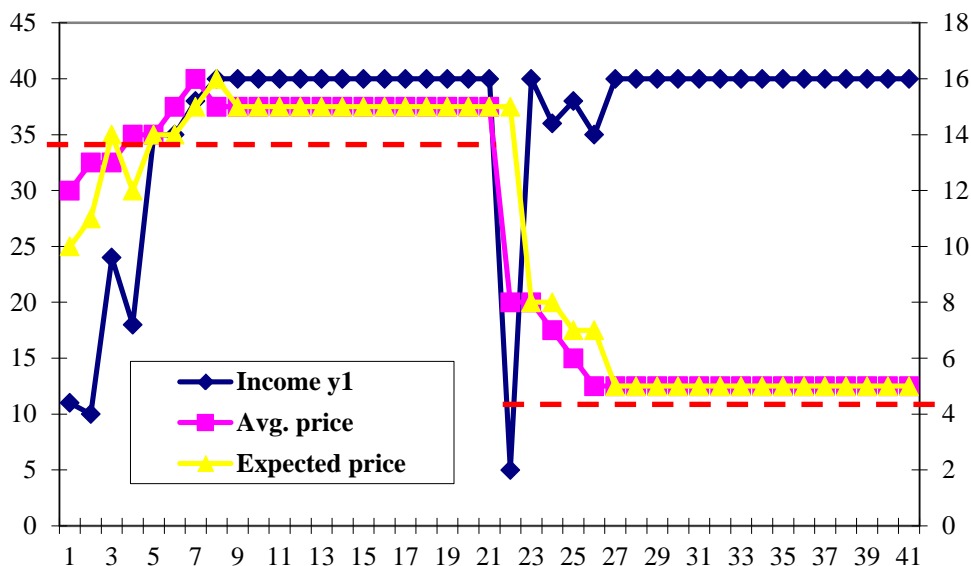
Figure 5: Development of income, expected price of player x_1 and average price of the other n-1 players in the economy, RH5



Since his expectations are not met with the development of the average price in the economy, which is much higher, his income is significantly reduced in the first post-shock period. From then, the best strategy is to behave in an adaptive way with a smooth adjustment to equilibrium. This provides proof that rational player who is upset in his expectations may switch to adaptive behavior. Behavior of player x_2 might be also described as a rational one directly after the shock. He also coordinates with his price downwards to new equilibrium, but the reduction is weaker as opposed to the previous player. After the correction is made, he follows adaptive behavior. Pricing behavior of both rational players is in line with performed simulations, (See Figure 1).

The behavior of player y_1 is typically adaptive, since his expectations are delayed in the first post-shock period and are in line with the pre-shock price development, significantly above the actual average price in the economy. Another piece of evidence that the player is adaptive is that his individual price exactly reflects the simulation price, which is set by the adaptive player of type y after the shock and which equals 18, (See Figure 1).

Figure 6: Development of income, expected price of player y_1 and average price of the other $n-1$ players in the economy, RH5

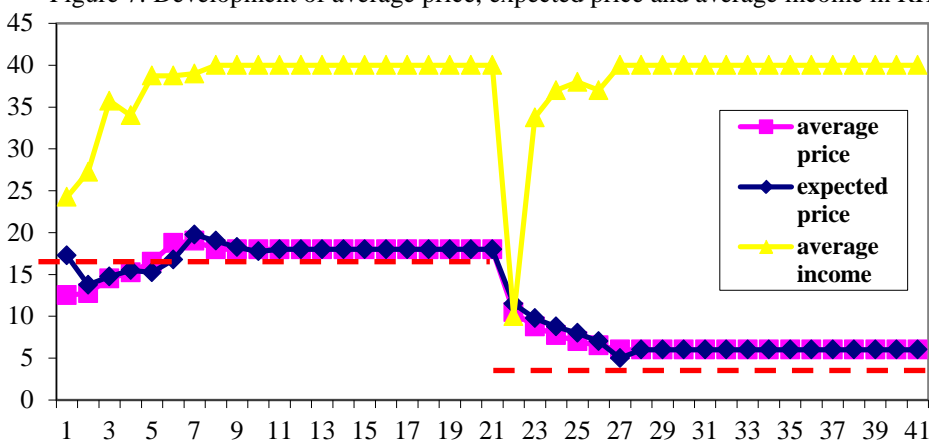


His adaptive behavior results in significant reduction in income for the first post-shock period. Player y_2 exhibits similar behavior and even overshoots his expectations, which are then above the pre-shock average price. He also sets an adaptive price of 18 after the shock, which results in significant reduction in income. As a result this player reacts in the next period by correcting his expectations downwards. This is met with success,

since his income immediately rises. From then, he follows the same adaptive behavior like player y_1 .

On average the group is coordinated in a good way, since the expected price is in line with the average price development and income is maximized most of the time, (See Figure 7). Coordination was mostly induced by rational players, who significantly correct their expectations towards the equilibrium in the first post-shock period, which is in line with flexible price adjustment. This also had a positive effect on the other adaptive players in the group, who reacted in the consequent period by correcting their expectations towards the average price. This contributed to the fact that the average price adjusted very quickly after the shock to the new equilibrium. This is also documented by the size of income, which is maximized for most of the time, the exemption being the first post-shock period. Rewards of rational players were slightly higher on average than that of adaptive players, which suggests that the real treatment benefits these players due to conditions prevailed at aggregate level.

Figure 7: Development of average price, expected price and average income in RH5

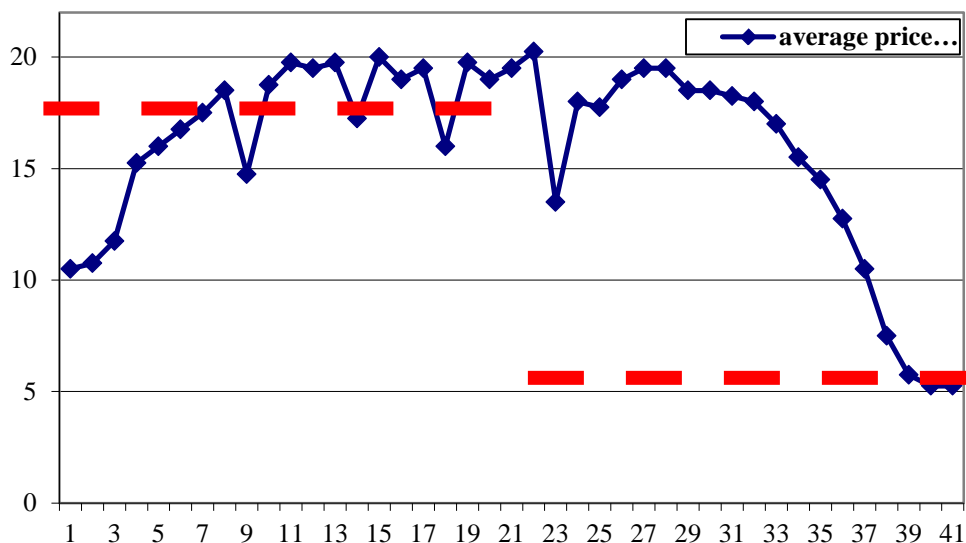


The nominal treatment

Groups present in the nominal treatment are mostly characterized by discoordination due to the fact that subjects have to cope with the nominal frame. The development of the average price in representative group NH5 is highly inertial, with a very slow speed of adjustment to the equilibrium, which is attained almost at the end of the post-shock phase, but eventually overshoot takes place. Slow adjustment suggests that confusion by nominal variables was so severe that some individuals were not willing to coordinate. The average price is even higher than the pre-shock level (See Figure 8 below). A closer look at individual pricing behavior shows that representative group consists mostly of players who are defeated by the nominal frame, less adaptive players are present. Most of the groups in the

nominal treatment exhibit similar features which in turn affects the speed of convergence at the aggregate level.

Figure 8: Average price development in NH5



The player x_1 is typical example of the player defeated by the nominal frame, who is not willing to coordinate to equilibrium. After the shock he raises his price to considerably high levels. His expectations are high and significantly above the average price in the economy.

Player x_2 is also not willing to coordinate, since he does not react anyhow after the shock and is still fixing his price at the same level. Since he achieves low income, he corrects his expectations about the average price upwards to 22 for 6 periods. This is in line with individual price, which is adjusted upwards to 17 and remains fixed for these periods. Although the player is penalized by quite a low income in these periods, he does not change his strategy anyhow. Then in the period 33 he corrects his expectations downwards, followed by price adjustment and is again fixing expectations and the price for the next three periods. From then he tries to adjust to the equilibrium in adaptive way.

Player y_1 retains his individual price at the same high pre-shock level, because he expects high average price. This is not met with the success as income reduction follows. As a result he reduces his price in the second period two units below the simulated price of the adaptive player and is rewarded by almost maximum income. His adjustment is full of downward and upwards swings, since he is probably confused by nominal values. He ends up overshooting the equilibrium price.

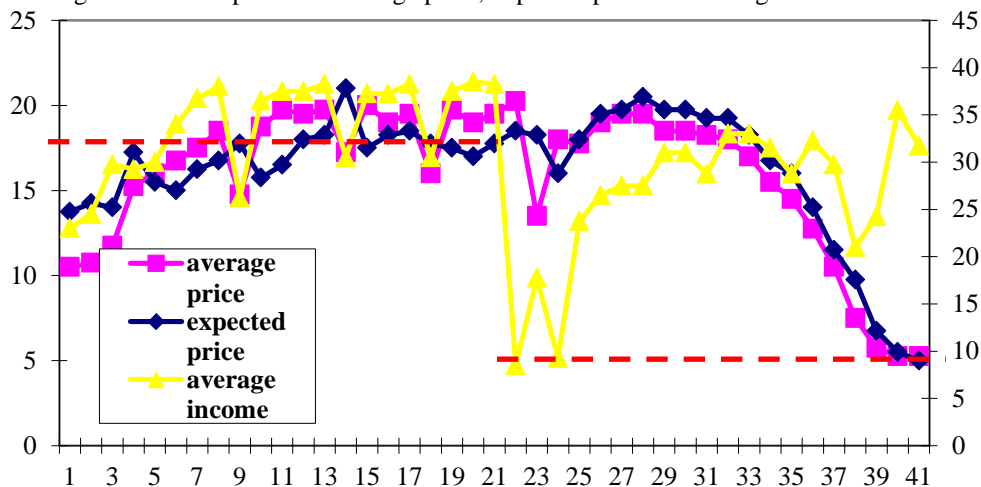
Player y_2 was the only one who reduced the price after the shock, which was in line with his expectations. In other words he tried to offer

coordination after the shock, but due to the behavior of player x_1 (who set a high price) and player x_2 (who was fixing the price), the average price was quite high and the coordinator achieved a low income. As a result he was no longer willing to coordinate and started to behave in complementary way to other players. As a result his pricing behavior became highly inertial.

The player x_1 later decided to correct his price closer to the equilibrium at the moment when player y_2 was already upset with his expectations. This shows that severe discoordination is present. Players who are willing to coordinate in a particular time are prevented from doing so, because other players are not willing to do so due to their confusion by nominal values. Coordination effort is persecuted by lower income and this provides incentives to behave in complementary way. As soon as the other players decide to adjust their price to equilibrium, because they start to see through the nominal veil, they are hindered in their behavior by upset coordinators, who already gave up any effort. Thus, the formation of expectations and consequent pricing behavior is much more difficult under the nominal frame, which leads instead to a discoordination at aggregate level.

If we have to evaluate the performance of the group NH5 on average in Figure 9, discoordination has a serious impact on the average price and expectations, which are fairly inertial.

Figure 9: Development of average price, expected price and average income in NH5



For the whole post-shock phase, expectations are delayed behind the average price. Rewards are not maximized, since the average price is fairly remote from the equilibrium. Only in the second half of the post-shock phase do subjects start to move downwards with their expectations and prices. Maximum rewards are achieved neither in the pre-shock phase, nor in the post-shock phase. After the shock, income reached the minimum levels

during three periods, but in consequent periods it grew only steadily, mostly being between 30 and 35.

Conclusion:

We tried to verify that the ability to coordinate under strategic complementarity is substantially affected by mutual interactive development at the individual and aggregate level. With help of the laboratory experiment inspired by Fehr and Tyran (2001) we conducted simulations, followed by evaluation of results gained at aggregate and individual level.

Simulations performed at the individual level reveal that basically two types of players are present. Either adaptive player not willing to coordinate or rational player willing to coordinate is present. Additionally, simulations at the aggregate level suggest that the presence of rational player increases coordination in the economy and speeds up consequent adjustment to the equilibrium. In contrast the presence of the player, who is not willing to coordinate (either adaptive player or upset rational player) slows down the adjustment to the equilibrium.

Experimental results at the aggregate and individual level are in line with our simulations. As a result we may confirm our presumptions that coordination, no coordination or discoordination exists at the aggregate level. The real treatment consists mainly of mix of rational and adaptive players with fast adjustment to equilibrium. Additionally, players have no tendency to exhibit complementary behavior in direction of naïve agents. This contributes to sufficient coordination at the aggregate level in this economy. The nominal treatment consists mainly of adaptive players or players confused by the nominal frame. Players tend to behave more in complementary way in direction of naïve adjustment. As a result, this treatment is rather representative of no coordination or even discoordination at the aggregate level.

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POTENTIAL OF SILVER ECONOMY IN THE EUROPEAN UNION (SELECTED VIEWS)

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Abstract

This paper deals with the assumptions of realization of silver economy in the EU, regarding expected effects related to aging in Europe. Intention is to present differences in size of potential demand formation of population in old and new EU countries. We also examine differences in consumption on EU level as well as in consumption of households in a given age groups. Special attention is paid to Slovakia and main consumption constraints including income inequality in particular regions and among them. The supplemented aspects of technological changes and determinants of consumption with both economical and non-economical character are included. For potential demand analysis we used EU-SILC data and individual data from Social Insurance Agency in Slovakia. In crisis period, problems with economic growth and high level of unemployment rate together with stagnation of wages represent barriers for formation of potential demand. These factors could significantly entail lower levels of average pensions, which could be accompanied with changing consumer preferences, purchasing power, aggregate demand, employment and sectors of production. At the end of the paper we conclude that in the new EU member states there is only little space for real saturation of consumption by goods and services for older people in terms of the concept of silver economy. On the other hand, Germany, Austria, France, Mediterranean, Nordic and Benelux countries represent a significant consumer opportunity in terms of the potential demand of older people aged 50 years and over.

Keywords: Silver economy, incomes, consumption, crisis

Introduction

Present situation in EU countries is marked by persisting debt crisis with significant problems of public budgets, stagnation of wages, high unemployment rate of young people and trend of aging population. From the

future perspective finding answers to questions on the impact of technologies (with related reduced need of workforce) and the deepening problems of income polarization is becoming very significant. Both effects are substantial in relation with demographic development. Therefore the search for new factors of growth gains an importance and it is also based on the effects of so-called „Silver Economy“.

The “Silver Economy” can be defined as the economic opportunities arising from the public and consumer expenditure related to ageing population and the specific needs of the population over 50 and it comprises a large part of the general consumer economy, but with considerable differences in spending priorities and patterns (European Commission, 2015). The review of literature about ageing population showed two opposite directions. The first (e.g. Bloom, DE and Canning, D., 2008, Sharpe, A. 2011) draws attention to the negative aspects associated with public finances. The second takes a positive look at our ageing population, which create social and economic opportunities and challenges (eg. Prettnner, K., 2009). It is expected that the new generation of older people (aged 50 and over) in Western Europe countries could be healthier, more educated and financially independent. This generation should have various interests and should devote higher share of their budget to leisure activities. It is expected that older adults should be more interested in innovative products and services which would help them to improve the quality of life and maintain their independence. Change in demographic profile of the EU is indicated by growing median age, which in the period from 2000 to 2013 increased by 3.9 years, reaching a value of 41.9 years. This means that half of the population of EU28 is younger and half is older than 42 years. The relative increase in the older age groups was caused by lowering fertility rates and increasing longevity. Demographic changes are also influenced by benefits from economic, social and medical advances and they differ across Europe. In the countries of Eastern and Central Europe there is faster process of aging population, while in other countries (with some exceptions) process of aging is already significantly advanced (Lukáčová, M., Pilinská, V., Vaňo, B.,2005).

Assumption of realization of silver economy concept more broadly is that convergence processes started in countries that joined EU. Although new EU countries took major steps towards economic integration in recent decades, due to the diverse economic level, the differences in wage and pension levels in old and new EU member states can be still observed. The amount of savings, propensity to save as well as saving rate also differ across countries at a given point in time. The territorial enlargement of the EU meant acceptance of countries, which were undergoing transformation process aiming to create a competitive free market. This was accompanied

by decreasing of economic importance of some sectors (e.g. agricultural), by increasing inter and intra-regional income disparities and by growing risk of poverty. Planned convergence of countries was achieved in some parameters at macro level. Considerably it was influenced by subsidiaries enterprises and parent companies, which were established and operated in new member states during the privatization and deregulation processes of transformation. In the new EU countries financial sector development allowed households to meet with loans the demand that they were not able to meet with their wages, which means that income and consumption situation was ameliorated mainly by increasing of households' indebtedness.

With the financial crisis that peaked in 2008 the conditions for real application of silver economy concept started to fundamentally change. Despite continuing trends in population aging in old and new EU member states, which means growing numbers of older people, the assumption of significant growth of disposable income of this age group was not fulfilled, mainly in new EU member states.. The crisis in fact slowed down and stopped economic convergence processes. As crisis is gradually deepening, differences rise between old and new member countries, but also inside these countries. These are visible mainly through high unemployment rate and long-term unemployment, which relate to problems of structural character in most European economies. These have deep regional differences also inside economy. In old EU member countries wages stagnate on much higher level than in new EU countries. So there exists a real threat of future retirement pension's creation on lower level than its current level. Neither in old EU countries with high unemployment rate (except Austria, Germany and Great Britain)⁴², it is not possible to expect a non-problematic creation of retirement pensions in the future. The process of creating savings in the age group over 50 slows down and existing savings depletes quite quickly. Crisis conditions thus create different level of older people potential demand in new and old EU member countries. This means that countries differ in reaction in the field of consumption of older people. Differentiation is not only in income formation of ageing population but also in size and performance of particular economies, as well as in flexibility of national policies supporting export of goods and services for seniors.

Methodology and Data

Aim of this paper is to characterize possibilities of realization of silver economy concept in EU conditions. Reason is the existence of need for finding the growth factors in concerned Europe's economies. This is forced by continuing crisis, high indebtedness of all subjects, narrowing space for

⁴² The unemployment rate stood below the 5% level in 2014 (Eurostat).

traditional export, problems in area of competitiveness of European production and by started trend of population aging. Framework of investigation of given issue represents analyzing the potential demand of older people in EU regions (special attention is devoted to Slovakia) and the structure of older people households' consumptions in EU. We also included presentation of potential forming of silver economy in terms of technological changes and determinants of future consumption of economic and non-economic character. In this paper we assume that the silver economy consists of consumers in post-reproductive age, thus consumers over 50 years (older people).

In the context of executed analyzes, for better identification of differences in potential demand, also in consumption behavior of older people, we consider these age groups: young-old (50 – 64 years), old-old (65 – 79 years) and the oldest-old (80+ years).

Achieving goal is secured through analysis of differences in the potential demand of older people in old and new EU countries in particular age groups. We also identified EU regions with the highest potential demand of population aged over 50 years using data from EU statistics on income and living condition (EU SILC). Special attention is devoted to income analysis of older people in Slovakia, in which data on individual basis from Social Insurance Agency in Slovakia are used. This database includes data about 3.7 million persons since 2005 in this structure: incomes earned from work, retirement pensions, family allowances, social and unemployment benefits. Due to exposing not only the overall income situation, but also to show existing income inequalities between regions in Slovakia we also included the development in income stratification. Characterized potential of consumption is confronted with the structure of consumption of older people in EU by particular age groups.

For analyzing consumer behavior we used Eurostat database, while more detailed data on the structure of expenditure were available on request for EU22⁴³ countries for year 2005. For examination of how consumer behavior differ among EU countries we used cluster analysis, which is a multivariate technique used to group households based on similarities in their budget allocation patterns through maximizing within-group similarities and between-group differences. The outcome of this cluster analysis is several clusters of older people households, with each cluster displaying a distinct in expenditure pattern. The data characterized pre-crisis period with specific features like stable influences on the consumer demand in long-term perspective and relative price stability. Despite this limitation, these results together with current development of potential demand allow to better

⁴³ Except for Czech Republic, Italy, Malta, Poland, Portugal and Croatia.

estimate changes in structure of future consumption of older people following considered price liberalization for example in energetics etc. We also analyzed the effect of age on consumer behavior according expenditures for several goods and services coming from household's survey from Statistical Office of the Slovak Republic for years 2004-2011. We are aware of the fact, that for analyzing life-cycle consumptions profiles are more appropriate panel data, where the same people are traced over time, but these data are not available for our country. In the analysis of Slovak consumers we included only those households, in which all members of households fulfill age requirement.

Following hypotheses were testing using an appropriate data:

1. The concept of silver economy as we know it won't have any realization problems in EU.
2. Differences in demographic development between old and new EU countries and problems in formatting of potential demand of older people in particular countries will represent a barrier in realization of silver economy concept in particular regions of Europe.
3. Continuing and deepening crisis will influence unemployment rate (especially long-term unemployment), which means that the gap in potential demand of older people between old and new EU countries will deepen.

Differences in ageing, income and consumption of older people in old and new EU member states

Demographic trends

According to data from Eurostat in the last 20 years the senior segment of the population (65+ years) in EU is continuously rising by average annual rate of 1.5 %. For the last ten years in EU28 the number of seniors has increased by around 12 million, reaching level of 92 million persons, of which more than half (57 %) live in Germany (17 mil.), Italy (12,6 mil.), France (11,5 mil.) and Great Britain (11 mil.). However, dynamics of the aging process is in each EU member country different. Gradually it will occur that the countries with the youngest population will belong to countries with the oldest populations. Slovakia belongs to the countries with the youngest population in EU. By the year 2050 there will be a dominance of post-productive population over the children component (about 223 people aged 65+ will fall on 100 people younger than 15; the share of those aged over 80 years will rise from current 3 % to 8 %). Aging process in Slovakia will belong to the most intensive ones and this country will become one of the oldest counties in EU (Jurčová, D., Vaňo, B., 2011). Similar aging process like in Slovakia will occur in countries like Poland, Latvia, Romania, Lithuania and Hungary. However in general (with a few exceptions), currently countries which are considered as part of Northern and

Western Europe have values of aging population indicators above the EU average. In these countries process of population aging should slow down. On the other hand, in Central and Eastern European countries with the lowest values of aging population indicators, we can expect one of the biggest demographic changes (Páleník, V., 2012).

Potential demand in EU

Table 1 shows difference in size of potential demand by selected age groups in old and new EU member countries. According to the results of data analysis, in the period covering mid-term perspective, due to the number of older people as well as due to higher level of average income, old EU member countries are more promising for silver economy realization.

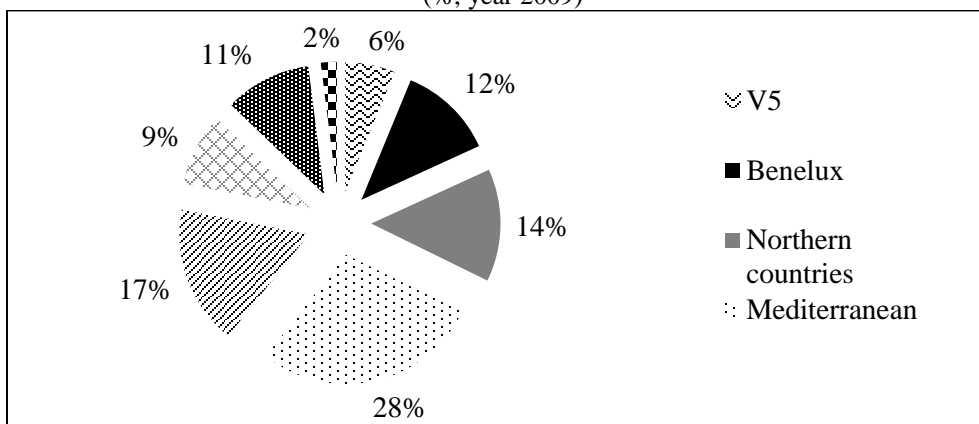
Table 1: Potential demand of older people in old and new EU member countries, as % of total EU potential demand in particular age groups, year 2009

	50+ y.	50 – 64 y.	65 – 79 y.	80+ y.
Old member countries	88,17 %	87,53 %	89,24 %	89,14 %
New member countries	8,10 %	8,49 %	7,45 %	7,42 %

Source: data processed from EU SILC 2009, based on average income

From the territorial point of view, regions (created by using multifactor analysis, Pauhofová, I., Páleník, M., 2013) with the highest potential demand are: those of Mediterranean Sea (mainly Italy), Germany and Austria but also region of France. Northern countries and countries of Benelux have also relatively good potential for realization of silver economy concept. Because of low income level, this feature cannot be applied for new EU member countries (figure 1).

Figure 1: Regions with the highest potential demand of population aged 50 years and over (% , year 2009)



Source: data processed from EU SILC 2009, based on average income; Eurostat

Income of older people in Slovakia

Comparison of income level development of population in active age with those aged over 50 shows, that the perspective of young old people (that are still more often active in the labor market) is significantly worse than the situation which old-old people had before they began receiving pensions. Slovakia lag behind old EU member countries in the degree of population ageing, but it is expecting to continue getting old over the next few decades more rapidly. It seems to be probable that higher income level of current active population in Slovakia will not be able to substitute decline in income of the next generation of old-old and the oldest-old people. These are the problems of generational polarization of income resulting in reducing consumption of specific goods and services. Results of our previous research (Pauhofová, Martinák, 2014) showed only small overall increase in consumption, which was more caused by rising households debt burden than by income growth. The formation of potential demand in Slovakia for the 2005-2013 period can be seen in table 2.

Table 2: Development of average net income of population of Slovakia for each age group. (Euro, constant prices 2013, 2005 – 2013)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	418	430	458	473	486	501	504	510	514
Active	491	502	539	551	552	566	569	573	577
Young old	439	454	476	494	524	543	552	559	560
Old-old	316	329	347	358	396	416	421	436	447
Oldest-old	302	315	335	342	372	384	379	384	394

Source: data processed from Social Insurance Agency in Slovakia

Significant disparities in regional income distribution create conditions for the differentiation of structure and size of consumption of older people in particular regions (table 3).

Table 3: Stratification of older people net income by region (% , year 2012)

	50-64 years				65-79 years				80+			
	<300	300-500	500-1000	>1000	<300	300-500	500-1000	>1000	<300	300-500	500-1000	>1000
BA	11	32	38	19	9	59	25	6	10	74	15	0,45
TT	19	41	32	7	17	70	12	1	19	78	3	0,04
TN	18	44	33	6	14	71	14	1	14	82	4	0,05
NR	23	43	28	6	21	69	10	1	25	72	3	0,05
ZA	20	44	30	6	15	72	12	1	14	82	4	0,06
BB	22	42	30	6	15	72	12	1	16	80	4	0,05
PO	24	45	26	5	17	73	9	1	17	80	3	0,02
KE	22	39	31	8	16	67	16	1	18	76	6	0,07

Source: data processed from Social Insurance Agency in Slovakia

Relatively low net income in the 50 -to-64 age group and problematic development in the labor market, multiplied by effects of the crisis do not create condition for sufficient creation of savings in several regions of Slovakia, which could be used in the future to ensure a higher consumption in retirement. The most significant problems are in PO – Prešov region.

Characteristics of similarities and differences in households consumption structure of older people in the old and new EU member states

Substantial income and wealth inequalities exist among EU countries, which lead to differentiated consumer behavior. In the new EU member countries lower income levels of older people are reflected in higher proportion of spending on food, non-alcoholic beverages and housing (including energy costs). Its share of total expenditures of households headed by a young old age person was about 50%. In the old EU member states it was lower by about 13.1 percentage points. This shows that after including other expenses, such as spending on clothing and footwear, furnishings, household equipment, transport, communication, miscellaneous goods and services, young-old households in new EU member countries can spend only a small proportion of their income for leisure activities. The consumption expenditures on recreation, culture and hotels and restaurants of households whose head was aged 50 to 64 years tended to be much higher in old than in new EU countries, which means that while in old EU countries were on the level 15,8% of total household budget, in new EU countries were by 6,5 percentage points lower. This proportion significantly diminished with increasing age of older people, especially after finishing their active working life. Expenditures on health as a percentage of total households budget of older people are not significantly higher in the old than in new EU countries (in old EU countries 3,2% of young-old households expenses were allocated for health, as compared to 4,4% for the old-old households and 7,2% for the oldest-old households; in new EU member countries these percentages were 4.4 %, 7.2 % and 9 %, respectively by age group). It may be seen that older adults tend to consume more frequent and more expensive types of health care services than younger cohorts, especially in the last years of their life.

The diversity of consumption patterns in particular countries is affected by the various factors (economic, cultural, geographical, historical, etc.). Traditions can play an important role in terms of the national strategy „let’s-support-local-business“ (for example in France, Italy and Austria). Climatic conditions resulting from the geographical location of the country fundamentally influence differentiation of consumer behavior of older people in the northern and southern parts of Europe. This is reflected, for example,

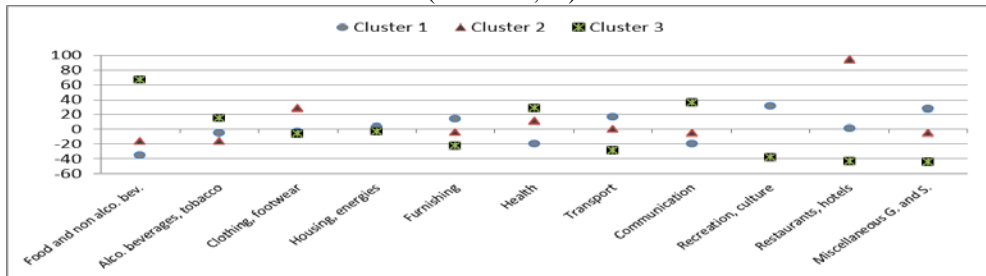
in the lower proportion of spending on energy in southern European countries compared with the Nordic countries (on average by 4 percentage points for young old and old-old people and by 6 percentage points for the eldest-old). The Nordic countries⁴⁴ have higher price levels for food and non-alcoholic beverages compared with southern countries. Lower income in the southern countries as well as different lifestyle compared to Nordic countries cause the higher proportion of expenditure on food in the southern European countries for young-old, old-old and the oldest-old households, on average by 4 p. p., 8 p. p. and 10 and p. p, respectively by age group. Households of older age people in southern countries have also higher share of restaurants and hotels expenses compared with those in the Nordic countries. On the contrary, due to milder maritime climate, they spend lower proportion of their household budget on recreation and culture (by about 6 percentage points). The high degree of solidarity in the Nordic countries leads to lower share of household expenditures on health compared to southern European countries. All these factors influenced the existence of similarities or differences of older people households' consumption patterns across EU countries. By using cluster analysis for households whose head was aged 50 to 64 years we found three clusters of countries that share reasonable similarities in terms of their consumption structure:

1. Cluster 1: old member countries of EU (AT, BE, DE, DK, FI, FR, IE, LU, NL, SE, UK) and Slovenia,
2. Cluster 2: southern countries of EU (CY, ES, EL),
3. Cluster 3: new member countries (BG, EE, HU, LT, LV, RO, SK).

Figure 2 shows how particular clusters differ compared to the EU22 average within the presented 11 product and services categories. From silver economy point of view, cluster 1 represents the most promising group of countries in this age group. One characteristic of this cluster is that households in these countries have significantly lower proportion of expenditure on food and non-alcoholic beverages and a significantly higher proportion of spending on household furnishings, transportation, recreation, culture and miscellaneous goods and services than average.

⁴⁴ The highest price level of food and non-alcoholic beverages among EU countries was observed in northern countries.

Figure 2: Differences in consumption of young-old households within three clusters (COICOP, %)



Source: data processed from Eurostat

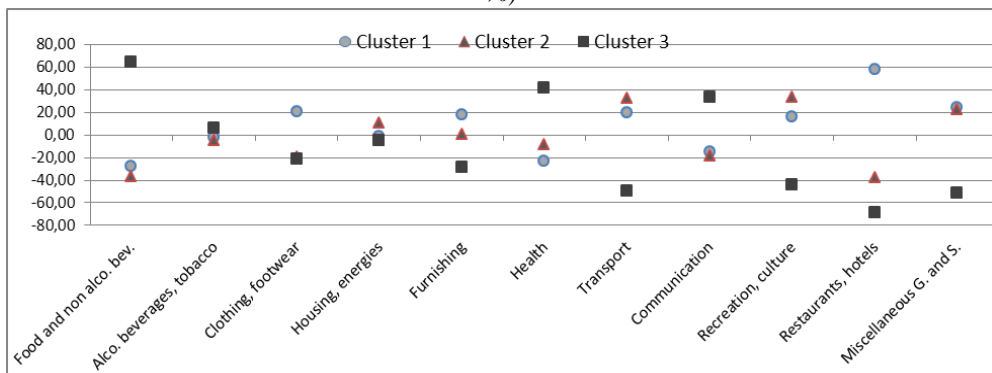
Second cluster analysis suggests that main differences in consumption of old-old households are within these three clusters (figure 3):

Cluster 1 – southern countries EU (CY, ES, EL), Benelux (BE, NL, LU), Austria, Germany, Ireland, Slovenia and Great Britain,

Cluster 2 – northern countries EU (DK, FI, SE) and France,

Cluster – new member states EU.

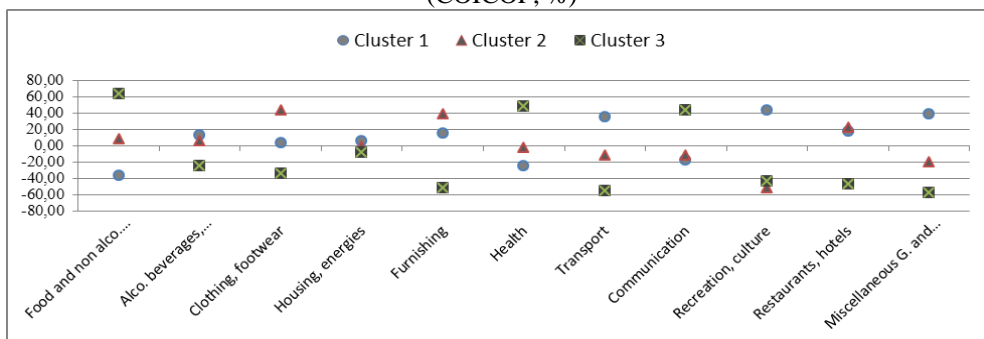
Figure 3: Differences in consumption of old-old households within three clusters (COICOP, %)



Source: data processed from Eurostat

By similar cluster analysis for the oldest-old households we found cluster 1 consisting of old EU member countries and Slovenia, cluster 2 comprising southern countries including Slovakia and cluster 3 consisting of new EU member countries (figure 4).

Figure 4: Differences in consumption of oldest-old households within three clusters (COICOP, %)



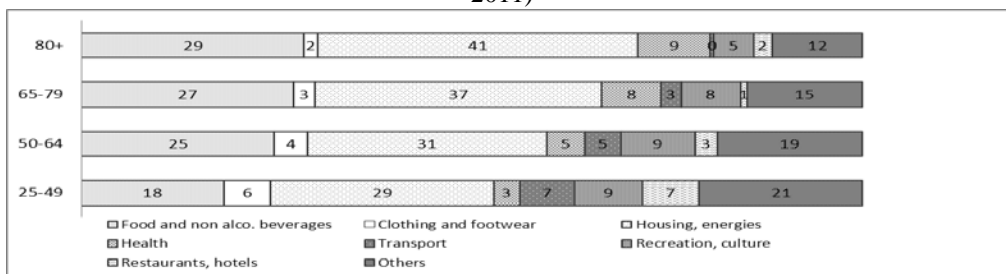
Source: data processed from Eurostat

Comparison of changes in consumer behavior of young and older people – a case study of Slovakia

From the potential demand point of view, Slovakia belongs according to the results of multifactor analysis to the Visegrad region (Pauhofová, I., Páleník, M., 2013). About 17 % out of total EU people aged 50 years and above live in this region (in Slovakia it is about 1.6 %). This percentage is expected to grow in coming decades, which makes this region more promising. However, lower effective demand caused by unsatisfactory economic situation of older people can be one of the biggest constraint for new business opportunities. Our analysis of average incomes showed that this region represents about 6.3 % of total EU potential demand, while the share of Slovakia was only 0.52 %.

In Slovakia, due to relatively lower incomes, older people tend to be more prices sensitive and spend more percentage of their total budget on food, housing (including energy) and health than younger ones. They also allocate less percentage of their budget on clothing and footwear, transport, recreation and culture, to restaurant and hotel services. Consumption expenditures of households on goods and services in particular age groups is shown in figure 5.

Figure 5: Structure of expenditures by age in Slovakia (% of total expenditures, COICOP, 2011)

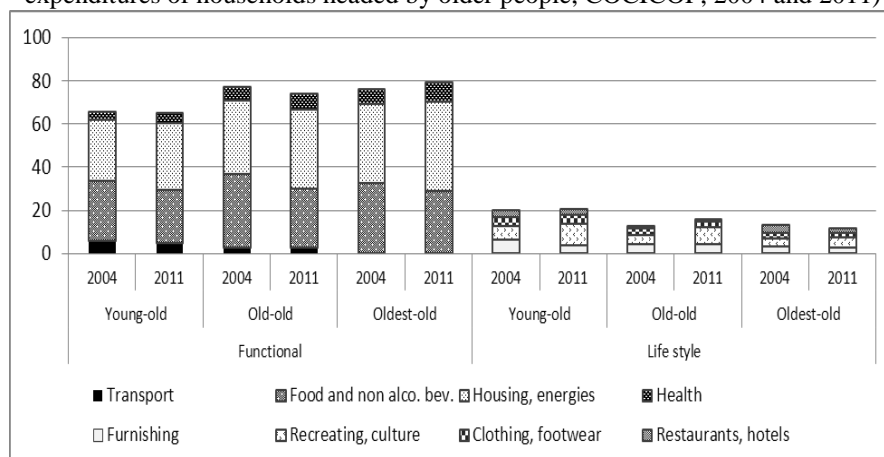


Source: data processed from Household budget survey of Statistical Office of the Slovak Republic

Due to identifying opportunities for the private sector we present household expenditures classified by purpose (COICOP) and divided into two groups consisting of functional expenditures (expenditure on food and non-alcoholic beverages, housing including water, electricity, gas and other fuels, transport and health) and expenses related to lifestyle (spending on furnishing including household equipment maintenance, clothing and footwear, recreation and culture, restaurant and hotels).⁴⁵

Figure 6 shows that households headed by person aged 50 of older dedicate a substantial proportion of their budget to the functional expenses. In 2011, these proportions of functional expenses were 65 %, 74 % and 79.3 % respectively for households headed by young-old, old-old and the oldest-old person. Only a relatively small percentage of total expenses was spent on goods and services related to the lifestyle. The process of population aging should significantly accelerate in Slovakia after 2015. By 2050 (EUROPOP 2013) Slovakia should be included among the countries with the oldest population (according to the median age). Therefore it can be expected that future trends in consumption will be significantly affected by aging population. This could subsequently lead to changes in sectoral production, as well as in employment.

Figure 6: Functional expenses and expenses related to lifestyle in Slovakia (% of total expenditures of households headed by older people, COICOP, 2004 and 2011)



Source: data processed from Household budget survey of Statistical Office of the Slovak Republic

The future of silver economy

In the long term, the potential of silver economy is influenced by the increase in average life expectancy, which was mainly caused by advances in medical care. The global average life span extended by nearly 20 years over

⁴⁵ Dividing expenditures into two groups was inspired by work Dujin – Lehuédé – Mathé – Siouandand (2010) and adjusted to Slovak conditions.

the past 200 years. Views on further development vary. According to Colin Mathers (WHO, 2013) it can be expected that the increase in life expectancy due to reductions in morbidity reached by better medical treatment will gradually slow down. Richard Willets (Partnership, an insurance company in the UK) has a similar opinion when he states that life expectancy will slowly increase but at a much lower rate than before.⁴⁶ Only in a small percentage of EU countries (e.g. Sweden, Finland) people have a good health status and live longer due to benefits of the traditional healthy lifestyle (WHO, 2013).

Number of older people in Europe continues to grow rapidly and it is necessary to take into account that ageing population with all of its effects will produce fundamental changes in future societies with consequences on population needs and consumption but also on modification of inter and intra generational relationships. With this situation are associated changes in access to the labor market in relation to occupational structure and options for moving into other professional fields, resp. to creation the workplaces which were tailored to the needs of older people. This will significantly affect the service sector, including intergenerational communication in general and it will have also an impact on the individual's social status. These processes will be significantly determined by the development of intergenerational solidarity in terms of using financial resources.

In relation to the needs and consumption the targeted individualization will reflect in proposals and implementation of advanced technological applications in each age group of older people, especially for those aged over 80 years. This includes the use of results from the fields of biotechnology, nanotechnology, genetic engineering that can directly affect life expectancy. The extent to which it will cover older people will depend on the particular price settings in relation to the development of consumer demand of relevant part of the population. It is expected that healthy life expectancy will increase and that the number of the people aged over 100 will grow significantly in developed countries. Retirement ages will extend not only because of the productivity of older people, but mainly due to make the welfare system more sustainable.

The first significant transformation is possible to gradually register in application of new technologies to the goods and for services that are oriented to the older generation with limited movement skills. These are mainly products and services related to modifications of housing, transport vehicles and the whole area of health care. Consideration is given to the trend among the younger generation, who has more freedom, choices and has an increasing proportion of women who have delayed having children or

⁴⁶ Progress was expected mainly in treatment of Alzheimer, Parkinson and metabolic diseases.

decided to be one-child, childlessness or a single parent and it is difficult for them to leave work and take care of their parents. Traditional family is changing and senior families will look different. It is expected that the predominant care of the elderly will be provided in the home community environment. Between old and new EU countries there are huge differences in the care range for older people provided by family members. In the new ones there is a much higher percentage of the elder family care provision (this percentage is in CZ and SR about 80 %). Old-age care creates a big part of the silver economy and it is closely connected with questions of financial well-being and constraints⁴⁷, as well as the issue of intergenerational solidarity. From an economic point of view it seems that home care for seniors, which is currently carried out mostly by women is less expensive. Given the demographic trends, it is anticipated that there will be 55 people aged over 80 for every 100 women in productive age by 2025. It is also expected that a large part of future seniors will use technological and robotic devices⁴⁸ and for communication will use more social media also because they will have already some experiences in these fields.

The aging population of Europe is a challenge reflected also in determining the research priorities of each country. It is obvious that countries which have already focused in the past on sectors of interest from the ageing population perspective will have a comparative advantage. For example the United Kingdom increases orientation towards biotechnology, pharmaceutical industry and medical technology, currently employing about 170 000 people in 5 000 companies investing to these areas. According to government statements, England is to become a global leader in biotechnology over the next 10 years, with the expectation of improving health care, the inflows of investment, creating new jobs and business opportunities.⁴⁹ For countries like the Czech Republic and Slovakia, which have tradition and good conditions for e.g. in making clinical studies would be challenging to orient research efforts in this direction.

Future consumption of older people in the EU is directly shaped by energy policy, which can influence energy prices and therefore can have a negative influence on structure of households' expenditures of older people.

⁴⁷ For example because of the significant increases in long term care costs in the beginning of 1995 the compulsory long-term care insurance was established in Germany, which means that every inhabitant in this country has to be insured against the risk of long-term care (in Czech and Slovak Republic this kind of insurance was not yet introduced). The amount of received benefits depends on the levels of care and services including home and inpatient care.

⁴⁸ For example robot Enon from Nara Institute of Science and Technology in Japan can communicate with older people.

⁴⁹ For supporting of transformation process of research results to practical use, they introduced lower rate of corporation tax to profits earned from patented inventions.

Furthermore it will also depend on changes in prices for health care goods and services, food commodities and transport services as well as on salaries and conditions in elderly care sector. The level of retirement pensions, which directly influence the demand of seniors, can be significantly affected by pension system reforms including changes like e.g. increasing retirement age, linking retirement to life expectancy, setting different age for retirement for hard-pressed workers, increasing expenditures for retirement benefits etc.

Conclusion

Mismanagement of the aging population was set as the fifth most significant risk for the next 10 years out of the top 50 global risks presented at the World Economic Forum 2013 in Davos. One of the key risks for the formation of silver economy can be considered a deepening income polarization. This situation in corresponding with the ongoing debt crisis in the EU, wage stagnation and vague approach toward the pension system reforms, do not create an adequate space for formation of consumer demand of seniors. These problems are the same for old and new EU countries, but these countries differ in the size of pensions (net incomes) and in magnitude and speed of population aging (new EU member countries have lower level of income and most of these countries still lag behind old EU member countries in the degree of population ageing, but in next few decades it can be expected a rapid increase in the proportion of older people). Pro-growth factors with effects of silver economy have therefore the higher opportunity to express themselves in the old EU countries, especially in the larger economies. Faster aging with higher pensions and growing number of older people in terms of saturation of needs create a strong pressure and but also a challenge for business and research sector, job creation and private investment especially in domestic conditions. It seems that small open economies such as Slovakia have in the ongoing crisis only a little chance to stop the “getting poorer process”. Opportunities for exporting goods and services from Slovakia to countries with strong potential demand of older people are scarce also because of overall problems of exporting within the EU. New official statements in Davos in 2015 shifted the economic problems associated with the growth of income inequality and with financing of aging population behind those of geopolitical nature. Therefore due to the influence of several negative factors, the possibilities of realization of the silver economy concept in many of the EU countries weaken.

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UNCERTAINTY, MONEY AND UNDEREMPLOYMENT

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Abstract

This paper presents a restatement of Keynes's underemployment equilibrium as a center-equilibrium system. The authors present their central-equilibrium underemployment model with the income-balancing mechanism. The authors postulate the existence of a causal link between the fundamental uncertainty and the center-equilibrium underemployment. Two channels of fundamental uncertainty are suggested here to capture this causal link, the capital channel and the money channel. Drawing upon Davidson (2009, p. 333; 1991, p. 138), the authors identify the capital channel of fundamental uncertainty with the entrepreneurial risk and the money channel of fundamental uncertainty with the cash-flow-managerial risk of asset-liability mismatch. From this, the author infer a conclusion that the economic policy of flexible liquidity supply cannot be mixed up with an economic policy of governmental spending under a highly ambiguous term "money pumping".

Keywords: General equilibrium, underemployment equilibrium, fundamental uncertainty, liquidity preference, natural rate of interest

Introduction

The post-keynesian economics has been showing a long-run interest in the issues of equilibria of dynamic systems. In this direction of expansion, the post-keynesian research program could not have avoided a head-on confrontation with the natural-rate hypothesis which represents one of building blocks of neoclassical economics. Davidson refers to the "fundamental neoclassical article of faith" (Davidson, 1993, p. 312) in this context. In the capital market, the natural-rate hypothesis finds its manifestation in the natural rate of interest. As long as the money rate of interest falls short of the natural rate, the inflation rate is going to increase. This two-rate theory of Knut Wicksell (1898, pp. 102-121) became a theoretical foundation of the New Consensus monetary policy of inflation targeting. What if the capital market is not getting cleared by changes in the

interest rate, though? What if both the desire to invest and the desire to save are independent of the interest rate? (Keynes, 1936, p. 97, 135; 1937, p. 250). An introduction of such an assumption would inevitably explode the whole concept of the natural rate of interest and, in effect, the general-equilibrium paradigm of permanent market clearing.

In this paper, we are going to examine the causal links interconnecting the most significant building blocks of post-keynesian monetary economics. These building blocks are fundamental uncertainty, liquidity preference, criticism of the general-equilibrium assumption and criticism of Say's law. We are going to discuss these elements with respect to Keynes's underemployment equilibrium such as expounded in *The General Theory* (1936). We will put forward our restatement of Keynes's underemployment equilibrium as a center-equilibrium system. Next, we will postulate the existence of a causal link between the fundamental uncertainty and this center-equilibrium underemployment. Drawing upon the research of Davidson (1991, 2009, 2012), we will distinguish two channels – the capital channel and the money channel – through which the fundamental uncertainty results in the central-equilibrium underemployment. We will base our effort to describe the differences between these two channels on the distinction between the notion of negative net worth on the one hand and the bankruptcy (/insolvency) on the other hand. Drawing upon Davidson's notions of "maintenance of one's liquid status" (Davidson, 2009, p. 333) and "certainty of cash flows (but not necessarily real outcomes) over time" (Davidson, 1991, p. 138), we will identify the capital channel of fundamental uncertainty with the entrepreneurial risk and the money of fundamental uncertainty with the cash-flow-managerial risk of asset-liability mismatch. Finally, based on our hypothesis of two channels, we will show that an economic policy of flexible liquidity supply cannot be mixed up with an economic policy of governmental spending under a highly ambiguous term "money pumping".

The first section of the paper provides an introduction of two theoretical foundations of neoclassical economics, the general-equilibrium theorem and Say's law. In the second section, we present our two center-equilibrium underemployment models, with the assumption of the natural-interest-rate-clearing capital market and, in the other case, with the assumption of the income-balancing mechanism of the capital market. The third section focuses on Keynes/post-keynesian criticism of Say's law through the income-balancing mechanism and from the liquidity-preference theoretical position. Our hypothesis of two channels of fundamental uncertainty is expounded at this place and the conclusions are drawn from it.

Say's Law and General Equilibrium

Neoclassical economics is based on Say's law. This principle, described by Jean-Baptist Say in the 18th century, explains why the idea of insufficient aggregate demand is erroneous. Whenever a good is produced, the factors of production used to produce this good are paid their remuneration, and so the aggregate value of all goods produced in an economy must be equal to the aggregate value of remunerations of factors of production which stand for the sum of all incomes. So, even though there may be markets with excess supply (the quantity produced exceeds the quantity demanded), there must be other markets with excess demand (the quantity demanded exceeds the quantity produced). Why? Because the system is closed.

This set-up changes substantially at the moment we accept the assumption that the subject can shift today's consumption into future, in other words, if we built the possibility of saving into the model⁵⁰. On the assumption that there are no intra-temporal exchanges and the money supply is constant, the condition of an inter-temporal closedness of a system consisting of n inter-temporal markets (actually, capital markets) can be expressed as follows:

$$\begin{aligned} & (Y^A)^{\text{today}+} + (Y^B)^{\text{today}+} + (Y^A)^{\text{tomorrow}+}/(1+r) + (Y^B)^{\text{tomorrow}+}/(1+r) = \\ & = (Y^A)^{\text{today}*} + (Y^B)^{\text{today}*} + (Y^A)^{\text{tomorrow}*}/(1+r) + (Y^B)^{\text{tomorrow}*}/(1+r) \end{aligned} \quad (1)$$

or

$$\begin{aligned} & [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] + [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] = \\ & = [(Y^A)^{\text{tomorrow}*}/(1+r) - (Y^A)^{\text{tomorrow}+}/(1+r)] + [(Y^B)^{\text{tomorrow}*}/(1+r) - (Y^B)^{\text{tomorrow}+}/(1+r)] \end{aligned} \quad (2)$$

In other words, the sum of today's incomes and tomorrow's incomes that the subjects A and B are endowed with has to be equal to the sum of today's incomes and tomorrow's incomes of the subjects A and B after the exchange. The exchange consists in that A saves a portion of his today's income and lends it to B, so that B can increase his today's consumption. But B will have to repay this loan to A with interest tomorrow.

What is the practical result of the above said? The practical consequence of the assumption of the inter-temporal closedness of a system is, as we could see, that all savings are consumed in the future. Or, vice versa, that all debts are repaid by future savings. However, since the future can be located to infinity, this assumption is more of theoretical than practical consequences. And, above all, this model does not incorporate the supply side of the economy. A's savings are used by B to increase his today's consumption. B's willingness to pay an interest rate to A is co-

⁵⁰ We assume a simple two-period model as introduced by Fisher, 1930, pp. 38-45.

determined by his time preference. But what if B used these savings to increase the productive capacities which would make possible for him to repay the interest to A without being forced to reduce his consumption in the future period? What would be the interest rate he would be willing to pay to A? Definitely, any interest rate lower than the net rate of return from this investment. In that case, the assumption we made that the goods do not “grow” is not valid any more. Increased productivity resulting from the investment means that the amount of (some) goods tomorrow will be higher than today

$$(Y^A)^{\text{today}^+} + (Y^B)^{\text{today}^+} + (Y^A)^{\text{tomorrow}^+}/(1+r) + (Y^B)^{\text{tomorrow}^+}/(1+r) < \\ < (Y^A)^{\text{today}^*} + (Y^B)^{\text{today}^*} + (Y^A)^{\text{tomorrow}^*}/(1+r) + (Y^B)^{\text{tomorrow}^*}/(1+r) \quad (3)$$

or

$$[(Y^A)^{\text{today}^+} - (Y^A)^{\text{today}^*}] + [(Y^B)^{\text{today}^+} - (Y^B)^{\text{today}^*}] < \\ < [(Y^A)^{\text{tomorrow}^*}/(1+r) - (Y^A)^{\text{tomorrow}^+}/(1+r)] + (Y^B)^{\text{tomorrow}^*}/(1+r) - (Y^B)^{\text{tomorrow}^+}/(1+r) \quad (4)$$

where

$$(Y^B)^{\text{tomorrow}^*}/(1+r) = (Y^B)^{\text{tomorrow}^+}/(1+r) + I \cdot (1+\eta)/(1+r) - (\Delta Y^A)^{\text{tomorrow}^+}/(1+r) \quad (5)$$

where η is the productivity growth, which means that as for $\eta > r$ (productivity growth rate higher than the interest rate paid to A), B's future income will be higher thanks to the investment made.

The conclusion is that there is such interest rate r – provided the productivity growth rate η is known (!) - at which A will be willing to abstain from consumption of the value I which will make it possible to B to increase productivity $(1+\eta)$ -times which ensures repayment of the interest to A and which ensures that B not only does not have to decrease his consumption in the future but he can even consume more (that is the meaning of the last inequality). On the other hand, the above said inequalities (3) and (4) be a question about the alleged closedness of this system. As long as a system is not described by equations, the problem of non-existence of a unique equilibrium prevails. How could this fly in the ointment be disposed of? Let us consider following. In retrospect, B knows that his investment lead to productivity growth and to increase of his income. Also, all of this had been expected by him before he did the investment, even though the precise numbers (namely, η) were not known to him. However, in a probabilistic sense, they were. Let us say that the risk of a bankruptcy had been estimated by him as a probability P . Then, though, we could incorporate the present value of this expected future income (with respect to the probability of a failure) and we could write from the ex post view:

$$(Y^A)^{\text{today}^+} + (Y^B)^{\text{today}^+} + (Y^A)^{\text{tomorrow}^+}/(1+r) + (Y^B)^{\text{tomorrow}^+}/(1+r) + I \cdot \eta/(1+r) =$$

$$= (Y^A)^{\text{today}*} + (Y^B)^{\text{today}*} + (Y^A)^{\text{tomorrow}*}/(1+r) + (Y^B)^{\text{tomorrow}*}/(1+r). \quad (6)$$

Inserting the member $I.\eta/(1+r)$ turned the inequality into an equality. On the other hand, the interpretation of such a step is inevitably that the exchange (A providing savings to B for interest, B doing an investment) does not change the real product. In other words, for a system to be closed, no operation can affect this size of the Edgeworth box. This closedness is not reached by assuming that the real output cannot increase – that would contradict both the facts and common sense – but, vice versa, by assuming that the real output had increased already. Any change affecting the size of the Edgeworth box is reflected before it happens. Any investment which will be done in the future is discounted to the present. This is more or less what the *complete markets theory* is about which is so strongly criticized by Davidson (2009, pp. 326-328).⁵¹

General Equilibrium Revised

A Center-Equilibrium Underemployment Model With the Natural Rate of Interest

The theory of general equilibrium (GE) sounds so plausible that it is very uneasy to escape it. All disequilibria will disappear through the process of market clearing. There is always a configuration of prices which will dispose of all excess demands and excess supplies. Yet, the cases of prevailing involuntary unemployment in many labor markets beg the question about the realism of the GE theory, nonetheless: “It is not surprising, therefore, that unemployment still plagues most 20th century economies, since neoclassical economists still formulate policy guidelines which are only applicable to a limited domain where agents choose “as if” they had specific and completely ordered knowledge about the future outcomes of their actions.” (Davidson, 1991, p. 137). The question to be asked here, is, then, what prevents the markets from getting cleared? Keynes noticed the wage rigidities but, unlike his followers who became called Keynesians, he did not regard these rigidities as the primary cause of unemployment.⁵² A second possible cause of malfunctioning of the market-clearing mechanism is imperfect information. Imperfect information is just a special case of transaction costs. Except for imperfect information, another example can be transportation costs, legal costs and other bargaining costs.

⁵¹ “To some an assumption that the future is already known may seem preposterous. Nevertheless this idea underlies the Greenspan belief [...] that the self interest of lending institutions in a free market should lead management to undertake transactions that protect shareholder’s equity.” (Davidson, 2009, p. 326).

⁵² For the misperceived role of nominal-wage rigidities see the whole chapter 19 of The General Theory.

However, flow of time, technological progress and institutional progress eliminate these obstacles to the market-clearing process.

All these factors may slow down the market-clearing process but they do not present a fundamental obstacle to the theory of general equilibrium in the long run. However, this theory stands and falls on the assumption of *the existence* of a unique **and** stable equilibrium. A distinction must be kept in mind between uniqueness of an equilibrium, which regards the very existence of a single gravitational center, and its stability, which regards the question whether the system can reach its equilibrium automatically, or not (Jespersen, 2009, pp. 164-165).⁵³ A dynamic system which possesses both a unique **and** stable equilibrium is a system of traditional equilibrium.⁵⁴ If such a system is deviated from its equilibrium configuration, there is no external influence necessary for such a system to restore its equilibrium. The equilibrium of this system gets restored by operation of the system's own endogenous dynamics. A system which possesses a unique but unstable equilibrium does not display such a characteristic. A dynamic system with a unique but unstable equilibrium – or a knife-edge equilibrium - only stays in its equilibrium configuration if (and as long as) it is not diverted from this position. As soon as the system gets diverted from this position – even infinitesimally – a slight balance gets disturbed and the system starts a process of divergence. There is another type of a dynamic system, though, which possesses a unique equilibrium which the system cannot reach by its own but, at the same time, when it reaches it, it stays in this position. This is a center-equilibrium system. As long as the system's parameters do not acquire the “right” values, the system will circulate along concentric orbits, unable to reach the equilibrium configuration by a mere operation of its own endogenous dynamics. To make the system reach its unique (but unreachable by endogenous forces) equilibrium, there has to be an exogenous force which helps the system get over the barriers of concentric orbits and brings it to its equilibrium.

⁵³ To the problem of (non-)uniqueness in post-keynesian literature see e. g. Kaldor, 1934; Davidson, 1993; Setterfield, 1995, 1998a, 2008; Berger, 2009 and to the problem of (in)stability in post-keynesian literature see e. g. Kaldor, 1972; Amable, 1993; Setterfield, 1997, 2005a.

⁵⁴ Setterfield, 1997, p. 52ff.; 2008.

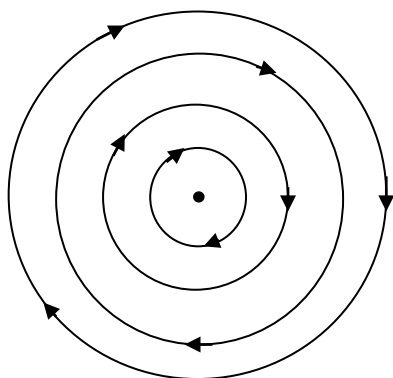


Fig. 1. A Center-Equilibrium System (own source)

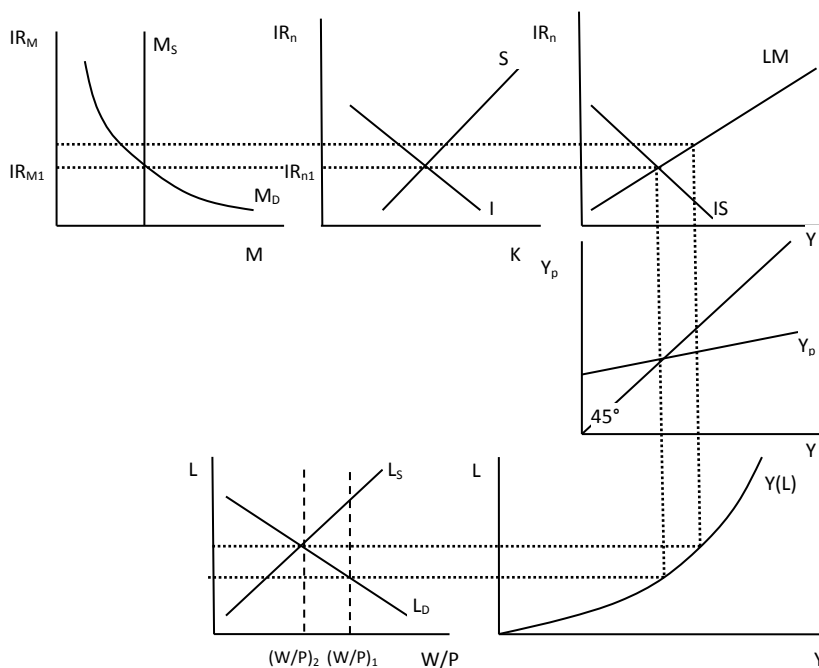


Fig. 2. A Center-Equilibrium Underemployment Model With the Natural Rate of Interest (own source)

In the graph, we can see that despite the money market (M) and capital market (K) are in equilibrium at IR_{M1} and IR_{n1} , respectively, the labor market is not at the real wage $(W/P)_1$. We also can see that if the labor market gets cleared by a decrease in the real wages from $(W/P)_1$ to $(W/P)_2$, this will only lead to increase in the product which will move both the capital market and money market out of equilibrium.

A Central-Equilibrium Underemployment Model Without the Natural Rate of Interest

What Keynes was criticizing, though, what not the mere fact that the economic system does not have to be a system with a unique stable equilibrium. Keynes's critique of the neoclassical paradigm was substantially more profound. Take notice what the capital market is modeled like in the graph. Savings are a positive function of the interest rate and investments are a negative function of the interest rate. The equilibrium interest rate at which the subjects are willing to save and lend exactly the same amount which the firms are willing to borrow and invest is the equilibrium natural rate of interest IR_n^* . As a result, it is not possible that the willingness to save exceeds the willingness to invest in the long run. Excess supply of savings pushes the natural interest rate down. Analogically, excess demand for savings drives the natural rate up. Keynes put forward a radical revision of this model of a capital market. In his conception, the savings do not depend positively on the interest rate but depend positively on the income (Keynes, 1936, p. 97). At the same time, the investment does not depend on the current interest rate but on the expected interest rate. The investment function itself is identical with a function of expected net marginal rate of return⁵⁵ (Keynes, 1936, p. 136). Both the expected net marginal rate of return and the interest rate, to which the former one is compared, are subjects of fundamental uncertainty⁵⁶. That means that they cannot be known even in the actuarial sense. However, if there is no relation either of the savings or the investment to the natural interest rate (whatever it is), then a change in the natural interest rate cannot be the mechanism of equilibrium restoration (Keynes, 1936, p. 165). As a matter of fact, there is nothing such as a natural rate of interest, then⁵⁷. The neoclassical capital market scheme will then look like this:

⁵⁵ Keynes uses a term "the marginal efficiency of capital".

⁵⁶ Keynes talks just about certainty. The term "fundamental uncertainty" was probably introduced by Paul Davidson (see Jespersen, 2009, p. 178).

⁵⁷ Arestis (2009, pp. 16-18) points out a development in Keynes's position as regards the natural rate of interest from *The Treatise on Money* – where he still subscribed to this concept – to *The General Theory* – where he rejected it. See Keynes, 1936, pp. 242-244.

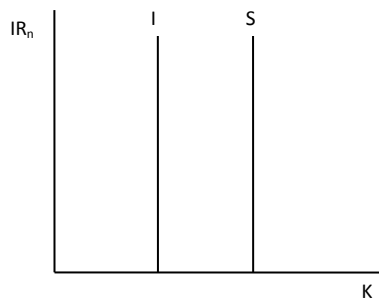


Fig. 3. Absenting Natural-Interest-Rate Balancing Mechanism in the Capital Market (own source)

Is there any mechanism which can bring the willingness to save and the willingness to invest into balance? Since the savings depend positively on the income, the amount of savings generated and supplied would decrease with lower income to exactly the amount which corresponds to the willingness of firms to invest (which itself is given by animal spirits, i. e. fundamentally uncertain expectations). The general-equilibrium problem can be looked at like this, then:

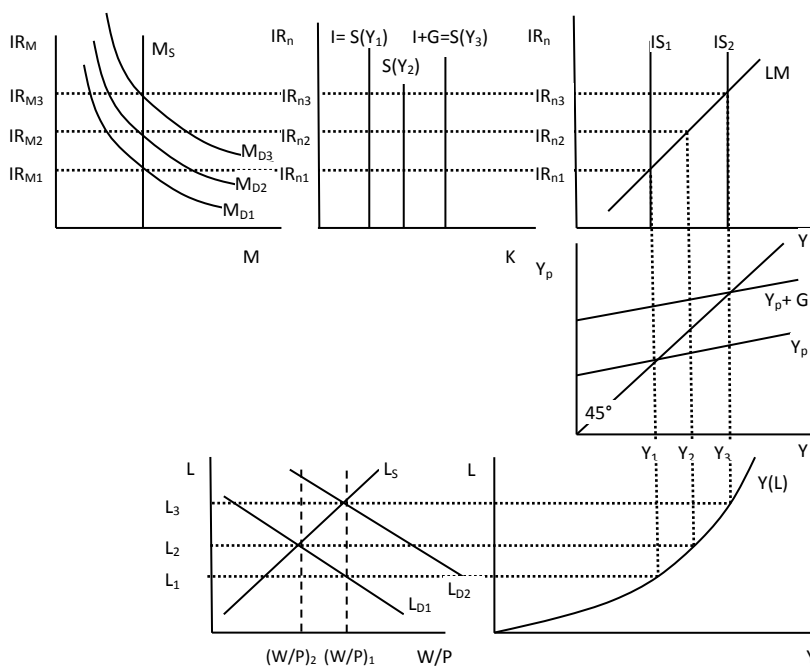


Fig. 4. A Center-Equilibrium Underemployment Model Without the Natural Rate of Interest: An Economy With the Fundamental Uncertainty (own source)

At the level of output Y_1 , both the capital market and the money market are in their respective equilibria but the labor market is out of equilibrium at the level of employment L_1 and the real wage level $(W/P)_1$. However, if the real wage decreases to $(W/P)_2$, the labor market restores its equilibrium at the level of employment L_2 but this level of employment will increase the output to Y_2 . At this level of output, though, the capital market will be out of its equilibrium. Excess savings in the labor market will motivate the firms to decrease their production back to Y_1 which brings down the aggregate demand. However, the insufficient aggregate demand pushes down the prices which increases the real wages back to $(W/P)_1$. At the higher wage level $(W/P)_1$ the labor market is out of its equilibrium, again. A vicious cycle of falling nominal and real wages, falling prices, increasing real wages and again falling nominal and real wages, falling prices, increasing real wages etc. etc. with the product unable to provide the economy with a permanent full employment.

It is thus not the nominal wage rigidities which prevents the economy to reach full employment permanently but the fact that willingness of households to save is not accompanied by an equivalent willingness of firms to invest (Keynes, 1936, p. 262). In other words, the real culprit is an insufficient aggregate demand.⁵⁸ Could a stimulation to aggregate demand ensure a permanently full employment, i. e. such a level of product which simultaneously restores the equilibrium in the labor market, the capital market and the money market? Let us assume the initial level of product Y_1 , again, at the level of employment L_1 and the capital market being in a state of equilibrium at the level $I=S(Y_1)$. Now, the government increases the aggregate investment by G to the level $I+G$. The governmental investments increase the product directly from Y_1 to Y_3 and this increase is accompanied by an increase of labor demand. The shift in the labor demand increases the employment level from L_1 to L_3 at the unchanged real wage level $(W/P)_1$. The full employment is restored and, at the same time, higher product increases the amount of savings generated to $S(Y_3)$ which is now equal to the level of the total of private desired and the governmental investments. The capital market restored its equilibrium. The money market equilibrium has not been affected. Thus, the full employment level is going to be permanent.

Say's Law Revised

Say's law suggests the impossibility of a problem of deficient aggregate demand. Any production, as Say's law implies, generates an equivalent flow of incomes to the factors of production, and – since the

⁵⁸ For the misperceived role of nominal-wage rigidities see the whole chapter 19 of The General Theory.

system is closed – these incomes must either be consumed in the present (intra-temporal closedness) or saved to be consumed in the future (inter-temporal closedness). If the incomes are saved to be consumed in the future, then, they must be invested in the present. In any case, the aggregate supply will equal the aggregate demand. This is the logic of a closed system which is an underlying principle of the Say's law. The capital market can never face a situation of long-run excess savings because this would push the natural interest rate down. If we abandon this model of a capital market, the situation of excess savings may be a permanent problem. The system does not have a unique stable equilibrium and the markets don't get cleared. As a matter of fact, not only the excess savings are not automatically accompanied by an equal desire to invest – which is a result we get in a classical model of a capital market thanks to a decrease in the natural interest rate to the market clearing level IR_n^* which guarantees this equality – but, the very opposite is true: the excess desire to invest will always find adequate savings. Keynes's approach has obviously reversed this causality. According to his conception of a capital market, the savings are always generated automatically along with the investment made (Keynes, 1936, p. 184).

The reason why Keynes rejects a simple functional dependence of investments on the current interest rate is the existence of fundamental uncertainty. It is precisely the fundamentally uncertain characteristic of the world which is Keynes's ultimate argument against the Say's-law-based general-equilibrium economics describing the neoclassical world of permanently clearing markets. That a *potential existence* of a unique stable equilibrium is a general case being in opposition the special case of its *guaranteed existence* is a strong argument of Keynes. Such a theoretical standpoint would still remain a black box, though. There would still be missing a theory explaining why the absence of a unique stable equilibrium may be a more probable case. Besides, such a standpoint could be reconcilable with a world characterized by a fundamental certainty, as well. However, it is the fundamental uncertainty by which Keynes explains the non-existence of interest-rate balancing mechanism of the capital market. And it is the latter which serves as his theoretical explanation of his assertion that the non-existence of a unique stable equilibrium is the cause why the permanently full employment cannot be reached via a process of market clearing.

To sum up: the fundamental uncertainty of the world eliminates the natural-interest-rate balancing mechanism of the capital market and replaces this mechanism by the income balancing mechanism⁵⁹; the income balancing

⁵⁹ As soon as in *The Treatise on Money*, Keynes points out that the decision making of entrepreneurs to invest into fixed capital is separated from the decision making of

mechanism implies that a desire to save may permanently exceed a desire to invest; this is a situation of insufficient aggregate demand which underlies the center-equilibrium underemployment model. We refer to this causal sequence as *the capital channel* of fundamental uncertainty. As mentioned above, the center-equilibrium nature of underemployment state is characterized by its feature of potential permanency. Unless the economy is affected by an exogenous force, it will not get out of the underemployment state. This implies, though, that such a system does not fulfill the condition of inter-temporal closedness such as defined above. The thing is that a certain amount of savings can stay not invested in the long run (!). The closedness of the system is then impaired:

$$(Y^A)^{\text{today}^+} + (Y^B)^{\text{today}^+} + (Y^A)^{\text{tomorrow}^+}/(1+r) + (Y^B)^{\text{tomorrow}^+}/(1+r) + I\eta/(1+r) > \\ > (Y^A)^{\text{today}^*} + (Y^B)^{\text{today}^*} + (Y^A)^{\text{tomorrow}^*}/(1+r) + (Y^B)^{\text{tomorrow}^*}/(1+r). \quad (7)$$

In other words, A saves a portion I of his today's income
 $(Y^B)^{\text{today}^*} = (Y^A)^{\text{today}^+} - I, (8)$

but B does not invest this sum. The aggregate demand falls short of the aggregate supply, a result contradicting the Say's law.

What link inter-relates the reversal of the Say's law resulting from the fundamentally uncertain nature of the world with money? Economic schools drawing upon the quantity theory of money regard money as a mere medium of exchange whose primary and, in effect, only function is reduction of transaction costs. As mentioned above, transaction costs are one of the sources of short-run frictions which prevent the economic system from reaching its state of general equilibrium via the process of market clearing. Money is one of the most powerful institutional devices which helps to reduce these obstacles to market clearing and to make the short run during which the frictions prevail as short as possible. However, the problem of transaction costs disappears in the long run. At that moment, though, the existence of money cannot be either justified or explained in the framework of neoclassical economics (Davidson, 1991, p. 137). Neoclassical models, then, express quantities in monetary values but, in their nature, they describe a barter economy where money is just a classical veil with neither long-run nor short-run effect on the real processes. It is only in the real world characterized by existence of fundamental uncertainty where the uncertainty cannot be expressed in terms of a probabilistic risk (non-ergodic world) where the money is of any meaning.⁶⁰

households to save (Keynes, 1930, p. 123) but the income balancing mechanism appears as late as in *The General Theory*.

⁶⁰ For the post-keynesian perspective of the phenomenon of fundamental uncertainty see e. g. Lawson, 1988; Davidson, 1991; Setterfield, 1996; Deprez, 2001; O'Donnell, 2011; Jespersen, 2009; Dequech, 2008.

Even though the future is fundamentally uncertain in most cases, the existence of money can reduce this uncertainty to a substantial degree. To understand this, it is necessary to distinguish between two kinds of financial failures, bankruptcy (or insolvency)⁶¹ and negative net worth. *Negative net worth* is a situation when the total of your liabilities exceeds the total of your assets. *Bankruptcy (insolvency)*, to the contrary, is perfectly compatible with positive net worth, i. e. it can affect a subject which is completely sound and fit financially. However, an insolvent subject suffers from the so called *asset-liability mismatch*⁶², that is, the time structure of the subject's assets is unfavorably matched to the time structure of his liabilities. Plainly speaking, such a subject suffers from insufficient liquidity, i. e. reduced "ability to meet [their] nominal contractual obligations when they come due" (Davidson, 1991, p. 138). As regards the uncertainty concerning the risk of *negative net worth* – which is a result of an entrepreneurial failure - there is not much the existence of money as such could do. But as regards the uncertainty resulting from the risk of becoming a victim of an asset-liability mismatch – which is a result of a failure in the cash-flow management, not an entrepreneurial failure - the money provides economic subjects with a powerful instrument of reducing this uncertainty substantially.⁶³ A real tragedy of every financial end economic crisis is the amount of fundamentally solid firms which are unable to meet their commitments just because of adverse development of the time structure of their balance sheets.⁶⁴ Despite their prosperity, such firms get in troubles because of lack of liquidity, they can't pay wages because their customer, who also is short of liquidity, has not paid them yet. The employees who don't get their wages in time cannot meet their commitments etc. What is a mere cash-flow problem, at the beginning, causes shut-down and lay-offs which implies a decrease in the real product and aggregate demand. These fluctuations intensify the already existing unavoidable uncertainty even more. Yet, this uncertainty could be pushed down considerably by providing the markets with sufficient liquidity (Davidson, 2012). Ironically, though, the asset-

⁶¹ As a matter of fact, bankruptcy and insolvency are not synonyms, strictly speaking. While insolvency is a financial state of being, bankruptcy is a legal process. Even though insolvency does not have to imply bankruptcy, we do not regard it necessary to distinguish between these two terms, at this moment.

⁶² A classic model is Diamond, Dybvig, 1983.

⁶³ "The social institution of money and the civil law of contracts enables entrepreneurs and households to form sensible expectations regarding the certainty of cash flows (but not necessarily real outcomes) over time." (Davidson, 1991, p. 138).

⁶⁴ "For business firms and households the maintenance of one's liquid status is of prime importance if bankruptcy is to be avoided. In our world, bankruptcy is the economic equivalent of a walk to the gallows. Maintaining one's liquidity permits a person or business firm to avoid the gallows of bankruptcy." (Davidson, 2009, p. 333).

liability mismatch (and uncertainty and fluctuations resulting from it) should not exist at all, in a general-equilibrium world ruled by market-clearing processes.⁶⁵ Except that there are some markets which consist of a supply and a demand which are not inter-related via a price-changing balancing mechanism. As the example of the capital market above demonstrates, even one such market may undermine and explode the whole market-clearing structure of a general-equilibrium building.

To sum up: the fundamentally uncertain nature of the world implies that the risk of asset-liability mismatch is a phenomenon which does not disappear in the long run – unlike phenomena such as price rigidities, imperfect information or transaction costs, which can be neglected in the long run. The long-run nature of the asset-liability mismatch problem implies that entrepreneurs – under certain conditions – start to prefer liquidity to real investments. In that case a desire to invest (i. e. real investments) falls short of the desire to save which is tantamount to the aggregate demand falling short of the aggregate supply. The ultimate consequence is the center-equilibrium underemployment model, again. We refer to this causal sequence as *the money channel* of the fundamental uncertainty. While the capital channel operates with the notion of excess savings, the money channel points out the notion of deficient real investment. At the first glance, the difference is but verbal. However, beyond this superficial identity, there is a substantial difference. Let us denote the amount of investment that the entrepreneurs are willing to make I_p . This level is given by the entrepreneurs' expectations of the future rate of return. If the households wish to save more than this amount, then the capital market faces an excess supply of savings. The cause of the capital market imbalance does not go down to worsening expectations of the entrepreneurs but to increasing desire to save of households. A capital market disequilibrium can result from pessimistic expectations of the entrepreneurs regarding their respective future capability to meet their respective payment obligations. Notice that it is not a higher level of subjectively perceived risk of *entrepreneurial failure* which decreases the willingness of entrepreneurs to make real investments here. It is a risk of *cash-flow managerial failure* what they perceive now with a

⁶⁵ Since any good has its own market which get cleared by a price change, so does any risk which is a good, too. A risk is traded in an insurance market where the demand side buys the insurance – willingness to pay being a function of individual expected losses – and the supply side, disposing of knowledge of the probability distribution of the event, sells it – the cost being a function of aggregate expected losses. Such market gets cleared by a change in the insurance premium. An asset-liability mismatch is an event the risk of which can be evaluated by an insurance market as any other risk. Davidson ads: “[The] need for check book balancing and desire for an additional liquidity cushion is an irrelevant concept for the people who inhabit the artificial world of classical economic theory where the future is risky but reliably predictable.” (Davidson, 2009, p. 333).

higher intensity. A reaction of entrepreneurs is an increased demand for liquidity and decreased demand for real investments, then. Could this perception of cash-flow managerial failure, i. e. asset-liability mismatch, be reduced or eliminated? Well, if the entrepreneurs knew that there is an orderly market which makes it possible for them to liquify their real investments for a price very close to that at which the last transaction was made at this market (definition of an orderly market), then their perception of the risk of cash-flow problems would be substantially reduced or eliminated. On the other hand, though, a willingness of the entrepreneurs to make real investments cannot be increased above the level of expected future rate of return by any degree of market orderliness.⁶⁶ It is thus obvious, that an insufficient liquidity supply can be a severe catalyst of the fundamental uncertainty and bring about the center-equilibrium underemployment situation. Elimination of this uncertainty-catalyst via flexible liquidity supply cannot be mixed up with the governmental-spending way out of the center-equilibrium underemployment caused by the excess desire to save under a highly ambiguous common term “money pumping”⁶⁷. The former solution focuses on the problem of pessimistic expectations regarding the cash-flow (asset-liability mismatch), while the latter focuses on the problem of pessimistic expectations regarding the rate of return. While the former represents a cash-flow managerial risk, the latter represents an entrepreneurial risk.

Conclusion

We made a short exposition of the neoclassical general-equilibrium framework by means of an intra-temporal and inter-temporal n-dimensional Edgeworth box apparatus. We demonstrated the closedness of a system, separately for a non-productive and a productive economy. In the next section, we pointed out differences between three types of dynamic systems as to the nature of their respective equilibria: traditional-equilibrium system, knife-edge-equilibrium system and center-equilibrium system. Drawing upon the well-known fact that Keynes did not consider nominal-wage rigidities as the primary shortcoming in the general market-clearing process but the insufficient aggregate demand, we presented our restatement of Keynes’s underemployment equilibrium as a center-equilibrium system.

We continued our case by designing our center-equilibrium underemployment model that would be compatible with the existence of the natural rate of interest. Next, we presented our center-equilibrium underemployment model where the natural-interest-rate balancing

⁶⁶ A possible objection of moral hazard will be discussed in another paper.

⁶⁷ E. g. Mui, 2014.

mechanism is replaced by the income-balancing mechanism. We expressed our conviction that Keynes's elimination of the natural interest rate in its capacity as the balancing mechanism of the capital market was a direct logical consequence of Keynes's postulate of the fundamentally uncertain nature of the world. Since the elimination of the natural-interest-rate mechanism resulted in the insufficient aggregate demand as a general case and, in effect, lead to the center-equilibrium underemployment, we postulated the existence of a causal link between the fundamental uncertainty and the center-equilibrium underemployment. We call this particular causality *the capital channel* of the fundamental uncertainty. At the same time, we presented an alternative way how the fundamental uncertainty results in the state of center-equilibrium underemployment. We call this alternative way *the money channel* of the fundamental uncertainty and we see its modus operandi in the liquidity preference of entrepreneurs. If the world were fundamentally certain, there would be no money needed in the long run (Davidson, 1991, p. 137; 2009, p. 333). The existence of money in the long run cannot be explained in terms of reduction of transaction costs. The money is demanded even in the long run because of their liquidity since possession of liquidity reduces the risk of bankruptcy (Davidson, 1991, p. 138; 2012). We claim that what Davidson means by "maintenance of one's liquid status" (Davidson, 2009, p. 333) and "certainty of cash flows (but not necessarily real outcomes) over time" (Davidson, 1991, p. 138) is an effort to avoid the asset-liability mismatch and to reduce the risk thereof. This risk does not disappear in the long run because it is a logical consequence of the existence of fundamental uncertainty. In case of a strongly perceived uncertainty regarding the future cash-flows, the demand for liquidity increases and the demand for investments into real capital decreases (Davidson, 1991, p. 139). This situation can prevail even in the long run. So, fundamental uncertainty leads to insufficient aggregate demand and, as a result, to the underemployment equilibrium.

From this hypothesis of two channels of fundamental uncertainty we draw the following conclusions: 1) both the capital channel and the money channel imply a breach of the inter-temporal closedness assumption because a certain amount of savings can stay not invested in the long run which implies that the aggregate demand falls short of the aggregate supply, a result contradicting the Say's law; 2) while in the *capital channel* the insufficient real investment goes down to the risk of *entrepreneurial failure*, the former results from the *cash-flow-managerial failure* in the *money channel*; 3) an insufficient liquidity supply can be a severe catalyst of the fundamental uncertainty and bring about the center-equilibrium underemployment situation; 4) while the flexible liquidity supply tackles the problem of pessimistic expectations regarding the cash-flow (asset-liability mismatch) –

i. e. the cash-flow-managerial failure – the governmental spending tackles the problem of pessimistic expectations regarding the rate of return – i. e. the entrepreneurial failure.

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SOCIO-ECONOMIC IMPLICATIONS OF MICRO CREDIT ON ECONOMIC DEVELOPMENT OF RURAL WOMEN IN NIGERIA

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Abstract

The study was undertaken to analyze the implications of micro credit experiences on rural women's economic development. In general, rural development through women participation is the most important strategy designed to improve the social and economic life of the farming community in Nigeria, because their economic contribution is substantial (Izugbara, 2004). However, Parveen & Chaudhury (2009) argued that traditional labor division places on women, the primary responsibility of domestic chores as cooking, childcare, cleaning and fetching of water, amongst others. Invariably, women have limited access to markets, education; health care and economic services, which has led to a lower well-being of the family, which in-turn is believed to have retarded the developmental and traumatized the goals of the state. Put succinctly, micro credit is a system of small loans for incoming-generating activities, which enable poor communities to gain some economic stability (Chavan & Ramakumar, 2002). This paper seeks the historical relationship between micro credit programmes and economic hardship elimination of women, as it enhances their development in Otan-Ayegbaju, Boluwaduro local Government Area of Osun State. Ten in-depth interviews and 40 self-administered questionnaires were distributed to the participants of Better Life for Rural Women Programme in order to collect data. The paper argued that the context for understanding the position of micro credit based on the in-depth interviews support that the programmes should equally be extended to male folk. Recommendation and suggestions are given that if the micro credit programmes are strengthened it would involve male participation.

Keywords: Development, Women, Empowerment, Micro, Credit, Rural

Introduction

It is instructive to note that micro-lending schemes emerged as a means of guaranteeing access to credit for the poor, through a financial intermediation strategy that is responsible, to their socio-economic realities. Closely related to this is the fact that, micro-credit programme is a unique innovation of credit delivery technique to enhance income generating activities. The programme extends small loans to poor people for self-employment activities, thus allowing the clients to achieve a better quality of life (Mordich, 2010). It is the most sensational anti-poverty tool for the poorest, especially for women (Micro-Credit Summit, 1997). To a very large extent, micro-credit smoothen consumption, reduces the vulnerability of the poor and leads to increase in their income, in order to increase the vicious cycle of poverty (Odejide, 1997). Therefore, micro-credit or finance programmes are aimed to increase women's income levels and control over income lending to greater levels of economic independence. Simply put, this enable women's access to networks and markets and; access to information and possibilities for development of other social and political role. They also enhance perceptions of women's contribution to household income and family welfare, increasing women's participation in household decisions about expenditure on women's welfare (Harish, 2012).

In a broader perspective, micro-credit depicts small loans for people who need money for self-employment project that generate income for urgent family needs such as, health problems and education. It is understood that it is meant to assist, thus improve people's quality of life by lending them a small amount of money for a short period of time. On the other way round, micro-credit provides loans at a very low interest and systematic guidance to low-income women, to pursue alternative income-generating activities aimed at improving their economic and social status. In addition, the programme provided women with loans to improve their existing economic activities or to start a new enterprise. Such investments, was believed, would lead to social and gender equality (Maheswaranathan & Kennedy, 2010).

The aim of this study is to explore the emerging need toward promoting women empowerment among the rural women for rural poverty eradication. Undoubtedly, as Nelson & Nelson (2012) observes, the concept of poverty reduction has gained topicality in development discourse against a background of the growing concern with high levels of poverty in many countries of the third World. Nigerian government through the establishment of National Economic Empowerment and Development Strategy (NEEDS) sought to strengthen and support private sector towards improved efficiency and productivity (NPC, 2004), in line with its commitment to engendering sustainable economic growth and general improvement in the quality of life

of the Nigerian people. To this end, government provides financial services to small and medium scale enterprises mostly through commercial banks.

Izugbara (2004) argues that poor people, most especially rural women have very limited access to the financial services provided by commercial banks, as a result of the disparities between their needs and concerns and the procedures of the banks.

Concept of micro-credit

It should be noted that, within the last two decades, micro-credit programmes have proliferated around the world. In actual fact, the Nobel Peace Prize 2006 awarded to the Grameen Bank and its founder signifies the global recognition of micro-credit programmes, as an effective strategy to generate income and employment; and poverty alleviation most especially amongst developing countries. They are considered as important approach to poverty alleviation and enhancement of living standards, particularly women. Therefore, micro-credit has come to be regarded as a supplementary development paradigm, which widens the financial service delivery system, by linking the large rural population with formal institution (Harish, 2012). The term micro-credit refers to providing very poor families with very small loans (Micro-finance) to help them engage in productive activities and grow their tiny business. With the passage of time, micro-credit has come to include a broader range of services like finance, savings and insurance and several others.

In Nigeria, micro-credit programmes are becoming increasingly popular. It is believed that in principles and practice, micro-credit programmes are very easy for achieving financial access and alleviating poverty. Economist, academics, and researchers feels that even though, there are many agencies working for the elimination of hardship by providing micro-credit to the poor women, there are a lesser contribution to the elimination of poverty (Latifee, 2003). However, Ahmed, et al. (2001) and Pitt, et al. (2003) submits that there are proven outcomes to show that micro-credit enriched the poor's income. Without doubt, an impressive literature exists on the concept and effectiveness of micro-credit or micro-financing programmes on improving the economic situation of women (Fernando 1997; Mayoux 1999 & Amin et al, 2001). Along this line, Ahmed, et. al., (2001) caution that despite the success of micro-credit, it can also affect the emotional well-being of women, because it actually creates tension, anxiety and stress among women that are involved in micro-credit programmes.

Impediments on micro-credit scheme

Historically, access to credit for Nigerian rural poor was problematized by incorrect pacing and sequencing of financial system

reforms during its earlier years, as noted by Soyibo (1996). In his argument, Tomori, et al. (2005) contend that the financial crises that resulted from these reforms, the reversals in several policy measures and general instability in the political and economic environments had adverse impact on the functioning of the financial system, including difficulty in obtaining credits for poor credits users. Along this line again, the formal banking system still faces impediments in reaching dispersed poor clients due to lack of improved service infrastructure. Collateral requirements help formal institutions in determining the credit worthiness of potential borrowers, since they often know very little about would-be borrowers. But they make financial services inaccessible to the poor. It is instructive to mention that improved access to credit for the rural poor is central to sustainable poverty alleviation, because it enables them to invest in, and improve productivity in small business, small-scale manufacturing, as well as in agriculture, thereby empowering them to break out of poverty in a sustained and self-determined way (Nelson & Nelson, 2010). Guaranteeing rural people's access to credit for meaningful economic activities require specific financial service schemes that mobilize savings and intermediate financial services. Put succinctly, micro-credit emerged to fill this gap in the financial service delivery system modeled after the Grameen Bank poverty reduction initiatives in Bangladesh. As pointed out by Olomola (2000) & Aryeteey, (2005), micro-credit schemes mediate the delivery of small, low interest and non-collateralized credits to the rural poor, relying on social collateral and joint liability. It is on record that the rural poor are the least recognized group of borrowers by formal financial institutions (Olomola, 2004).

Meanwhile, Iheduru (2002) & Akanji, (2004) contend that the effort of the rural poor to improve their condition, by accessing and utilizing small credits is largely ignored by the formal financial system. Basic impediments against the rural poor women from accessing small credits from formal institutions include; lack of material and other assets based collateral; high interest rate on credits; complex procedures for accessing credit (including a formidable amount of paper work which goes beyond the capacity of largely illiterate and semi-illiterate borrowers); the unwillingness of most formal institutions to incur the set-up costs involved in reaching a dispersed (rural) poor clientele due to the risk analysis as well as lack of familiarity with the rural poor. Put differently, these bottlenecks pose a formidable obstacle to the effort of the rural poor to obtain credit for income generating activities. Therefore, due to the fact that they are not recognized as credit-worthy or perceived as a profitable market for credit, the (rural) poor are forced to turn to traditional money lenders, who may in turn charge them, high in returns.

From the foregoing, Mayoux (1997) argues that micro credit projects are right now being advanced as a key technique for both poverty alleviation

and women's empowerment on the premise that these projects have the effect of expanding women's income levels and control over wage which eventually brings about greater economic independence. Another factor is that micro-credit programs provide women in Africa with the access to networks and markets which equips them with a wider experience of the world outside the home. In this process, access to information and possibilities of other social and political roles are enhanced. Mayoux (1997) further contends that micro-credit programs enhances the perception of women's contribution to household income and family welfare and this increases women's participation in household decision-making about expenditure and invariably creates a greater expenditure on women's welfare. Therefore it arguable that programs and services offered through micro-credit are usually established for the purposes of creating and developing self-employment opportunities for women in general.

Clark and Kays (1995) argued that the characteristics of micro-credit loans as “ facilities within an average terms which thus ranges from one year to 4.75 years. Clark and kaya contends that the programs charge a market rate of interest that is between eight to 16 percent, and these loans are generally secured by non-traditional collateral, flexible collateral requirements or group guarantees”.

Further to the argument above, it is imperative to that micro-credit programs in Africa in the business of micro-credit financing is premised on the basis that borrowers are the best judges of their own circumstances and as a result, they know best how to utilize credit facilities when it is available. The thrust of this argument is that each individual has the opportunity to choose the income- generating activity appropriate to her own peculiar situation. Based on this notion of peculiarity of situation, if a borrower is involved in group lending, she enjoys the benefit of constructive criticism from the members of her lending group. In this context, the programs have the benefit of both participatory planning initiatives by a group of peers and individual creativity. The concepts of group planning and individual creativity are just two of the many important characteristics of micro-credit programs.

Furthermore some of the essential characteristics of micro-credit are enumerated as; tailoring program operations to reach women considered as key recipients of micro-credit; targeting of poor people in the society; delivering of credit and other related services to the village level in a convenient and user-friendly way; establish simple procedures for reviewing and approving loan applications; facilitate the quick disbursement of small, short -term loans usually for a three to one year duration; designing clear loan recovery procedures and strategies; establish an incentive program which grants access to larger loans based on a successful repayment of first

loans; maintain interest rates that are adequate to cover the cost of operations; encourage and accept savings in tandem with lending programs; develop a culture, structure, capacity and operating system that can support sustained delivery to a significant and growing number of poor women; provide accurate and transparent management and information systems which can be utilized to take decisions, motivate performance, and provide accountability of management performance and the use of funds, and clearly demonstrate program performance to commercial financial institutions and provide access to business information, expertise, and advice to micro-entrepreneurs. In addition to these aforementioned characteristics, micro-credit programs offers loan menus that meet the needs of women who are unable to cater for their daily needs most especially in the village areas. In other words, granting of consumer loans can contribute to the productivity of the poor entrepreneur as well as providing security and reducing vulnerability in the society and particularly in the rural settings.

Materials and method

The study focus on women's who is the participants of Better Life for Rural Women Programme (BLRWP) in micro-credit scheme in Otan Ayegbaju, Boluwaduro Local Government Area of Osun State, Nigeria. A total number of 140 out of 1,400 BLRWP beneficiaries' women were considered for this study and questionnaires was administered while interviews were conducted with ten women. An interview guide with open-ended questions guided the interviews, and the main goal was to capture women's stories, perception and the experiences regarding investment of the loans obtained from micro-finance institution and making repayments. Verbal consent was obtained to participate in the interview and to have the discussions. In addition to the interviews, the researchers visited the women who were involved in the self-employment. The interviews were held in places that allowed for privacy and confidentiality of discussions. The interviews took place in the classrooms of public schools and lasted for an average of 30 minutes. Basically, the interviews centered on women's perceptions and experiences regarding provision of loans as capital to start new economic activities or improve on existing ones. The researchers explored the impact of this on social and gender inequalities.

Notably, the researchers sought information on social and economic outcomes of the women's participation in government sponsored micro-credit programme and lessons to be learnt from such a programme. Finally, the discussions addressed women's standing position on how to improve the repayment strategy.

Result of findings

Majority of the women interviewed by the researchers were of child-bearing age - between 20 to 40 years old only nine of the women were above 50 years; 18 of them had primary education, 22 had secondary education. Although some of the women had children and were economically active prior to receiving the loans, it was noted that they had the habit of saving in the same institution, so the loans were intended to improve their economic activities and may not allow them venture into new economic self-employment activities. 28 percent of women lived in nuclear families and 72 percent were living together with their parents. Prior to receiving the loan; every single woman was self-employed or had the basic requirement for starting up the self-employment activity. The micro financing institutions were satisfied with these prior arrangements and approved the credits to the women in this area.

It is feasible from the findings of this research that the participants had at least a pre-secondary and post primary education which thus might be an advantage for them to understand the usefulness of credit facility and how to properly utilize the loan. In other words, it is imperative to note from the results of this research that loan been borrowed by the participants from micro-finance institutions are basically used to sustain their day to day livelihood. However, the results in this research revealed that small cohort of women are married which thus means that they reside with their families, while large cohort of women were still single and likely not have much responsibilities to invest the little profit they make on the loan borrowed.

Therefore, the findings shows that women of the rural areas of this research are basically into establishing a small petty business with the ample opportunities they have access to in getting loans from micro-finance institutions which thus, assist them to overcome certain challenges such as inaccessibility to finance to start up a business that can sustain them in their locality.

Implications of micro-credit on rural women's lives

The lending institutions expected the borrowers (women) to start repayment of the loan after the first week of obtaining the credit. The loan should be repaid to the institution within 60 weeks. However, the repayment amount depends on the amount of the credit obtained by the beneficiaries. As such, micro-credit is a very viable strategy for ameliorating the inadequacies of the formal lending system and guaranteeing access to credits for the rural poor, through a financial intermediation option that is responsive to their livelihood conditions. It emerged in response to the irrepressible desire of the rural poor to improve their conditions and to meet the basic needs of their households. In the face of limited opportunity for employment in the wage

labour market, the bulk of the rural poor survive by creating work and sourcing income for the betterment of themselves and their families where no job existed. Self-employed rural poor population comprises about 60 percent of the labor force of developing countries (Micro-Credit Declaration, 1996).

Significantly, poor savings culture of beneficiaries of micro-credit poses a formidable danger to the scheme. Most women find savings a very difficult practice to imbibe; they spread most of their income on household food, children's education and on the acquisition or redemption of leased lands. Further afield, some beneficiaries consider their income too small to be saved away. Thus, in the face of pressing economic challenges such as feeding, they consider spending the fund to address these needs a rational decision. Hence, they most often lack the funds to make repayments for credit obtained.

Another notable implication of micro-credit on rural women's lives is poor financial record keeping. Evidence abound that beneficiaries of the scheme lacked proper record of their daily financial transactions. This problem factored largely on their level of illiteracy (inability to read and write).

Conclusion and recommendations

It is expected that female entrepreneurship will make a living attractive in the provision of social amenities for the nation through education, health, transport, housing facilities, flow of information and social services, coupled with self-independence and self-sufficiency if supported through the provision of finance, women's property rights and worker's rights, community education for the promotion of equality in gender, transparency and monitoring of micro-credit institutions meant for entrepreneurs.

Against this backdrop, growth can only be effective, if it is accompanied by redistribution policy. Thus, it is recommended that female entrepreneurs need to be proactive in forming organizations that will boost their businesses instead of the various weak organizations they engage in that only take care of their social networks (Omoyibo, Egharevba, &Iyanda, 2010). Again, evidence from micro-credit programme in different developing countries support the argument that limited capacity and lack of management skills is the reason behind the failure of most credit-financed businesses. The lack of business management skills among credit beneficiaries" manifest two traits; 'start big mentality' and uncalculated investments', the outcome of this is avoidable waste of credit funds.

A number of important lessons may be gleaned from this study to improve micro-credit policies and programmes targeting rural women

dwellers in Nigeria. It is further recommended that micro-credit programmes should focus more on women, especially those who reside in rural communities. This recommendation came on the grounds that women's credit performance in terms of funds management, savings and repayment increases the efficiency of micro-credit schemes and their economic empowerment usually translates into improvement of poor rural households and communities.

Closely related to this, the design of micro-credit programmes must be sensitive and responsive to the socio-cultural realities of the rural people and should equally be extended to male folk, in order to enhance male participation bringing about gender equalities. Therefore, incorporating the men in the micro-credit scheme would also make the credit loan amount to be higher, since the men are the bread winners of the family, and since the perception that man will work hard would bring the man to get more money for investment through micro-credit. By and large, micro-credit programme should lead to macro-credit programme where the women can be allowed a larger amount of money.

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TAX MORALE DETERMINANTS IN PORTUGAL

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Abstract

Tax morale has been recognized as the key to understand the levels of compliance achieved in most countries in the world. We applied a structural equation model (SEM) to gain a better understanding about the factors shaping tax morale of Portuguese taxpayer's. Our purpose was to analyze through SEM the direct effects of political democratic system, political participation, religiosity, individual satisfaction, trust in others and institutional trust on tax morale. A sample of 1,553 Portuguese individuals representative of Portuguese population obtained from European Values Study (EVS), carried out in 2008-2010 was used. The results confirmed that Portuguese taxpayers' tax morale is influenced by taxpayers trust on institutions like government, parliament and the judicial system, by political participation and by the belief that democracy is a good political system for governing the country. Tax morale is also influenced by individual's satisfaction, by religiosity and by societal behavior (trust in others). We concluded that tax morale is strongly influenced by political and psychological factors.

Keywords: Tax morale, Tax compliance, Structural Equation Model

Introduction

The reasons underlying taxpayers' behavior are not yet completely understood by researchers and by politicians. Tax morale is understood as the intrinsic motivation to comply with fiscal duties (Torgler, 2003) and is recognized as having an important role in explaining the high degree of tax compliance observed in many countries (Molero and Pujol, 2005; Güth et al., 2005). Simultaneously, tax morale has a strong negative impact on shadow

economy level (Alm and Torgler, 2006; Torgler and Schneider, 2009) and on tax evasion (Torgler and Schneider, 2007). Recently, increased research has been developed about tax morale and its main determinants (Alm and Torgler, 2006; Alm et al., 2006; Barone and Mocetti, 2011; Cummings et al., 2009; Frey, 2003; Güth et al., 2005). Additionally, it seems that the concept of tax morale still remains open to interpretation (Pope and McKerchar, 2010).

Torgler and Schneider (2005) defined the concept as the intrinsic motivation to comply and pay taxes, and thus voluntarily contribute to public welfare. A better understanding about individual heterogeneity in shaping tax morale may contribute for the development of alternative mechanisms to reduce tax evasion (Riahi-Belkaiou, 2004; Lago-Peñas and Lago-Peñas, 2010) and to improve tax compliance. A comprehensive understanding of tax compliance should help decision-makers to shape better communication policies with taxpayers (Trivedi et al., 2003). Also, tax authorities will be able to develop more targeted enforcement strategies for non-compliant taxpayers (Devos, 2008). Such measures are of particular importance because of the negative consequences that tax evasion has on public revenues, on equity level of the tax system (Kim, 2008) and on the perceptions of potential foreign investors (Frey, 2003; Richardson, 2006).

This paper contributes to the literature by extending previous studies about tax morale. Our paper applies SEM in order to study the influence of multidisciplinary factors on tax morale. Despite the existence of a considerable number of research papers on this topic, we believe that little is known, in particular, on the constraints of Portuguese taxpayers' tax morale. Data provided by EVS was used to apply SEM to analyze the factors that influence Portuguese taxpayers' tax morale in 2008. The results achieved are a contribution for a better understanding of the factors shaping tax morale. The conclusions obtained can be used by politicians and the tax administration, in order to improve compliance levels and reduce noncompliance and underground economy through the implementation of more efficient rules. Given the present challenges faced by Governments, studies of this nature can be valuable to promote voluntary tax compliance.

The paper is organized as follows. In Section 2, we briefly review the literature on tax morale and its main determinants. Section 3 describes data and variables used in the study. Section 4 presents the empirical results. Section 5 concludes.

Literature review and research hypothesis

Empirical research clearly shows that taxpayers exhibit a wide range of behaviors towards their tax obligations under similar conditions. What still remains to be understood are the reasons behind taxpayer's behavior.

Behavioral differences are justified for several motives, ranging from an economic point of view (Allingham and Sandmo, 1972; Yitzhaki, 1974) to behavioral, political and psychological motivations (Andreoni et al., 1998). Traditional economic models based on the economics-of-crime approach (Allingham and Sandmo, 1972) pointed out deterrence factors to explain taxpayer's behavior. However, empirically based studies showed that higher levels of compliance were obtained when compared to the ones predicted by economic models (Andreoni et al., 1998; Alm et al., 1992; Feld and Frey, 2002). A proper understanding of taxpayers' behavior requires the consideration of theories referred by sociologists and psychologists (Alm et al., 1995). The puzzle of tax compliance can only be understood if research takes into account individual's willingness (Torgler, 2003) and moral sentiments, like shame and guilty (Erard and Feinstein, 1994).

Tax morale is linked to a civic duty, which can be crucial to explain the level of acceptance of a certain tax burden (Martinez-Vazquez and Torgler, 2009). It can be conceptualized as a set of moral principles or values that individuals have regarding the payment of their taxes (Alm and Torgler, 2006). Song and Yarbrough (1978) define it as the norms of behavior governing taxpayers' in their relationship with the state. Among the range of tax morale definitions provided by the literature, it seems clear that moral rules and feelings, equity and the relation between taxpayers and government are important factors for an understanding of the concept.

Tax morale is a multidimensional concept and requires an interdisciplinary approach (Alm and Torgler, 2006). There is no readily available objective or observable measure of tax morale (Frey and Torgler, 2007). There are many advantages in working with a multi-item index instead of a single question to measure tax morale (Kirchler, 1997; 1999). An analysis of the factors that influence tax morale based on SEM allowed us to assess tax morale using three indicators. Simultaneously we avoid the disadvantages associated with the construction of an index, especially regarding the measurement procedure (Alm and Torgler, 2006).

Empirical studies results support the influence of a large number of behavioral, political and psychological variables on tax morale. Torgler (2005) studied religiosity (church attendance), trust in the President, trust people to obey the law, perception of being caught, satisfaction with national officers, national pride, pro-democratic attitude and wealth. Alm et al., (2006) consider the effect of confidence in the courts, pride and perception of tax evasion. Alm and Torgler (2006) considered the effect of confidence in the courts, trust in parliament and church attendance. Alm and Torgler (2006) referred church attendance, trust in legal system and trust in the parliament. Torgler (2006) considered religiosity (church attendance, religious education, being active in a church group, importance of religion,

religious guidance), corruption and trustworthiness. Torgler and Schneider (2007) considered direct democracy, national pride, trust in political institutions and government and attitude towards democracy. Barone e Mocetti (2011) analyzed public spending inefficiency.

From our point of view, analyses of tax morale determinants could be improved if those factors were studied simultaneously. In our opinion, we can contribute to an improvement in the understanding of factors shaping tax morale if the study simultaneously includes a higher number of factors. Empirical evidences from other areas, like political science, psychology, and sociology show that they influence each other.

Democratic political system

A democratic political system is understood as representing, according to the opinion of taxpayers, a good political system for governing the country. Empirical studies provide evidences of the influence of political democratic system on tax morale (for Asian countries see Torgler, 2004; for Latin America see Torgler, 2005). Individuals satisfied with how democracy has evolved and with the way the country is being governed, have higher levels of tax morale. Individual's support for democracy helps to maintain a high level of tax morale (Torgler, 2004; 2005). A democratic political system offers citizens the possibility to express their preferences. Also, a more active role of the citizens helps them to better monitor and control politicians, and thus to reduce the asymmetry of information, which reduces the discretionary power of the government (Torgler, 2004). Frey and Stutzer (2000) argue that democracy influences happiness through a higher satisfaction with policy outcomes. People are happy if they have (and use) the opportunity to participate in direct democracy. Dorn et al., (2005) observe a significant relation between democracy and happiness. We hypothesize that:

H 1.1 – Political democratic system positively influences tax morale.

H 1.2 – Political democratic system positively influences individual satisfaction.

Political Participation

Opportunities for political participation contribute to what Lane (1988) calls “procedural goods of democracy”. It implies, for instance, dignity goods such as self-respect, feeling of personal control or understanding and public resonance (Frey and Stutzer, 2006). There are several forms of political participation. Some involve active interactions with others, like being part of a political party, and others are usually performed in an individual manner, for example signing a petition (Quintelier and Hoodghe, 2011). Political participation in elections encourages citizens to

discuss relevant issues, which helps to improve their political awareness. Moreover, knowing that citizens are discussing and monitoring its behavior provides government with an incentive to act more effectively. Such participation further contributes to more effective governance, by offering citizens the opportunity to speak out, and show their preferences. The more aware a government is of citizens preferences, the better its policies will reflect citizens' needs (Boix and Posner, 1998). Politically interested citizens will tend to associate and engage in discussion. Exchange of arguments and face-to-face interaction enhances group identification and give citizens the opportunity to identify others' preferences. As these preferences become visible, the moral costs of free-riding or behaving illegally increase, reducing the justification for corruption and tax evasion. We hypothesize that:

H 2.1 – Political participation positively influences tax morale.

H 2.2 – Political participation positively influences political democratic system.

H 2.3 – Political participation positively influences trust in others.

Religiosity

Since the 1990's researchers have paid attention to a discipline called "economics of religion" considering mainly two approaches: the economic analysis of religious behavior within an economic model, and the study of the consequences of religion and religiosity on economic behavior (Innaccone, 1998). Religion can be seen as a proxy for characteristics like work ethics, tolerance and trust (La Porta et al., 1999). Every society has moral constraints, which are not formally laid down (Torgler, 2006), but nevertheless influence citizens' behavior. Many of these standards are highly influenced by religious motives (Torgler, 2006). Church as an institution induces moral constraints in a community and influences people's behavior (Torgler and Schneider, 2005). Torgler et al., (2008) results support such previous findings in that a high sense of religiosity leads to a higher level of tax morale. Beit-Hallahmi and Argyle (1997) wrote extensively about the effect of individual religiosity, which is related to the development of a sense of compassion, honesty and altruism, as well as happiness and quality of life, health and mental health. Lehrer (2004) emphasize the positive outcomes between being a religious individual and well-being and healthy. Walker (2003) concluded that religious experience is important in moral functioning. Also, Roccas (2005) found a high correlation between religiosity and values. Religiosity induces choices between what is seen as right and wrong behavior (Margolis, 1997) Adicionaly, Guiso et al., (2003) found that in general there is a positive relationship between religion and trust (toward others, in the government and in the legal system). Brañas-garza et al., (2009) confirmed the link between religious practices and trust in several

institutions (the government, the police, the armed forces, the courts and the banks) and trust toward others. Some studies found that religiosity improves people's civic engagement (Wald and Wilcox, 2006). Being a member of a religious organization is positively related with political participation (Gibson, 2008). Religiosity is used as a proxy to analyze the impact of standards imposed by non-governmental organizations or the impact of values that promote compliance and punish non-compliance (Torgler, 2007). We hypothesize that:

- H 3.1 – Religiosity positively influences tax morale.
- H 3.2 – Religiosity positively influences institutional trust.
- H 3.3 – Religiosity positively influences trust in others.
- H 3.4 – Religiosity positively influences political participation

Individual Satisfaction

The level of happiness of an individual can influence economic decisions, including consumption, behavior at work, investment decisions and political behavior (Frey and Stutzer, 2002). In this context it will be interesting to examine whether the level of happiness of citizens affects their tax morale. Many economists have made use of subjective questions on welfare (financial satisfaction), well-being, and health satisfaction, among others, to address a wide range of scientifically and politically relevant questions. The interest of considering happiness as a variable influencing individual willingness to comply increases significantly, given that there is little empirical evidence on the impact of happiness on tax morale (Torgler 2004; 2005). Happiness and individual satisfaction were found to have a significant positive effect on taxpayers' tax morale in Asian countries (Torgler, 2004) and in Latin America (Torgler, 2005). We hypothesize that:

- H 4.1 – Individual satisfaction positively influences tax morale.

Trust in Others

According to Uslaner (2002) people trust others based upon the belief that their fellow citizens are part of a moral community. "When we believe that "most people can be trusted," we are more likely to give of ourselves and to look out for the welfare of others. When we believe that "you can't be too careful in dealing with people," we are likely to be on our guard and to feel little compunction in taking advantage of others who may not have our best interests in mind" (Uslaner, 2002: 9). Generalized trust rests upon the psychological foundations of optimism and control, which leads people to believe that the world is a good place, it is going to get better, and that you can make it better Uslaner (2002).

Individuals do not act in isolation. They have perceptions about the behavior of other individuals. The greater the perception by an individual

that others engage on tax evasion practices, the more he will tend to lower his level of tax morale (Molero and Pujol, 2005). Similarly, the greater the perception, that other taxpayers meet their tax obligations, the greater is the individual willingness to pay taxes. Frey and Torgler (2007) also corroborate the idea that taxpayers' behavior depends on the social behavior of other taxpayers. In fact, taxpayers are willing to pay their taxes conditionally. If trust is matched by trustworthy behavior in others, the costs of dealing with risks and uncertainty are reduced (Helliwell, 2001). Also, results from public goods experiments suggest that most people are only willing to cooperate if they expect others to cooperate as well (Gächter et al., 2004). Trusting other citizens and political leaders are two contributing factors for people to pay taxes more willingly (Scholz and Lubell, 1998). We can conclude that the social context and institutional structure, in which the tax compliance occurs, influence the level of tax morale of each taxpayer. We hypothesize that:

H 5.1 – Trust in others positively influences tax morale

H 5.2 – Trust in others positively influences individual satisfaction

H 5.3 – Trust in others positively influences institutional trust.

Institutional trust

Institutional trust measures the degree of confidence that individuals have in institutions (government and parliament) and public administration of the country where they live (OECD, 2007). A sustainable tax system is based on a fair tax system and responsive government, achieved with strong connection between tax payments and the supply of public goods (Bird et al., 2006). The relationship between taxpayers and state can be seen as a relational or psychological contract, representing “a complicated interaction between taxpayers and the government in establishing a fair and reciprocal exchange” (Feld and Frey, 2007: 104) which involves strong emotional ties and loyalties. Institutional trust can only be created if the government acts in line with citizens' needs and desires (Hardin, 1998). Generally, it can be argued that positive actions by the state are intended to improve taxpayers' attitudes and commitment to the tax system, and thus enhance compliant behavior (Smith, 1992). If the state acts trustworthily, taxpayers might be more willing to comply with taxes. On the other hand, perceived unfairness increases the incentive to act against the tax law, as it reduces psychological costs. In this context, if taxpayers trust the government and the state, their willingness to comply with their tax obligations will be higher (Torgler and Schneider, 2007).

Cummings et al., (2009) use an experimental setting to show that tax morale increases with individual perceptions of good governance. Institutions that respect the preferences of the citizens will have more support from people than a state that acts as Leviathan (Prinz, 2002). Not

only trust in the government may have an effect on tax morale, but also trust in courts and the legal system, and thus the way the relationship between the state and its citizens is established. Slemrod (2002: 13) points out that costs of tax collection and government running are lower if taxpayers are more willing to pay their taxes voluntarily: “It is as if there is a stock of goodwill, or social capital, the return to which is the more efficient operation of government. This social capital stock may be reduced by a policy change that decreases the incentive to be a law-abiding citizen”. We hypothesize that:

H 6.1 – Institutional trust positively influences tax morale.

H 6.2 – Institutional trust positively influences individual satisfaction.

Methodology

Instrument

For our analysis, we used data from EVS survey carried out in 2008 (EVS, 2010). Year 2008 is the most recent EVS data available for Portugal. The EVS is a research project on human values in Europe that explores the differences and changes in the values of citizens. The survey provides details about ideas, beliefs, preferences, attitudes, values and opinions of citizens across Europe. By covering a broad variety of questions on different topics, EVS has the advantage of reducing the likelihood of respondents’ suspicions of surveys’ motivation and reduces the appearance of framing effects that may be present in surveys based only on tax compliance questions (Martinez-Vazquez and Torgler, 2009). EVS (2010) provided us with data to measure the constructs referred in the empirical literature as tax morale determinants.

Model of research

In our proposed SEM tax morale is directly influenced by individual’s institutional trust, by the level of trust in others, by political participation, by religiosity, by political democratic system and by individual’s satisfaction.

Democratic political system construct represents Portuguese citizens opinion that democracy is the best regime to govern the country and was measured with 2 indicators. Political participation represents individual’s involvement in political activities on an individual level was measured with 3 indicators. Religiosity represents moral constraints on individual’s behavior was measured with 4 indicators. Individual’s satisfaction with life was measured with 3 indicators. Trust in others represents individual’s perception of others behavior and was analyzed with 3 indicators. Institutional trust allowed us to consider the effects of institutional trust at

the current politico-economic level (Alm e Torgler, 2006; Torgler, 2004) and at the constitutional level (trust in the legal system/justice system) thereby focusing on how the relationship between the state and its citizens is established. Institutional trust was measured with 3 indicators. There is not a unanimous opinion about the number of indicators a construct should have for SEM purposes, It is normally accepted that three or more indicators are suitable for analysis SEM (Hair et al., 2009).

Sample and procedure

EVS allows us to work with a representative set of individuals of Portugal ($N = 1,553$).

Multivariate outliers were evaluated with Mahalanobis squared distance (p_1 and $p_2 < 0.001$). From an initial sample of 1,553 individuals, 39 were considered multivariate outliers and were deleted. The final sample contains 1,514 individuals.

Sample includes individuals aged between 18 and 98 years old with an average of 53 years old. Around 59.40% of respondents are women and 40.60% are male. Most respondents are married (60.00%), around 18.00% have never been married or with registered partnership. There are individuals from all regions of Portugal, with emphasis for North (39.0%), Center (28.4%) and Lisbon (17.4%). Around 91% of respondents have up to (upper) secondary education, 8.1% have first stage of tertiary education and only 1% has second stage of tertiary education. Around 67.90% of the respondents declare to earn less than €18,000 a year. However, a significant percentage of the respondents (48%) did not answer the question or did not new how much their annual income was. Regarding to employment status, 44.10% of the respondents are employed, 34.10% are retired or pensioned, 6.5% are housewife, 3.2% are students and 7.6% are unemployed.

We applied SEM to test the relationships between the variables included in the research framework. For the missing data we applied an imputation technique by replacing the missing values by the mean value of the responses of the variable (Hair et al., 2009). We used Amos 19.0 to generate maximum likelihood parameter estimates through the analysis of the matrix of covariance among variable scores. All the complementary analyses were conducted using SPSS 19.0.

Normality of data was analyzed through skewness (sk) and kurtosis (ku) which allowed us to check univariate normality. In AMOS multivariate normality is measured by the use of Mardia's multivariate kurtosis (Mardia, 1970).

Firstly we developed the measurement model supported by the literature reviewed. We verified the existence of unidimensionality, adequate reliability and validity of all constructs measures using an exploratory factor

analysis (EFA) and a confirmatory factor analysis (CFA). Sample adequacy for all variables was assessed by Kaiser-Meyer-Olkin test (KMO). The adequacy of factor analysis was measured with Bartlett test.

Scale reliability or internal consistency analysis of the constructs was assessed by Cronbach's alpha (α). A value of α higher than 0.60 is considered acceptable and a value greater than 0.7 is considered ideal (Hair et al., 2009). However, Nunnally (1967) considers the range of 0.5 to 0.6 is acceptable for exploratory research. Another measure of construct reliability (CR) was computed from the squared sum of factor loading for each construct and the sum of the error variance terms for a construct on the measurement model.

Construct validity was analyzed with both convergent validity and discriminant validity. Convergent validity exists if the indicators of a construct have a high portion of variance in common. Convergent validity is assured if standardized factor loadings are higher than 0.5 or ideally than 0.7 (Hair et al., 2009). Other measure of convergence is average variance extracted (AVE). AVE values greater than 0.5 (Hair et al., 2009) indicate good convergence.

Discriminant validity was assessed through the comparison of the values of AVE for each construct with the squared multiple correlations between two constructs (Hair et al., 2009).

Global model fit was assessed using the Goodness of Fit (GFI) and the Root Mean Square Error of Approximation (RMSEA). Incremental model fit was assessed with the Tucker Lewis Index (TLI), Comparative fit index (CFI) and Normed fit index (NFI). Incremental model fit was assessed with adjusted goodness of fit index (AGFI) and Parsimony Normed Fit Index (PNFI).

Results and discussion

Results showed values of sk between -1.278 and 2.588, and values of ku between -1.545 and 4.699. All indicators had univariate normal distributions. In a conservative assumption of normality for absolute values of sk less than ± 3 and less than ± 10 ku are considered acceptable for assumption of normality (Kline, 2004). In our model Mardia's multivariate kurtosis was 51.721. Bentler (2005) considers a cut off value of 5 for the assumption of multivariate normality. According to Hair et al. (2009) the maximum likelihood method is the most effective when the requirement of multivariate normality is verified and has shown to be very robust even in the presence of violation of multivariate normality.

The measurement model includes twenty indicators and seven constructs. Constructs' unidimensionality was assured through EFA procedure. Seven constructs and 21 indicators were evaluated using EFA. A

value of KMO = 0.713 obtained is considered acceptable for this type of analysis (Hair et al., 2009). The values of Bartlett's test were $\chi^2 = 7618.568$, $df = 190$ and $p = .000$, which confirmed the appropriateness of the factor analysis procedure as used. The principal component method, with a varimax rotation was used to extract relevant factors. The EFA results showed that all indicators with loadings greater than 0.56 in just one factor, and eigenvalues greater than 1 according to Guttman-Kaiser rule (Guttman, 1954; Kaiser, 1960; Kaiser, 1970) were considered. The measure of sample adequacy (MSA) is greater than 0.62 for all variables. The seven-factor (tax morale, political participation, democratic political system, religiosity, individual satisfaction, trust in others and institutional trust) solution obtained explained 66.355 percent of the total variance.

All constructs present a value of Cronbach's alpha (α) higher than 0.6, except for individual satisfaction with a 0.573 value. Values of CR greater than 0.7 suggest good reliability (Hair et al., 2009). All constructs CR values ranged from 0.7 to 0.9, showing good reliability. We concluded that all constructs presented acceptable reliability for this analysis purpose.

CFA shows standardized loading estimates greater than 0.5 except for two indicators: job security and religious services. All constructs have AVE values greater than 0.46. These results suggest the existence of convergent validity.

We concluded that all constructs of measurement model show discriminant validity. The matrix of factor score weights for CFA model show that indicators associated to each construct present high scores and have residual scores in all other constructs.

Tax morale measurement model exhibits good global fit indicators with GFI = 0.976 and RMSEA = 0.031. Values of GFI higher than 0.9 and RMSEA between 0.3 and 0.8 are considered good (Hair et al., 2009). TLI = 0.963, CFI = 0.971 and NFI = 0.953, suggest good incremental fit indicators. According to Hair et al., (2009) values of TLI greater than 0.95 and values of NFI and CFI greater than 0.9 suggest good fit. The model also presents good parsimony fit indicators with AGFI = 0.967 and PNFI = 0.747. Hair et al., (2009) recommends values of AGFI greater than 0.95 and values of PNFI greater than 0.5.

Final SEM of tax morale determinants included six endogenous constructs and one exogenous construct. Tax morale is influenced by institutional trust, by religiosity, by political participation, by trust in others, by individual satisfaction and by the political democratic system. Institutional trust is influenced by religiosity and trust in others. Political participation depends on religiosity. Individual's satisfaction is influenced by trust in others, by institutional trust and by political democratic system.

Political democratic system depends on political participation. Trust in others is influenced by political participation and by religiosity.

SEM model presents good global fit indicators with GFI = 0.976 and RMSEA = 0.031. For incremental fit TLI = 0.964, CFI = 0.971 and NFI = 0.951. For the Parsimony fit AGFI = 0.967 and PNFI = 0.776. All values are considered good fit indices (Hair et al., 2009). SEM has $\chi^2(155) = 373.170$ and so the Normed Chi-square (χ^2/df) is 2.408 ($p < 0.001$). Hair et al., (2009) recommends a value less than 2 for an acceptable model. However, Kline (1998) argues that a value of 3 or less is acceptable. Considering that the Normed Chi-square is sensitive to sample size and considering our study has a sample greater than 1,000 observations, we concluded that Normed Chi-square of 2.408 is acceptable. Our SEM presents good fitness indicators. Table I presents structural model direct effects.

Table I – Structural model direct effect analysis

Structural relationships (direct effects)	Estimate	t-Value	Hypothesis	Expected sign	p-Value
Political Democratic System → Tax morale	0.665	4.887	H 1.1	+	***
Political Participation → Tax morale	-0.217	-2.831	H 2.1	+	0.005
Religiosity → Tax morale	0.161	2.598	H 3.1	+	0.009
Individual Satisfaction → Tax morale	0.193	5.527	H 4.1	+	***
Trust in Others → Tax morale	-0.142	-3.103	H 5.1	+	0.002
Institutional Trust → Tax morale	-0.127	-1.617	H 6.1	+	0.106
Political Democratic System → Individual Satisfaction	0.733	4.620	H 1.2	+	***
Political Participation → Political Democratic System	0.185	7.606	H 2.2	+	***
Political Participation → Trust in others	0.478	6.087	H 2.3	+	***
Religiosity → Institutional Trust	0.155	5.731	H 3.2	+	***
Religiosity → Trust in Others	0.156	2.267	H 3.3	+	0.023
Religiosity → Political Participation	-0.206	-7.363	H 3.4	+	***
Trust in Others → Individual Satisfaction	0.323	5.666	H 5.2	+	***
Trust in Others → Institutional Trust	0.141	7.184	H 5.3	+	***
Institutional Trust → Individual Satisfaction	0.233	2.440	H 6.2	+	0.015

In general, we find support for the hypothesis that behavioral, political and psychological variables influence Portuguese taxpayer's intrinsic motivation to pay taxes. SEM show direct effects of a

multidisciplinary set of constructs on the formulation of tax morale. Political democratic system, political participation, religiosity, individual satisfaction and trust in others have a direct significant influence on tax morale formulation. Democratic political system and individual satisfaction present the highest positive statistically significant effect on the formulation of individual's motivation to comply. Furthermore, we also conclude that political democratic system positively contributes to individual satisfaction. Individuals who believe that democracy is the best government regime tend to state high levels of tax morale and satisfaction with life. Similarly, individual's satisfied with their life's tend to exhibit higher tax morale. Individual taxpayers are negatively statistically significant influenced by behavior of the other taxpayers. The knowledge that other individuals are not trustworthy reduces the motivation to act according the rules and to comply.

Religiosity presents a positive statistically significant effect on tax morale, although with lower influence compared to democratic political system, individual satisfaction and trust in others. Regarding to Portuguese taxpayers, a higher commitment to obey non-governmental rules increase their tax morale level and stands for an increasing level of institutional trust. Commonly, empirical studies analyze the impact of religiosity on tax morale just with one indicator, church attendance. We measured religiosity using four indicators. In our understanding this is more appropriated given the multidimensional dimension of the concept. Among the four indicators considered in the analysis, the one that contributes more to capture individual's religiosity level is the level of trust individual's state on church.

Political participation and trust in others behavior present a negative statistically significant effect on tax morale. Taxpayers with a higher level of political participation are less willing to pay their taxes unconditionally. Active individual's in political activities, in an individual level, like signing petitions, joining boycotts and be part of manifestations, present lower levels of tax morale. Commonly empirical studies present a positive relation between political participation and tax morale. Our result is not in line with previous studies. The result obtained in our study can be explained by the fact that most people stated that would never do any of the referred individual political activities, like signing a petition (mean = 2.26, Std. 0.777), joining boycotts (mean = 2.64, Std. 0.566) and be part of manifestations (mean = 2.46, Std. 0.691). Literature review showed that knowing that other people are trustworthy increases the motivation to act according the rules and to comply. However our study revealed a negative influence of trust in others behavior and tax morale. In our understanding, the result achieved because a high percentage of taxpayers stated high levels of tax morale and also stated the perception that people do not try to be fair or just look out for themselves.

Many empirical studies about tax morale determinants evidence a positive relation between institutional trust, and tax morale. When citizens believe governments act according to their interests willingness to comply increases. Our results show a negative not statistically significant relation between institutional trust and tax morale. We justified our result based on the fact that, in average, citizens report a low level of trust on government, parliament and justice system. Trust in parliament (mean = 2.80, Std. 0.802), trust in justice system (mean = 2.68, Std. 0.869) and trust in government (mean = 3.01, Std. 0.834).

Political participation presents a positive and statistically significant relation with political democratic system with trust in others. People with high levels of political participation believe democracy is the best political system and are more aware of others behavior. Individuals who engage in political activities tend to state that others are trustworthy. Religiosity presents a positive and statistically significant relation with institutional trust and a negative and with trust in others. Religiosity presents a negative and statistically significant relation with political participation. People who are strongly influence by non-governmental institution are less willing to engage acts like petitions or manifestations.

Trust in others presents a positive and statistically significant relation with individual satisfaction and with institutional trust. Institutional trust presents a positive and statistically significant relation with individual satisfaction. Trust in public institutions contributes for satisfaction with life.

Conclusion and limitations

This paper contributes to the debate about the determinants of tax morale using a structural equation model. Using data from EVS regarding to Portugal, year 2008, we explored the direct and indirect effects of political, behavioral and psychological factors on tax morale. Tax morale gains importance in tax compliance research given the limitations of traditional economic models to explain taxpayers behavior. The intrinsic motivation to pay taxes is a key factor to provide an explanation about taxpayer's behavior over the years. It is also a crucial variable to explain tax evasion levels and the level of underground economy. Individual's tax morale is a multidimensional concept not directly observable. So the study of the factors that shape it seem to give awareness to researchers and politicians of how to maintain or even increase individual's motivation to comply.

Our work extends previous empirical studies by analyzing simultaneously the influence of political democratic system, political participation, religiosity, individual satisfaction, trust in others and institutional trust on the formulation of Portuguese taxpayers tax morale. Most of the estimated coefficients of tax moral causes analyzed in our model

are statistically significant at conventional levels. We conclude that Portuguese taxpayers tax moral is positively influenced by individual satisfaction and by democracy. Our results seem to indicate that, in Portugal, individual's intrinsic motivation to pay taxes is positively influenced by the existence of a democratic political regime and by individual's satisfaction with life. However, we did not find a significant negative relation between institutional trust and tax morale. Individuals who support democracy as the best political regime, individual's satisfied with their lives and strongly identified with the country tend to have a higher intrinsic motivation to comply. Thus, for Portuguese taxpayers, political and social conditions are important to explain the level of motivation to comply.

We studied a wide range of constructs as determinants of tax morale, although it is justifiable to state that further constructs could have been included. In the choice of the constructs and the indicators to be included in the model we were limited by the variables included in the EVS.

This paper provides detailed insights into Portuguese taxpayers tax morale and thus contributes to understanding why so many taxpayers in Portugal are willing to pay their taxes.

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UNCERTAINTY, MONEY AND THE “FAIR” RATE OF INTEREST

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Abstract

This paper presents a redefinition of notion of the inter-temporal distributional neutrality underlying the “fair” rate of interest of Lavoie (1999). The authors re-define the notion by replacement of the labor-time constant purchasing power method by a more feasible method of a discounted value of consumption. Next, a general proof is provided by the authors of Lavoie’s postulate of the equality of the real “fair” rate of interest to the productivity growth rate. This proof is provided separately for a non-productive and a productive economy. Subsequently, the authors present their own 45° “fair” rate model which inter-relates both the real and nominal “fair” rates with the productivity growth rate in a single graphical scheme. Finally, the authors amend their own center-equilibrium underemployment model by this 45° “fair” rate model to produce a complex fair-rate-amended center-equilibrium underemployment model. This model incorporates Lavoie’s “fair” rate of interest into a fundamental-uncertainty-based model of underemployment with an endogenous money supply.

Keywords: New Consensus, underemployment equilibrium, “fair” rate of interest, natural rate of interest, inter-temporal distribution

Introduction

Current discussions about both the theoretical and practical consequences of a negative rate of interest, referred to as breaking through the zero lower bound⁶⁸, have called into question the monetary policy of New Consensus (NC) based on the Wicksellian two-rate hypothesis with a new intensity. Keynes’s income-balancing mechanism (Keynes, 1936, p.

⁶⁸ E. g. Seccareccia, M.; Lavoie, M. 2015; Summers, Lawrence H. 2014; Sutch, Richard. 2014; Ilgmann, Cordelius; Menner, Martin. 2011.

64)⁶⁹ which effectively disposed the natural rate of interest begged a positive question of a determination of the interest rate. Since Keynes's answer to this question was that the interest rate is positively determined by mere conventions (Keynes, 1936, p. 152), then, it was legitimate to ask a normative question of the interest rate determination: "What should the interest rate be?" A feasible answer to this question seems to be provided by a post-keynesian concept of the "fair" rate of interest which "preserves the intertemporal distribution of income between borrowers and lenders." Lavoie (1999, p. 4)⁷⁰. In other words, it is such a rate of interest at which neither the borrowers enrich themselves at the expense of lenders, nor the lenders enrich themselves at cost of borrowers. Replacement of the current natural-interest-rate framework by a new one based on the normatively determined "fair" rate of interest would necessarily lead to a fundamental reshape of the monetary policy as we know it.

We are going to re-define the "fair" rate of interest – and the intertemporal distributional neutrality concept which underlies the "fair" rate of interest – by means of replacing the labor-time constant purchasing power method of Lavoie (1999, p. 4) by discounting the future value, which we regard more feasible. Next, we are going to make an effort to provide a general proof of Lavoie's (1999, p. 4) postulate of an equality of the real "fair" rate of interest to the productivity growth rate, for both a non-productive and a productive economy. Our ambition will be to provide a simple model which would capture the inter-relatedness of the real "fair" rate of interest, nominal "fair" rate of interest and the productivity growth rate in a single graphical scheme. Finally, we will built this simple model into the center-equilibrium underemployment model that we presented in our preceding paper to produce a complex fair-rate-amended center-equilibrium underemployment model that will incorporate the "fair" rate of interest concept of Lavoie into a fundamental-uncertainty-based model of underemployment with an endogenous money supply.

⁶⁹ "Saving, in fact, is a mere residual. The decisions to consume and the decisions to invest between them determine incomes. Assuming that the decisions to invest become effective, they must in doing so either curtail consumption or expand income. Thus the act of investment in itself cannot help causing the residual or margin, which we call saving, to increase by a corresponding amount." (Keynes, 1936, p. 64).

⁷⁰ The concept of "fair" rate of interest originates from Luigi Pasinetti's "The Rate of Interest and the Distribution of Income in a Pure Labor Economy", yet, the term itself comes from Lavoie and Seccareccia: "Fair Interest Rates", *Encyclopedia of Political Economy*, Vol. 1, ed. by P.A. O'Hara, London/New York, 1999, Routledge.

Monetary Theory and Policy of New Consensus

In the framework of neoclassical economics – where we count all schools of economic thought which accept Say's law⁷¹ – the money is neutral in the long run. In the short run, though, money is not neutral. Increase in the rate of money supply growth causes money illusions which shifts a short-run equilibrium in the labor market to the right, pushes down the rate of unemployment below its natural level and increases the real product. In the long run, though, the money illusions disappear, the short-run equilibrium in the labor market shifts left to its long-run position, the rate of unemployment increases to its natural level and the real product returns to its potential level. However, higher money supply and higher price level are not the only two things which have been permanently changed. The expected inflation rate has increased permanently, too. The growth rate of real product has not been affected by the increase in the inflation expectations, though. The LR Phillipse curve is vertical.

From the viewpoint of the New Consensus (NC) – and also the monetarists but unlike the RBC school and the post-keynesians – it is the change in the rate of money supply growth which is a source of the short-run fluctuations in the real product. The reason for this was described by Knut Wicksell (1898, pp. 102-121) who distinguished a money interest rate⁷² (IR_M) from a natural interest rate (IR_n). Changes in the former bring the money market into its equilibrium, while changes in the latter restore the equilibrium of the capital market. As soon as these two interest rates are not equal, the price level starts increasing or decreasing. As long as the money interest rate is lower than the natural interest rate, the price level increases. As long as the money interest rate is higher than the natural interest rate, the price level decreases. If the money were neutral both in the long run and the short run – which is a situation compatible with a vertical AS curve - then these price level changes would not affect the real product either in the long run or the short run which is a position of proponents of the rational expectations hypothesis (Lucas, Sargent, Wallace). Since this is not the case in the short run - according to either monetarists or the NC adherents (Blinder, Taylor) - the changes in the price level bring about fluctuations in the real product in the short run, which is a situation compatible with an upward-sloping short-run AS curve. So, short-run fluctuations in the real product can be traced back to the inequality of the money interest rate and the natural interest rate, according to the NC (Fontana, 2006, p. 14). The first question to be answered is, then, whether the equality $IR_M = IR_n$ can be better provided by a one-level system of free banking, where individual

⁷¹ Keynes referred to them as classics. (Holman, p. 359).

⁷² In Wicksell's terminology a rate of interest on loans.

commercial banks issue their own respective currencies, or by a two-level system with a central bank, where credits provided by individual commercial banks are denominated in the same currency and where the central bank is a lender of the last resort and a clearing center. However interesting this discussion is⁷³, we cannot pay attention to it in this paper because it is both beyond its scope and beyond the main line of the post-keynesian – neoclassical controversy about monetary policy. The standpoint of both the mainstream economics and the post-keynesian economics is the same in this matter (although for different reasons), i. e. the system with a central bank is more feasible.

The second question to be answered is, then, how the central bank should achieve its goal to make the monetary IR and the natural IR equal and, through this, to eliminate or reduce the short-run fluctuations in the real product. The problem is the “capital market” is a highly abstract phenomenon which cannot be observed directly in practice and, therefore, neither the value of the equilibrium interest rate of the capital market IR_n^* can be known by the central bank (or anyone). Nonetheless, it must hold true that if the central bank sets the money interest rate at the right level – that is at the level which is equal to the equilibrium natural interest rate – then the inflation rate will be constant and the real product will not fluctuate. In other words, if we observe a constant inflation rate and no real fluctuations, then, it is an evidence that the central bank set the money interest rate at the right level, i. e. $IR_M = IR_M^* = IR_n^*$. The monetary policy rule, known as the Taylor rule (see Taylor, 1993, p. 202), consists in adjustment of the money interest rate whenever the inflation rate deviates from the target. An absence of real product fluctuations can be presented indirectly as an absence of fluctuations of the unemployment rate u above or below its natural level u^* .⁷⁴ Underlying the 3-equation conceptualization of the NC model⁷⁵ is the simplifying assumption of only 3 macro-markets: 1) the money market – whose equilibrium can be captured as an equality of the quantity of money balances demanded to the money balances supplied at the equilibrium money interest rate IR_M^* ; 2) the capital market – whose equilibrium can be captured as an equality between the savings supplied and the savings demanded

⁷³ For example Hayek (1990), in opposition to the anarcho-capitalist stream inside the Austrian school (Rothbard, de Soto), does not subscribe to the full-reserves-banking approach and – drawing upon Wicksell’s theory of two interest rates – suggests a partial-reserves one-level free-banking system which displays some common features with the inflation targeting approach of the New Consensus.

⁷⁴ For a discussion about an optimal definition of the output gap see Kriesler, Lavoie, 2007, pp. 393-395.

⁷⁵ Compare various modifications in Rochon, 2004, pp. 7-8; Fontana, 2006, p. 12; Lavoie, 2006, pp. 169-170; Lavoie, 2008, pp. 3-4; Setterfield, 2005b, pp. 5-6; Arestis, Sawyer, 2008, p. 762.

(investment) at the equilibrium natural interest rate IR_n^* ; 3) the labor market – whose equilibrium can be expressed as an equality of the current unemployment rate u to the natural unemployment rate u^* . These three markets are inter-related, so if one of them is out of equilibrium, the system is out of its general equilibrium (whether such exists, at all). The general equilibrium is a following configuration

$(IR_M^* = IR_n^*)$ AND $(u = u^*)$

which is compatible with a situation

$(\Delta\Pi = 0)$ AND $(\Pi = \Pi^T)$,

i. e. the inflation rate is constant AND equal to its target value. Whether this inflation target Π^T can be chosen arbitrarily or not is a matter of disputes.⁷⁶

Interest Rate Policy Revised

A need for a natural rate of interest as a balancing mechanism of the capital market was denied by Keynes.⁷⁷ Since he supplanted the interest-rate mechanism by his income mechanism, he did not “need” the interest rate to explain either the equilibrium-restoration process of the capital market, or the restoration of full employment, and the problem he was facing was now that the determination of the interest rate via the capital market was so excluded.⁷⁸ Explanation of the interest rate which Keynes set forth is his liquidity preference theory according to which the interest rate is a purely monetary phenomenon, having nothing to do with savings, investment and capital market as such. In a world ruled by fundamental uncertainty, possession of liquid assets becomes “a safe haven for not committing one's monetary claims on resources when the threat of uncertainty becomes great”

⁷⁶ E. g. Lavoie (2006, pp. 176-177) points out an inconsistency of New Consensus in this regard. According to the proclaimed long-run money neutrality, the output growth should be compatible with any inflation target. However, the inflation target is usually suggested relatively low which implies that the inflation target matters in the long run. Lavoie calls this the hidden equation of the New Consensus.

⁷⁷ “But the notion that the rate of interest is the balancing factor which brings the demand for saving in the shape of new investment forthcoming at a given rate of interest into equality with the supply of saving which results at that rate of interest from the community's psychological propensity to save, breaks down as soon as we perceive that it is impossible to deduce the rate of interest merely from a knowledge of these two factors.” (Keynes, 1936, p. 165).

⁷⁸ “As I have said above, the initial novelty lies in my maintaining that it is not the rate of interest, but the level of incomes which ensures equality between saving and investment. The arguments which lead up to this initial conclusion are independent of my subsequent theory of the rate of interest, and in fact I reached it before I had reached the latter theory. But the result of it was to leave the rate of interest in the air. If the rate of interest is not determined by saving and investment in the same way in which price is determined by supply and demand, how is it determined?” (Keynes, 1937, p. 250). – We want to thank Robin Kraffer for pointing out this paper of Keynes and, especially, this passage of it to us.

(Davidson, 1991, p. 139). Liquidity of an asset is a valuable characteristic. Banknotes and current accounts do not yield an interest, though. If anyone decided to issue new interest-free bonds, no one would buy them unless the liquidity of these bonds is equal to the liquidity of banknotes and current accounts. As long as this is not the case, the bond issuer must compensate the potential buyer for lower liquidity thereof by a non-zero rate of return. The interest rate is so a compensation of an asset holder for the benefits of liquidity (liquidity-premium)⁷⁹ of the alternative more liquid asset he gives up. Or, vice versa, if someone holds cash balances, he bears the (implicit) costs of holding the cash balances which are equal to the liquidity-premium of the cash balances which are equal to the sacrificed rate of return of the alternative asset (e. g. bond).

The Concept of the “Fair” Rate of Interest

With the concept of the natural interest rate gone, two crucial questions emerged. The first question is a positive one: if the supply-demand scheme in the capital market does not determine the interest rate, what does then? The liquidity-preference theory explains a negative dependence of a demand for cash balances on the interest rate but it does not explain the precise value of the interest rate for any given quantity demanded. That is why Keynes resorts to conventions as the ultimate determinant.⁸⁰ Both the discount rate of the central bank and normal rate of profit are given by conventions and from these rates others are derived, depending on the maturity, expected risk and liquidity premium of the particular asset. The second question following a disposal of natural-interest-rate concept is a normative one: what should the interest rate be? A normative question like this is irrelevant with respect to a process of market clearing. Asking a question what a price of apples should be like does not make any sense as long as a price of apples is co-determined by a supply and a demand. There is nothing like a “fair” price here. There is just a market price at which there

⁷⁹ “(...) it is something for which people are ready to pay something. The amount (measured in terms of itself)

which they are willing to pay for the potential convenience or security given by this power of disposal (exclusive of yield or carrying cost attaching to the asset), we shall call its liquidity-premium *l*.” (Keynes, 1936, p. 226).

⁸⁰ “The essence of this convention - though it does not, of course, work out quite so simply - lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect

a change. This does not mean that we really believe that the existing state of affairs will continue indefinitely. We know from extensive experience that this is most unlikely. [...] Nevertheless the above conventional method of calculation will be compatible with a considerable measure of continuity and stability in our affairs, so long as we can rely on the maintenance of the convention.” (Keynes, 1936, p. 152).

is neither an excess demand, nor an excess supply. At the moment when this balancing mechanism is eliminated and the price is determined by conventions, it is legitimate to ask whether these conventions are good or not. It is only in such a framework that a term like “fair” rate of interest can make any sense. However, a macroeconomic environment ruled by the fundamental uncertainty is exactly that kind of a framework. An environment where the prevalence of fundamental uncertainty makes the existence of money necessary even in the long run. An environment where the existence of money helps reducing the risk of bankruptcy caused by an asset-liability mismatch. An environment where the liquidity premium of money for any given amount of cash balances is determined by mere conventions.

A concept of the “fair” rate of interest is an answer to the normative question “what should be the interest rate?”. According to Lavoie (1999, p. 4), the “fair” rate of interest is such a rate which “preserves the intertemporal distribution of income between borrowers and lenders.” Lavoie (1999, p. 4) postulates an equality of the real “fair” rate of interest – we will denote this r_f^R – with the productivity growth rate⁸¹

$$r_f^R = \eta. (1)$$

Making use of the Samuelson-Solow formula for price inflation

$$\Pi = g_w - \eta, (2)$$

where Π is a rate of the price inflation, g_w is a rate of the *nominal* wage inflation, η is a productivity growth rate, the *real* “fair” rate of interest can also be expressed

$$r_f^R = g_w - \Pi, (3)$$

i. e. r_f^R is equal to the *real* wage growth rate.⁸² Since the nominal “fair” rate of interest is

$$r_f^N = r_f^R + \Pi, (4)$$

we can write

$$r_f^N = g_w, (5)$$

and since

$$g_w = \eta + \Pi, (6)$$

the nominal “fair” rate of interest can also be expressed as⁸³

$$r_f^N = \eta + \Pi. (7)$$

Postulating an equality of the rate of interest to the productivity growth rate as a condition for inter-temporal distributional neutrality does

⁸¹ More precisely “rate of increase in the productivity of the total amount of labour that is required, directly or indirectly, to produce consumption goods and to increase productive capacity” (Lavoie, 1999, p. 4).

⁸² Of course, provided that productivity (and, as a result, real remuneration growth rate) of other factors of production has not changed.

⁸³ Lavoie, 1999, p. 4.

not lack plausibility. Lavoie (1999, p. 4) explains the concept of the “fair” rate of interest by means of a “constant purchasing power in terms of labor time” on a following example.

$$\Pi = 5 \%$$

$$W = 10\$/h$$

$$\text{a loan} = 10\,000\$$$

$$\eta = 2 \%$$

From the formulas above we can compute both the nominal and real “fair” rates of interest:

$$r_f^N = 7 \%$$

$$r_f^R = 2 \%$$

The borrower takes a loan which corresponds to a labor-time equivalent of 1000 hours. The lender provides the borrower with a loan of 1000 hours. Now, the borrower has to pay back to the lender a sum of 10 000\$.1,07 = 10 700\$ which – since the nominal wage has increased by 7 % to 10,7\$ - corresponds to 1000 hours of labor. Let us assume the real rate of interest

$$r^R = 1 \% < r_f^R$$

and the nominal rate of interest

$$r^N = 6 \% < r_f^N.$$

Now, the borrower would take a loan of a value corresponding to 1000 hours. Next year, he would pay back 10 000\$.1,06 = 10 600\$ which – since the nominal wages increased by $\Pi + \eta = 7 \%$ to 10,7\$, again – would only correspond to $10\,600\$/10,7\$ = 990,65$ hours of labor. Thanks to a rate of interest lower than the “fair” rate of interest, the borrower would enrich himself at the expense of the lender. Let us suppose an opposite case:

$$r^R = 3 \% > r_f^R$$

$$r^N = 8 \% > r_f^N.$$

In this case, the borrower takes a loan of 1000 hours of labor and pay back $10\,800\$/10,7\$ = 1009,35$ hours of labor. As a consequence of an interest rate bigger than the “fair” rate of interest, the lender enriches himself at cost of the borrower. Of course, this is just a numerical example, not a proof. To make a proof of the statement $r_f^R = \eta$, we need to show that this statement holds true irrespective of the exact value of the borrower’s present income, savings (loan) and future income and the lender’s present income and future income. First of all, let us re-define the constant purchasing power. Instead of recalculating the nominal inflated money prices and wages to a constant indicator of labor hours, we will use a simple discounting of the future value. E. g. the future value (FV) of the investment is computed as

$$FV_{\text{investment}} = \text{loan} \cdot (1+\eta) \cdot (1+\Pi) \quad (8)$$

$$FV_{\text{investment}} = 10\,000\$ \cdot 1,02 \cdot 1,05$$

$$FV_{\text{investment}} = 10\,700\$.$$

10 700\$ will be discounted by the alternative nominal rate of return, which can be said to be the same for all market participants in equilibrium since the rates of return of investments tend to be equal in the long run and, as a result, the rate of return of the second best alternative is equal to the rate of return of the current investment. So, we get

$$r^N = r^R + \Pi \quad (9)$$

$$r^N = 3 \% + 5 \%$$

$$r^N = 8 \%$$

Then, the present value (PV) of the future cash-flow from the investment is

$$PV_{\text{investment}} = FV_{\text{investment}} / (1 + r^N) \quad (10)$$

$$PV_{\text{investment}} = 10\,700\$ / 1,08$$

$$PV_{\text{investment}} = 9907,4.$$

The future value of the repayment will consist of the principal (loan) plus interest:

$$FV_{\text{repayment}} = \text{loan} \cdot (1 + r^R) \cdot (1 + \Pi) \quad (11)$$

$$FV_{\text{repayment}} = 10\,000\$ \cdot 1,03 \cdot 1,05$$

$$FV_{\text{repayment}} = 10\,800\$.$$

The present value of the repayment is then

$$PV_{\text{repayment}} = FV_{\text{repayment}} / [(1 + r^R) \cdot (1 + \Pi)] \quad (12)$$

which yields us

$$PV_{\text{repayment}} = \text{loan} \cdot (1 + r^R) \cdot (1 + \Pi) / [(1 + r^R) \cdot (1 + \Pi)] \quad (13)$$

i. e.

$$PV_{\text{repayment}} = \text{loan} \quad (14)$$

Since

$$PV_{\text{investment}} - PV_{\text{repayment}} < 0 \quad (15)$$

in this particular case, the lender enriches himself at the cost of the borrower. As a result, an application of the discounting method leads to the same conclusion which Lavoie draw by an application of the labor-time method which means that we can use the discounting method to derive a proof of Lavoie's postulate without running a risk of inconsistency.

The “Fair” Rate of Interest in a Non-Productive Economy: A Proof

At this point, we need to make a general proof of the statement $r_f^R = \eta$. In our preceding paper, we started with a simple model of non-productive economy. Let us, therefore, start with a derivation of the “fair” rate of interest for the case of a non-productive economy. In a non-productive economy, we can write

$$\begin{aligned} & [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] + [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] = \\ & = [(Y^A)^{\text{tomorrow}*} / (1+r) - (Y^A)^{\text{tomorrow}+} / (1+r)] + [(Y^B)^{\text{tomorrow}*} / (1+r) - (Y^B)^{\text{tomorrow}+} / (1+r)] \end{aligned}$$

$$(16)$$

or

$$\Delta S^A + \Delta S^B = \Delta C^A/(1+r) + \Delta C^B/(1+r) \quad (17)$$

or

$$\Delta S = \Delta C/(1+r). \quad (18)$$

In other words, a sum of savings of A and B today needs to be equal to a sum of consumption increase of A and B tomorrow. For example, if A saves 50 today and lends it to B, so that B can increase his today consumption by 50, then, A will increase his tomorrow consumption by $(1+r).50$ and B will have to decrease his tomorrow consumption by the same amount to be able to repay his debt to A. In case of a “fair” inter-temporal distribution, it must hold true

$$(1) \Delta S^A - \Delta C^A/(1+r) = 0 \quad (19)$$

AND

$$(2) \Delta C^B/(1+r) - \Delta S^B = 0. \quad (20)$$

The first condition means that if, for example, A saves 50 today, his tomorrow consumption needs to increase by $(1+r).50$ the present value of which is 50, again. The second condition means that if, for example, B saves 0 and takes a loan 50 from A, then, B’s consumption tomorrow needs to decrease by $(1+r).50$ the present value of which is 50, again.

The above said equation (16) does not imply these conditions, though. For example, we could assume a case

$$(Y^A)^{\text{today}*} = 0 \quad (21)$$

$$(Y^A)^{\text{tomorrow}*}/(1+r) = (Y^A)^{\text{tomorrow}+}/(1+r), \quad (22)$$

in other words, A saves all of his today’s income but, at the same time, he does not increase his tomorrow’s consumption by any amount. This would imply

$$\Delta S^A = \Delta C^B/(1+r) - \Delta S^B, \quad (23)$$

that is, if A saves 50 today and lends it to B and B saves 0 today, then, either B increases his consumption by 50 today or tomorrow but he will not repay this loan to A and, as a result, he will not have to decrease his tomorrow consumption. The above said equation (16) still holds true but neither the “fair” inter-temporal distribution condition (1) nor the condition (2) is fulfilled, as obvious.

Let us derive a “fair” rate of interest for a non-productive economy.

From the first condition it can be inferred that

$$r_{(1)} = [(Y^A)^{\text{tomorrow}*} - (Y^A)^{\text{tomorrow}+}] / [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] - 1. \quad (24)$$

From the second condition it can be inferred that

$$r_{(2)} = [(Y^B)^{\text{tomorrow}*} - (Y^B)^{\text{tomorrow}+}] / [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] - 1. \quad (25)$$

Since obviously

$$r_{(1)} = r_{(2)} = r_f, \quad (26)$$

because the “fair” rate we are looking for must be the same for A and B, by definition,

then, the “fair” rate of interest can simply be computed by plugging into either $r_{(1)}$ or $r_{(2)}$.^{84,85}

The “Fair” Rate of Interest in a Productive Economy: A Proof

Now, let us examine the “fair” rate of interest for a case of productive economy with a productivity growth rate η :

$$\begin{aligned} & [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] + [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] < \\ & < [(Y^A)^{\text{tomorrow}*}/(1+r) - (Y^A)^{\text{tomorrow}+}/(1+r)] + [(Y^B)^{\text{tomorrow}*}/(1+r) - (Y^B)^{\text{tomorrow}+}/(1+r)] \end{aligned} \quad (27)$$

or

$$\begin{aligned} & [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] - [(Y^A)^{\text{tomorrow}*}/(1+r) - (Y^A)^{\text{tomorrow}+}/(1+r)] < \\ & < [(Y^B)^{\text{tomorrow}*}/(1+r) - (Y^B)^{\text{tomorrow}+}/(1+r)] - [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}]. \end{aligned} \quad (28)$$

In other words, reduction in today consumption by e. g. 50 will increase tomorrow consumption by $\eta \cdot 50$ as a result of the investment. How this additional consumption will be distributed between A and B is not determined by this inequality. Substituting for

$$(Y^B)^{\text{tomorrow}*}/(1+r) = (Y^B)^{\text{tomorrow}+}/(1+r) + I \cdot (1+\eta)/(1+r) - I, \quad (29)$$

i. e. B can increase his tomorrow consumption by the return from the investment after subtraction of the repayment of the loan plus interest to A. At the same time, it holds true that

$$(Y^B)^{\text{today}*} = (Y^B)^{\text{today}+}, \quad (30)$$

in other words, the loan I does not increase B’s current consumption because B invests this I .

The loan I is A’s saving, i. e. the amount by which A reduces his today consumption:

$$[(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] = I. \quad (31)$$

⁸⁴ More precisely, we can find the “fair” rate of interest by plugging into any of the following 4 equations: 1) $r_f = [(Y^A)^{\text{tomorrow}*} - (Y^A)^{\text{tomorrow}+}] / [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] - 1$ or 2) $r_f = [(Y^B)^{\text{tomorrow}*} - (Y^B)^{\text{tomorrow}+}] / [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] - 1$ or 3) $r_f = [(Y^A)^{\text{tomorrow}*} - (Y^A)^{\text{tomorrow}+}] / [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}] - 1$ or 4) $r_f = [(Y^B)^{\text{tomorrow}*} - (Y^B)^{\text{tomorrow}+}] / [(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] - 1$.

⁸⁵ That the real “fair” rate of interest in a non-productive economy is not equal to zero, as the formula $r_f^R = \eta$ would indicate, is not a mistake. Zero value of the productivity growth rate is not the only difference between the model of non-productive economy and the productive economy. The other difference that we assume here is the use of the savings. While the savings lent by A to B is consumed by B in the first period in the non-productive economy, i. e. $[(Y^A)^{\text{today}+} - (Y^A)^{\text{today}*}] = [(Y^B)^{\text{today}+} - (Y^B)^{\text{today}*}]$, these savings are not consumed by B in the first period in the productive economy but invested, i. e. $(Y^B)^{\text{today}*} = [(Y^B)^{\text{today}+}$ and $(Y^B)^{\text{tomorrow}*}/(1+r) = (Y^B)^{\text{tomorrow}+}/(1+r) + I \cdot (1+\eta)/(1+r) - I$.

After substitution, we can write

$$- [(Y^A)^{\text{tomorrow}*}/(1+r) - (Y^A)^{\text{tomorrow}^+}/(1+r)] < I.(1+\eta)/(1+r) - 2.I. \quad (32)$$

So, for a “fair” inter-temporal distribution, it must hold true

$$- [(Y^A)^{\text{tomorrow}*}/(1+r_f) - (Y^A)^{\text{tomorrow}^+}/(1+r_f)] = I.(1+\eta)/(1+r_f) - 2.I, \quad (33)$$

i. e. the additional production needs to be distributed between A and B in such a way that the present value of the additional consumption of A is equal to present value of the additional consumption of B, which implies

$$- I = I.(1+\eta)/(1+r_f) - 2.I \quad (34)$$

from which it can be derived that

$$(1+\eta) = (1+r_f) \quad (35)$$

which yields us

$$r_f = \eta. \quad (36)$$

By this, we have made a general proof of Lavoie’s postulate of the equality of the “fair” rate of interest to the productivity growth rate.

A Fair-Rate-Amended Center-Equilibrium Underemployment Model Without the Natural Rate of Interest

Now, we can build the “fair” rate concept into our center-equilibrium underemployment model that we presented in our preceding paper. This model captures the characteristic feature of post-keynesian theoretical approach, the feature of fundamental uncertainty. This fundamental uncertainty is reflected by the absence of the natural-interest-rate balancing mechanism of the capital market and by the presence of Keynes’s income-balancing mechanism. This is our fair-rate-amended underemployment equilibrium model:

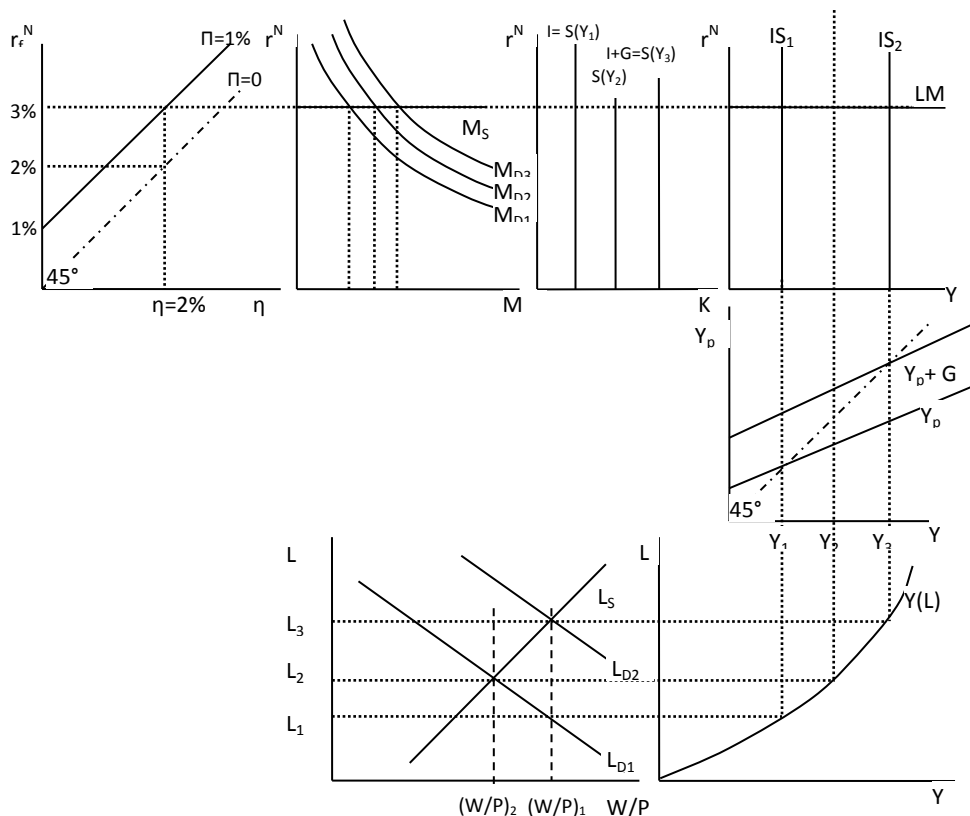


Fig. 5. Fair-Rate-Amended Center-Equilibrium Underemployment Model Without the Natural Rate of Interest: An Economy With Fundamental Uncertainty (own source)

At the level of product Y_1 , both the money market and capital market are in their respective equilibria but the labor market displays involuntary unemployment (L_3-L_1) at the real wage $(W/P)_1$. The first diagram on the left captures our 45° “fair” rate model. The “fair” rate of interest is equal to the productivity growth rate in real terms. The nominal “fair” rate of interest r_f^N is the productivity growth rate η plus the price inflation rate Π . The real “fair” rate of interest is equal to the productivity growth rate along the 45° line intersecting the start of the coordinate system (the $\Pi=0$ line). The nominal “fair” rate of interest is equal to $(\eta + \Pi)$ along the 45° line intersecting the $(0; 1\%)$ point in this case (the $\Pi=1\%$ line). As a result, r_f^N is exogenous to the money market, and so the M_S curve is horizontal at the level of r_f^N . Amount of savings supplied is determined by the level of product Y_1 at the level of $S(Y_1)$ which is equal to the amount of investments that the firms are willing to make. The independence of the capital market equilibrium of the interest rate is projected into the vertical IS curve, while the horizontal money supply curve – which implies the endogeneity of the

money supply – determines the horizontal shape of the LM curve. Since both the money market and the capital market find themselves in their respective equilibria at the level of product Y_1 , the economy finds itself in the intersection of the IS and LM curves. However, the labor market is out of its equilibrium at this product.

If the nominal and real wages decreased to the level $(W/P)_2$, the labor market would restore its equilibrium at the level of employment L_2 . Higher employment would increase the product to the level Y_2 which would lead to a higher supply of savings $S(Y_2)$ and, effectively, bring the capital market out of its equilibrium. Higher product would result in a higher money demand (M_{D2}) which, because of the horizontal M_S curve, would not affect the interest rate, though, and, therefore, the economy would shift along the LM curve to the right, away off the IS_1 curve. Since this fair-rate-amended model is also a center-equilibrium system, it possesses a unique equilibrium but it cannot reach this equilibrium as long as left to its own endogenous dynamics. Therefore, an exogenous force must overcome the long-run (!) and endogenously insurmountable barriers which protect the system from getting to its equilibrium. When the government increases the aggregate demand by the governmental investments G , the labor demand will shift up to L_{D2} , and so the labor market gets to a new equilibrium at the level of employment L_3 and the real wage $(W/P)_1$. At the same time, higher aggregate demand shifts the equilibrium product from the level Y_1 to the level Y_3 , at which the supply of savings increases to the level $S(Y_3)$ and, simultaneously, the private investment I get increased by the governmental investment G , and so the new level of willingness to invest corresponds exactly to the willingness to save. The capital market restores its equilibrium at a new level $S(Y_3)=I+G$ which shifts the IS_1 curve to a position IS_2 . At the same time, a higher product results in a higher money demand M_{D3} , without any change in the interest rate, so, the economy shifts along the LM curve to the right and the IS curve shifts as well, resulting in a new intersection of the IS and LM. All three markets are in equilibrium now.

Conclusion

We presented the concept of the “fair” rate of interest (Lavoie, 1999) as an alternative foundation of the monetary policy in case that the natural-interest-rate hypothesis is rejected. We pointed out that in absence of natural interest rate, two questions must follow. Since Keynes (1936, p. 152) had answered the positive question (what determines the interest rate?) by determination of the interest rate by conventions, the normative question is now mostly legitimate (what should the interest rate be?). After explaining the concept, we suggested to re-define the notion of the inter-temporal distributional neutrality underlying the “fair” rate of interest by means of

replacing the labor-time constant purchasing power method by discounting the future value. We re-defined the “fair” rate of interest as such a rate of interest which guarantees that the additional production is distributed between the borrower and the lender in such a way that the present value of the additional consumption of the former is equal to present value of the additional consumption of the latter. Since we showed that this redefinition does not affect Lavoie’s conclusion, then, we could maintain that we do not run a risk of inconsistency when we derive a proof of Lavoie’s postulate for this re-defined “fair” rate.

Following this adjustment, we provided a general proof of Lavoie’s (1999, p. 4) postulate of the equality of the real “fair” rate of interest to the production growth rate. We provided a general derivation of the nominal and real “fair” rates of interest, separately for a non-productive and a productive economy. Next, we designed a simple 45° “fair” rate model which inter-relates the nominal “fair” rate of interest, real “fair” rate of interest and the productivity growth rate in a single graphical scheme. Then, we built this 45° “fair” rate model of ours into a center-equilibrium underemployment model presented by us in our preceding paper. Like this, we got our fair-rate-amended center-equilibrium underemployment model which incorporates Lavoie’s concept of “fair” rate of interest into a fundamental-uncertainty-based model of underemployment with an endogenous money supply.

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EFFECT OF GENDER ON THE CONSUMER'S CHANNEL SELECTION OF FAST FASHION APPAREL PRODUCTS

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Abstract

This paper takes the consumers of fast fashion clothing products as research subjects, and EMB model as logistic basis to compare and analyze the preference of male and female on three channels including Internet, mail order catalogue (telephone ordering) and entity shops in the whole purchasing process (including need recognition, information search, alternative evaluation, purchase, and after purchase evaluation) with the influential factors by means of questionnaire. Throughout the research, it is concluded that the consumers of fast fashion clothing products of different gender consumers have difference in preference on the channels in different stages of purchasing decision. It has great reference significance that Fast Fashion Costume makes the effective market strategies according to gender difference.

Keywords: Apparel, fast fashion, consumption, gender, channel choosing

Introduction

As the Internet and new interaction technique are constantly applied in the marketing strategy, there are more and more channels for consumers to gain the goods information and purchase goods. In the condition with multiple channels, the purchase behavior of consumers becomes complex. The multiple marketing channels refer to Internet, mail order catalogue (telephone ordering) and entity shop. The study on the effect of gender on the channel selection of fast fashion clothing products can help enterprises understand complex buying behavior of consumers, and provide theoretical basis for the adjustment of management idea as well as marketing strategy. This paper takes EMB model as logistic basis to analyze the effect of gender

on the selection of fast fashion apparel products in different stages. At present, EBM Model is a comparatively complete and clear theory in the study of consumer behavior, and it divides the consumer decision process into five stages: (1) Confirmation of demand. In this stage, the consumer demand is generated and confirmed, forming the consumer motivation. (2) Seeking information. After the formation of demand, the consumers will collect the relevant information, during which process the consumers will deepen the understanding of the market and brands, helping them make evaluations of the products. (3) Comparison and evaluation. Consumers will evaluate the feasibility of each purchase plan according to the collected information. (4) Purchase decision. Consumers make decisions on the purchase of products. (5) Evaluation after purchase. Consumers will be either satisfied with the products they purchased or dissatisfied. EBM model tries to theoretically explain the process of consumers' purchasing decisions, and it is widely applied in the study on different types of consumers' behaviors.

I.

Basic information of the channel preference of different gender consumers

Among the consumers surveyed, there are 153 men, accounting for 31.1% of the total number, and there are 339 women, accounting for 68.9% of the total number. Through comparison, this article finds out the preferences of male and female consumers on the channel selection of fast fashion clothing products and the corresponding influencing factors. Different gender consumers of fast fashion apparel products show different preferences on the three channels, which are the Internet, mail order catalogue (telephone ordering) and entity shops, during the whole purchasing procedures, including confirmation of demand, seeking information, comparison and evaluation, purchase decision and evaluation after purchase. Detailed analysis is as follows:

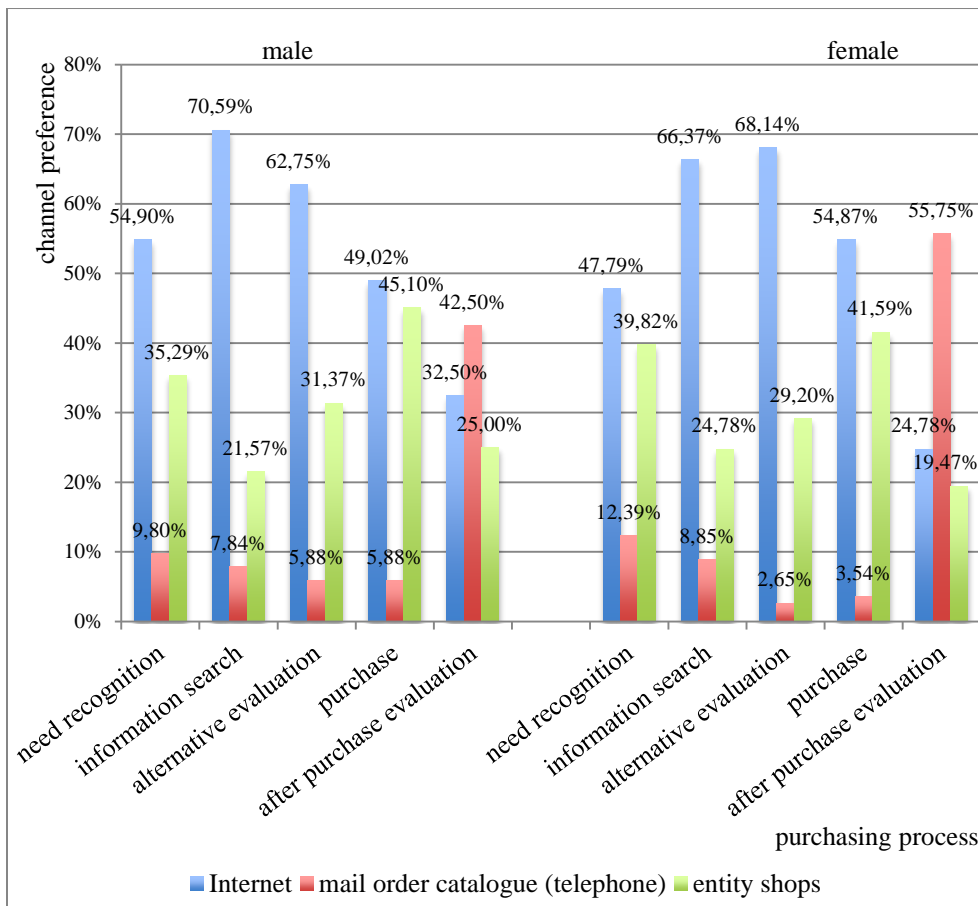


Figure 1 The channel preference of different gender consumers on fast fashion clothing products.

It can be seen from Figure 1 that, during the whole purchase process, male and female consumers showed different channel preferences on fast fashion clothing products (see Figure 1). The behaviors of different gender consumers on fast fashion clothing products in each purchasing stage are analyzed one stage by another, and Figure 1 shows all relative analysis on "channel preferences".

The channel selection of fast fashion apparel products by different gender consumers and the influencing factors

The first stage: Need recognition

In this stage, most of the surveyed male consumers (54.9%) showed more interest in the Internet display, and the other 35.29% and 9.80% male consumers felt more interested in the display in entity shops and the display in mail order catalogue/magazine, respectively; in terms of the surveyed female consumers, 47.79% of them believed the Internet display can attract them more, while the other 39.82% and 12.39% felt they were more attracted

by entity shops and mail order catalogue/magazine (see Figure 1). In terms of the Internet display, more surveyed male consumers showed interest than the female consumers; while regarding entity shops and mail order catalogue/magazine, the surveyed female consumers who showed interest are more than the male consumers. This means that fast fashion clothing products that are displayed in entity shops and mail order catalogue/magazine are more attractive to female consumers.

The second stage: Information search Channel preference

In the seeking information stage, the surveyed male consumers that selected the Internet, entity shops and mail order catalogue/magazine accounted for 70.59%, 21.57% and 7.84% of the total number of male consumers; the surveyed female consumers that selected the Internet, entity shops and mail order catalogue/magazine accounted for 66.37%, 24.78% and 8.85% of the total number of female consumers; (see Figure 1). It can be seen from this group of data that both male and female consumers tended to select the Internet channel for seeking information, and there were more female consumers who select entity shops and mail order catalogue/magazine than male consumers.

Influence factors and comparative analysis

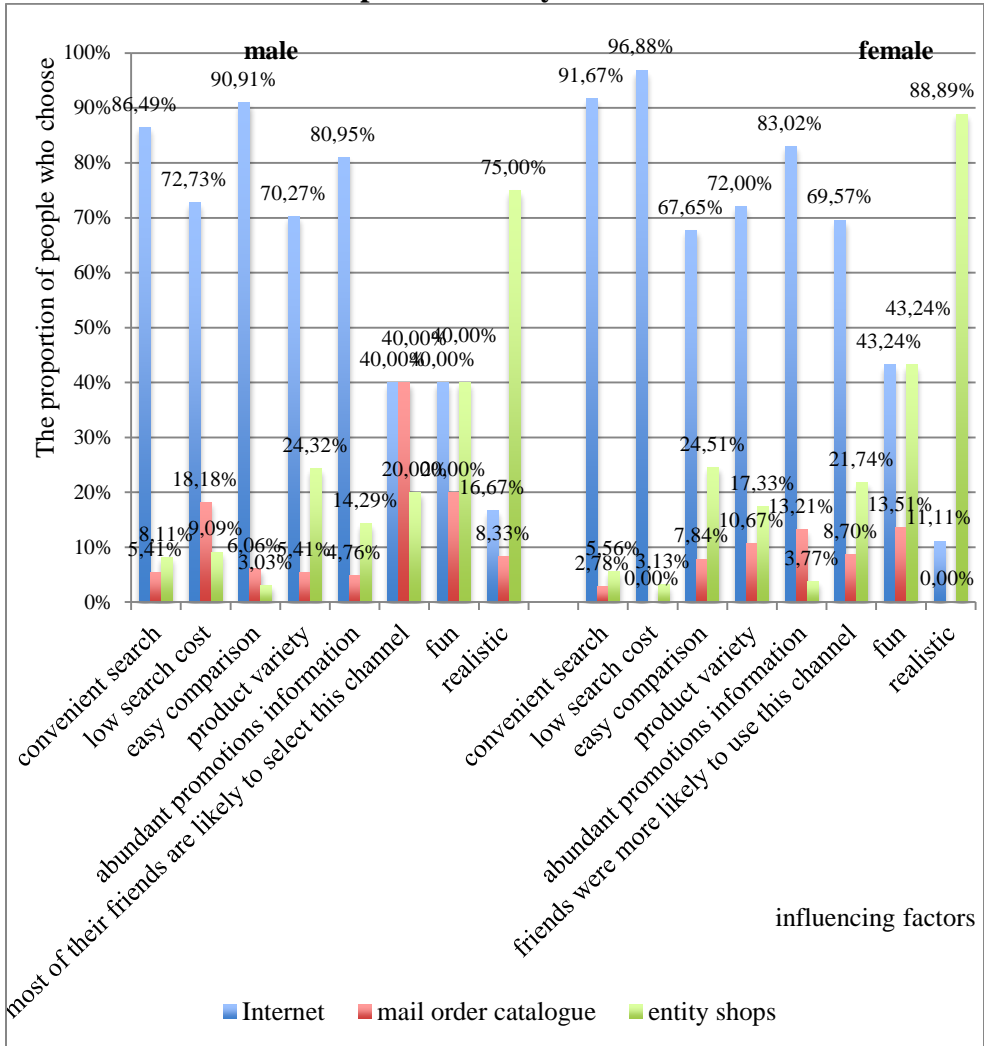


Figure 2 Analysis of the factors influencing the channel selection of male and female consumers of fast fashion clothing products in the seeking information stage

It can be seen from Figure 2 that, in this stage, male consumers mainly felt satisfied with the "easy comparison" (90.91%), "convenient search"(86.49%), "abundant promotions information" (80.95%) and other features of the Internet channel. Most male consumers (75%) hold the opinion that the channel of entity shops were more realistic than the Internet, but there were a certain amount of consumers (40% for both male and female) believed the Internet has as much pleasure as entity shops. Female consumers mainly felt satisfied with the "low search cost" (96.88%), "convenient search" (91.67%) and "abundant promotions information" (83.02%) and other features of the Internet. In respect of "fun", female

consumers also believed the Internet had as much fun as entity shops. And they held the opinion that entity shops were more realistic (88.89%) as well.

It can be seen from the comparison that, in the seeking information stage, both male and female consumers thought the Internet had some incomparable advantages over entity shops and mail order catalogue, such as "easy comparison", "low search cost", "convenient search" and "abundant promotions information", etc. Both male and female consumers believed the Internet had as much fun as entity shops, but entity shops were far more "realistic" than the Internet. There were more female consumers, most of whose friends were more likely to use this channel, meaning that seeking information through the Internet channel was more common in female consumers than male consumers.

The third stage: Alternative evaluation Channel preference

In the comparison and evaluation stage, the surveyed male consumers that selected the Internet, entity shops and mail order catalogue/magazine accounted for 62.75%, 31.37% and 5.88% of the total number of male consumers; the surveyed female consumers that selected the Internet, entity shops and mail order catalogue/magazine accounted for 68.14%, 29.20% and 3.54% of the total number of female consumers; (see Figure 1). It can be seen that the preferred channel of both male and female consumers was the Internet, but there were more male consumers selecting entity shops than female consumers.

Influence factors and comparative analysis

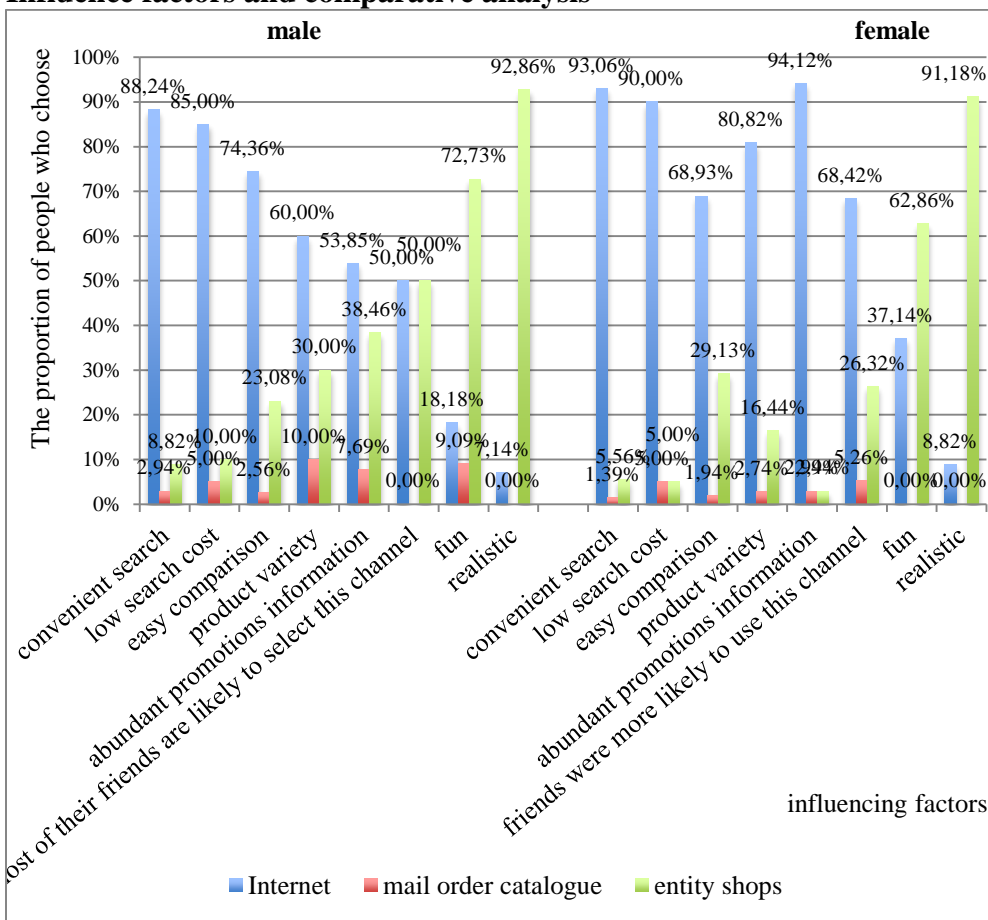


Figure 3 Analysis of the factors influencing the channel selection of male and female consumers of fast fashion clothing products in the comparison and evaluation stage

It can be seen from Figure 3, male consumers believed the main advantages of the Internet are "convenient search", "low search cost" and "easy comparison", etc. and the percentages of their friends selecting the Internet and entity shops accounted for 50% for each, but they all thought entity shops are absolutely more "realistic" and "fun". Female consumers believed the main advantages of the Internet were "convenient search", "low search cost" and "easy comparison", etc. and most of their friends selected the Internet, and they also thought entity shops are more "realistic" and "fun" than the Internet.

In the comparison and evaluation stage, both male and female consumers preferred to select the Internet, but there were more male consumers selecting the Internet than female consumers. The features of the Internet, such as "convenient search", "low search cost" and "easy

comparison", were highly attractive to both male and female consumers. There were more male consumers, who believed entity shops had more types of commodities, than female consumers. And male consumers held the opinion that, although the promotions information of entity shops were less than that of the Internet, it was still very abundant; but most of female consumers believed the promotions information in the Internet was more abundant. There were more male consumers whose friends were more likely to use this channel than female consumers, which means male consumers prefer to compare and evaluate fast fashion products through the channel of entity shops. And there were more male consumers who think entity shops had more "fun" in respect of comparison and evaluation than female consumers.

The Fourth stage: Purchase Channel preference

The surveyed male consumers that selected the Internet, entity shops and mail order catalogue accounted for 49.02%, 45.10% and 5.88%, respectively; and the surveyed female consumers that selected the Internet, entity shops and mail order catalogue accounted for 54.87%, 41.59% and 3.54%, respectively (see Figure 1). Both male and female consumers preferred to select the Internet, but there were more male consumers who selecting entity shops than female consumers; there were more female consumers who are likely to purchase fast fashion clothing products in the Internet than male consumers.

Influence factors and comparative analysis

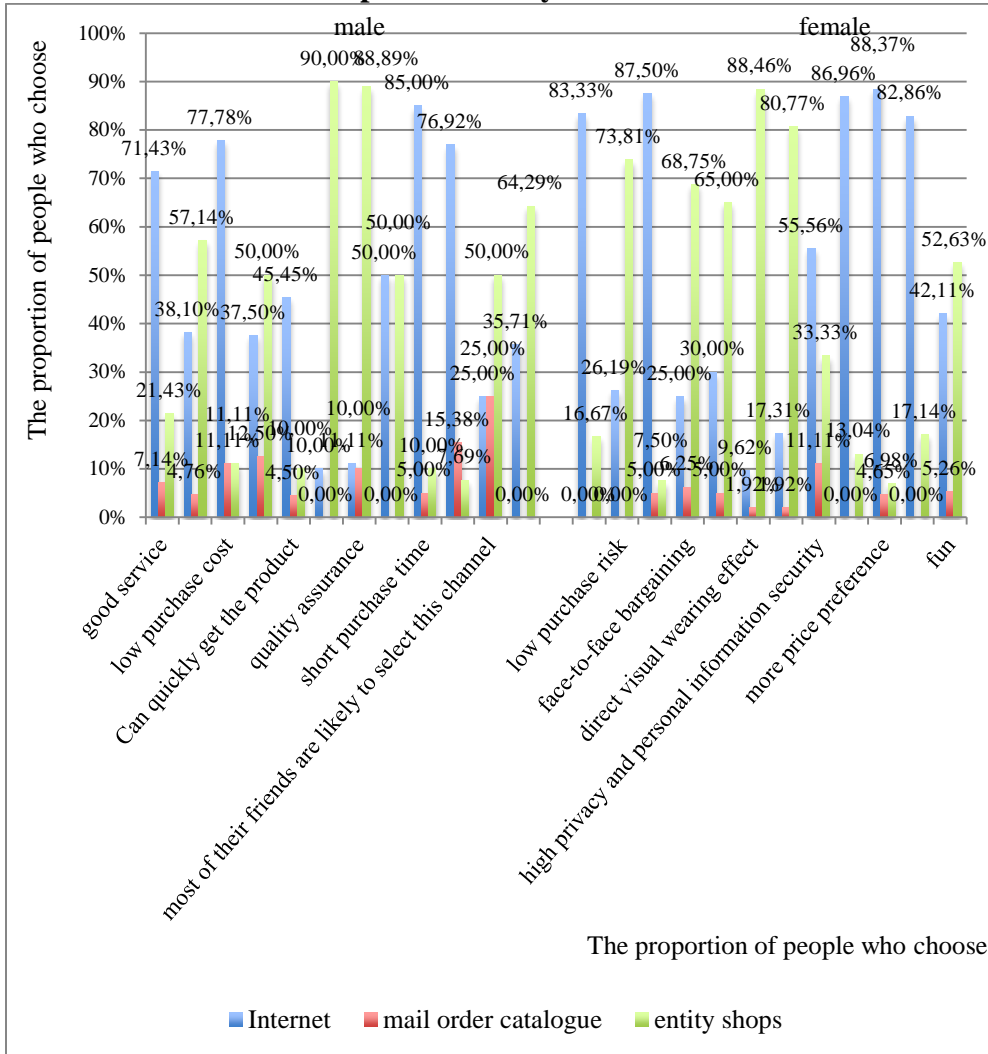


Figure 4 Analysis of the factors influencing the channel selection of male and female consumers of fast fashion clothing products in the purchase decision stage

The surveyed male consumers held the opinion that the Internet had the advantages like "short purchase time", "low purchase cost", "more price preference" and "good service", etc., while entity shops had the advantages like "direct visual wearing effect", "quality assurance", "fun" and "low purchase risk", etc. And they also held the opinion that the Internet had as high privacy and personal information security as entity shops. The surveyed female consumers held the opinion that the Internet had the advantages like "more price preference", "low purchase cost", "short purchase time" and "good service", etc., while entity shops had the advantages like "direct visual

wearing effect", "quality assurance", "low purchase risk" and "face-to-face bargaining", etc (see Figure 4).

In the purchase decision stage, there were more male consumers who selected entity shops than female consumers. Both male and female consumers who selected the Internet were satisfied with the features like "low purchase cost", "short purchase time", "more price preference" and "good service", etc. While the male and female consumers who selected entity shops were content with the features like "direct visual wearing effect", "quality assurance", "low purchase risk" and "face-to-face bargaining", etc. There were more female consumers who believed the Internet has "high privacy and personal information security" than male consumers. Although both surveyed male and female consumers preferred to select the Internet for purchase, there were more male consumers selecting entity shops than female consumers. And in respect of "most of their friends are likely to select this channel", male consumers were likely to purchase fast fashion clothing products in entity shops, while purchasing fast fashion clothing products in the Internet was more common in female consumers.

The fifth stage: After purchase evaluation Channel preference

In the evaluation after purchase stage, the surveyed male consumers that selected the channels of telephone, the Internet and entity shops were 42.50%, 32.50% and 25.00%, respectively; the surveyed female consumers that selected the channels of telephone, the Internet and entity shops were 55.75%, 24.78% and 19.47% (see Figure 1). It can be seen that, telephone was the first choice for both male and female consumers, then the Internet, and directly going to entity shops came the last. But it was obvious that more female consumers were willing to communicate with the sellers on telephone than male consumers, who would prefer directly going to entity shops for expressing their opinions.

Influence factors and comparative analysis

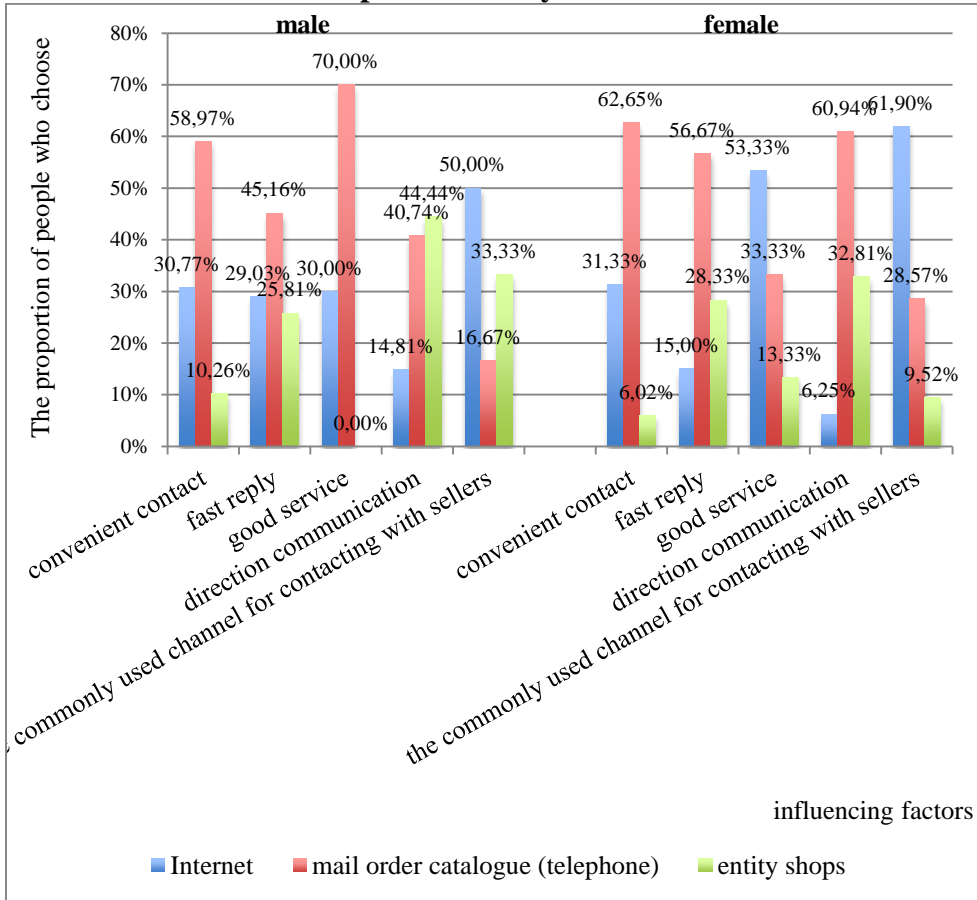


Figure 5 Analysis of the factors influencing the channel selection of male and female consumers of fast fashion clothing products in the evaluation after purchase stage

It can be seen from Figure 5, for "convenient contact", male consumers preferred making phone calls (58.97%); for "fast reply", male consumers preferred making phone calls (45.16%); for "good service", male consumers preferred making phone calls (70.00%); for "direction communication", male consumers preferred going to entity shops (44.44%); for "the commonly used channel for contacting with sellers", male consumers preferred the Internet (50.00%). For "convenient contact", female consumers preferred making phone calls (62.65%); for "fast reply", female consumers preferred making phone calls (56.67%); for "good service", female consumers preferred the Internet (53.33%); for "direction communication", female consumers preferred making phone calls (60.94%); for "the commonly used channel for contacting with sellers", female consumers preferred the Internet (61.90%).

It can be seen that male consumers held the opinion that making phone calls had the advantages like "convenient contact", "fast reply" and "good service"; entity shops had the advantage of "direct communication"; and the Internet has faster reply than going to entity shops. While female consumers held the opinion that making phone calls had the advantages of "convenient contact", "fast reply" and "direct communication"; the Internet had "good service"; and going to entity shops is faster in reply and more direct in communication than the Internet.

Conclusion

From the above analysis, it can be concluded that the preferences of male and female consumers on the channel selection of fast fashion clothing products have certain differences in the stages of confirmation of demand, seeking information, comparison and evaluation, and purchase decision.

In the stage of confirmation of demand, it is found that the number of female consumers who think internet display attract more purchase interests is less than that of male consumers; while the number of female consumers who think entity shops and mail order catalogue/magazine create more purchase desire is more than that of male consumers. This suggests that fast fashion clothing products that are displayed in entity shops and mail order catalogue/magazine are more attractive to female consumers.

In the stage of seeking information, both male and female consumers prefer the Internet channel. Internet channel has the advantages which entity stores and mail order catalogues are incomparable such as " low search cost ", " convenience in search ", "rich promotion information", "a variety of products" and "easy comparison" etc.. Both male and female consumers believe the Internet channel has as much pleasure as entity shops, while entity shops are far more "authentic" than the Internet. However, more female consumers purchase fast fashion clothing by means of entity stores and mail-order catalogues/magazine than males, but it is much common for female consumers to seek information on Internet.

In the stage of comparison and evaluation, both men and women prefer the internet The features of the Internet, such as "convenience in search", "low search cost", "easy comparison", "a variety of products" and "rich promotion information" are highly attractive to both male and female consumers. But the number of male choosing entity shop is significantly more than that of female. They believe that entity shop had more "fun" in the stage of comparison and evaluation.

In the purchase decision stage, both male and female consumers prefer internet channels, because the online shops have "better service", "lower cost", "less purchase time" and "more preferential price" than entity shops. However, more female prefer online purchasing fast fashion clothing

products online than male consumers; while more male prefer entity shops. They choose entity shops because of their "good service", "low cost", "direct wearing effect", "quality guarantee", "high safety in personal information privacy and security", "more preferential price", "surrounding friends using this channel" and "fun". Female consumers pay more attention on shopping environment; product variety, price and shopping time while male consumers care more about the shopping cost, service and personal information safety of entity shops.

In the stage of evaluation after purchase, both male and female prefer telephone channels, then the Internet, and finally the entity shops. Female prefer contacting with telephone while male consumers prefer directly going to the shops. For male, telephone channel is easy for contact, fast in response and has best service, but in entity shops, people can communicate directly while Internet channel has a faster response than entity shops. For female, telephone channels are convenient to contact, quick in response and the most direct way of communication; the Internet has the best service; entity shops had a faster response and more direct communication than that of Internet shops.

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LOW EMPLOYMENT INTENSITY OF GROWTH AND SPECIFICS OF SLOVAK LABOUR MARKET

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Abstract

This paper aims to explain low employment elasticity of growth in the Slovak Republic as a factor behind some atypical trends that occurred in the Slovak labour market in the pre-crisis period. Lower employment intensity of growth is common in some developing economies overcoming the technology and productivity gap – the idea behind the weak relation between output growth and employment increases in Slovakia is the same, however, the “employment growth threshold” in Slovakia has been remarkably high even when compared to other economies in the region. As a result, the shift towards more flexible working arrangements as well as unusually low wage share (in total income) persisted in the economy before the crisis. The very recent development suggests that the crisis could have created the opportunity to change the nature of economic growth and move towards more labour intensive sectors.

Keywords: Employment elasticity, economic growth, wage share

Introduction

Since the second half of the 90s, economic development in Slovakia came along with relatively high values of “employment growth threshold” – relatively high rates of economic growth were needed to initiate marginal increases in employment. Weak relation between economic growth and growth in employment may be typical for economies that are overcoming the productivity gap, however, in Slovakia, the relation between growth and employment has been unusual, also when compared to other similar economies in the region. The nature of economic growth in Slovakia and its atypically low labour intensity has been reflected in various labour market aspects. Divergence from the European trends in the rate between profit and wage increases in favour of profits during the period of favourable macroeconomic development in Slovakia (especially when compared to EU 15) was remarkable. Low rates of employment (again European comparison)

leading to unusual structure of employment (substitution of contract-type employment by self-employment in order to compensate weak relation between economic growth and employment growth) and other specifics led to a decline of wage share in income structure. Structural problems in the Slovak labour market, in a background of low labour intensity of growth, mean continual struggle for higher employment rates and emerging of more and new policy strategies (active labour market policy programs) aimed at combating the persistent problem of remarkably high long-term unemployment. Labour market development in Slovakia is profoundly marked by the structural unemployment and the post-crisis situation at the Slovak labour market is of concern to many policy makers (unemployment rose notably due to recession in 2009), however, there are some signs that the crisis invoked decent structural changes in the economy towards more labour-intensive sectors with the obvious positive impact on closer relation between future economic growth and job creation (decreasing “employment growth threshold”).

Low labour intensity of growth

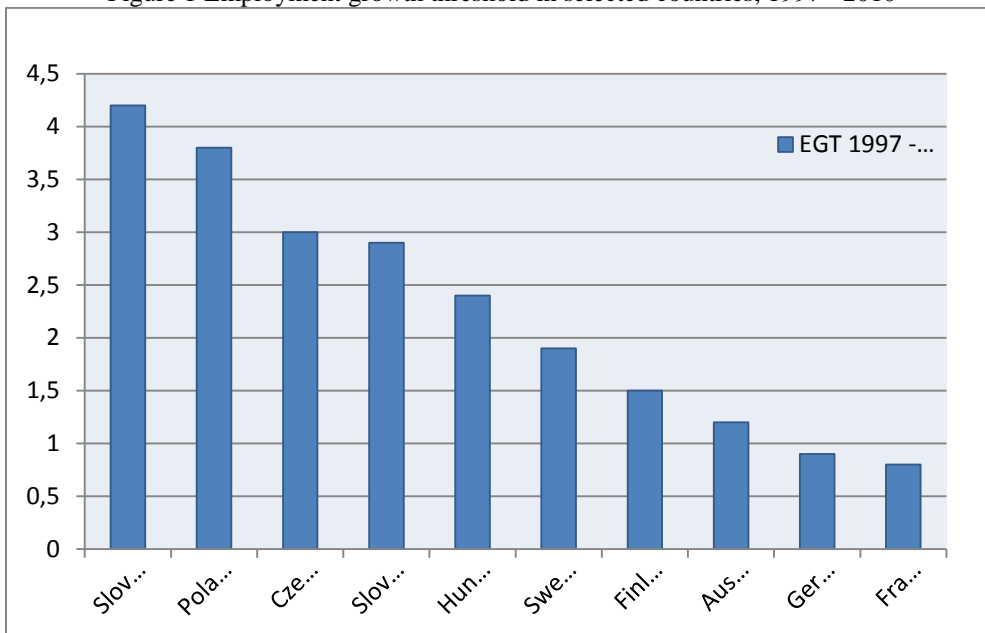
Although the Slovak economy could have been assessed as a quite positive example in terms of the results in its real convergence (during the transformation period), successful convergence to the EU trends was missing something. The convergence in the social sphere lagged behind other macroeconomic parameters – the development in employment and incomes did not succeed to follow trends in other countries. Let’s presume that the reasons consist in the quality and structure of the economic growth, which did not contribute sufficiently to expansion of employment or increase of the wage level. We can confront this hypothesis by exploring employment intensity of growth, in other words, by assessing elasticity of employment with respect to output (how employment varies with economic output).

Previous studies on this topic mostly used empirical data to estimate employment elasticity, some of them were focused on international comparison (Kapsos, 2005; Padalino and Vivarelli, 1997), some tried to identify structural determinants of country’s employment elasticity (Choi, 2007), some analyzed the effect of structural and macroeconomic policies on the employment intensity of growth (Crivelli, Furceri, and Toujas-Bernaté, 2012). Even though our methodology is different, the results are comparable. We use “employment growth threshold” calculation (not the elasticity coefficients of change in employment; and/or wage), which is defined as a critical level of economic growth rate (real GDP, in %), when employment is no more constant and start to increase.

$$EGT = 100 \times \frac{\delta(VA t) + \delta(VA t - 1)}{2\delta(EMP t)} - 100$$

Presented formula defines “employment growth threshold” (EGT) and reflects (year-on-year) changes in employment in time t related to changes in value added (real gross value added extracted from national accounts) in time t and $t-1$ (as employment tend to react to output changes with a time delay). The results of comparison with other economies in the region as well as leading economies are shown in Figure 1.

Figure 1 Employment growth threshold in selected countries, 1997 - 2010



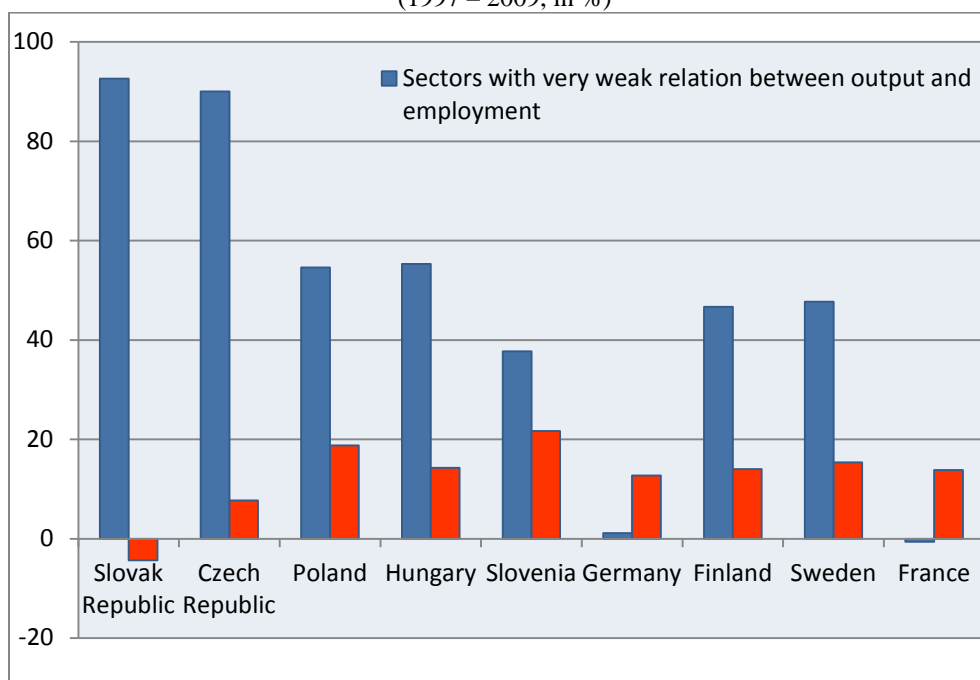
Source: Own calculations based on Eurostat data.

In CEE countries the values for EGT are markedly higher than in selected developed countries – it is an outcome of strong productivity increases. This phenomenon is typical for economies that find themselves in the stage of productivity gap overcoming, when economy with low initial level of capital capacities is able to grow at solid pace without increases in the number of employed (Solow-Swan growth model). In case of Slovakia, the existence of productivity gap can be confirmed by comparing the data for hourly labour productivity (labour productivity in the Slovak economy grew cumulatively by 21 % between 2005 and 2011; Morvay, 2012). As Kapsos (2005) says, in CEE countries we could have observed a rapid decline in labour intensity values after 1999 (in these countries the productivity grew at the expense of employment growth after collapse of the Soviet Union).

As it can be seen in the Figure 1, EGT in the Slovak economy is especially high, even when compared to other economies in the region. In

average (during 1997 – 2010 period), the Slovak economy needed to grow at least at 4.2 % rate to achieve increases in employment. When decomposed by sectors of the economy (the SR), we have found out that extremely high values were recorded in industrial production sectors (10 % in average). We compared the EGT values for individual sectors as well as contribution of sectors to value added increases and the results showed that the industrial sectors with above average values of EGT contributed to the economic growth (value added) the most. The comparison with selected countries is shown in Figure 2.

Figure 2 Share of selected sector groups in cumulative increase of real GDP (1997 – 2009, in %)



Note: Sectors with weak relation between output and employment: those with EGT in interval 2 to 3.5.

Sectors with very weak relation between output and employment: those with EGT above 3.5.

Source: Own calculations based on Eurostat data.

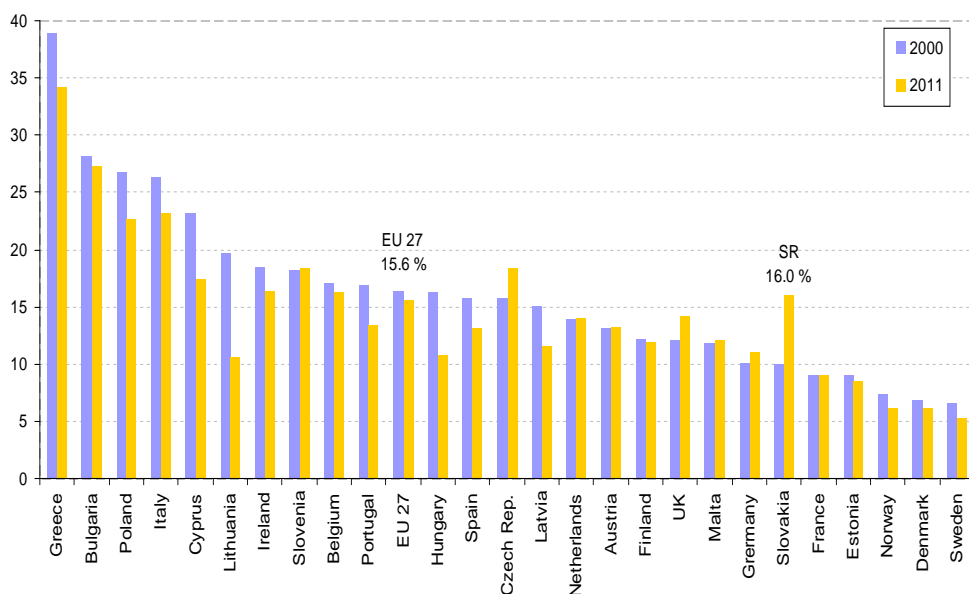
The growth of the Slovak economy in examined period has been pulled predominantly by the sectors with poor arrangement between economy output and employment rather than labour intensive sectors. In the past period, the structural change in economy towards higher capital intensity brought steep growth in productivity (and high economic growth rates), but was not in accordance with the labour market needs. If the next stage of development is related to expansion of “human development services” sectors (education, healthcare, social services, culture, etc.), it

would help the labour market to adjust better. As a result, we have been witness to increasingly more complex segmentation of the labour market, more diverse composition of work arrangements and more diverse structure of incomes. Increasing diversification and segmentation of the labour market represent a serious challenge for policy makers (when designing labour legislation or tax regulation at the background of various groups with diverse interests).

Consequences of weak relation between output and employment

The nature of economic growth in Slovakia with its extremely low labour intensity contributed not only to (naturally) very low rate of total employment (which lagged behind the EU average almost at a constant extent), but also to an atypical structure of income and atypical relation between standard employment and self-employment. At the background of above mentioned, the position of disadvantaged groups at the labour market is getting worse.

Figure 3 Change in share of self-employment in total employment (2000 and 2011, in %)



Source: Based on Eurostat data.

Over one decade, the share of self-employment in the total employment has doubled in Slovakia, even though this share in the EU average stayed almost constant during the same period. The expansion of self-employment was observed also in the Czech Republic and the Great Britain, but not in such extent. The increase of self-employment share at the

expense of regular employment contracts in Slovakia could be assessed as the substitution of contract work by self-employment. This substitution was typical for recession period (and early post-crisis period) from the obvious reasons, but in case of Slovakia, this trend wasn't invoked by the crisis, it has persisted from the past years (before crisis), the crisis only intensified this substitution. On the one hand, increasing share of self-employment was a consequence of overcoming the initially low level of this kind of employment in the past in Slovakia; on the other hand, it was a result of compensation for low labour elasticity.

The other remarkable trend related to such development was unusual combination of economic level development and wage share (the share of compensation of employees in gross value added in current prices). Better economic performance normally comes with higher wage share, in Slovakia, it came with its decline. Lower wage share has obvious implications for households (consumption, domestic demand etc.) and related atypical position of mixed income (the share of gross mixed income in gross value added was increasing b. o. thanks to expansion of self-employment) has implications for the public finance. Technology and structural changes during the period of overcoming the economy's undercapitalization play in favour of higher incomes from entrepreneurial activities at the expense of employees incomes. When looking at the other CEE countries, in Slovakia the wage share was the lowest in "growth" period (2005-2007), but the increase in employees' compensations in the "stagnation" period (2009-2012) was the highest. It might be explained by the fact that the development during stagnation period was mitigated thanks to initially very low wage share during the favourable economic era.

Difficult situation at the Slovak labour market makes disadvantaged groups of persons unemployable. Persons who have never had a job represent in Slovakia 20 to 25 % of total unemployment in a long run, unemployment rate of young people (younger than 25 years) reaches above 30 %, unemployment rate of low-qualified persons (ISCED 0-2) oscillates between 40 – 50 %, which makes Slovakia European leader in this point in a long-run (between 2000 and 2009 average difference between SR and second-ranked country in low-qualified unemployment was incredible 18.3 p. p., difference between the SR and the EU average was 33.6 p. p.). Long-term unemployment counts for two thirds of all unemployment, of which persons unemployed for more than two years represent almost 50 % of total unemployment (Slovakia's leadership in the EU in this context lasted ten years: 2002 – 2012).

Conclusion

Labour market was the last segment of the Slovak economy where the recession consequences preserved at longest, long after the economic growth has been restored. In the last quarter of 2010, after two years of decline, a slight increase in employment occurred. In the mid-2013, the employment declined again, reflecting worsening of the overall macroeconomic situation in the precedent months (“the second wave” of the crisis). The final stagnation of employment in 2013 was replaced by unexpected size of employment recovery in 2014. The relation between economic growth and employment growth seen for long period before the crisis has been disrupted – the employment growth threshold of app. 3 - 4 % (of output growth) was no more needed to invoke increase in employment.

Returning back to the growth trajectory with the same character of labour intensity could put the break on the potential employment growth – presuming that the economic growth rates will be lower than in the pre-crisis period, with the similar employment elasticity, the growth in employment will be threatened. The policy makers should be aware of supporting employment in past structure; in fact, they cannot increase employment elasticity or wage share directly. However, economic policy can partially influence structural characteristics of growth: by promoting desired sectors of economy (in this case, labour intensive sectors). Some studies suggest that structural policies aimed at labour (and product) market flexibility and reducing government size may have a positive effect on employment elasticity (Crivelli, Furceri, and Toujas-Bernaté; 2012).

In Slovakia, continuous existence of „dual economy“ (highly productive sectors ruled by major foreign companies and slower sectors attended mostly by domestic firms) deepens the problem – high productivity sector observe and adopt behaviour of low productivity sectors (high productivity FDI's exhibit 2.2 times higher productivity, but only 20 % higher wage level). However, weak relation between output and employment growth and related low wage share might have been a temporary effect of mentioned catching-up process; other countries in similar economic development stage have similar experience. The new circumstances of the post-crisis period may create an opportunity to begin a process of structural change – it seems that recent economic growth (since the end of 2013) obtained the new characteristics. While speed-up of GDP growth was in accordance with the expectations, some attendant factors have changed. The compensation of employees raised their share in value added in unexpected extent. The structure of incomes in 2013 – 2014 has changed, and the trend has been confirmed in the first quarter of 2015 as well. As the new tendencies have been occurring for 9 quarters so far, they cannot be assessed as a short-term swing. The Ministry of Finance published a study (Habrman,

2015), according which the reaction of employment in the post-crisis era is not only longer (employers use changes in amount of working hours rather than in number of workers to adjust to the short-term instabilities), but also twice that strong. It means that the growth rate of 1.5 % (instead of previous 3 – 4 %) will be sufficient to invoke increases in employment. It is related to changes in demand, as well as shifts in the pillars of recent growth (towards higher share of the service sectors).

Acknowledgement::

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SILENCE IN ORGANIZATIONS AND PSYCHOLOGICAL SAFETY: A LITERATURE REVIEW

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Abstract

In the business world, employees can contribute with information, ideas, concerns, opinions and proposals to their managers in respect of: (1) the way work could be performed, (2) what should / should not be done in the workplace, (3) how a particular decision can be implemented, and (4) how an organizational policy should be formed and executed (Rego, 2013). However, due to a diverse set of factors, employees often choose to remain silent in the workplace. One of these factors is psychological safety, which describes employees' perceptions of the consequences of taking interpersonal risks in the workplace (Edmondson, 2014). The following paper is essentially a literature review and its aim is to, firstly, make a brief approach to factors reported in the literature that may affect employee voice and silence, followed up by an explanation of the types of silence that can be engaged by employees. Besides that, the authors will also make an approach to physical and psychological safety. Lastly, it will be reported some links, mentioned in the literature, between employee silence and psychological safety.

Keywords: Employee silence, organizational silence, employee voice, upward communication, psychological safety

Introduction

Organizational silence and employee silence are subsets of a diverse range of behaviors that involves employees decision to communicate (expressive communicative choices) or to not communicate (suppressive communicative choices), such as issue selling to top management, principled organizational dissent or the MUM effect (Hewlin, 2003 cited by Tangirala

& Ramanujam, 2008); (For a further understanding, see Brinsfield, Edwards & Greenberg, 2009; Brinsfield, 2009; LePine & Van Dyne, 1998; Van Dyne, Ang & Botero, 2013; Tangirala & Ramanujam, 2008; Morrison, 2011).

In addition, researchers have defined employee silence as a multifaceted construct (Van Dyne *et al.*, 2003). That is, it may include a variety of topics, be adopted and directed by and for many people, involve different types of communication and communication channels and comprehend different withholding of information (see Brinsfield, 2009). Being such a broad construct, the authors adopted the most commonly definition reported in the literature, which addresses employee silence as the omission of work-related opinions, information about problems, concerns and suggestions, derived from a conscious decision taken by the employee (Morrison & Milliken, 2000; Tangirala & Ramanujam, 2008; Pinder & Harlos, 2001; Van Dyne *et al.*, 2003). Therefore, the definition of employee silence adopted in the following paper does not describe unintended failures to communicate, which can result from having nothing to say (Van Dyne *et al.*, 2003). Similarly, in this paper the authors not only restricted the definition of employee silence to face-to-face communication, but they also restricted their study to informal, ascending and internal silences, in particular, acquiescent, defensive, prosocial /relational, diffident and deviant silences, being the target of them the direct supervisor.

Factors that may lead to employee voice and silence

In order to do a better framework of the relation between employee voice and silence and psychological safety, the authors decided to do a brief approach to some factors identified in the literature that may influence employees decision to speak up or to remain in silence (for a better understanding, see Morrison, 2014; Ashford, Sutcliffe and Christianson, 2009; Kish-Gephart, Detert, Treviño & Edmondson, 2009; Detert & Edmondson, 2011; Milliken & Morrison, 2003; Morrison & Milliken, 2003; Tangirala & Ramanujam, 2008; Edwards, Ashkanasy & Gardner, 2009).

The first factor mentioned in the literature is the existence of a latent voice opportunity, that is, employees must be aware of the existence of problems or opportunities. Similarly, they may also have ideas, concerns, or a particular perspective that may be relevant or important to be shared (Miceli, Near & Dworkin, 2008; Pinder & Harlos, 2001; cited by Morrison, 2014). A second factor is voice efficacy, that is, employees' perceptions about the impact of their voices in the decision-making process. Another factor that may affect employees' decision to speak up are emotions, that is, employees can be in a situation involving a large intensity of negative emotions, leading to a "short-circuiting" of systematic processing (Kish-Gephart et al, 2009;. cited by Morrison , 2014). For example, if an employee

experience anger due to his boss, that employee can respond automatically, without any careful consideration of the pros and cons of speaking up (see Morrison, 2014; Kish-Gephart et al, 2009; Edwards *et al.*, 2009).

Moreover, speaking up can also be the result of unconscious processes, employees' desire of achieving positive and relevant results for themselves, or it can also be driven from employees' personal identity (see Morrison, 2014).

Another dimension that has been identified in the literature as relevant for speaking up and that will be portrayed in this paper, is related to the safety dimension: that is, employees' likelihood of engaging in voice may increase as their perceptions with regard to a better voice efficiency and safety increase, and vice versa. If employees perceive the lack of the safety component associated with speaking up, resulting in a possible harm to their image, they may feel afraid of engaging in voice, because if they challenge the current or past organizational practices or if they highlight a serious problem, they may: be labeled as troublemakers or as complainers, losing the respect and support of others; subject themselves to get a bad performance evaluation, not receiving a possible promotion; or put themselves at risk of being fired (Detert & Trevino, 2010; Grant, 2013; Milliken & Morrison, 2003; cited by Morrison, 2014; Ashford *et al.*, 2009; Adler-Milstein, Singer & Toffel, 2011). Furthermore, if employees decide to speak up they can also put their colleagues in trouble (Morrison, 2014). Thus, to avoid any social discomfort due to the transmission of bad news and to provide a harmonious environment, employees often withhold information, giving rise to the MUM effect (Morrison, 2014).

Besides the role of the existence of a latent voice opportunity, voice efficacy, unconscious processes, employees' desire of achieving positive and relevant results for themselves, or employees' personal identity, on employee voice and silence, the literature also mentions possible motivators and inhibitors that can be taken into account by the employee in his decision of speaking up or remaining at silence (see Table 1).

	Motivators	Inhibitors
Individual dispositions	Extraversion Proactive personality Assertiveness Conscientiousness Duty orientation Customer orientation	Achievement orientation
Job and organizational attitudes and perceptions	Organizational identification Work-group identification Felt obligation for change Job satisfaction Role breadth Control or influence Organizational support	Detachment Powerlessness
Emotions, beliefs, and schemas	Anger Psychological safety	Fear Futility

		Image or career risks
Supervisor and leader behavior	Openness Consultation Leader-member exchange Transformational leadership Ethical leadership Leader influence	Abusive leadership
Other contextual factors	Group voice climate Caring climate Formal voice mechanisms	Job and social stressors Climate of fear or silence Instrumental climate Hierarchical structure Change-resistant culture

Table 1: motivators and inhibitors of employee voice and silence
Source: Morrison (2014)

Types of silence that can be engaged by employees

There are different types of silence, as summarized in table 2, which differ among themselves based on employees’ motive. However, as stated previously, our study will be restricted to acquiescent, defensive, relational, diffident and deviant silences, not including, for example, the instrumental silence (employee remains in silence with the aim of generating a good impression of him on the boss and to get rewards) or the ignorant silence (employee remains in silence due to no knowledge of the matter).

Employee silence - Intentional withholding of ideas, information or opinions related to the workplace	Type of behavior Employee’s motive
Acquiescent silence (Pinder & Harlos, 2001) - Intentional withholding of ideas / opinions / suggestions due to resignation and to low decision-making capacity.	Resignation Resulted from resignation; Feeling of inability to make a difference
Defensive Silence (Pinder & Harlos, 2001) - Withholding of information and problems based on fear - Withholding of facts for self-protection, with the aim of not being penalized or reprimanded by the boss.	Self-protection Resulted from the fear of consequences
Prosocial/relational silence - Withholding of confidential information, based on cooperation. - Protecting proprietary knowledge to benefit the organization.	Cooperation and assistance Willingness to cooperate and help
Deviant silence - Employee remains in silence in order to make their superior or colleague to decide wrong.	Evil intentions
Diffident silence Brinsfield (2013) Composed by insecurities, self-doubt and uncertainty in respect of a situation and to what to say. This kind of silence may result from the fear of suffering embarrassment or losing the job.	Timidity

Table 2- Types of employee silence
Built from: Van Dyne *et al.* (2003); Rego (2013); Brinsfield (2013)

Next, it will be made a brief explanation of the different types of silence found by the authors in the literature.

Acquiescent silence

Having regard to Pinder and Harlos' study (2001, cited by Van Dyne *et al.*, 2003), Van Dyne *et al.* (2003, p. 1366) defined acquiescent silence as "withholding relevant ideas, information, or opinions, based on resignation". Being acquiescent silence a form of inaction (Kahn 1990, cited by Van Dyne *et al.*, 2003) it is more passive than active.

Employees who choose this kind of silence are conformed to the context where they live in and are not willing to make any effort to speak up, get involved in, or to try to change their current situation (strongly rooted resignation). For example, an employee may withhold his ideas, because of the belief that speaking up is pointless and would not make a difference. On the other hand, the employee may keep his opinions and information to himself, believing that he holds little influence to change his current situation (Van Dyne *et al.*, 2003).

Defensive silence

Suggested by Pinder and Harlos (2001, cited by Van Dyne *et al.*, 2003) defensive silence describes the withholding of ideas, information and opinions as a form of self-protection, based on fear. Defensive silence is an intentional and proactive behavior, intended to protect the employee from external threats (Schlenker & Wigold, 1989; cited by Van Dyne *et al.*, 2003). Moreover, defensive silence has a more proactive nature, it is conscious and involves the reflection of alternatives before being adopted. In this type of silence, there's a conscious decision of withholding ideas, information and opinions, as the best strategy for the moment.

More recently, Gephart-Kish *et al.* (2009) suggested that defensive silence should be categorized with regard to the level of fear experienced by the employee (low-high) and to the amount of time employee has to take action (short-long). The aim of table 3 is to make a brief summary of the existing types of defensive silence.

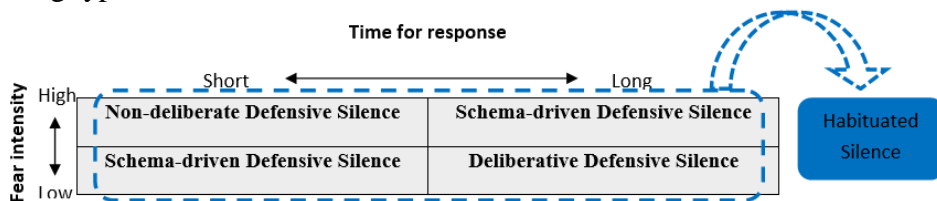


Table 3- Types of defensive silence
Adapted from: Kish-Gephart *et al.* (2009)

Non-deliberate defensive silence

Gephart-Kish *et al.* (2009, p. 171) define this subcategory of defensive silence (upper left corner of the table) as “an automatic, nonconscious psychological retreat from a high threat severity voice situation that allows little time for a response”. For example, an employee might begin to speak up to a manager and, unexpectedly, finds out the manager is angry. Consequently, the employee can experience a high intensity of fear, not communicating what he meant to say, leading to non-deliberative defensive silence (Kish-Gephart *et al.*, 2009).

Schema-driven defensive silence

Kish-Gephart *et al.* (2009) suggest in this kind of defensive silence employees are aware of their intention to remain in silence, but have not yet decided exactly what to do. This can happen in two occasions. The first one occurs when employees experience a high level of fear in situations where they still have time to decide (upper right corner of the table). For example, after finding a flaw in a new project led by his leader, if the employee perceive communication as highly threatening (due to the fact he had a bad experience with his leader's temperament in the past), he is more likely to remain in silence. The second situation (lower left corner of the cell) occurs when the employee experiences a low level of fear and a need to give an immediate response. For example, an employee may experience a low level of fear when he finds out, on a meeting, he has a suggestion to propose, however, due to lack of time to deliberate, that employee is likely to remain in silence, believing that it is better to be safe than sorry (Kish-Gephart *et al.*, 2009).

Deliberate defensive silence

Deliberate defensive silence (lower right corner of the table) is driven from an employee's deliberate and conscious choice in order to protect himself in a potentially dangerous situation. This kind of silence occurs in situations that meet a low intensity of fear and enough time for the employee to make a decision. For example, an employee may experience a low level of fear when he reflects on going to talk to the boss about suggestions for improvement. In this situation, the employee has time enough to deliberately and consciously determine the costs and benefits of speaking up (in case he wants to), to consult others and to evaluate different strategies instead of speaking up (Kish-Gephart *et al.*, 2009).

Habituated silence

In the long run, the three types of silence previously discussed may lead to habituated silence. According to Kish-Gephart *et al.* (2009, p. 172),

habituated silence "results from humans' natural tendency to develop safety-oriented avoidance behaviors to reduce fear by minimizing exposure to threatening situations that might trigger fear". For example, for an individual who developed fear of talking openly to his leader due to a past negative experience, he is unlikely to check again if there are still threats by speaking up (contributing, that way, for the climate of silence) (Kish-Gephart *et al.*, 2009).

Prosocial / relational silence

Derived from the organizational citizenship behavior literature (OCB), Van Dyne *et al.*, (2003) defined prosocial silence as the withholding of ideas, information and opinions related to the workplace, in order to benefit the organization and its members. Thus, this type of silence is based on altruism and cooperative motives, not being controlled by leadership. Moreover, in contrast of defensive silence, the use of prosocial silence is motivated by the intention of protecting others, rather than by fear of receiving negative outcomes for the "self" (Van Dyne *et al.*, 2003). For example, an employee can show other-oriented behavior and cooperation by preserving proprietary knowledge for the benefit of the organization. That is, an employee can have an opinion regarding to an important decision and not be in a position of discussing it with other individuals (Van Dyne *et al.*, 2003).

However, Brinsfield (2009, 2013) after trying to find explanatory reasons for employee's choice of remaining in silence at the workplace, found out that only 3 of 574 reasons given by the respondents pointed to prosocial silence. Given the fact most of the reasons given by them had a more relational nature, Briensfield (2009) suggested that prosocial silence is the result of a misunderstanding, renaming that type of silence as relational silence.

Deviant silence

Deviant silence is a kind of destructive deviant behavior in the workplace. According to Rego (2013) in deviant silence employees remain silent in order to lead their superiors or colleagues to decide wrong.

Employees' adoption of deviant behaviors is a common problem in organizations and can be categorized into two categories: constructive deviant behaviors or destructive deviant behaviors. Besides deviant silence, theft, workplace aggression and sabotage are included in destructive deviant behaviors and the aim of them is to hurt the organization and its members (Ahmad & Omar, 2014).

According to Ahmad and Omar (2014), the interest around the deviant behaviors in the workplace is due to the negative impact of this kind

of behaviors on organizations and individuals. That is, deviant behavior in the workplace can cause to employees stress, lower productivity and lower commitment, increasing the levels of turnover and absenteeism (Hoel & Salin, 2003; Keashly & Jagatic, 2003; cited by Ahmad & Omar, 2014). Consequently, all of that will result in financial costs to organizations.

Diffident silence

Diffident silence was mentioned in Brinsfield's studies (2009, 2013) and it involves employees' insecurities, self-doubt and uncertainty in respect of a situation and to what to say. In addition, Brinsfield (2013) also refers that there may be an overlap between diffident silence and defensive silence, since in both types of silence the employee tries to avoid negative outcomes for himself. Diffident silence may be a form of passive behavior, which is characterized by a shy and withdrawn body posture (Rego, 2013). The person finds difficulty in defending her own interests, to communicate her thoughts or to show disagreement. This situation may encourage others to take advantage and to disregard her. Consequently, that person may feel misunderstood, believing that "others should know where they can get".

Lastly, passive behavior may result in the loss of individual's self-esteem. Furthermore, the person that engages in that kind of behavior may not be respected and may feel guilty of acting that way. In addition, individuals may experience anxiety, depression, feeling of lack of control and loneliness (Loureiro, 2011).

Literature review on Psychological Safety

In order to make a better framework of psychological safety and taking into account the high similarities between physical and psychological safety constructs, firstly, the authors will make a brief approach to the physical safety literature, followed up by an analysis of the psychological safety literature, giving greater focus to psychological safety at the individual-level research.

The Physical Safety construct

Most of the interest around the physical safety construct in organizations is due to the aim of reducing the number of accidents at the workplace and its consequences (Zavareze & Cross, 2010). The literature on physical safety suggests that organizations that have implemented a good proactive functional safety management, will be less likely to experience work-related accidents (Wright & Marsden, 2010; cited by Ek, Runefors, Burell, 2014). In other words, the physical safety management is a management system in which formal safety practices are established and responsibilities are documented (Ek et al., 2014), with the aim of reducing

possible accidents and to keep them under control (Rosness, Blakstad, Forseth, Dahle & Wiig, 2012).

Besides that, physical safety has links to Maslow's work (1943, cited by Schepers, Jong, Wetzels & Ruyter, 2008), particularly to his hierarchy of needs theory. According to the author, the sorting of different motivational needs, conceptualized in a pyramid model, implies that the satisfaction of higher needs is only possible when the lower needs have been already satisfied. In other words, a particular need is only replaced by the following one, in the ascending hierarchy, when satisfied. Safety needs appear at the second position from the bottom of the hierarchy, being preceded by physiological needs (e.g. hunger and thirst), which are more primitives. As reported by Maslow, people need a safe environment to work effectively (Feldman, 2001).

After having satisfied their physiological needs, individuals strive to protect themselves from physical or mental threats. Only after satisfying those basic needs, individuals will be able to pursue higher needs, such as love/belonging, self-esteem and self-actualization. Thus, taking into account Maslow's hierarchy of needs theory in the organizational context, employees need a safe working environment to be able to motivate themselves to reach higher needs (Schepers *et al.*, 2008).

Physical safety has been receiving some attention in the organizational behavior literature. For example, Zohar (2000, cited by Schepers *et al.*, 2008) demonstrated empirically that the greater the safety perceived by an individual, the smaller the amount of damage inside the working unit. However, mental safety dimension (psychological safety) has only received some attention only very recently (May *et al.*, 2004; cited by Schepers *et al.*, 2008). That is, most of the studies about safety science that the authors have accessed are about physical safety. Only more recently researchers have been giving more attention to the psychological safety issues, which may be related, for example, to risk management in decision-making, uncertainty, organizational change and organizational stress.

The Psychological Safety construct

Nowadays, much work in organizations is done collaboratively, involving sharing of information and ideas, coordinating tasks and integrating perspectives (Edmondson, 2003), that is, the need for work specialization, require people to work together to achieve organizational goals. However, the interdependence between team members is not always easy, since some individuals work well together while others have difficulties in doing so (Hackman, 1990; cited by Edmondson, 2003).

Psychological safety is taken here as corresponding to employees' perceptions about the consequences of taking interpersonal risks in the

workplace, affecting their willingness to "express themselves physically, cognitively and emotionally during role performances", instead of defending "their personal selves" (Kahn, 1990, p. 694; cited by Edmondson & Lei, 2014; Edmondson, 1999). In other words, psychological safety refers to the employee's belief that his team (supervisor and colleagues) won't embarrass, reject or punish him in case he decides to engage in voice (Edmondson, 1999), that is, in case he decides to ask something, ask for feedback, to report a bug or to propose a new idea (Edmondson, 2003; Detert & Burris, 2007; cited by Liang, Farh & Farh, 2012). Thus, when employees feel free of fear about expressing their points of view, their concerns about possible negative outcomes resulting from speaking up will be minimized, making them more likely to engage in voice and vice versa (Zhao & Oliveira, 2006; Ashford, Rothbard, Piderit & Dutton, 1998; Edmondson, 1999; Kahn 1990; cited by Liang *et al.*, 2012; Passos, Silva & Santos, 2011).

On the other hand, Brown and Leigh (1996, cited by Baer & Frese, 2003) added to Kahn's psychological safety approach (1990, cited by Baer & Frese, 2003 and by Schepers *et al.*, 2008) employee's feeling that it is safe for him to be himself without suffering negative outcomes for his self-image, status and career.

In addition, psychological safety does not imply a cozy environment where individuals are close friends or the absence of problems and stress. Rather it describes a climate focused on productive discussion to stimulate problem prevention and to achieve goals (Edmondson, 2003).

Psychological safety at three levels of analysis

Psychological safety has been categorized in three levels of research: the individual, group and organizational levels. For the following paper, the individual-level research is the one that best suits.

In general, there are many similarities between the outcomes of the three different levels. First, in all three levels, psychological safety is crucial for the learning and changing behaviors in organizations, which is the main reason given in the literature for the growing interest around the psychological safety construct (Edmondson & Lei, 2014). Another consistency among the three levels of research is the attention given to performance as a dependent variable, that is, the three levels of psychological safety research suggest the existence of a significant relation between psychological safety and performance (Edmondson and Lei, 2014).

However, there are also differences among them, that is, in contrast to the other two levels, individual-level research has also focused on other constructs, such as work and organizational commitment. In addition, individual-level research has also established links between psychological safety and in-role and extra-role behaviors (Edmondson & Lei, 2014).

Psychological safety at the individual-level research

With regard to psychological safety at the individual-level research, the literature addresses it from two points of view: psychological safety influence on in-role and extra-role behaviors. On other words, behaviors that are expected from the employee but not always played vs. behaviors that are performed voluntarily by the employee, for the good of the collective.

In role-behavior

The literature on in-role behavior also examines the relationship between individual's perceived psychological safety and work engagement (commitment and knowledge sharing).

Regarding the possible influence of psychological safety on commitment, Kark and Carmeli's study results (2009) suggest that a good employee's perceived psychological safety induces feelings of vitality (which encompasses the belief of being alive and fully functional, vigor and zest) which, in turn, enhances creativity (development of new and useful ideas or solutions to address existing problems).

Relatively to the psychological safety influence on knowledge sharing, Gong, Cheung, Wang and Huang (2012), suggested that proactive employees seeking for change, more often, share information with their colleagues and the relationship between information exchange and creativity is affected by trust (similar construct to psychological safety).

On the other hand, Siemsen, Roth, Balasubramanian and Anand (2009) argued that psychological safety is an important antecedent of knowledge sharing between co-workers, and suggested that the relationship between psychological safety and knowledge sharing is moderated by the level of confidence that employees have on the knowledge to be shared. Thus, the greater the confidence, the smaller the role of psychological safety as a stimulus for knowledge sharing.

Extra-role behavior

Next, the authors will approach the impact of psychological safety in extra-role behaviors, in particular on employee voice.

As discussed earlier, the literature has shown that employees' perceptions about psychological safety have a significant impact on speaking up (Detert & Burris, 2007; Wembhard & Edmondson, 2006; cited by Cheng, Chang, Kuo & Lu 2014). That is, if employees realize that negative outcomes may result from their decision of speaking up, they will be reluctant to communicate their constructive points of view (Detert & Burris, 2007; cited by Cheng *et al.*, 2014).

Similarly, Walumbwa and Schaubroeck (2009, cited by Edmondson & Lei, 2014) suggested that ethical leadership influences employee voice,

being that relationship partly mediated by employee's perceived psychological safety (Edmondson & Lei, 2014; Liang *et al.*, 2012).

Moreover, Liang *et al.* (2012), approached employee voice in a different perspective of the current literature, by categorizing it into two groups: promotional voice and prohibitive voice. They also tried to establish links between these two categories of voice and three psychological antecedents (psychological safety, felt obligation for constructive change and organizational-based self-esteem). Similarly, Liang *et al.*, (2012, pp. 74-75) defined promotional voice as "employees' expression of new ideas or suggestions for improving the overall functioning of their work unit or organization". On the other hand, prohibitive voice was defined as describing "employees' expressions of concern about work practices, incidents, or employee behavior that are harmful to their organization". The results of the study suggest that psychological safety is strongly related to prohibitive voice by reducing employees' perceived risks of speaking up.

Furthermore, with the aim of understanding why employees, sometimes, remain silent at work, through a series of studies, Detert and Edmondson (2011) investigated implicit voice theories (also known as IVTs), and they identified five IVTs: fear that a suggestion will be taken as criticism, concern with speaking up to bosses in the presence of others or not wanting to embarrass bosses, a need to have solid data or polished ideas and a fear of negative career consequences for speaking up. In their study, Detert and Edmondson (2011) found that psychological safety may be negatively correlated with the strength of IVTs.

Finally, according to Brinsfield's study (2013), psychological safety may be negatively related to the defensive, relational and diffident silences, not being related to acquiescent and deviant silences because, as stated below, if employees feel free to express their ideas without running the risk of being penalized, they will be more likely to speak up rather than adopting the previous types of silence.

Summary of psychological safety at the individual-level research

Next, the authors will make a brief summary of the relations between psychological safety at the individual-level research and other constructs (see figure 1). Thus, as it can be observed, in-role behaviors (engagement and knowledge sharing) and extra-role behaviors (speaking up) can be affected by some variables: for example, leaders' behavior (such as the adoption of ethical leadership) can influence employees' decision of adopting the previous behaviors, being that relation influenced by psychological safety. In addition, the authors underline the possibility of employee voice be affected by implicit voice theories (IVTs), being a good psychological safety mitigating those effects. However, it is also important to highlight that

employee's in-role and extra-role behaviors adoption may be moderated by the level of confidence in knowledge, that is, the higher the level of confidence, the smaller may be the role of psychological safety. On the other hand, the authors recall that proactive employees may adopt in-role and extra-role behaviors more often, being that relation affected by trust.

Subsequently, a good level of voice, engagement and knowledge sharing may result in the improvement of individual's levels of creativity.



Figure 1 – Relationships between psychological safety at the individual-level research and other constructs.

Source: Edmondson and Lei (2014).

Conclusion

As stated below, literature has shown that employees' perceptions regarding the psychological safety have a significant impact on speaking up. That is, if employees realize that potential costs may result from their decision of speaking up, they will be reluctant to show their constructive point of view, due to fear of suffering personal and interpersonal negative outcomes (Detert & Burris, 2007; cited by Cheng *et al.*, 2014; Edmondson & Lei, 2014; Liang *et al.*, 2012; Detert & Edmondson, 2011; Morrison, 2014; Brinsfield, 2009, 2013).

Furthermore, it is pertinent to recall that according to Brinsfield's study (2013), psychological safety may be negatively related to the defensive, relational and diffident silences, because in a good psychological safety environment employees can be themselves, without fearing to receive negative outcomes in case they decide to express their suggestions, concerns, work-related opinions or information about problems to someone in a higher organizational position. As for the acquiescent and deviant silences, the authors believe that psychological safety does not exercise a prominent role on them, given that in the first one is related to voice instrumentality, while in the second one deviant silence adoption is due to deviant reasons related to the organizational world.

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THE INTERNATIONAL STANDARDS AND THE KAZAKHSTAN LEGISLATION IN THE SPHERE OF SOCIAL RESPONSIBILITY OF BUSINESS

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Abstract

Today social responsibility of business is recognized the major making long-term strategy of a sustainable development of the country. In this regard the considerable attention is paid to advance of ideas of corporate social responsibility, creating favorable conditions for socially responsible behavior of the enterprises. In 2008 at the first Forum on social responsibility of business, the head of state Nursultan Nazarbayev set qualitatively new level of inclusion of business in the solution of major problems of development of society and in this regard charged to continue work on formation of the favorable environment stimulating increase by subjects of business of corporate social responsibility. Signing in 2008 of the Agreement between the Ministry of Labor and Social Protection of the population of RK and the large companies on advance of the principles of the Global contract of the UN in the sphere of the social and labor relations became the important instrument of development of social responsibility of business. For the first time business structures assumed obligations for observance of requirements of national laws, the principles of 12 ratified Conventions of the International Labor Organization (ILO) which are directed on freedom of association and recognition of the right for the conclusion of collective agreements, elimination of all forms of forced labor, including, child labor, elimination of discrimination in the sphere of work and employment. Today in Kazakhstan many elements of world practice of maintaining corporate social responsibility are used.

Keywords: Business, social responsibility, Kazakhstan legislation, standards of OECD

Introduction

Social responsibility in any kind of business is difficult and ambiguous concept which causes various and is frequent even opposite judgments. By definition such responsibility consists in carrying out business and the account thus by the organization not only personal mercantile interests, but also public. That is the organization assumes a role of responsibility for improvement of welfare of society, and it not only improvement of quality of life of the workers, but also all modern society. Also such responsibility includes due positive impact on all subjects of business, including suppliers, customers, shareholders, employees of other enterprises and all other parties public business of the sphere.

For the last decades the social role of business, its influence on human rights, and therefore need and an obligation of the state to protect these rights from violations and its negative influence significantly increased. At the same time the number of campaigns and claims against business in connection with human rights violation increased (Introduction, 2014). The highest level of such violations – 28% - is observed in the Pacific Rim, the lowest – 3% - in Europe. Most of all from activity of the companies their employees and local communities long (for 45%); a share of end users among what rights are violated in connection with business actions, makes 10%. Most "harmful" are the extracting and retail trading companies.

Therefore the question is actual, what preventive and correcting measures of the state have to undertake to cope with these problems. At least, the states have to give methodical help to the companies, regarding a solution of the problem of negative consequences for human rights; to provide existence of extrajudicial and judicial remedies for citizens (workers, consumers, clients and interested parties) as whom business activity has an adverse effect; to integrate questions of business activity in aspect of human rights as the ministries and departments which interact with business and regulate business activity; and to seek to eliminate any possible gaps in regulation or policy which can disturb performance of their duty to provide protection against violation with business of human rights (The report, 2013). In a broader sense, the international organizations declare the requirement to the states to provide observance of the principle of the rule of law and acceptance of anti-corruption measures which are understood as the factor promoting a positive contribution of business to life of society and a sustainable development.

As for business, each company in each branch has duties in the field of human rights. The companies have to observe human rights, at least, without allowing tortures, discrimination, sexual harassments, to protect health and safety, to guarantee freedom of associations, creation of labor unions, a freedom of speech, personal privacy, etc. Achievement of the state

in the field of protection of human rights is adoption of the relevant legislation, introduction of the politician, distribution of voluntary initiatives, and also recognition of that the companies bear responsibility for observance of human rights. But these measures didn't provide full compliance with human rights from the companies. Therefore more careful checks, transparency, means of protection for victims and other mechanisms of the accountability that ensures more functioning for civil society, the governments, the international organizations, and also the companies are required. It has special value in the new and developing economies as the negative behavior often leads to an erosion of a favorable business environment. Due to the opening by these countries of own markets and arrival on them new foreign investments, there is a real opportunity for investors to introduce, from the very beginning, the behavior models promoting providing a sustainable development.

In June, 2011 Council for human rights of the UN approved the Guidelines of business activity in aspect of human rights (further – the Guidelines of the UN) developed by the Special representative of the UN Secretary General, professor John Ruggie. These principles are the international standard on which the policy of the state and business structures in aspect of business and human rights has to be based. The guidelines of the UN are developed for the purpose of their introduction, proceeding from three main frames (three-pillar Framework) – protection, observance and remedies (Protect, Respect and Remedy) which include:

1. An obligation of the state to protect human rights from encroachments of the third parties, including business.
2. Corporate responsibility to observe human rights.
3. Need of ensuring wide availability of effective remedies of legal protection with all state and non-state institutes to affected persons in case of violation by business of their rights.

The guidelines of the UN uniting in themselves 31 principles provide steps (measures) for the states promoting business structures to observe human rights; provide the plan of action for the companies how to operate risk from negative influence on human rights; offer a set of criteria for interested parties for an assessment of observance of human rights by business structures. It means that responsibility for creation of a healthy business environment lies on all participants of "process". The governments perform a duty to protect international recognized the law and to improve functioning of the markets through appropriate management, fair regulation and transparency.

The governments perform a duty to protect international recognized the law and to improve functioning of the markets through appropriate management, fair regulation and transparency. The enterprises bear responsibility for

observance of the principles of responsible behavior of business (corporate social responsibility) which has impact not only in the enterprise, but also on society in general. Workers and civil society have to be active and are structurally involved in process, and also to play a key role in providing the accountability. At the same time, the international organizations can serve as a forum for dialogue, mutual exchange of experience, establishment of standards, the analysis and providing recommendations about improvement of policy in this sphere.

Ways of integration of the Guidelines of the UN in the different countries can be the most different. The states can provide to the enterprises the general management (grant) about business and observance of human rights through, for example:

1) distribution of the Guidelines of the UN and mechanisms of their introduction;

2) legislation and other ways of administrative regulation.

Some states have a legislation which directly obliges business to respect human rights in certain spheres: discrimination, work, environment, corporate responsibility, property right and access to land resources, right for private life, consumer protection, corruption, etc.

The majority of the states develop the National plans and other similar documents directed on a formulation of comprehensive policy on introduction of the Guidelines of the UN and also analyze the existing legislation regarding existence of gaps and definition as far as it (legislation) is able to solve problems, arising in the sphere of business activity in aspect of observance of human rights (The report, 2013).

Concerning calls (problems) which complicate introduction and observance of the Guidelines of the UN, are that on a bigger measure arise in the developing states. Often treat such calls: shortage of effective sanctions in the legislation, mechanisms of implementation of precepts of law, judicial mechanisms of protection, resources, and desire to observe these principles.

Need of introduction and observance of the Guidelines of the UN in the legislation and practice of the Republic of Kazakhstan it is caused, first, by membership of Kazakhstan in this organization and a capture on itself the corresponding obligations, and secondly, the existing problem of negative influence of business on human rights in the conditions of the prompt economic growth of the country.

Besides, since fall of 2011 the Government of the Republic of Kazakhstan carries out active work on the entry of Kazakhstan into the Organization for Economic Cooperation and Development (OECD).

Membership in this organization gives opportunity of access to the best practice of public administration and introduction of the advanced standards, promotes increase of investment appeal of the country and

depreciation of attraction of financial resources abroad. Accession of the Republic of Kazakhstan to OECD assumes reduction of standards of the national legislation in compliance with standards of the organization.

One of such standards are the Guidelines of OECD for the Multinational Enterprises (The recommendation about responsible business in the context of globalization) (The guidelines, 2011). Besides, for Kazakhstan OECD prepared the review of a situation and the recommendation about introduction of the principles of responsible business (responsible business conduct) (Responsible, 2014).

In Kazakhstan human rights need protection, including against encroachments of the state. One of the serious reasons is the low level of awareness of citizens on the rights, mechanisms of their realization and protection, including about the Guidelines of the UN and OECD. Many enterprises still not up to the end understand degree of the responsibility while citizens can't understand what and how many resources are available to them to ensuring the rights.

Also the state should use the various tools motivating business to respect human rights. First of all, the principles of observance of human rights need to be introduced in activity of the state corporations. Observance of these principles needs to be made one of criteria at a choice of the contractor on execution of the state orders. One more way – to demand from the companies to specify in reports existence or absence the politician and strategy in the field of corporate responsibility.

As for the third group of the Guidelines of the UN – ensuring availability of effective remedies of legal protection – that their realization directly depends on efficiency of extrajudicial mechanisms of protection of the rights which functioning, in fact, is a little productive in Kazakhstan.

Thus, need of introduction of the Guidelines of the UN and OECD, as well as development of institute of responsible business in Kazakhstan is dictated by deeper integration into the world community, presidency in OSCE in 2010, the forthcoming accession to the World Trade Organization and OECD, and also with realization of a new political policy Kazakhstan till 2050 aimed at providing entry into number of 30 most competitive developed countries of the world (The message, 2012).

The countries which observe the specified principles, encourage a positive contribution which business can bring in a sustainable development and try to minimize potential difficulties in which business of structures can result activity (Introduction, 2014). They meet expectations of the states in understanding that such responsible business and help the enterprises will be convinced that their activity answers policy of the state.

The Main Results of the Research

Today the government of Kazakhstan carries out active work on the accession to the Organization for Economic Cooperation and Development (OECD). Kazakhstan seeks to receive the status of the constant observer in four committees of OECD (Committee on investments, Committee on policy in the fields of education, Committee on agriculture and Committee on the industry, innovations to business) that will give opportunity to develop and carry out more effective economic policy of the country. For obtaining such status, and also for accession of Kazakhstan to OECD it is necessary to satisfy the corresponding conditions and recommendations of this organization that includes reduction of the legislation of RK in compliance to standards of OECD.

It is known that in October, 2005 the review of OECD of Kazakhstan by results of which to the country 34 recommendations were made was carried out. These recommendations concern economic development of the country, and also development of new provisions and the legislation, for example, as the National plan of action in the field of business and human rights which will promote development of the state. Very important as for member states, and the states seeking to enter OECD observance and introduction in a state policy and practice of the Guidelines of OECD (The guidelines, 2011) for the multinational enterprises is

– the recommendations addressed by the governments to the multinational enterprises about standards of responsible behavior to which the companies have to adhere voluntary in such spheres as: transparency and disclosure of information, employment and labor relations, human rights, environment, fight against bribery and corruption, interests of consumers, competition and taxation. These principles are urged to provide activity of these enterprises according to policy of the governments for strengthening of a basis of mutual trust between the enterprises and societies in which they work to help to improve external investment climate and to raise a contribution of the multinational enterprises to a sustainable development (The guidelines, 2011).

It was already mentioned that in 2011 Council of the UN for human rights approved the Guidelines of the UN in the sphere of business activity in aspect of human rights which became the universally recognized norm directed on the prevention and elimination of negative impact of business activity on human rights. Following these principles, the state is obliged to protect human rights, to provide protection against human rights violations by the third parties, including the enterprises.

The guidelines of the UN formed the basis of the concept of the Guidelines of OECD which offer standards of conscientious practice according to the current legislation and world-wide recognized standards. In

the countries where internal laws and provisions contradict the principles and standards of the Guidelines of OECD, the enterprises have to look for ways to consider the principles and standards in full, but not to put them as opposed to the domestic legislation. For the Guidelines of OECD exact definition of the multinational enterprises isn't required. These enterprises work in all sectors of economy. As a rule, they represent the companies or other legal entities created in more than one country, and connected in such a way that they can coordinate in common the activity in the different ways.

It is also necessary to emphasize that the Guidelines of OECD are closely connected with standards and the principles of the ILO, including also those standards of Conventions of the ILO.

Provisions of the Guidelines of OECD, the Head (Section) V precisely displays the relevant provisions of the Declaration of the ILO of 1998 on the fundamental labor law and freedoms, and also the Tripartite declaration of the principles of the ILO of 1977 concerning multinational corporations and social policy (reconsidered in 2006). The declaration of the ILO of 1977 fixes the principles in the sphere of employment, training, working conditions, and also relations of production when the Guidelines of OECD cover themselves all main aspects of corporate behavior.

Concerning RK it should be noted that the sphere of responsible business (OVB – RBC – responsible business conduct) is one of priorities of a state policy. Testifies to it, as well as official statements of the President of Kazakhstan (in particular, the Message to the people of Kazakhstan. Strategy "Kazakhstan-2050", December, 2012), and increasing participation of business in support of the purposes of a sustainable development. Also the acceptance fact in 2012 Board of the Kazakh independent investment fund "Samruk-Kazyna" of the Program of social responsibility, which directed on the social and labor relations, training and development, providing safe working conditions, ecological safety, and also expenses of social projects is important (Responsible, 2014).

In January, 2008 at the Forum of social responsibility of business to Zhezkazgan the Head of state of the Republic of Kazakhstan Nursultan Nazarbayev founded annual competition on social responsibility of business "Paryz" for definition of a contribution socially oriented business of structures of Kazakhstan in advance of the principles of the Global contract of the UN in the sphere socially - the labor relations, moral encouragement of their efforts, demonstration of high efficiency of development of system of social partnership on the example of the best enterprises. The purpose of carrying out competition is stimulation of subjects of private business to the solution of social problems, both for the workers, and for society in general.

Also at the Forum between the Ministry of Labor and Social Protection of the population, socially oriented business by structures the

Agreement on advance of the principles of the Global contract of the UN in which the main indicators of internal and external social responsibility of business are defined is signed: compensation; protection and safety of work; vocational training, retraining, professional development; quota of employment of youth; obligatory preventive treatment of workers; conducting transparent business; system development and techniques of management of corporate ethics and social reporting. Today the Atameken Union, the Eurasian corporation of natural resources, the Union of producers and exporters of Kazakhstan, and also more than 1058 enterprises of the republic joined this Agreement National economic chamber of Kazakhstan.

Thus, the companies have essential obligations for implementation of acts of RK. Besides, OVB assumes the activity of business which is beyond the social obligations ordered by the law. And in this plan the role of state regulation is extremely important for the purpose of motivation and creation of conditions for manifestation of social responsibility of business.

Guidelines of OECD and legislation of RK

As the Guidelines of OECD fix standards of responsible behavior which the companies have to adhere voluntary in certain spheres, it is expedient to analyze as far as they are displayed in the legislation of RK.

II. General political policy

"The enterprises have to consider fully the established policy in the countries in which they work, and to consider opinions of other interested parties" (The guidelines, 2011).

Providing observance of this principle, the enterprises have to execute a number of requirements, namely:

1. To promote economic, ecological and social progress for the purpose of achievement of a sustainable development.
2. To respect international and recognized human rights concerning those people who suffered from their activity.
3. To encourage strengthening of local potential on the basis of close cooperation with local community, and also development of activity of the enterprises in the internal and external markets.
4. To encourage formation of the human capital, in particular, by creation of workplaces and assistance of vocational training for employees.
5. To abstain from search and acceptance of the exceptions which aren't provided by legislative or standard and legal base.
6. To support the good principles of corporate management.
7. To develop and apply the effective self-regulating practices and control systems which promote the relations of trust and mutual trust between the enterprises and societies in which they work.

8. To carry out educational work for workers, including by means of programs of training.

9. To abstain from discrimination or disciplinary actions concerning workers who submit conscientious reports on the practices contradicting the law, the Guidelines or policy of the enterprise.

10. To carry out a complex assessment of activity taking into account risks.

11. To avoid rendering an adverse effect on the questions relating to the Guidelines by means of own activity, and to eliminate such influence if it occurs.

12. To try to prevent or soften negative impact if it didn't promote such influence when influence is nevertheless directly connected with their activity, products or services, business relations. It isn't necessary to shift responsibility from the legal entity causing negative impact to the enterprise with which he does a business.

13. In addition to elimination of adverse effects to encourage business partners to apply the principles of responsible business compatible to the Guidelines.

14. To interact with the relevant interested parties for providing real opportunities for the accounting of the points of view concerning planning and decision-making on projects or other activity which can significantly affect local communities.

16. To abstain from any illegal participation in local political activity.

The legislation of RK fixes OVB bases in certain normative legal acts. These and other norms define "the general political policy" for the enterprises which work in Kazakhstan.

The labor Code of RK consolidated norms:

- the concerning developments of social partnership – system of relationship between workers, employers, government bodies – aimed at providing coordination of their interests concerning regulation of the labor relations (chapter 29 of Section 4 of the Code);

- the concerning conclusions of collective agreements, industry agreements between employers and workers (chapter 30 of Section 4 of the Code).

The law RK "About Private Business" of January 31, 2006 proclaimed the voluntary right of the businessman to apply in the activity of a measure of social responsibility of business by realization or participation in implementation of projects in social, economic and ecological spheres (article 8 of the Law). Social responsibility of business is defined as a voluntary contribution of subjects of private business to development of society in social, economic and ecological spheres (point 2 of article 1 of the Law) (The law about Private Business, 2006).

It should be noted one of very important problems in approaches to definition of the concept "social responsibility of business" (SOB) of the legislation to RK and its understanding in practice. Proceeding from legislative definition (point 2 of article 1 of the Law RK "About Private Business"), this concept as a rule, is associated with charity of the enterprises. Besides, it is unclear, whether such charity is voluntary, or it is obligatory. In practice deposits of the enterprises seldom are voluntary and investors often perceive OVB (SOB) as a charitable tax. For example, many enterprises in the extracting sector, according to the contractual obligations, are obliged to offer percent from their capital expenditure for social projects. These means come to management of the regional authorities (akimats) within budgets of regional development. Some enterprises have limited opportunities in a choice and implementation of such projects. It can result in difficulties in the ratio of these projects with corporate strategy of OVB as they can not correspond to risks which the enterprise identified (Responsible, 2014).

The documents which don't have legislative force, having advisory nature are state standards of RK which form regulatory base for the organizations seeking to improve the activity in the field of social responsibility. Treat such documents:

1. State standard of RK "Social responsibility. Requirements" (CT PK 1352-2005 (SA 8000:2001, Mod)) - is developed for advance of corporate values in questions of social employer's liability, promotes distribution of the requirements to social responsibility of the organization accepted on a global scale.

2. State standard of RK "Systems of management of professional safety and labor protection. Requirements" (CT PK 1348-2005 (OHSAS 18001:1999, mod)) - regulates policy and the purpose of the organization in the field of professional safety and labor protection and an assessment of its activity in this area, both the third-party organizations, and the organization.

3. The international ISO 26000:2010B Standard - contains the principles which are the cornerstone of social responsibility, recommendations about integration of socially responsible behavior into activity of the organization and about interaction with interested parties are made, and also the main subjects of social responsibility and expectation of interested parties recognized today concerning actions of the organizations are systematized (Ongarbayev, 2015).

III. Disclosure of information

"The enterprises have to guarantee granting timely and exact information on all vital issues, the concerning their activity, structure, a

financial position, results of activity, property and management" (The guidelines, 2011).

This information has to be open for the enterprise in general, and, if necessary, on activities or geographical areas. The policy of disclosure of information at the enterprise has to be adapted for character, the size and location of the enterprise, taking into account the accepted expenses, a trade secret and other competitive questions.

The principles provide types of information (information materials) which have to be opened. The list of such information isn't exhaustive and includes information materials on:

- a) to financial and operational results of activity of the enterprise;
- b) to the purposes of the enterprise;
- c) property on large equity stakes and votes, including on structure of group of companies and the relations in group, and also on control strengthening mechanisms;
- d) to policy of remuneration for board members and the main officials, and also information on board members, including qualification, selection process, the management in other enterprises and whether each board member independent of board is;
- e) to operations with the related parties;
- f) to the predicted risk factors;
- g) to the questions concerning workers and other interested parties;
- h) to structure and policy of management, in particular, contents of any code of corporate management or policy and their implementation.

Annual audit has to be booked by the independent, competent and qualified auditor to provide an external and objective guarantee to board and shareholders that the financial statements fairly reflect a financial position and results of activity of the enterprise in all essential relations.

This principle provides transparency of the enterprises for improvement of public understanding of their activity, and also their interaction with society and environment. More and more the enterprises understand importance of disclosure of information on the efforts to integrate social and ecological aspects of the activity into the business activities.

Disclosure and the reporting helps to satisfy need for transparency of business and increase in mutual trust between the enterprises and interested parties.

For Kazakhstan ensuring transparency still is a relative call. The enterprises have to play an important role in fight against opaque schemes which conduct to bribery and corruption. For the purpose of transparency increase, the Law on joint-stock companies (article 4-1, 79) (The law about Joint-stock Companies, 2003) of May 13, 2003 and the Law on accounting and financial statements of February 28, 2007 (The law about accounting,

2007) were added with requirements to provide (to open) corporate information in annual reports.

According to the Law "About Accounting and Financial Statements", annual accounting reports from the organizations of public interest and the large companies, in particular, in the extracting sector, have to be prepared according to the International Financial Reporting Standards (IFRS), statements have to be included the description of any conflicts of interests in these. Nevertheless, disclosure of information on non-financial information, for example, of social and ecological indicators, remains on a voluntary basis.

It should be noted that in October, 2013, the complaint was shown to Kazakhstan by the Initiative of transparency of the extracting branches (EITI) which is directed on assistance of transparency of the income in the oil and gas industry. It is the culmination of process which began in 2005 when the government, the enterprise (foreign and national) and civil society signed the Memorandum of Understanding (MU) obliging the parties to implement EITI. This obligation was underlined in 2010 in the Law "About a Subsoil and Subsurface Use" (article 76) of June 24, 2010 that obliges to satisfy all companies memorandum conditions, and also to confirm this performance in the auditor report. The new memorandum obliging the parties to implement EITI was signed on October 9, 2013. Such actions testify to the RK positive direction how OPB at the conceptual level is understood. It is important that disclosure and the reporting fit into broader efforts of OPB to make the contribution to a sustainable development and inclusive growth (Responsible, 2014).

IV. Human rights

"The states are obliged to protect human rights. The enterprises are obliged, within international and recognized human rights, the international obligations for human rights of the countries in which they work, and also the relevant national laws and rules, to respect human rights" (The guidelines, 2011).

Treat such obligations of the enterprises:

1. To respect human rights, that is they have to avoid infringement of human rights and other persons and have to consider negative impacts of human rights on faces with which they conduct activity.
2. Within the activity not to cause or promote negative impact on human rights and to prevent such influence when it happens.
3. To look for ways for prevention or mitigation of negative impact on human rights which results directly from their economic activity, production or services even if they don't participate in these consequences.
4. To pursue commitment policy to respect of human rights.

5. To carry out a complex inspection of human rights according to their volume, character and a context of activity and weight of risks of negative impact of human rights.

6. To provide or cooperate by means of lawful processes in restoration of negative impact on human rights where they define that they brought or promoted these influences.

The main guarantor of observance of social norms in the Republic of Kazakhstan is the Constitution of RK in which human rights on life are affirmed, freedom, inviolability of advantage, a freedom of speech and conscience, freedom of associations, etc. (articles from 12 to 23), and also the main obligations of business (article 24 of the Constitution of RK) which guarantee the right of everyone for freedom of work, a free choice of a kind of activity and a profession, the right for the working conditions meeting safety requirements and hygiene, on remuneration for work without any discrimination, and also on social protection against unemployment, prohibition of forced labor, recognition of the right for individual and collective labor disputes with use of the ways of their permission established by the law, including the right for a strike, a right to rest.

V. Labor and relations of production

"The enterprises have to, within the current legislation, rules and the developed labor relations, practice of employment and applicable international labor rules to respect the labor law of workers" (The guidelines, 2011)

This principle provides a number of requirements rules which have to observe the enterprises for the purpose of providing the labor law of workers, namely:

1. Concerning the right for association:

a) to respect the right of workers to establish or enter into labor unions and the representative organizations for their own choice;

b) to respect the right of workers to have the labor unions and the representative organizations for their own choice recognized for conducting collective negotiations and to start, individually or through associations of employers, constructive negotiations with such representatives for the purpose of reaching an agreement on terms and working conditions.

2. Concerning abolition of forced labor:

a) to promote effective abolition of child labor and to take the immediate and effective measures providing quickly prohibition and eradication of the worst forms of child labor;

b) to promote elimination of all forms of forced or obligatory labor and to take adequate measures for providing that forced or obligatory labor wasn't applied in their activity.

3. Concerning discrimination in the sphere of work:

a) to be guided in all the activity by the principle of equal opportunities and the relation in the field of work, not to discriminate the workers concerning work and employment, except for cases when selectivity concerning characteristics of the worker promotes creation of government policy which promotes bigger equal opportunities of employment or is related to inherent requirements of work.

4. Concerning the right for conducting collective negotiations and for information:

a) to give such opportunities for representatives of workers who can be demanded for assistance in development of effective collective agreements;

b) to provide information to representatives of workers which is necessary for constructive negotiations under the terms of work;

c) to provide information for workers and their representatives who allows them to receive a reliable and objective picture of activity of the subject or, if necessary, the enterprise in general.

5. To promote consultations and cooperation between employers and workers and their representatives on the questions representing mutual interest.

6. Concerning conditions and compensation:

a) to observe standards of employment and the labor relations which aren't less favorable, than that are observed at the similar enterprises in the country of residence;

b) to provide the highest level of a salary, privileges and working conditions within a state policy if multinational corporations carry out the activity in developing countries where comparable employers can not exist;

c) to take appropriate measures for safety and occupational health in the activity.

The legislation of RK provides legal guarantees and mechanisms of implementation of the labor law of citizens which, unfortunately, not in all cases conform to the international standards, including recommendations, are fixed in the Guidelines of OECD.

VI. Environment

"According to laws, regulations and administrative practice in the countries in which they work, and taking into account the relevant international agreements, the principles, the purposes and standards of the enterprise have to consider properly need of environment protection, public health and safety, and in general to conduct the activity so that to promote more sustainable development" (The guidelines, 2011).

In particular, the enterprises have to:

1. To establish and support systems of ecological management of the relevant enterprises, including:

a) to collect and estimate information on environment, health and safety of consequences of their activity;

b) to establish the purposes for improvement of ecological indicators and use of resources;

c) to carry out regular monitoring and an inspection of progress of the purposes of environment, health and safety.

2. In view of concern about cost, a trade secret and protection of intellectual property rights:

a) to provide to the public and workers information on potential influence of environment, health and safety of activity of the enterprise.

b) to attract to adequate and timely communication and consultations with society that directly depends on environment, health and a security policy of the enterprise and their realization.

3. According to scientific and technical knowledge of risks where there is a threat of serious damage to environment, to health and safety of the person not to use absence of full scientific confidence in quality of the reason for a delay of acceptance of economically effective measures for the prevention or reduction of such damage.

4. To support plans for prevention, mitigation and control of serious influences on ecology and damage to health as a result of their activity, including accidents and emergency situations, and also mechanisms for the immediate reporting in competent authorities.

5. Constantly to seek for improvement of corporate ecological indicators at the level of the enterprise.

6. To provide adequate education and training of workers in the field of environment protection and labor protection, including concerning the treatment of dangerous materials and prevention of ecological accidents.

7. Assistance to development of ecologically significant and economically effective state policy.

The review of the UN of a state of environment of RK of 2008 notes increase in environmental problems in regions where oil and gas, in connection with activities for getting of resources and construction of pipelines, roads, the railroads and plants is made. Besides, systems of monitoring of environment can't adequately reflect the current ecological situation, because of shortage of resources for monitoring systems concerning air pollution and water. Therefore the actual environmental pollution isn't displayed in ecological statistics.

Despite it, Kazakhstan actively pursues policy on environment protection that is displayed in the relevant normative legal acts. So, the Ecological code of RK adopted on January 9, 2007 meets the international

standards; governs the relations in use and reproduction of natural resources at implementation of the economic and other activity connected with use of natural resources and impact on environment.

Besides, the Strategic plan of the Ministry of environmental protection and water resources for 2011-2015 is accepted⁸⁶. It is directed on improvement of conditions of quality of environment and taking measures of more sustainable development. The priorities specified in the Strategic plan, in particular, are improvement of water resources management, the address with waste and reductions of emissions.

In May, 2013, the Concept of transition of the Republic of Kazakhstan to "green economy"⁸⁷ with intention to invest 1% of GDP a year in green technologies is accepted. Kazakhstan also participates in regional ecological initiatives, such as the Initiative "Astana Zelyony Bridge" for an exchange of the best practices of management and realization of green growth, and also the member of the Water Plan of Astana on 2012-15 for the solution of the serious problems connected with water and water resources. Kazakhstan is also the member of the OECD Working group on implementation of the Action program on environment protection (Responsible, 2014).

There are three spheres – water, the earth and air – to which the enterprises have to pay special attention in Kazakhstan.

VII. Fight against bribery, bribery and extortion

"The enterprises shouldn't directly or indirectly, offer, promise, give, or demand bribes or other illegal advantage for implementation or preservation of economic activity or other illegal advantages. The enterprises have to resist also the petition of a bribe and extortion" (The guidelines, 2011).

In particular, the enterprises have to:

1. Not to offer, not to promise or not to provide excessive monetary or other benefit to the state officials, employees or partners in business. Besides, the enterprises shouldn't demand, agree or accept excessive monetary or other benefit from the state officials, employees or partners in business.

2. To develop and accept adequate mechanisms of internal control, ethics and observance of programs and measures for the prevention and the identification of bribery developed on the basis of an assessment of risks concerning an individual financial condition of the enterprise, in particular,

⁸⁶ Approved by the Resolution of the government of the Republic of Kazakhstan, February 8, 2011, No. 98

⁸⁷ Approved as the Decree of the President of the Republic of Kazakhstan of May 30, 2013, № 577.

the risks of bribery facing the enterprise (for example, its geographical and industrial sector of activity).

3. To forbid in the programs or measures of internal control of the company, ethics and programs providing observance legislative and regulations to forbid or interfere with use of insignificant payments which are, as a rule, forbidden in the countries where they are made, and if such payments are made, to display them in the account book and in financial reports.

4. In view of special risks of bribery which the enterprises face to be convinced that documents on complex check, concerning employment, and also need and regular control of agents are properly made, and also that remuneration of agents is corresponding and suitable only for the services provided in the lawful way.

5. To increase transparency of the activity in fight against bribery, the petition for a bribe and extortion.

6. To promote understanding and observance of corporate policy, programs and measures of internal control and ethics, and also the programs providing observance legislative and regulations on fight against bribery, extortion of a bribe by employees by means of the corresponding distribution of such programs or actions and on the basis of training programs and disciplinary procedures.

7. Not to do illegal donations to candidates for the state positions, to political parties or other political organizations.

In 2013 Kazakhstan occupied 140 of 177 places on the World Index of Perception of Corruption (Transparency International Corruption Perception Index). On poll of the enterprises by the World Bank in 2011, 45% of the enterprises in Kazakhstan bribe (expect gifts from them) to receive the state contract when expect certain informal contributions from 34% for this purpose that "everything was made" (Responsible, 2014).

For the purpose of corruption counteraction Kazakhstan takes a number of measures by means of development and deployment, various anti-corruption tools. So, on March 31, 2011 the Government of RK approved the Industry Program for counteraction of corruption in RK for 2011 – 2015 (The industry, 2011). At the institutional Government level created the Commission at the President of Kazakhstan concerning fight against corruption and fight RK Agency with economic and corruption crime (Financial police) as which prevention of corruption and anti-corruption policy enters.

The basic principles of fight against corruption, types of the offenses connected with corruption and also conditions of occurrence of responsibility are defined by the Law RK "About Fight Against Corruption" of July 2,

1998. Besides, the bill of corruption counteraction is under consideration of Parliament of RK (June, 2013).

The main problems are at the level of introduction of policy of counteraction of corruption. There are problems with transparency of judicial system, Department of Internal Affairs, Customs administration, in protection of the property rights, and also in registration of the land plots and registrations of construction licenses.

VIII. Interests of consumers

"During the work with consumers, the enterprises have to work according to rules of honest business, marketing and advertising and have to take all reasonable measures for ensuring quality and reliability of goods and services which they provide" (The guidelines, 2011).

The enterprises have to:

1. To be convinced that goods and services which they provide, conform to all standards of health care and safety of consumers coordinated or demanded under the law.

2. To provide the exact, checked and accurate information to allow consumers to make reasonable decisions, including information on the prices and, if necessary, on the contents, safe use, ecological characteristics, maintenance, storage and the order goods and services.

3. To provide to consumers access to fair, simple in use, to timely and effective pre-judicial mechanisms of settlement of disputes and legal protection, without excess expenses or restrictions.

4. Not to do representation or inaction, or to be engaged in any other practice which misleads, is roguish or unfair.

5. To support efforts on assistance to education of consumers in areas which are connected from their business activity.

6. To respect private life of consumers and to take the appropriate measures for safety of personal data which they collect, store, process or extend.

7. Fully to cooperate with public authorities on prevention and fight against deceptive practice of marketing, and also to reduce or prevent the serious threats for health and safety of the population or environment following from consumption, use or the order goods and services.

8. To take into account at application of the above-mentioned principles i) needs of vulnerable and unfortunate consumers and ii) specific problems which electronic trading can create for consumers.

The rights of the consumers who are one of the main recipients of services of the companies are defined and protected by the Law RK "About Consumer Protection" from May 4, 2010 which defines legal, economic and

social bases of consumer protection, and also measures for providing consumers with safe and qualitative goods (works, services).

IX. Science and technologies

The enterprises are obliged:

1. To make efforts for that their activity was compatible to science and technology, strategy and plans of the countries in which they work, and as required to promote development of local and national innovative capacity.

2. To accept, as far as possible, in the course of the economic activity, practice which allow to transfer and quickly to extend technologies and a know-how taking into account protection of intellectual property rights.

3. If necessary, to perform works on development of science and technology in host countries for satisfaction of local requirements of the market, and also to employ the personnel of the host country for scientific and technical potential and to encourage their training taking into account commercial requirements.

4. To provide licenses for use of the rights for intellectual property or at a different way to transfer of technology on reasonable conditions and as it should be which promotes long-term and steady outlook of development of the host country.

5. For a commercial purpose to develop communications with local universities, the public research institutions, and also to participate in joint research projects with the local industry and branch associations (The guidelines, 2011).

X. Competition

The enterprises are obliged:

1. To carry out the activity according to all applicable laws and rules of the competition.

2. To abstain from the conclusion or implementation of anti-competitive agreements between competitors, including agreements on establishment of the price; falsifications of the auction (tenders of arrangement); to establishment of output restrictions or quotas; on division of the markets by distribution of clients, suppliers, territories or the line of trade.

3. To cooperate with authorized bodies on control of the competition, among other things and according to the applicable law and the corresponding guarantees, by means of expeditious granting the fullest replies to the requests about information, and taking into account use of the

available tools, such as refusal of confidentiality, in case of need, for assistance to effective cooperation between investigating authorities.

4. Regularly to promote awareness of employees on importance of observance of all applicable laws and rules of the competition, and, in particular, to training of the top management of the enterprise for questions of the competition (The guidelines, 2011).

This principle is displayed in the Law RK "About the Competition" of December 25, 2008 which purposes are protection of the competition, creation of conditions for effective functioning of the commodity markets, ensuring unity of economic space, free movement of goods and freedom of economic activity in the Republic of Kazakhstan (article 1).

XI. Taxation

1. It is important that the enterprise carried out a contribution to public finances of host countries by timely payment of tax obligations.

2. The enterprises have to consider internal revenue service and observance of the tax law as an important element of their supervision and wider control system of risks. In particular, the board of the enterprise has to accept tax strategy of risk management for the purpose of definition and an assessment of the financial, regulatory and reputation risks connected with the taxation (The guidelines, 2011).

The duty of timely payment of tax obligations is provided in the Code of RK "About Taxes and Other Obligatory Payments in the Budget" (The tax code) of December 10, 2008 which contains norms on payment of taxes and other obligatory payments in the budget and governs the relations arising between the state and the taxpayer at execution of tax obligations.

The tax code of RK provided measures for stimulation of business for participation in social projects. So, taxpayers have the right for reduction of income tax at a rate of the total amount which isn't exceeding 3 percent from the taxable income to such types of expenses as: the cost of the property donated to the non-profit organizations and the organizations which are carrying out activity in the social sphere, the sponsor's and charitable help (article 133 of the Code).

Non-profit organizations (article 134) and the organizations which are carrying out activity in the social sphere (article 135) are exempted from payment of this tax. Business firms can also use privileges, transferring property (article 133 of the item of 1 items 1), performing works and services noncommercial the companies, giving sponsor's and charitable help (article 133 of the item of 1 items 1), paying training of natural persons with which labor contracts (article 133 of the item of 1 items 3) aren't signed yet.

Also tax law provided privileges on a value added tax: for the organizations employing physically disabled people (article 248 of item 13)

for the organizations which are carrying out the activity in the social sphere (article 253) for the organizations connected with medical and veterinary care (article 254) and for the non-profit organizations rendering certain social and religious services (article 252).

The organizations employing physically disabled people significantly save on taxes, including, on a social tax, because of application of the lowered rate – 4,5% (a rate for all usual companies of 11%) (article 358 of item 3).

For calculation of corporate income tax for subsoil users privileges in the form of tax deductions are also provided: deductions on expenses on elimination of consequences of development of fields (article 107) and deductions on the subsoil user's expenses on training of the Kazakhstan shots and development of the social sphere of regions (article 112).

The code of the Republic of Kazakhstan "About taxes and other obligatory payments in the budget" (The tax code) provided measures for stimulation of business for participation in social projects. So, taxpayers have the right for reduction of income tax at a rate of the total amount which isn't exceeding 3 percent from the taxable income to such types of expenses as: the cost of the property donated to the non-profit organizations and the organizations which are carrying out activity in the social sphere, the sponsor's and charitable help (article 133 of the Code).

Also since January 1, 2009 measures for stimulation of business in the form of decrease in a rate of corporate income tax (article 147 of the Code) are provided (The Code, 2008).

Conclusion

As it was already mentioned, in April, 2014 OECD published the report "Responsible business in Kazakhstan" which basis was formed by the Guidelines of OECD as standards for introduction RK. In the report some shortcomings of the legislation and practice of RK concerning OVB, and also recommendations to the enterprises are specified as it is possible to improve a situation and to overcome difficulties of introduction of standards and the principles in practice. These recommendations are displayed in this subparagraph of research, as a basis of mechanisms of improvement of the legislation and practice in the sphere of OECD (The guidelines, 2011).

Earlier it was mentioned that one of essential barriers in providing OVB in Kazakhstan is absence of knowledge among interested persons (parties) of rules by which business structures, knowledge of human rights and special instruments of their providing, including the Guidelines of the UN and the Guidelines of OECD have to be guided. Set of business structures still don't understand fully the responsibility while interested

persons don't understand, how many and what resources are available to them to be sure that their rights are observed.

Investors and the enterprises, in turn, also want to understand that from them it is expected in the concrete environment in which they work in order that capable to be most effective to make the contribution a sustainable development and inclusive growth through observance of the principles of OPB.

For improvement of the legislation and practice of introduction of the Guidelines of OECD it is expedient:

1) To develop and approve the State program (The national concept) of development of responsible business or corporate social responsibility. It is necessary to involve all interested parties in this work (authorities, representatives of the enterprises, public organizations, etc.).

2) To create or authorize the special coordinating body responsible for policy of introduction of OVB (in Kazakhstan there is no understanding of uniform such body), and also a regional network in the sphere of policy of OVB which could coordinate the general policy at the regional level.

3) First of all, to authorities, and also public organizations to carry out educational campaign for illumination of a perspective of OVB, need of development and deployment of policy for this for the sphere.

4) To authorities and the enterprises to involve civil society in process of selection and introduction of social projects which are financed by the enterprises, providing thereby openness of this process.

5) To organize dialogue between the enterprises and local authorities to understand their expectations and requirements, and also to promote transparency of receipt of funds (contributions) from the enterprises to social projects.

6) To provide an obligation of the enterprises to open exact, reliable, timely information about the activity, structure, finance, profitability, property and management at the legislative level.

7) To toughen control of performance of the ecological legislation, and also actively to introduce the Concept of transition of RK to "green economy".

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TOURISM ON THE AZORES AND MADEIRA ISLANDS: ISSUES OF PERIPHERAL AND DEVELOPMENT REGIONS

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RESUMO

De um modo geral, todos os governos, quer sejam eles locais, regionais ou nacionais, procuram definir políticas e estratégias para o turismo. Estas podem originar um envolvimento ativo ou uma postura laissez-faire. Esta abordagem estende-se a diferentes áreas e reflete-se no apoio do desenvolvimento dos recursos humanos e das práticas no âmbito turismo. Como resultado desta estratégia, tenderão a variar os fatores determinantes de retenção e desenvolvimento e conseqüentemente o modo como os funcionários se encaixam um trabalho específico, numa organização, numa localidade específica. Não obstante a relevância deste tópico, poucos trabalhos de investigação têm sido realizados neste domínio. Neste trabalho, aborda-se brevemente a natureza do turismo como um setor relevante da economia e identificam-se os determinantes da evolução de estratégia de recursos humanos. Como o papel dos recursos humanos em permitindo que as empresas de turismo é fundamental, este trabalho discute as implicações teóricas e aplicações práticas que as diferentes abordagens acarretam para se enfrentar os desafios da gestão de recursos humanos nas organizações de turismo e destinos, especialmente aqueles que se encontram em locais mais remotos.

PALAVRAS-CHAVE: Recursos Humanos, Turismo, Excelência, Destino

Abstract

In general all governments, be they local or national, have a policy for tourism, whether it represents an active involvement or a laissez-faire approach. This strategic approach reflects in different areas concerning the support for human resource development and practices in tourism. As result

of this human resource strategy the determinants factors of how employees fit a particular job in a particular organization at a particular location will vary. Regardless the relevance of this topic, few research works have been carry out in this domain. Therefore, in this paper, we briefly address the nature of tourism as a sector within the economy and identify the determinants of the human resources strategy evolution in terms of the key themes in this paper. Since the role of human resources in enabling tourism businesses is critical, this work discusses the theoretical implications and applications for meeting workforce challenges of tourism organizations, associations and destinations, especially those in remote locations.

KEYWORDS: Human Resources, Tourism, Destiny, DMO

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Introdução

Nos últimos anos, constatou-se uma relação intrínseca entre o sucesso da indústria de turismo e a gestão de recursos humanos (Liu & Wall, 2006). A evolução do paradigma do turismo conduziu à procura apenas de produtos turísticos, mas acima de tudo de experiências de turismo (Niininen, Buhalis, & March, 2007) e nestas os recursos humanos são um dos elementos críticos de sucesso (Wu, Morrison, Yang, Zhou, & Cong, 2014).

Muitos têm sido os trabalhos académicos que se debruçam sobre o modo como as organizações no geral gerem os seus recursos humanos no que respeita à formação, motivação e retenção (Nyberg, Moliterno, Hale, & Lepak, 2014). Porém, tal como o trabalho recente de Wu, et al. (2014) refere, é necessário procurar compreender como é que estes elementos podem ser valorizados em contextos distintos, em especial quando o turismo não se encontra numa fase de maturidade completa e é afetado pela sazonalidade da procura.

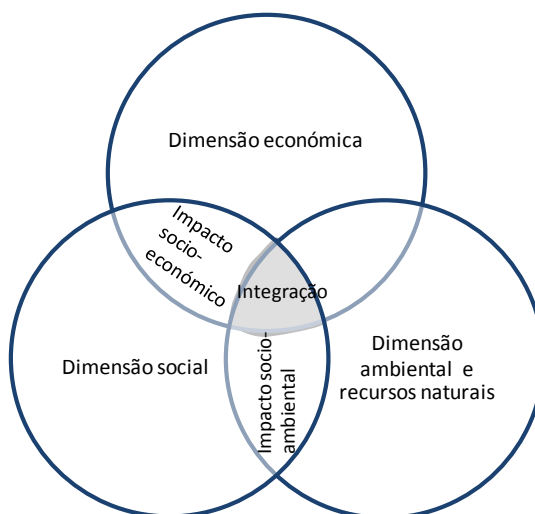
Para se compreender a importância dos recursos humanos na oferta turística de uma região periférica, como é o caso da Região Autónoma dos Açores, deve-se procurar identificar os modelos de outras regiões onde o turismo se encontra numa fase de maior maturidade. Porém, na maioria dos casos, os modelos que se encontram referenciados na literatura dizem respeito a regiões com contextos culturais muito diferentes, pelo que os resultados desta aplicação poderiam não refletir toda a complexidade do processo para a região em causa. Assim, sendo procurou-se aferir a existência de elementos comuns com a outra região autónoma portuguesa - a Madeira, pois esta tem uma matriz cultural e política mais próxima dos Açores e está numa fase de maior maturidade da sua oferta turística.

Este é um trabalho de investigação ainda em curso, pelo que este paper apresenta as primeiras referências encontradas e aponta alguns dos trilhos de investigação que deverão ser seguidos. Assim, este artigo foi estruturado do seguinte modo: a secção com maior predominância é a da revisão de literatura, onde se apresentam as principais correntes de investigação neste domínio; e, na última secção referem-se as principais considerações que surgem desta análise e enunciam-se os desenvolvimentos deste trabalho de investigação.

Revisão de Literatura

O turismo enquanto atividade tem ganho destaque nas agendas económicas e sociais dos governos, independentemente do nível governamental, bem como no domínio académico. Daí que o turismo é muitas vezes visto como motor do crescimento económico. E, este seu cariz pode ser reforçado a longo prazo através de investimento em infraestruturas e pelos impactos diretos e indiretos sobre as economias locais, quer pelo surgimento de atividades económicas conexas às principais, quer pelo aumento do emprego. A este respeito Cooper & Hall (2008) apresentaram um diagrama que procura congregar todos os impactos da atividade turística e que se apresenta de seguida:

Figura 1 – Impacto das atividades turísticas



Fonte: Adaptado de Cooper & Hall (2008)

De acordo com a UNWTO (2006), o desenvolvimento do turismo em destinos periféricos é considerado como um eixo importante para a redução da pobreza, permitindo que essas áreas consigam acompanhar os objetivos de desenvolvimento do novo milénio.

Hay and Morrison (2012), acrescentaram que o desenvolvimento do turismo em qualquer país é função da predisposição do governo para este tipo de atividade económica, bem como dos impactos que esta atividade tem na sociedade, na cultura e na economia local.

Para compreender o papel dos governos locais no processo de desenvolvimento do turismo, C.-l. J. McLennan, Ritchie, Ruhanen, and Moyle (2014) analisaram três regiões em diferentes fases do ciclo de vida da indústria do turismo e identificaram quatro dimensões críticas para o desenvolvimento do turismo numa região: (i) tempo; (ii) estruturas; (iii) espaço; e, (iv) empresas prestadoras de serviços. Todas estas dimensões podem ser influenciadas pelas políticas públicas e condicionam a atividade na indústria. Na dimensão tempo estão inclusos todas as medidas referentes ao processo de formação de recursos humanos, alteração da mentalidade dos habitantes face à atividade e adequação da postura local (C.-l. McLennan, Ruhanen, Ritchie, & Pham, 2010). As estruturas compreendem todos os elementos integrantes da cadeia de valor a jusante e a montante da atividade hoteleira e que compõe a experiência global do turista (Cooper & Hall, 2008). Por espaço entende-se todas as evidências físicas que promovem o processamento do serviço turístico. Por último, temos as empresas prestadoras de serviços que podem estar no local de oferta turística, ou no local de origem dos turistas. Nestas organizações, maioritariamente prestadoras de serviços, um dos elementos críticos de sucesso são os recursos humanos (Fernández-Pérez, Prado-Prado, & Comesaña-Benavides, 2014).

Compreendem-se, pois, as referências à necessidade de se envolver a população local no desenvolvimento das políticas e da oferta turística (Seddighi & Theocharous, 2002). Porém, nem sempre se presta suficiente atenção aos meios e às capacidades da população local para responderem às oportunidades de turismo (Liu & Wall, 2006). Embora não haja muita literatura sobre os recursos humanos em turismo, a existente raramente está ligada a uma abordagem mais ampla de desenvolvimento do destino turístico.

Para se compreender melhor a importância destes elementos convém, em primeiro lugar, analisar os elementos constituintes do destino turístico e da cadeia de valor, através de uma revisão bibliográfica integrativa. Um procedimento desta natureza é particularmente útil quando se procura integrar os resultados de estudos distintos sobre questões mais emergentes e permite identificar os desafios para o desenvolvimento de estudos futuros.

Em 2006, Liu & Wall apresentaram evidências de que o planeamento do turismo deve considerar não só os visitantes, mas também os residentes. Estes autores sugerem que estes últimos devem ser considerados a dois níveis: (i) enquanto prestadores de serviços turísticos; (ii) enquanto

indivíduos que terão de partilhar com terceiros os recursos do seu local de residência. Será neste primeiro ponto que iremos focalizar a nossa análise.

Vários são os trabalhos no domínio da psicologia organizacional que procuram compreender o que atrai os empregados, o que os faz querer sair ou ficar num emprego específico. Uma das referências principais neste domínio é o trabalho de Schneider (1987) que sugere a existência de um modelo atração-seleção-atrito (ASA), onde se procura explicar o comportamento dos empregados com base na sua personalidade e no ambiente de trabalho.

Para compreender o grau em que as pessoas se encaixam num emprego, grupo de trabalho e organização está relacionado com a capacidade de se atrair, seleccionar e reter os trabalhadores conduziu a inúmeros estudos que analisam a variedade de fatores, que podem ser vistos como influenciadores e fazem parte do ambiente da pessoa (Solnet, Ford, Robinson, Ritchie, & Olsen, 2014).

No trabalho de Fernández-Pérez et al. (2014) são apresentadas seis dimensões que devem ser trabalhadas no âmbito da gestão de recursos humanos, de modo a tornar os recursos humanos uma vantagem competitiva sustentável para uma organização: (i) envolvimento; (ii) seleção e recrutamento; (iii) formação; (iv) comunicação; (v) definição da função; e, (vi) remuneração e recompensa. Os autores referem que os recursos humanos podem ser o “segredo” mais difícil de imitar num negócio. Em especial, quando a organização consegue ter uma gestão que valoriza o alto envolvimento dos recursos humanos.

Como resultado da revisão de literatura efetuada e procurando integrar a dimensão governamental com as práticas de recursos humanos, chegamos à matriz que seguidamente se apresenta.

Tabela 1 – Estratégias governamentais e práticas de RH

Intenções empresariais	Formação de RH	Estratégia concertada	Especialização empresarial
	Retenção de RH	Enfoque especialização	Enfoque empresarial
		Focus	Laizer-faire
	Estratégia governamental		

Considerações Finais

Os estudos de recursos humanos no turismo, também referenciados como avaliações do impacto do emprego no turismo, são geralmente um reflexo das manifestações do turismo como um fator motriz ou estímulo do crescimento económico.

Porém, os recursos humanos afetos à atividade turística têm de ser analisados de forma mais ampla, por serem um dos fatores críticos de

sucesso desta atividade de prestação de serviços (Fernández-Pérez et al., 2014).

Neste artigo, discutimos que o recrutamento, gestão e especialmente a formação e desenvolvimento de recursos humanos são preocupações vitais para o contínuo sucesso das operações da indústria do turismo, bem como para o contínuo desenvolvimento económico e social das regiões.

Assim, as empresas turísticas que procuram atrair, recrutar e reter funcionários qualificados em locais de turismo, especialmente em destinos remotos, devem procurar um entendimento claro sobre os fatores de atração e retenção de capital humano qualificado. Neste processo, um dos fatores a considerar é a própria estratégia governamental local.

Neste domínio, é clara a necessidade de pesquisa adicional, tendo por base o modelo proposto. Uma vez que este pode fornecer considerações práticas sobre intervenções potenciais ou medidas que quando implementadas podem alterar o posicionamento da oferta turística de uma região.

Até porque, tal como referenciado anteriormente, algumas intervenções podem ser desenvolvidas pelas empresas de turismo per si ou enquanto associação de organizações num destino. Outras, porém, requerem intervenções que exigem uma coordenação entre a intenção empresarial e a ação governamental.

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ALBANIAN HOTELS AND SUSTAINABLE TOURISM PRACTICES

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Abstract

The tourism industry is growing rapidly and the loss of natural landscapes, local identities and traditional cultures; degradation of the environment are often listed as negative impacts associated with the tourism industry's development. The accommodation sector has been described as part of the industry, which activities cause negative impact on the environment, calling urgently for greater participation in sustainable tourism practices. Previous studies indicate that SMTEs, often focus on business returns by employing unsustainable business practices. To minimise any negative impacts that may arise as the result of tourism activities, efforts are now geared towards alternative form of tourism (Butler, 1993), which most academic literatures describes as 'sustainable tourism' (Edwards, 2004; Bohdanowicz, 2005). The research objective of the study in this paper is to explore and discuss the concept of sustainable practices within the tourism industry. The paper moves on to look at albanian tourism enterprises which develop their activity in Korca, Vlora, Saranda, Durres, Pogradec cities, their current level of participating in sustainable tourism practices in daily routine operations. As conclusion, findings of this study revealed hotels commitment to different sustainable practices varies to some extent and certain practices are unpopular to them. To have a tourism which relies heavily on sustainability, a massive involvement in these practices should be undertaken.

Keywords: Tourism industry, sustainable tourism, tourism businesses, sustainable tourism practices

Introduction

Tourism is one of the largest industry in the world. Travel & tourism represents approximately 10% of total global Gross Domestic Product (GDP) and covers 10% of world employment (direct & indirect). As we know, tourism development is associated with consumption of existing resources such as energy, water, oil which are limited. Tourism is putting pressure to

ecosystems, so inappropriate constructions, massive cutting of forests, taking sand from the seas and rivers, uncontrolled hunting, different waste dumped at water is bringing irrevocable consequences to the environment. These consequences are erosion, deforestation, disappearance of habitats etc. Tourism generates high levels of pollution, ranging from air pollution that is intensified with the rapid growth of transportation, increasing noise, increase of solid waste and wastewater pollution. Naturally, everyone can ask: what are the risks to this growing and developing industry? Nowadays is necessary to promote sustainable tourism development in order to minimize negative impacts and to maximize all its benefits from it. The competitiveness of the Albanian tourism industry is closely linked to its sustainability, as the quality of tourist destinations is strongly influenced by their natural and cultural environment and their integration into the local community.

To sum up what we said above concerns about participating urgently in sustainable tourism practices. Making tourism more sustainable is not just about controlling and managing the negative impacts of the industry. Based on the Brundtland definition, Landrum and Edwards (2009: 4) define a sustainable business as 'one that operates in the interest of all current and future stakeholders in a manner that ensures the long-term health and survival of the business and its associated economic, social, and environmental systems'. A sustainable business should focus on all three dimensions of sustainability:

- **Economic Dimension of sustainable business practices** - Economic sustainability refers to a business's ability to make profit in order to survive and benefit the economic systems at the local and national level'
- **Socio-cultural Dimension of sustainable business practices** - A respectful interaction between hosts and guests, involvement of the local people and recognition of the contribution of traditions and culture to the tourist experience are key issues for sustainable businesses (Roberts and Tribe, 2008).
- **Environmental Dimension of sustainable business practices** - The environmental dimension of sustainability is the most widely documented one. In the hospitality industry a wide range of information exists about environmental issues such as energy saving, water savings, etc

Albanian tourism businesses, only recently became aware of the concept of sustainability.

The reasons why have used some sustainable practices by Albanian accommodation sector have been the intention of reducing operating costs. In general Albanian tourism businesses are considered as new businesses, with a strong lack of experience compared to the region's tourism businesses, as

they are created only after the advent of democracy. Albanian tourism businesses in generally are characterised by

- small size
- short-term profit-oriented
- centralised management, where the owner controls every aspect
- lack of financial resources
- short term development strategies
- lack of skilled, trained labor

Sustainable practices and benefits related to the accommodation sector

The most cited benefit of sustainable business practices is the reduction of costs (Landrum and Edwards, 2009; Bohdanowicz et al., 2004; Hobson and Essex, 2001; Hitchcock and Willard, 2009; Swarbrooke, 1999). Service quality but also productivity are likely to be improved through more sustainable developments and business practices (Swarbrooke, 1999; Butler, 2008). Sustainable business practices can also bring benefits to a tourism business in terms of positive public relations and improved hotel image with shareholders and local community. These benefits can differentiate the business from its competitors and can be the source of competitive advantages and new market opportunities (Hitchcock and Willard, 2009; Landrum and Edwards, 2009; Swarbrooke, 1999)

According to Bader (2005), the hospitality industry is becoming the greatest example that shows that sustainable practices within a business are crucial for its long-run success. The benefits of sustainable tourism practices are:

- Economic – cost savings due to energy, water management saving measures
- Environmental- cost saving measures which help to protect the environment
- Social- setting an ethical stance and support local economy.

The most obvious benefits of sustainable practices within a tourism business have a financial character. A huge amount of costs can be reduced by using energy-water saving measures like installation of solar panels. Also, energy-saving light bulbs, LED bulbs can be installed. Furthermore, hotels can install sensors and timers for light installations which ensure that the light is only switched on in areas/rooms when it is needed. Key tag controlled switches for hotel rooms are another very effective action. This means that the key card for the door is simultaneously the card who switches on the electricity including air condition in the room. This ensures that guests do not have the chance to leave the light or air condition turned on when they

are leaving their rooms. In addition, hotels can save water by installing things like low-flow showerheads and toilets. All these named measures that aim at reducing water and energy consumption help the hotel business to keep costs down. Moreover, it is environmentally friendly to save energy and water. Due to lower costs, hotel businesses can create additional revenues, because less money needs to be spent on energy, water, etc. (Bader, 2005).

As costs for energy, water, etc. are rising, hotels are more or less forced to act economically, environmentally and socially responsible. Also hotels are depended on its surrounded environment, because this is the main reason why people come to a certain area. In other words, hotels rely on their immediate surrounding and therefore, they should preserve it in order to exist in the long-run. (Bader, 2005)

The last category of benefits is socially oriented. Hotels can contribute to a good relationship with the locals and prevent tensions between the guests and locals. Especially regarding the food, hotels can make use of local products. This supports one the one hand local businesses and one the other hand, hotels and their restaurants can differentiate itself by serving locals specialties. Besides the given benefits there are overall advantages for hotels that implement sustainable practices. Next to the cost savings and additional revenues, sustainable businesses are oriented towards to long-term.

Methodology

Sustainable tourism practices ,were a distant reality in Albania, but albanian tourism businesses can no longer stay away from this obvious reality. Therefore, a study on STP among albanian hotels located in Korca ,Pogradec, Durres, Vlora and Saranda was conducted during June – August 2014 . The development of this study was based on a similar paper ” Hotel involvement in Sustainable Tourism Practices in Klang Valley ,Malaysia”. The survey involved a data collection using questionnaires to obtain information on the current level of hotels’ participation to sustainable tourism practices and the benefits generated from the adaption .7-point Likert scale was used in the questionnaire(1= strongly disagree, and 7= strongly agree) . 12 items, adapted from Park (2009) were used to collect information on the current level of hotels’ participation in sustainable tourism practices, while 13 items were used to measure the benefits .A total of 105 questionnaires were sent ,but only 82 hotels from them showed their readiness in completing the questionnaire. The questionnaires was sent by e-mail.

Results and Discussion

From 105 questionnaires sent ,a total of 82 respondents were received ,representing 78 % response rate. The two major research variables analysed in this study are: (1) the current level of hotel's participation in sustainable tourism practices; and (2) the benefits from sustainable tourism practices participation. The attributes were measured using the seven-point Likert type scale with a response value of 1=strongly disagree, 2=disagree, 3=partially disagree, 4=neutral, 5=partially agree, 6=agree, 7=strongly agree.Data processing was done by SPSS programme . Below are presented data on the demographic profile of the respondents:

Characteristics of the business

In general albanian tourism businesses are considered as new businesses, with a strong lack of experience compared to the region's tourism businesses, as they are created only after the advent of democracy.Albanian tourism businesses in generally are characterised by:

- small size
- short-term profit-oriented
- lack of financial resources
- lack of skilled,trained labor.

All these limit the performance of tourism businesses , as well as the mass implementation of sustainable practices.

As can be seen from table 1, the majority of albanian tourism enterprises involved in the study are small hotels (85,4%),only 14,6% of them are medium ones .Almost 45,1 % of the respondents had been running their business for 6-10 years , 37,8 % for less than 5 years and only 17,1 % had an activity for more than 10 years. These statistics reinforce the idea that tourism in Albania has been widespread only the last two decades.In relation to the number of guestrooms 42,7 % of respondents had 10-20 guestrooms, 25,6% had 20-50 rooms, 20,7 % had less than 10 rooms and only 11 % more than 50 rooms. Also 52,4% of respondents is employing 6-10 staff .

Small ,medium or large hotel	Frequency	Percent
Small hotel	70	85,4
medium hotel	12	14,6
Large hotel	0	0
Years of operation in this business	Frequency	Percent
1-5 years	31	37,8
6-10 years	37	45,1
more than 10 years	14	17,1
Nr of employees in this business	Frequency	Percent
1-5	36	43,9
6-10	43	52,4
11-20	3	3,7
Nr of guestrooms	Frequency	Percent
Less than 10	17	20,7
10-20	35	42,7
20-50	21	25,6
more than 50	9	11,0

Table 1: Summary Statistics of Sample Responses by characteristics of the business

Hotel participation in sustainable tourism practices

The first intention of this paper was identifying sustainable tourism practices ,most used by albanian accomodation sector.Table 2 displays the participation level in STP.

Tab:2 Items in measuring sustainable tourism practices

	Mean	Std. Deviation
Installation of occupancy sensors/key cards	4,87	1,624
Energy efficient equipment	5,62	1,118
Renovation of facilities	4,09	1,549
Solar panel	5,89	0,903
Energy saving light bulbs	5,63	1,060
Reuse linens and towels	3,77	1,468
Low water volume toilets	4,12	1,551
Water saving campaigns in the kitchen	4,17	1,506
Low -Flow shower-head	3,82	1,708
Recycle bins in front and back of house areas	2,84	1,262
The use of environmentally friendly cleaners	3,16	1,374
Environment anagement involving aste,energy,and water conservation	5,52	1,230

Seven-point Likert type scale (1=strongly disagree, and 7=strongly agree)
M=Mean, SD=Standard Deviation

The most used sustainable tourism practices among energy, water, waste management resulted them towards energy management, while much less those for waste management. Most of the hotels surveyed revealed that energy use and costs have limited the hotel's profitability to a very high extent. According to this, a lot of energy-saving measures have been implemented by albanian hotels to improve the performance. In particular the solar panel for water heating (mean score 5.89 and Std.Dev =0.903) and energy efficient equipment (mean score 5.62 and Std.Dev =1,118) were the major practices used among all the items. Also they are the most energy saving items. A popular energy saving measure is the use of low energy light bulbs. Energy saving light bulbs was rated approximately with the same importance. Initially all the hotels made extensive use of low energy light bulbs such as florescent lighting, and now according to the last technology they are using lights with very low consumption or LED bulbs. Water savings in the kitchen (mean score 4.17 and Std.Dev =1,506), followed by low-flow volume toilets (mean score 4,12 and Std.Dev =1,551) were the most water saving items. In terms of waste management, very little has been done. Recycle bins in front and back of house areas was rated only (mean score 2,84 and Std.Dev =1,262). As conclusion, findings of this study revealed that even though the participating hotels indicate their commitment to various practices which support to sustain the environment, however, their level of commitment varies to some extent and certain practices are unpopular to them. Also the dominant opinion of albanian hotels surveyed is that one, whereby investments in sustainable tourism practices is a major capital outlay which is beyond the financial capability of hotels particularly in the short-term and particularly for small hotels.

Benefits of hotel participation in sustainable tourism practices

The benefits for hotels adopting sustainable tourism practices are measured by 13 items according to seven-point Likert-type scale (Table 3).

Findings revealed that "By adopting various measures of sustainable of sustainable tourism practices, our hotel ensures a good future for the tourism industry as the most important benefit from the total of sustainable tourism participation benefits. This scale has a (M=5.7, SD=1.015). The second important benefit was "Sustainable tourism practices has help our hotel to increase environmental quality enhancement (M=5.45, SD=1.079), followed by "Our hotel has reduced its operational cost through energy management (M=5.41, SD= 1.276).

The less important benefit was "Our hotel has reduced its operational cost through waste management (M=3.84, SD= 1.644). Potential reason to this low result is that albanian hotels didnt adapted more from these practices. Also hotels think that they didnt benefit so much from "Our hotel

has reduced its operational cost through water management. This is rather disappointing as water saving measures among hotels should be one of the most widely adopted practices in environmental management.

Tab 3: Benefits of sustainable tourism participation

	Mean	Std. Deviation
Our involvement in sustainable tourism participation has increased our customer loyalty	4,17	1,616
To our hotel ,sustainable tourism practices enhance customer satisfaction	4,21	1,790
By adopting various measures of sustainable tourism practices ,our hotel ensures a good future for the tourism industry	5,70	1,015
Guests satisfaction has help to improve our revenue generation	4,76	1,732
Sustainable tourism practices have helped to improve the relationship between our hotel and the local communities	4,12	1,738
Our hotel has reduced its operational cost through energy management	5,41	1,276
Our hotel has reduced its operational cost through waste management	3,84	1,644
Our hotel has reduced its operational cost through water consumption	4,57	1,678
Sustainable tourism practices has help our hotel to increase environmental quality enhancement	5,45	1,079
Sustainable tourism practices is now a major public campaigns in our hotel	4,27	1,595
Involvement in sustainable tourism practices has given us a marketing advantage over our competitors	4,15	1,772
Sustainable tourism practices also improves our hotel image to the guests and local communities	4,56	2,505
Our hotel has improved on revenue generation due to a better image	4,62	1,488

Seven-point Likert type scale (1=strongly disagree, and 7=strongly agree)

M=Mean, SD=Standard Deviation

Conclusion

Recently,sustainable tourism has become an increasingly popular field of research because sustainable tourism is considered as harmonious and balanced relationship with the environment. It is an approach which involves working for the longterm viability and quality of both natural and human resources. . It is is positive approach intended to reduce the tensions created by the complex interactions between the tourism industry,visitors, the environment and the communities . □

It shows clearly that there is no ‘one-fits-all’ solution to address the question of sustainability in tourism development. It does, however, highlight one key universal message: to succeed in making tourism more sustainable it is crucial to work hand in hand with all relevant stakeholders .

At the end ,for hoteliers in general are the economic advantages the most relevant benefits from implementing sustainable practices in their business,they aim cost reductions and increased revenues by implementing those practices.

The adoption of sustainable tourism practices and environmental management more generally will improve the competitiveness and sustainability of a tourism destination

The albanian tourism industry's awareness of sustainable tourism is low. This study revealed that even though the participating hotels indicate their commitment to various practices which support to sustain the environment, however, their level of commitment varies to some extent and certain practices are unpopular to them . Also the dominant opinion of albanian hotels surveyd is that one whereby investments in sustainable tourism practices is a major capital outlay which is beyond the financial capability of hotels particularly in the short-term and particularly for small hotels .

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O CHÁ: VIAGENS DE UMA PLANTA DO PACÍFICO AO ATLÂNTICO

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Resumo

Neste ensaio, iremos acompanhar, numa perspectiva global - transcontinental e transoceânica-, a aventura da planta do chá. A par do café, do algodão, da batata, do cacau e da cana-de-açúcar, o chá mudou a economia e a sociedade mundiais. Necessário se torna seguir as movimentações desta planta dentro das rotas dos impérios europeus da Ásia à Europa, observando-as de fora, ora recuando ora avançando no tempo e no espaço. Ao centrar a nossa atenção nos contactos entre os impérios europeus ultramarinos e os impérios e povos asiáticos, pretendemos entender, primeiro, como de produto comercial produzido e exportado da China, passou também a produto comercial produzido por alguns dos Impérios coloniais Europeus.

Palavras-chave: José do Canto; Chá; Alexander Reith; António Feliciano de Castilho; Aníbal Cabido; Ribeira Grande; Brasil; Açores, Ingleses, Holandeses, Índia; Java; viagens; impérios coloniais; Jardim Botânico

Abstract

In this paper, we will follow, in a global transcontinental and transoceanic way, the adventure of the tea plant. With coffee, cotton, potatoes, cocoa and sugar-cane, tea has revolutionized socially and economically the entire world landscape. It is necessary to explain why this plant moved to the interior of the European empires. To understand tea's journey from Asia to Europe, looking it from the inside and the outside, moving back and forward in time and space. Gazing our attention at the interior and margins of the European empires with peoples and Asian empires, we want to understand tea, first as a commercial commodity coming from China, next as a commercial commodity also produced by some Europeans.

Keywords: José do Canto; Chá; Alexander Reith; António Feliciano de Castilho; Aníbal Cabido; Ribeira Grande; Brasil; Açores, Ingleses, Holandeses, Índia; Java; viagens; impérios coloniais; Jardim Botânico

Introdução

Historiadores do Chá como Mary Lou e Robert Heiss atribuem a esta bebida estimulante não alcoólica ‘(...) *uma longa e turbulenta História, recheada de intriga, aventura, ganhos, perdas, embargos, drogas, impostos, contrabando, guerra, revolução, estética da religião, expressão artística e mudança social*’⁸⁸. Outra investigadora, Sarah Rose, garante ‘(...) *que tempos houve em que os mapas do mundo foram redesenhados em nome de duas plantas, quando dois impérios, Britânico e Chinês, foram para a guerra por causa de duas flores: o ópio e a camélia*.’⁸⁹ É dado adquirido afirmar-se que o reconhecimento e uso do chá se iniciou na província Chinesa do Yunan e daí se difundiu ao resto da China, espalhando-se depois a toda a Ásia e finalmente ao Ocidente Europeu. É esta viagem que queremos delinear os contornos de forma necessariamente sumária. Ocorrenos uma primeira pergunta: de que modo é que culturas como a portuguesa, holandesa, francesa e inglesa, que não conheciam o chá, passam a incluir o chá nos seus quotidianos?

Quanto ao conhecimento, consumo e fabrico do chá, uma das primeiras ideias importantes a reter é que se desenvolveu e circulou no interior e nas margens, primeiro na área de influência do Império Chinês, depois na dos impérios coloniais europeus com interesses económicos no Índico⁹⁰.

⁸⁸ Cf. Heiss, Mary Lou, Robert J. Heiss, *The Story of tea: A Cultural History and Drinking Guide*, The Speed Press, Berkeley, 2007, p. 1. (Tradução do Autor)

⁸⁹ Cf. Rose, Sarah, *For All The Tea in China: espionage, empire and the secret formula for the world’s favourite drink*, Arrow Books, London, 2010, p. 1.

⁹⁰ Recomendam-se leituras como *Elusive Empires: Constructing Colonialism in the Ohio valley, 1673-1800*, de Eric Hinderacker, ou *Middle Ground: Indian Empires and Republics in the Great Lakes Region (1650-1815)*, de Richard White, esclarecem-nos o modo como os impérios se interligavam e comunicavam. Numa perspectiva de integração na História Global da História do Império Colonial Português, numa abordagem distinta da de Charles Boxer, A. J. R. Russell-Wood, em *Um Mundo em Movimento: os portugueses na África, Ásia e América (1415-1808)*, ainda que referindo de relance o chá, explica-nos como plantas e animais transpuseram os territórios de origem alcançando novos territórios de destino. Partindo do global para o local, Jared Diamond, *Armas, Germes e Aço: Os destinos das Sociedades Humanas*, 1997, traça-nos o itinerário de diversas plantas conhecidas desde o local de origem (muitas vezes presumível) ao seu local de aculturação. James Delbourgo e Nicholas Dew, em *Science and Empire in the Atlantic World*, esclarecem as técnicas náuticas sobretudo as utilizadas no Oceano Atlântico. O mar era o caminho privilegiado, na ida e na volta, dos contactos transoceânicos, transimperiais e transcontinentais. Um artigo de Peter Coclanis ilustra na perfeição que a História Atlântica vai além do quadro geográfico

Viagens do chá: No interior do berço

É ponto assente afirmar-se que o chá é consumido desde os tempos pré-Históricos no Assam (nordeste da Índia), na província chinesa de Yunan (no sudoeste da China), ao longo das fronteiras norte da vizinha Birmânia, no Laos, no Vietname e na Tailândia⁹¹. Antropólogos *‘sabem agora que árvores de chá existiam e ainda existem em vastas e remotas áreas de florestas da fronteira daqueles países.’*⁹² Desde há muito que a China é considerada como berço dos arbustos de chá sendo, mais tarde, ainda berço das primeiras plantações de chá.

Historiadores Chineses adiantam que o modo como o chá foi consumido na China vem mudando ao longo das diversas dinastias chinesas. Assim, servido numa mistura, no tempo da dinastia *‘(...) Shang (1766-1050 AC), o chá era consumido na província de Yunan pelas suas propriedades medicinais’*⁹³. Já na dinastia *‘(...) Zhou (1122-256 AC), adquirira outro uso. Haviam-se, entretanto, encontrado na província de Sichuan, a nordeste de Yunan, árvores de chá autóctones crescendo espontaneamente. Acredita-se que foi aí em Sichuan, que pela primeira vez, em vez da mistura medicinal do chá, se passou a usar o chá como bebida: amarga mas estimulante. Começou-se a ferver as folhas do chá, sem as misturar com outras ervas.’*⁹⁴

Foi ainda no decurso da dinastia (Zhou), prolongando-se até finais da dinastia Han que se desenvolveram as três grandes filosofias religiosas dominantes na China: o Budismo (vindo da Índia), o Confucionismo e o Taoísmo. Cada uma destas filosofias religiosas *‘adoptou o chá pelas suas saudáveis virtudes e poderes de rejuvenescimento. Monges e padres descobriram que esta bebida ajudava-os a manterem-se acordados durante as suas longas meditações. O chá era um tónico virtuoso e necessário para estes homens sagrados, um elixir da vida que deveria ser consumido diariamente por toda a gente. À medida que a popularidade do Budismo, Confucionismo e Taoísmo se espalhava por toda a China, espalhava-se o conhecimento do chá.’*⁹⁵

do Oceano Atlântico. Entre 1500 e 1800, o comércio mais importante desenvolvia-se no ‘interior do Velho Mundo e não entre o Velho Mundo e o Novo’. Adiantando, para o mesmo período, os exemplos do peso do comércio asiático nos Impérios coloniais portugueses e holandeses. A viagem transoceânica do chá, da China à Europa, ou a dos têxteis indianos vendidos na costa Ocidental de África a troco de escravos ou o chamado galeão de Manila, segundo Coclanis, é mais um exemplo do peso real do comércio da Ásia na Europa e do peso exagerado que a historiografia do Atlântico confere à América. (Coclanis 2002: 178-179)

⁹¹ Cf. Heiss, Mary Lou, Robert J. Heiss, OP. Cit., p. 4. (Tradução do Autor)

⁹² Cf. Heiss, Mary Lou, Robert J. Heiss, Op. Cit., p. 4. (Tradução do Autor)

⁹³ Idem, p. 6. (Tradução do Autor)

⁹⁴ Ibidem, p. 7. (Tradução do Autor)

⁹⁵ Ibidem, p. 7. (Tradução do Autor)

Foi durante o reinado do primeiro imperador da dinastia ‘*Qin (221-210 AC), contudo, que um maior número de chineses ouviram falar deste tónico benéfico. Durante o seu reinado a China unificou-se; (...) num único império com uma administração central.*⁹⁶

Já na era cristã, ‘*(...) a célebre e clássica dinastia Tang (618-907 AD) acrescentou refinamento e sofisticação ao simples beber o chá.*⁹⁷ Nessa altura, ‘*o chá deixou de ser associado a uma bebida popular, rude e amarga, convertendo-se a sua ingestão num ritual social e cultural (...).*⁹⁸ Foi a partir de então que ‘*Lu Yu – um académico, recolhido (...) reconhecido geralmente como pai do chá da China – codificou os rituais que ele achava necessários a uma fervura adequada do chá. Além do objectivo de proporcionar um chá agradável, Lu Yu advogava que harmonia interior poderia ser atingida através da cuidadosa e atenta preparação do chá.*⁹⁹

Viagens do chá: Da China para o Japão

O chá chega ao Japão vindo da China a partir ‘*de meados da dinastia Tang a meados da dinastia Song (...).*¹⁰⁰ O Japão ‘*vivia o seu período Heian (794-1185), em que a influência chinesa ainda se encontrava no seu ponto mais alto e no Japão a classe dos samurais começava a ganhar poder.*¹⁰¹

Fora o ‘*monge japonês Kukai (774-835) o primeiro a regressar da China e descrever a sua experiência com o chá.*¹⁰²

Enquanto os Ming na China apuravam os chás obtidos através da infusão das folhas em água a ferver, os Japoneses persistiam na técnica ancestral dos Song de obter chá de pó de chá¹⁰³.

Viagens do chá: Para ocidente (comércio e estudo)

Comércio de chá com a Europa: Japão e China

Encontrava-se no poder a dinastia Manchu ‘quando o comércio com a Europa tornou a China o país comercial mais importante do mundo (...).¹⁰⁴

Não se pode pretender estudar isoladamente o comércio do chá da China com o Ocidente Europeu porque ‘*(...) este na realidade fazia parte de um pacote de mercadorias mais alargado onde o seu peso e possibilidade de crescimento dependiam da sua saída nos mercados consumidores. Assim*

⁹⁶ Ibidem, p. 9. (Tradução do Autor)

⁹⁷ Ibidem, p. 6. (Tradução do Autor)

⁹⁸ Ibidem, p. 9. (Tradução do Autor)

⁹⁹ Ibidem, p. 9. (Tradução do Autor)

¹⁰⁰ Ibidem, p. 14. (Tradução do Autor)

¹⁰¹ Ibidem, p. 14. (Tradução do Autor)

¹⁰² Ibidem, p. 14. (Tradução do Autor)

¹⁰³ Ibidem, p. 17. (Tradução do Autor)

¹⁰⁴ Ibidem, p. 19. (Tradução do Autor)

sendo, o chá aparecia associado a outros produtos chineses, como as sedas e as porcelanas.^{105,}

Nem se pode falar igualmente de chá sem precisar de que tipo se trata. Os europeus foram primeiramente habituados *‘ao chá verde em pó, o matcha, que os holandeses vendiam por estarem instalados no Japão. As variedades chinesas em folha, com destaque para os ditos chás pretos, na realidade vermelhos (...) apenas despontaram em Setecentos (...).*^{106,}

Há que distinguir ainda o chá de comércio do para estudo e aclimatização do para produção. Estes diferentes interesses no chá, chamemos-lhes assim de forma imperfeita, tanto ocorreram em tempos e em espaços coincidentes como ocorreram em tempos e espaços distintos. O chá para comércio é adquirido sobretudo na China (porque também vem do Japão) e transportado para a Europa por navios das potências imperiais europeias. Este comércio inicia-se no século XVI e prolonga-se pelos séculos XVII, XVIII, XIX fora até à actualidade. Pode dizer-se que o chá começa a ser objecto de estudo por parte de europeus na Ásia ou de europeus na Europa no exacto momento em que é transportado por mar para a Europa no século XVI. Há notícias de que começa no século XVII a ser tentada a sua aclimatização por europeus (no caso holandeses em Java) fora da China e do Japão. Mais tarde, nos séculos XVIII e XIX, é produzido por estas mesmas potências coloniais europeias fora da China ainda no Índico (Java ainda no século XVIII, Índia na primeira metade do século XIX) ou já no Atlântico (Brasil ainda no primeiro quartel do século XIX).

Ao alcançarem os navios portugueses no século XVI a China e o Japão, o chá de comércio (consumido como bebida medicinal ou não) chega à Europa. Ao que parece tal não acontece logo. Mesmo assim, num primeiro momento, ainda no século XVI, é consumido localmente por elites jesuítas e trazido em quantidades pouco significativas da China via Macau e Goa ou do Japão.

Henry Hobhouse, os portugueses foram *‘provavelmente (...) os primeiros a beber chá na Europa. Trouxeram o chá para Lisboa de 1580 em diante.’* (Hobhouse 2007: 95)

Os europeus ganharam o gosto pelo chá, sem imitarem a maneira chinesa ou japonesa. Criaram um ritual diferente do japonês. Por o beberem quente, mudaram a configuração das chávenas, a asa, o pires, o bule¹⁰⁷. O consumo do chá, inicialmente bastante caro, começou pelas elites e, mais

¹⁰⁵ Pires, António Pedro, A Via do Chá, in Revista Oriente, N.º 21, 2012, p. 106.

Cunha, João Teles e, O Chá: uma História do Oriente ao Ocidente, in Revista Oriente, N.º 21, 2012, p. 34.

¹⁰⁶ Idem, p. 106.

Ibidem, p. 34.

¹⁰⁷ Ibidem, pp. 35-36.

barato, alastrou-se posteriormente no século XIX a todas as classes¹⁰⁸. Aponta-se o ano de 1715, continuando a citar a nota anterior, como o que marcou o início de consumo de chá pelas massas.

No interior do Império português, no coração, ainda no século XVIII ‘A Lisboa o chá chegava, juntamente com muitos outros produtos orientais, pela Carreira das Índias.’ (Albergaria [s.s] [no prelo]) E do que chegava, ‘boa parte dessa carga era reexportada mal chegava ao Tejo, servindo os mercados consumidores francês, castelhano, genovês, alemão e sobretudo, inglês.’ (Albergaria [s.s] [no prelo]) A capital do Império português ‘(...) desempenhava um papel de entreposto comercial mais do que mercado de destino (...).’ (Albergaria [s.s] [no prelo]) São várias as explicações apontadas para o facto de Portugal ser mais exportador e vendedor de chá do que consumidor. Primeiro, havia ‘o sucesso atingido por outros estimulantes, como o café, o tabaco ou o chocolate (...).’ (Albergaria [s.s] [no prelo]) Depois, não era popular, como na China ou no Japão, permanecia o seu consumo ‘na esfera da corte e das elites sociais.’ (Albergaria [s.s] [no prelo]).

Outro autor, embora corroborando as explicações anteriores, aponta outras, como a de ser o de o chá ter um sabor amargo, algo que viria a ser superado com a adição do açúcar e do leite. Além disso, o faltava aos portugueses um tempo (a que refeição tomar chá?) e um espaço (taberna?).¹⁰⁹

No século XVI, os portugueses, em parte, pelo seu desinteresse comercial, apostaram mais nas especiarias, de Goa à China era mais longe do que ir de Goa a Lisboa, por outro, por incapacidade de imporem esse novo hábito cultural, pouco fazem (ou conseguem fazer) pelo maior aproveitamento comercial do chá¹¹⁰. Embora só tenhamos dados para a segunda metade de seiscentos, parece que o gosto dos europeus pelo chá é inicialmente fruto do talento comercial dos holandeses. Estavam em Java, que ficava muito mais próximo da China, e no Japão eram então, após a expulsão dos portugueses, os únicos europeus permitidos. Distribuindo com sucesso o chá em vários pontos da Europa, criam no século XVII um mercado bastante lucrativo¹¹¹.

¹⁰⁸ Ibidem, pp. 34-35.

¹⁰⁹ Ibidem, pp. 27-28 e 30.

¹¹⁰ Ibidem, p. 27.

¹¹¹ Ibidem, pp. 30-32. Terá ‘começado modestamente na Europa, discretamente mesmo em Amesterdão, segundo os registos disponíveis para o triénio de 1668-1670. O seu comércio começou a disparar apenas em finais do século XVII, a par do café, mas mesmo assim, apenas correspondeu a 4,2% do tráfico total da Companhia das Índias Orientais Holandesas (VOC), longe dos 32,2% atingido cerca de meia centúria mais tarde (1738-1740).’

Tão apetecível que, atraídos pelos altos lucros deste comércio, a partir de finais daquele século XVII, os ingleses, vencendo a concorrência holandesa, alargam o mercado do chá na Europa¹¹². A tal ponto que, na sequência da Guerra do Ópio, a fim de equilibrarem as transações comerciais com a China, na primeira metade do século XIX, impuseram o consumo de ópio à China. A passagem do domínio holandês para o inglês marcou também a mudança do chá japonês para o chinês.

No espaço de um século, de 1700 a 1800, as importações de chá de Cantão, na China, para a Inglaterra, aumentaram de 50 toneladas para 15 000 toneladas. (Hobhouse 2007: 109) Em 1801, estimava-se que cada inglês consumia uma média de 2 ½ libras de chá e 17 libras de açúcar. (Hobhouse 2007: 119) Tais quantitativos, expressavam, no século XIX, ‘5% do produto interno bruto inglês, e, no entanto, ninguém sabia como o chá se desenvolvia ou preparava.’ (Hobhouse 2007: 96-97)

Consumo de chá: nos Açores e no continente português

Em Portugal Continental, ao princípio o chá era consumido por uma elite, por parte de gente nobre, de freiras e frades nos conventos para depois passar no início do século XIX a ser consumido por classe média e povo em geral. Se bem que ainda não fosse consensual, na Câmara dos Deputados, alguém afirmava em 12 de Janeiro de 1844 que *‘os hábitos do princípio deste século são mui diferentes dos actuais; que diferença não existe nos hábitos, que existiam até 1800, para aqueles que se dão em 1811 Nesse tempo era muito raro nas Províncias o chá; não se tomava chá todas as noites, como agora quotidianamente se está tomando; nem mesmo ao almoço o havia; ele então era como remédio da Botica; hoje o chá toma-se, e usa-se mesmo nas Povoações do interior das Serras do Gerês, e da Estrela (...).’*¹¹³ Outro, em 1846, exclamava: *‘Quando vimos nós, há 15, 20, ou 30*

¹¹² Ibidem, p. 34: ‘(...) Ao fracassarem as tentativas holandeses de estabelecimento na China, a VOC ficou prisioneira dos intermediários, como Macau, que descarregavam mais chá em Batávia, e por isso, foi incapaz de competir coma rival inglesa, a East India Company, quando esta conseguiu instalar-se no Império do Meio no princípio do século XVIII (1713). A companhia inglesa obteve outro triunfo por volta de 1653, o monopólio da sua introdução na Inglaterra, privilégio que manteria de pé até 1833 (...) Os chás em folha chineses (negociados pelos ingleses), ao serem mais baratos que o exclusivista e caro *matcha* (comerciados do Japão pelos holandeses), puderam ser apreciados por pessoas de menos recursos económicos. A subida dos salários na Inglaterra (...) Habituarom-se (os ingleses) a beber chá na refeição com que fechavam o dia de trabalho, mais tarde chamada high tea (...) o sucesso foi estrondoso em menos de quarenta anos, tanto que os valores do chá traficado pela EIC em 1760 eram cinco superiores aos registados em 1721 (...).’

¹¹³ C. Câmara dos Deputados, 12 de Janeiro de 1844, p.39; Visto em 21 de Abril de 2015; <http://debates.parlamento.pt/page.aspx?cid=mc.cd&diary=a1844m01d12-0039&type=texto&q=ch%C3%A1&sm=p>

*anos, como eu quando viajei pelo país, quando ouvimos nós falar em chá em aldeias do interior! Era género que lá se não conhecia; era artigo de botica.*¹¹⁴

Em 1848, ainda na Câmara dos Deputados, dizia-se já que *‘o chá é hoje entre nós bebida habitual de ricos e pobres, e pôde dizer-se, sem exageração, que três quartas partes do Povo Português fazem uso daquela bebida. Converteu-se pois de objecto de luxo, que era ainda há anos, em objecto de primeira necessidade.*¹¹⁵

Mas nem todos pensavam assim, pois ainda em 1851, era tido por outros como objecto de luxo: *‘por exemplo, chá, café e cacau, são aqueles que têm meios para comprar estes artigos, quase de luxo; e que os de primeira necessidade são mui pouco onerados (...).*¹¹⁶

E veja-se como à margem do centro, no interior, ingleses e holandeses chegavam aos Açores: *‘(...) Durante o século XVIII estão assinalados, nos registos das alfândegas, a entrada nos portos açorianos de diversos produtos provenientes dos mercados ingleses e holandeses (em especial dos primeiros) com quem o comércio externo se estabelecia de longa data. No rol das mercadorias importadas figura o chá.’* (Albergaria [s.s] [no prelo])

A reforçar a ideia do consumo elitista do chá nos Açores, aduzem-se três provas. Em 1808, por exemplo, na casa de João Caetano Botelho, tio de Madre Margarida, existiam *‘(...) dois bules, um preto e outro branco (...) 12 xícaras de chá (...).*’ Em 1829, consumia-se chá no mosteiro do Santo Nome de Jesus na Ribeira Grande. Em casa da freira Margarida Isabel do Apocalipse também.

Nem todo o chá passava pela Alfândega. Já bem dentro do século XIX, na segunda metade, para as décadas de trinta, de quarenta e de cinquenta do século XIX, Francisco Maria Supico refere inúmeros episódios de contrabando de chá em S. Miguel. Neles fala-se de um comerciante inglês de origem judaica. As redes funcionavam no interior dos Impérios: neste caso no seio do Império informal inglês.

Nos seus regulamentos, o clube Micaelense (segundo Margarida Machado) oferecia aos sócios em certas ocasiões chá. Assim se compreende,

¹¹⁴ Cf. Câmara dos Deputados, 4 de Março de 1846, p. 7, 10; Visto em 21 de Abril de 2015; <http://debates.parlamento.pt/page.aspx?cid=mc.cd&diary=a1846m03d04-0007&type=texto&q=ch%C3%A1&sm=p>

¹¹⁵ Cf. Câmara dos Deputados, 26 de Abril de 1848, pp. 1-3; Visto em 23 de Abril de 2015; <http://debates.parlamento.pt/page.aspx?cid=mc.cd&diary=a1848m04d26-0003&type=texto&q=ch%C3%A1&sm=p>

¹¹⁶ CF. Câmara dos Pares, 21 de Fevereiro de 1851, p. 233; Visto em 21 de Abril de 2015; <http://debates.parlamento.pt/page.aspx?cid=mc.cp2&diary=a1851m02d21-0233&type=texto&q=ch%C3%A1&sm=f>

creio, que o primeiro chá feito em 1878, fosse levado ao clube Micaelense para ser provado. Começava o chá a ser consumido por todos e passava a ser uma bebida de primeira necessidade.

Quanto ao consumo de chá nos Açores, pode dizer-se que, com um ligeiro atraso, terá conhecido sensivelmente o mesmo percurso do continente português. Temos, pois, dados documentais de que o chá de comércio chega aos Açores no século XVIII. Porém, é crível que comece a vir desde o início. Do Japão ou de outro ponto do Extremo Oriente. Sabendo, no entanto, que desde sempre houve jesuítas oriundos dos Açores no Oriente, entre outros o beato João Baptista Machado (Angra, 1582 – Omura, Japão, 1617), que aprendeu japonês, é provável que o chá (planta e folha bebível) fosse trazido para os Açores desde então.

A Europa estuda o chá

Os europeus ainda no século XVI iniciam o estudo científico do chá. Isabel Albergaria é de opinião de que ‘*os Europeus tomaram conhecimento do chá através das redes portuguesas estabelecidas no Oriente (pois) são em obras portuguesas que aparecem os primeiros testemunhos directos acerca da bebida*¹¹⁷. Diz ainda: ‘*O jesuíta italiano Matteo Ricci (1562-1610) que está na China desde 1582 até ao fim da vida, conta a forma como tomou conhecimento da bebida e observa as diferenças existentes entre o processo chinês, com a infusão da folha, sem que esta fosse ingerida, para os hábitos japoneses que continuavam a usar o chá em pó.*¹¹⁸ Não passariam, então, ‘(...) de meras curiosidades relativas aos hábitos e costumes de um mundo estranho e exótico.’(Albergaria [s.s.] [no prelo]) Será, porém, ‘(...) só no primeiro quartel do século XVII que surgem as primeiras descrições e classificações botânicas desta theacea pela mão do helvético Gaspard

¹¹⁷Cf: Frei Gaspar da Cruz, «Tractado em que se contam muito por estenso as cousas da China...» (1556). in Raphaella d'Intino (Ed.) *Enformação das cousas da China. Textos do século XVI*, Lisboa, 1989, p.202; Pe. Luis de Almeida (1525-1583) descreve a cerimónia do chanoyu de que tomou parte no castelo de Nara. In Charles Ralph, *The Christian Century in Japan 1549-1650*, Manchester/Lisboa, 1993, pp.52-54; o Pe. Luis Fróis escrevendo sobre o Japão nos fins do século XVI menciona igualmente o uso nipónico do chá. In Luis Fróis, *Europa-Japão. Um diálogo civilizacional no século XVI* (Ed. Por José Manuel Garcia e Raphaella d'Intino), Lisboa, 1993.

¹¹⁸ O jesuíta italiano Matteo Ricci (1562-1610) que está na China desde 1582 até ao fim da vida, conta a forma como tomou conhecimento da bebida e observa as diferenças existentes entre o processo chinês, com a infusão da folha sem que esta fosse ingerida, para os hábitos japoneses que continuavam a usar o chá em pó Matteo Ricci e Nicolas Trigault, *Histoire de l'Expédition chrétienne au royaume de la Chine, 1582-1610* (Editado por Joseph Shih, Georges Bessiere, Joseph Dehergne), Paris, 1978, Livro I, cap. III, pp.82-83.

*Bauhin (1550-1624) e do português, seu contemporâneo, o jesuíta João Rodrigues (1562-1633)*¹¹⁹.’ (Albergaria [s.s] [no prelo])

Sabe-se que já no século XVII, os holandeses terão tentado, sem sucesso, aclimatar chá fora da China e do Japão na ilha de Java¹²⁰. A produção, porém, continuou na China e no Japão. O chá produzido na China (essencialmente) mas também no Japão é transportado por mar, atravessava o Índico ou o Pacífico e alcançava a América ou a Europa. Havia também o que vai por terra em direcção à Rússia e países próximos.

Russell-Wood diz-nos que a transferência de espécies botânicas começou logo no século XV com o povoamento das Ilhas Atlânticas. A aclimação da planta do chá fora da China e do Japão, continuou a ser alvo de esforços regulares por parte das potências imperiais europeias durante os séculos XVIII e XIX. Sementes, rebentos e estacas de chá chegam a diversos jardins de aclimação de países europeus na metrópole ou em áreas sob o seu domínio fora da Europa. No caso português, a Tapada da Ajuda, em Lisboa, o Jardim Botânico de Coimbra, na Europa, ou Goa e o Brasil, fora da Europa, serão locais onde a aclimação de várias espécies foi ensaiada com diversos graus de sucesso¹²¹. No caso britânico, há que ter em atenção os Kew Gardens, na Inglaterra, ou os jardins de Calcutá, ou nos Himalaia, na Índia¹²². Ou nas ilhas de S. Vicente e Santa Helena, também dos ingleses, no

¹¹⁹ O destino destas duas obras foi no entanto bastante diverso, pois se a obra do botânico suíço *Pinax Theatri Botanici* (1623) foi amplamente divulgada na Europa, fornecendo ao público culto o conhecimento da planta com base nas informações que havia obtido dos holandeses, a obra histórica e descritiva do Pe. Português *História da Igreja do Japão* (1621-1) – onde fazia a descrição pormenorizada da planta do chá e do seu cultivo em solo japonês –, permaneceu inédita só tendo sido publicada na íntegra na segunda metade do século XX. O original da obra do Pe. Rodrigues perdeu-se tendo subsistido uma cópia setecentista que só foi dada à estampa recentemente. Ver. *João Rodrigues’s Account of Sixteenth-Century Japan* (Ed. Hakluyt Society por Michael Cooper), Londres, 2001.

¹²⁰ Cunha, João Teles e, O Chá: uma História do Oriente ao Ocidente, in *Revista Oriente*, N.º 21, 2012, p. 32: ‘(...) Procurassem obter um chazeiro no Japão para o transplantar em solo javanês, o que ocorreu finalmente em 1685 por obra do médico alemão Andreas Clayer (...)’.

¹²¹ CF. Russell-Wood, A J. R., *Um Mundo em Movimento: os portugueses na África, Ásia e América* (1415-1808), Difel, 1998, p. 259; CF. Raminelli, Ronald, *Viagens ultramarinas: monarcas, vassallos e governo à distância*, São Paulo, Alameda, 2008, pp.66-67; Cf. Domingues, Ângela, *Monarcas, Ministros e Cientistas. Mecanismos de Poder, Governação e Informação no Brasil Colonial*, CHAM, Centro de História de Além-Mar, Lisboa, 2012, pp.136-150; Cf. Cunha, João Teles e, *Op. Cit.*, p. 33.

¹²² Cf. Cunha, João Teles e, *Op. Cit.*, 2012, p. 33.

Atlântico¹²³. Ou a França¹²⁴. A Holanda, como vimos, tinha Java como campo experimental¹²⁵.

No Império Colonial Português

Conhecer o território para o aproveitar economicamente. Era notória a existência de uma política de reconhecimento das potencialidades do território, que unia os quatro cantos do Império à sede do Império onde o rei tinha o seu trono. Para entrar no assunto, o trabalho de Ronald Raminelli, Viagens Ultramarinas (...), é fundamental e deveras esclarecedor.

Primeiro, a fundação da Academia das Ciências de Lisboa, em 1779, é decisiva. Três a quatro anos depois da sua criação, a partir de 1783, promovem-se quatro importantes expedições a quatro parcelas do Império Português: Cabo-Verde, Angola, Brasil, Moçambique.

Depois, o estudo no próprio terreno continental português. Joahnn Hoffmannsegg e Joahnn Link, naturalistas alemães, que entre 1795 e 1801, percorreram em estudo o território continental português, são autores da *Flore Portugaise* que começa a ser publicada em 1801. Aí garantiram que ‘a planta do chá (tinha) pouca cultura na Europa. Link e Hoffmannsegg elogiaram a aclimação deste arbusto no país: quando se pretende cultivar o chá na Europa, o país que se deve preferir como mais próprio para este arbusto, seria sem dúvida Portugal nas suas províncias do norte. (...).’ A rede informal (ou formal, nalguns casos) constituída por informadores situados nos mais diversos pontos do Império Colonial Português, faz-nos luz sobre o papel desempenhado pelo Governador em Angra ao enviar duas caixas contendo plantas selvagens de chá. Fica-se melhor esclarecido lendo o trabalho (parte) de Ângela Domingos, *Monarcas, Ministros de Poder, Governação e Informação no Brasil colonial*. São agentes: governadores, outros funcionários, gente das localidades, ou os tais formados em Coimbra, que informam o rei e enviam espécimes. Mas a troco de benesses.

Ainda a rede de informadores. No Arquivo dos Açores, há uma carta do Capitão Geral dos Açores datada de 1802, a acompanhar dois caixotes de plantas e estacas enviadas ao rei: chá, junça e mamonas. É a peça mais antiga conhecida a confirmar a existência espontânea de chá nos Açores. Também atesta que aquele chá não era utilizado. Este documento, quanto a nós, é uma espécie de documento fundador do chá açoriano. É a explicação da integração dos Açores no desígnio do Rei. Não tivemos uma expedição como de Cabo Verde, Angola, Brasil, Moçambique, mas D. Antão de Almada, funcionou como um agente local no levantamento, ao que parece,

¹²³ Cf. Rose, Sarah, *OP. Cit.*, p. 130.

¹²⁴ Cf. Raminelli, Ronald, *Op. Cit.*, p.98; Cf. Cunha, João Teles e, *Op. Cit.*, p. 33.

¹²⁵ Cf. Cunha, João Teles e, *Op. Cit.*, p. 32.

escrupuloso, das potencialidades dos Açores. Tem sido citado, mas, não usado (em nossa opinião) com o relevo que a sua importância exige.

Pelo que, para se entender o chá nos Açores, transcrevemos partes substanciais daquele documento. O Rei havia ordenado a D. Antão de Almada a ‘29 de Novembro de 1799’ que remetesse para a ‘Corte alguma Planta do Chá, que tem vegetado nesta Ilha [Terceira].’ D. Antão de Almada fora nomeado Capitão Geral dos Açores a 15 de Junho de 1795, mas apenas desembarcaria em Angra a 6 de Novembro de 1799.

A junça: em ‘Aviso de 12 de Junho do ano próximo passado [1800],’ continua, o Rei havia ‘(...) determina(do) a remessa do Grão chamado Junca, de que se sustentam os habitantes da Ilha do Corvo, indo esta acompanhada de uma informação sobre aviso, que se faz dela, o modo da sua cultura, e qual é o terreno mais próprio para a sua produção.’ Insere-se, como se vê, na preocupação geral do Rei, em aproveitar os recursos dos seus territórios.

Voltando a dar atenção ao chá: ‘(...) satisfazendo a mesma determinação (...) remet(ia) agora [11 de Junho de 1801] pela Fragata Cisne dois caixotes com a planta do dito chá.’ Por que razão terá demorado de finais de 1799 a Junho de 1801 a satisfazer o pedido do Rei? O monarca havia-lhe pedido conhecimentos e exemplares de junça, de mamona e de chá, pelo que Almada terá necessitado tempo para o fazer.

Almada desloca-se aos locais onde se procede à recolha, descrevendo com rigor o que neles vê: ‘como eu já pessoalmente examinei.’ Continuando no chá: ‘cuja vegetação é muito fácil nestes sítios, produzindo sem outra alguma cultura mais, do que fazer a sua plantação, chegando a produzir ainda mesmo por entre as pedras (...).’ (Arquivo dos Açores, v. XIII 1983: 515-516)

Consciente do seu potencial, detém-se nesta importante planta. Afirma serem várias as pessoas que o possuem na ilha da Terceira: ‘porém as (...) que por curiosidade o têm (...)’ revela, ‘não fazem desta planta o menor apreço (...).’ Por ‘(...) lhes ser inteiramente incógnito o modo de secarem para poder chegar àquela consistência, que tem o chá (...).’ Era o que se ignorava. E de onde vinha? Da ‘Índia’. Equívoco? Não, vinha da China através de Goa, cabeça do Estado da Índia. Por não saberem secar ‘(...) abandona(va)m esta planta de tanta utilidade.’ (Arquivo dos Açores, v. XIII 1983: 515-516)

Acclimação no Império Português: Brasil

O interesse económico gerado pelo chá, levou os europeus a experimentarem o seu cultivo e fabrico fora da China. Java, já no Oceano Índico, fora uma primeira tentativa conhecida fora do Oceano Pacífico, seguiu-se uma nova em finais do século XVIII, ainda no Índico mas na Índia

pelos ingleses¹²⁶. Fora do Índico, já no Atlântico, no Rio de Janeiro, na capital brasileira, na altura sede do governo do Reino de Portugal, espaço colonial português por excelência, ocorre em 1816 a primeira experiência bem-sucedida de cultivo e produção de chá¹²⁷. Entretanto, nas décadas seguintes, a guerra do ópio e a perda do monopólio do comércio do chá por parte da companhia inglesa (1833), levou a que esta investisse na produção de chá na Índia: nas áreas de Assam e Darjeeling¹²⁸.

Os chineses, detentores da tecnologia, protegiam naturalmente o segredo do seu fabrico. Os europeus, tal como haviam feito com a porcelana, tentavam desvendá-lo, porém, com limitado êxito. A ajuda para desvendar o segredo viria, de onde menos se esperaria: da própria China. O segredo do fabrico da porcelana e da seda, já fora desvendado pelos europeus, o do chá seria oferecido ao rei de Portugal no Brasil.

Quatro chineses foram enviados pelo Imperador da China ao Rei de Portugal. Por que razão o terá feito? Em reconhecimento do papel desempenhado pelos portugueses em Macau, como alguns nos querem fazer crer? Ao favorecer mais uns do que outros, conseguir algum equilíbrio geoestratégico entre o Império Chinês e os Impérios Coloniais Europeus?

¹²⁶ Cf. Cunha, João Teles e, *Op. Cit.*, pp. 33: '(...) o aumento verificado nas importações de chá chinês e o consequente défice na balança comercial com a China, que nem a reexportação ajudava a equilibrar. Isto e certos incidentes de natureza comercial levaram a Grã-Bretanha a procurar transplantar o chazeiro para solo indiano desde o último quartel do século XVIII. Os esforços envolveram o naturalista Sir Joseph Banks e o recentemente criado jardim Botânico de Calcutá, mas só vieram a dar resultado no século XIX, com a descoberta no Assam da cameleira, levando a que a exploração comercial começasse de forma titubeante em 1835.'

¹²⁷ *Idem*, pp. 33-34: '(...) Portugal viria a trilhar o mesmo caminho botânico no século XVIII (que os ingleses) apesar do atraso costumeiro (...) Mas o Brasil continuou a ser uma peça central na estratégia de aclimação do chazeiro no Império português, algo que veio a ocorrer por volta de 1812-1816, tendo o recentemente criado Jardim Botânico do Rio de Janeiro (1808) desempenhado uma acção fundamental na transplantação da cameleira e de outras espécies asiáticas para o solo brasileiro, dando início à sua exploração comercial. Ainda assim um obstáculo de monta a ultrapassar, que era dominar as técnicas de transformação das folhas da cameleira em chá, um conhecimento guardado ciosamente pelos principais produtores no Extremo Oriente. Mesmo assim, foi à China que todos os (p. 34) países ocidentais foram buscar inicialmente os técnicos para transformar as folhas, porque o Ocidente se viciara em chás tipo chinês, a começar pelos ingleses e a continuar pelos portugueses, tanto no Brasil (1812-1816), como mais tarde em S. Miguel (1878). Este recrutamento de técnicos pôde processar-se porque o quadro das relações entre a Europa e o Império do Meio estava a alterar-se, com este a perder progressivamente a sua capacidade de resposta e, consequentemente, a sua autonomia política e económica frente às potências industrializadas europeias, coma Grã-Bretanha à cabeça.'

¹²⁸ Cf. Rose, Sarah, *OP. Cit.*, 2010, pp.1-6; Cf. Heiss, Mary Lou, Robert J. Heiss, *Op. Cit.*, pp. 24-29. (Tradução do Autor)

Assim, enfraquecia o poderio inglês exercido sobre a China? Somos levados a pensar na segunda hipótese, sem esquecer a primeira.

Fosse qual fosse a intenção do imperador chinês, a oferta de quatro técnicos chineses ao rei de Portugal, na altura no Brasil, veio ao encontro da sua intenção em promover o desenvolvimento económico do Império Português: de o libertar dos domínios britânico e holandês e o tornar concorrencial. Não era uma intenção nova, pelo menos a nível de recomendação, vinha já muito de trás.

Se havia nos Açores chá em 1801, não seria também provável que no Brasil já existisse chá antes de 1816? Talvez por influência dos Jesuítas, que se dedicaram a diversas experiências de aclimação? Terá havido chá no Brasil anteriormente a 1816, só que, a sua memória ainda não foi resgatada ao esquecimento?

Para saber como chegou a produção do chá ao Brasil, damos a palavra a Aníbal Cabido: ‘*Conta-se que o Imperador da China fizera ao Rei de Portugal, (...) um valioso presente da planta de chá, que fez acompanhar por quatro naturais daquele país para ensinarem a cultura e manipulação da folha.*¹²⁹ E claro, a razão da dádiva, continua, ‘*parece que (...) fora feita em sinal de gratidão pelo auxílio prestado por Portugal contra a pirataria que infestava os mares da China.*¹³⁰ Pode ser, como insinuámos, mas também pode ser por outras razões mais prosaicas: geoestratégicas. Talvez, se houvesse chá mais perto da Europa, produzido por um país mais fraco, Portugal, os ingleses, perdessem o interesse pelo chá chinês e deixassem, veja-se a subtileza, de vender ópio contra a vontade das autoridades chinesas.

O Brasil era, pois, o primeiro local, fora da Ásia, onde se cultivara e transformara com sucesso o chá. Mais precisamente: ‘uma colónia de chineses foi trazida de Macau para o Rio de Janeiro pelo Governo Real Português, entre 1812 e 1819, de maneira a introduzir a cultura do chá no Brasil. Tratava-se de um projecto económico estratégico, organizado pelo governo de D. João VI, estimulado pelo Ministro do Reino, Conde de Linhares - nesse período, o ofício era representado por Francisco de Sousa Coutinho Teixeira de Andrade Barbosa (1790-1857), - e protegido pelo Ministro de Guerra e dos Estrangeiros, Conde da Barca - António de Araújo e Azevedo (1754-1817).¹³¹

No Brasil, o Rei continuava a política da Metrópole: ‘(...) Em 1808 D. João VI cria o *Jardim de Aclimação*, depois *Real Horto Botânico do Rio*

¹²⁹ Cf. Aníbal Gomes Ferreira Cabido, A indústria do chá nos Açores, Boletim do trabalho industrial, n.º 88, Direcção Geral do Comércio e Indústria, Coimbra, 1913, pp.4-13.

¹³⁰ Idem, pp. 4-13.

¹³¹ Cf. <http://leiturasdahistoria.uol.com.br/ESLH/Edicoes/17/artigo125466-1.asp>

de Janeiro com o objectivo de aclimatar as especiarias vindas das Índias Orientais¹³².

Decorrido um ano sobre o envio de plantas em 1801 de chá dos Açores para o Reino, são enviadas sementes e estacas de todos os pontos do reino e colónias, incluindo os Açores, para o Jardim Botânico de Goa. Pretendia-se que aquele jardim botânico, criado pelo Príncipe Regente D. João, futuro D. João VI, fosse um local de experiências. No caso de sucesso, seriam introduzidos noutros pontos do Império: no Brasil ou noutros domínios do reino¹³³. Em carta de 1805, quer-se que se dê atenção ‘às plantas económicas e medicinais exóticas.’¹³⁴ O projecto pouco tempo durou, sendo interrompido pelas invasões francesas e a fuga da corte para o Brasil. É do conhecimento geral que no exército francês seguiam botânicos e naturalistas com instruções muito precisas para estudar as colecções portuguesas. Com a corte no Brasil, o esforço foi transferido da Europa para a América.

Deste modo, logo nos primeiros tempos da corte no Brasil (a partir de 1808), a corte interessou-se pela introdução do chá no Brasil. 1803, e um ano ou dois depois, o Jardim Botânico de Goa e o envio de sementes e estacas de todo o reino, ajuda-nos a perceber o circuito do chá no Império português¹³⁵.

No caso português, antes ainda do século XVII, à medida que o Império do Oriente ia sendo perdido para Ingleses, Holandeses e Franceses, sentiu-se a urgência em implementar novas medidas de fomento económico. A introdução de novos produtos era uma preocupação e uma prática recorrentes. Todavia, o chá, apesar do sucesso do seu fabrico, talvez porque os cultivadores brasileiros preferissem o café, nunca alcançou o êxito pretendido. E pouco depois, com o Brasil independente, Portugal perdeu mais aquela potencial fonte de rendimentos.

O Brasil em 1812-1816 e a abertura do canal de Suez em 1869: reflexos

Além dos ensaios bem-sucedidos do Brasil entre 1812 e 1816 e os dos Açores em 1878, há conhecimento seguro de tentativas no próprio território continental português: ‘Do Brasil, o chazeiro chegou ao Continente, onde a cultura foi ensaiada no Norte, Centro e Sul. Ainda hoje existem plantas desse tempo, embora abandonadas, sendo o maior conjunto conhecido aquele que existe no talhão n.º 14 do Parque da Pena, na Serra de

¹³² Cf. João Conrado Niemeyer de Lavôr, *Histórico do Jardim Botânico do Rio de Janeiro*, Rio de Janeiro, 1983

¹³³ Cf. Russell-Wood, A. J. R., OP. Cit., p. 259.

¹³⁴ Idem, p. 259.

¹³⁵ Idem: ‘Em 1805, foram enviadas do Real Jardim Botânico de Lisboa para Goa, sementes de 23 plantas, o que constitui presumivelmente, a introdução destas espécies na Índia.’

Sintra, no local denominado Alto do Chá (...).¹³⁶ Diz-se que o primeiro a tentar o chazeiro em Portugal Continental, vindo do Brasil, em finais do século XVII, foi Gaspar Pereira de Castro ‘ex-emigrante no Brasil que, após várias tentativas fracassadas em Coura e Ponte de Lima, regressou ao Brasil, sem conseguir vender as plantações em que investira.’¹³⁷

Joaquim Manuel de Araújo Correia, antes da experiência de 1878 nos Açores, ‘que foi professor do Real Colégio da Missão Portuguesa de Pequim, e aí se tornou um aficionado do chá e aprendeu as técnicas necessárias ao seu fabrico, quando teve conhecimento da existência de chazeiros em Portugal, procurou ajuda junto da Casa de Bragança, no intuito de implementar esta cultura no nosso país. Nomeado director da cultura do chá, enviou plantas e sementes para diversas terras da Casa de Bragança em Vila Viçosa, Vendas Novas e Quinta do Alfeite, onde experimentou também, sementes também de proveniência brasileira. Como estas sementes não germinaram, correram boatos de que pessoas íntimas dos responsáveis pelos serviços alfandegários, interessados em proteger a cultura do chazeiro, entretanto, implementada nos Açores, haviam destruído essas sementes. Como era natural, a cultura do chazeiro teria muito poucas probabilidades de se desenvolver nas terras alentejanas para onde a Casa de Bragança mandou as sementes e as plantas.’¹³⁸

Antes de Agosto de 1842, procedera-se a ensaios sobre o chá em Lisboa. Pela mão do Visconde de Vilarinho de S. Romão, chá no Jardim Botânico da Ajuda, em estufa e fora dela, vindo da Índia para o Brasil e daí para Portugal Continental. Diz-se assim: ‘(...) fui membro da Comissão Inspector do Jardim Botânico da Ajuda por três anos; ali mandei semear o chá da Índia, cujas sementes vieram do Rio de Janeiro; lá existe dentro das estufas, e fora das estufas; de maneira que está aclimatado, e o podemos cultivar no Algarve, e talvez em todo o Sul de Portugal, por que este País dá tudo (...).’¹³⁹

Ou, perdido o Brasil, estando a Inglaterra a tentar no Assam e Djarleing e os Holandeses em Java, sugestões para o cultivo do chá em Moçambique. Diz-se aí que é tão rico como o Brasil: ‘(...) Sr. presidente,

¹³⁶ Cf. Rosa, Paulo, Chá uma bebida da China, Património Natural dos Açores, Mirandela, Viseu, 2004, p. 39.

¹³⁷ Idem, p. 39.

¹³⁸ Ibidem, pp. 39-40. (Chá: uma das mais remuneradoras actividades no Brasil) (...) como afirma Chernoviz, sábio agrónomo brasileiro, na terceira edição do seu Dicionário de Medicina, impresso no ano de 1868 (...);’ Cf. Moraes, Joaquim Manuel de Araújo Correia, Manual do Cultivador do chá do comércio, resumo dos apontamentos, que acerca de tão importante e fácil cultura, foram publicados no pretérito ano de 1881, Lisboa 1882.

¹³⁹ Cf. Câmara dos Pares, 31 de Agosto de 1842, p. 237; Visto em 21 de Abril de 2015; <http://debates.parlamento.pt/page.aspx?cid=mc.cp2&diary=a1842m08d31-0237&type=texto&q=ch%C3%A1&sm=f>

quem ignora que a província de Moçambique é a possessão porventura mais preciosa que nós temos? Ali dá-se ou pode dar-se tudo que se dá no Brasil. (...) a cultura do chá e especiarias (...).¹⁴⁰

E mesmo na remota China, um pouco esquecido e quase totalmente desprotegido pela metrópole, em Macau, produzia-se chá apesar de não se cultivar chá. É o representante daquele território na Câmara dos Deputados, Horta e Costa quem, ao sugerir o aproveitamento de Macau, tal como faziam os Espanhóis nas Filipinas, os Holandeses em Java e os Ingleses em Hong-Kong, nos fala do assunto: ‘Há ali um grande número de fábricas importantes onde o chá, vindo do interior quase em bruto, ou preparado e passado por tantas operações sucessivas, de modo a sofrer uma alteração tão completa, que quase deverá ser esquecida a sua classificação primária, para ser considerado apenas como um produto da indústria daquela colónia.

Ainda há pouco tempo havia ali, e creio que ainda hoje (1889) há, quinze fábricas (...).¹⁴¹

No interessante trabalho sobre o chá que vimos a citar, Aníbal Cabido comenta o efeito que o sucesso do chá brasileiro produziu na Europa: ‘(...) alguns países europeus enviaram ao Brasil agentes seus. A França encarregou um sábio naturalista de seguir no Brasil os processos culturais, o qual retirou levando para os jardins públicos de Angers e para alguns particulares numerosas plantas. Ainda estas tentativas se frustraram’.

Continuando o mesmo autor, afirma que ‘os ingleses, assistindo ao malogro de todas as experiências e estudos, e cheios do espírito prático que os caracteriza, abandonaram a ideia de introdução e aclimação da planta na Europa, e começaram de desenvolver a cultura do chá na Índia e nas proximidades do Himalaias, onde vão buscar o que consomem.’ Os holandeses, com o êxito dos ingleses na Índia, fazem-no na ilha de Java.

Desistindo de tentar em solo europeu, a Inglaterra, investe a partir da década de 30 do século XIX, na província de Assam, na Índia, onde obtém sucesso. Por esta mesma altura, os holandeses, investem também com sucesso na Ilha de Java, na Indonésia. Entretanto, dá-se a guerra do Ópio, em que uma China vencida é obrigada a abrir portas. A guerra deu-se por causa do ópio que os europeus vendiam à China de modo a equilibrarem a sua balança de pagamentos.

¹⁴⁰ Cf. Câmara dos Deputados, 14 de Fevereiro de 1856, p.296; Visto em 24 de Abril de 2015;

<http://debates.parlamento.pt/page.aspx?cid=mc.cd&diary=a1857m02d14-0296&type=texto&q=ch%C3%A1&sm=f>

¹⁴¹ Cf. Câmara dos Deputados, 3 de Maio de 1889, pp. 523-524, 528; Visto em 22 de Abril de 2015;

<http://debates.parlamento.pt/page.aspx?cid=mc.cd&diary=a1889m05d03-0524&type=texto&q=ch%C3%A1&sm=f>

Em 1878, ‘o sucesso inglês na Índia levou os holandeses a importar estacas de chá do Assam para a ilha de Java. Depois de perto de 45 anos de pouca sorte cultivando arbustos de chá vindos da China e do Japão, este era a tentativa final de estabelecer uma florescente indústria de chá nesta ilha Indonésia.¹⁴²

Aclimação do chá nos Açores

Tanto quanto se sabe, foi António Feliciano de Castilho quem, em artigo de 1848, primeiro sugeriu a aposta da cultura do chá nos Açores. Quando ainda as laranjas ofereciam chorudos rendimentos, Castilho acreditava que era sensato diversificar a aposta em outras culturas. Até porque poderia, como viria a acontecer, advir algum mal à laranja: doenças e concorrência. Por esta altura, diga-se, começou a surgir um grave problema com os laranjais.¹⁴³

De onde terá vindo a planta de chá para os Açores? Da China directamente para os Açores ou da China através do Brasil? Ou do Japão? Ou da Índia? Desconhece-se a origem das plantas referidas no Arquivo dos Açores de finais do século XVIII, inícios do XIX. Já em 1883, Gabriel de Almeida, natural de S. Miguel, que acompanhou de perto os primeiros passos as primeiras experiências bem-sucedidas de 1878/79, e estudou o chá em S. Miguel, confessava ‘*Não sabemos ao certo como é que a planta do chá chegou a S. Miguel (...)*’.¹⁴⁴ Russell-Wood, um estudioso inglês do Império colonial português, em 1992, afirmava que ‘*quanto ao transporte de plantas oriundas da Índia e da Ásia é mais difícil detectar datas ou disseminadores específicos*’.¹⁴⁵

Não iremos referir as diversas versões conhecidas da introdução do chá na ilha de S. Miguel¹⁴⁶. Vou usar o caso de José do Canto para responder

¹⁴² Cf. Heiss, Mary Lou, Robert J. Heiss, OP. Cit., p. 29. (Tradução do Autor)

¹⁴³ Cf. António Feliciano de Castilho, Agricultor Michaelense, n.º 1, Janeiro de 1848, fls. 1-16.

¹⁴⁴ Cf. Almeida, G., Breve Notícia sobre a Cultura da Planta do chá, Ponta Delgada, Typographia Imparcial, 1883

¹⁴⁵ Cf. Russell-Wood, A J. R., OP. Cit., p. 255.

¹⁴⁶ **As quatro versões segundo Amâncio Machado de Faria e Maia entre 1750 e 1850:** 1- ‘Segundo uns, a planta chegou até nós trazida do Jardim Botânico do Rio de Janeiro, entre 1750 e 1800, pelo arquitecto Leite, que construiu o Solar da família Leite, na Rua dos Pinheiros, em Ponta Delgada. Também construiu o 2.º solar da família morgada Machado de Faria e Maia, em estilo D. João V, a Casa da Arquinha. No vasto jardim desse solar existem plantas de chá e no solar do Cabouco uma pequena plantação (700m2), sendo lá colhida a folha verde para as primeiras experiências de fabrico e sementes e estacas para outras plantações;’ 2- ‘Segundo o eng.º Ferreira Cabido, teria sido trazido do Brasil, por um micalense de nome Jacinto Leite, que no Brasil como comandante da guarda Real de D. João VI, em 1820. Foram por ele semeadas as bagas de chá numa sua propriedade das

à pergunta inicial. As sementes, estacas e rebentos chegam em dois períodos bem distintos: antes e depois das caixas de ward. Seu autor foi Nathaniel Bagshaw Ward. Ou seja antes e depois de finais da década de trinta do século XIX. Uma espécie de estufa inventada por Ward permitiu a transferência de espécies de pontos diversos e longínquos do globo com taxas de sobrevivências muito altas¹⁴⁷. Antes e depois do século XIX, também se aplica a viveiristas ou não. O que significa que ou vêm directamente da origem ou indirectamente através dos viveiristas. O século XIX vê surgir viveiristas e caçadores de plantas.

E temos que ter em conta a perspectiva de José do Canto. De 1846 até inícios da década de sessenta, fora quase só o coleccionador movido pelo prazer de coleccionar. Em carta de 5 de Abril de 1866, confessa: '(...) (fl. 444) (...) *Desde 1846 que colijo plantas e pouco encontro já em França, Inglaterra e Bélgica que seja novo ou me convenha. Da Alemanha e do Norte da Europa só conheço os estabelecimentos de (...) Booth em Hamburgo (...)*'.¹⁴⁸

Porém, José do Canto, como se depreende de carta de Fevereiro de 1866, ainda em Paris, não pondo de parte o coleccionismo de plantas,

Calhetas;’ 3- O mesmo eng.º Ferreira Cabido, segundo Faria e Maia, ‘Apresenta também uma outra versão, segundo a qual um antigo serviçal do morgado João Soares, regressando do Brasil, presenteara o antigo patrão com aquela especialidade;’ 4- ‘Segundo dizem outros, foi o meu bisavô José Inácio Machado de Faria e Maia quem as trouxe do Brasil no regresso da sua aventura amorosa. Enamorara-se loucamente da filha de um hóspede da casa da Arquinha, o reposteiro-mor da corte, de nome Correia Caupers, o qual esteve em São Miguel de passagem para o Brasil. O meu bisavô, ainda muito novo, embarcou clandestinamente na nau que o levou ao Brasil, lá casou, sendo afillhado de D. João VI, e de regresso a S. Miguel teria trazido as sementes do chá, ou mais, ou mais, além das que já haveria por cá (...). Julgo possível que qualquer das versões tenha fundamento.’

Cf. Amâncio Machado de Faria e Maia, *Esboço Histórico da Indústria Agrícola do chá em S. Miguel, Insulana*, vol. XV, ICPD, 1959, pp. 427-428; *Ensaio fora do SPAM? De Jacinto Leite Pacheco que trouxe o chá do Brasil para S. Miguel por volta de 1820.*

Esta nota teria vindo (?) no *Agricultor Michaelense*, portanto o mais tardar entre a década de quarenta e a de cinquenta? ‘Consta-nos [Supico?] que o sr. Jacinto Leite tem aumentado muito a cultura da planta do chá, nos seus terrenos no lugar das Calhetas. Seria para desejar que se fizessem alguns ensaios, em vários pontos da ilha, e que se estudasse o modo de fazer a colheita e de preparar o chá, para o comércio.’

A notícia precedente foi encontrada no *Agricultor Michaelense*.’

Se foi, então é muito anterior a 1874. Recua á década de 50!!! *Persuasão*, 15 de Abril de 1874, Francisco Maria Supico, *As Escavações*, vol. III, 1995, p. 1024

¹⁴⁷Rose, Sarah, *For All The Tea in China: espionage, empire and the secret formula for the world's favourite drink*, Arrow Books, London, 2010, pp. 49-51.

¹⁴⁸ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 157in [Copiador de correspondência de José do Canto (Nov. 1865-Abril 1866)] Carta de José do Canto a Frederick Welwitsh, Paris, 5 de Abril de 1866, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 157

acrescentava uma nova dimensão: agora, além de continuar com as ornamentais, adquire plantas para as rendibilizar economicamente. Depreende-se que além das laranjas e outros, o chá possa estar incluído: ‘(...) Arranjei um bom número de plantas económicas: nestas é mais a curiosidade do que a esperança de êxito, que me moveu ou ao menos seria necessário dirigir os ensaios de cultura por método muito diferente daquele que até agora temos seguido, e em localidades bem escolhidas e adaptadas (...).¹⁴⁹ Preparava-se para regressar de Paris a São Miguel onde queria reformular a sua casa. Para isso investira na aquisição das terras do Pico Arde. É aí que será o seu palco do chá. A Caldeira Velha.

A década de sessenta do século XIX é um período fundamental para o chá de S. Miguel. Uma carta do jardineiro Alexander Reith escrita de Ponta Delgada e dirigida a José do Canto, seu patrão, na altura a residir em Paris, dá-nos conta de uma pequena remessa de três sementes de chá provenientes do Japão em 1860. É a primeira nota que se conhece depois da de inícios do século do Arquivo dos Açores. Reza assim: ‘(...) Sir (...) A list of Japanese seeds received from Capt. Sundetrall (...) N.º 6 Seed of the Thea Bush from Japan 1860, 3 seeds.¹⁵⁰ (Tradução nossa: Senhor (...) Uma lista de sementes japonesas recebidas do Capitão Sundetrall (...) N.º 6 Semente do arbusto Thea do Japão 1860, 3 sementes.’

A visita de Edmond Goeze (n.1838 – f. 1929) em 1866, aponta para experiências anteriores a 1866. Talvez para aquelas sementes oriundas do Japão ou porventura de outras. José do Canto mandara vir também sementes e plantio algures da China. Estamos a falar de uma altura antes de 1864¹⁵¹.

¹⁴⁹ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155, in [Copiador de correspondência de José do Canto (Nov. 1865-Abril 1866)] Carta de José do Canto a Ernesto do Canto, Paris, 9 de Fevereiro de 1866, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155

¹⁵⁰cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 95, 595-C, 1455-list/Ap, in Carta de Alexander Reith a José do Canto, Ponta Delgada, 11 de Dezembro de 1863, A list of Japanese seeds received from Capt. Sundetrall, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 95, 595-C, 1455-list/Ap

¹⁵¹ Escreve Goeze: ‘(...) Quando, no Verão de 1866, viemos de Coimbra para visitarmos demoradamente S. Miguel, tivemos ensejo de travar relações com o grande proprietário José do Canto, cujo pensamento dominante era o progresso e a prosperidade da sua terra (p. 127) (...) O sr. José do Canto comunicou-nos também o seu plano de proceder a plantações de chá e quis ouvir-nos sobre o assunto (...) por intermédio do professor Decaisne, que mantinha relações directas com a China, pôs-se Canto em contacto com algumas firmas comerciais dali [onde precisamente na China?].

Pediu que lhe remetessem sementes em grande quantidade [Portanto, antes de 1866] bem como uma determinada porção de plantio que, para uma viagem tão longa, foi necessário acondicionar em caixas de sistema ‘ward.’

Apenas um problema, José do Canto, naquela data estava em Paris¹⁵². Goeze e Canto não se conheciam ainda pessoalmente: ‘(...) (fl. 468) (...) *Je n’ai pas l’honneur de vous connaitre personnellement* (...)’¹⁵³. O que, ainda assim, não invalida liminarmente o testemunho, pois é possível que Goeze tenha confundido o pai com o filho ou mesmo o irmão Ernesto com José do Canto. O que parece ter sido o caso.

José do Canto, desta vez vindo da Firma James Veitch, em Londres, a 16 de Janeiro de 1866: ‘(...) (fl. 184) (...) *I Thea Bohea* (...)’¹⁵⁴. Depois de 19 de Janeiro de 1866, entre as plantas que Mr. Alexander Reith deveria receber nos meses de Abril, Maio e Junho de 1866, enviadas por José do Canto de diversos viveiros da Europa: ‘(...) [fl. 6 v.] (*Economical Plants*) (...) (*a lápiz V.*) *V. – Thea Bohea* (*V = James Veitch*) (...)’¹⁵⁵.

Enquanto as preciosas encomendas vinham em viagem, foi preciso cuidar de tudo para as receber e, decorridos poucos meses, estava povoado um pequeno viveiro colocado em situação apropriada e em terreno cuidadosamente preparado.

As sementes, mal chegaram, foram logo dispostas em canteiros.

As plantas que, viajando em pequenas caixas, tinham perdido a maior parte da folhagem, completaram a vegetação interrompida e os seus rebentos foram plantados por estaca ou enxertados em camélias.

Assim decorreram aproximadamente (129) dois anos até se proceder à plantação definitiva.

Como fora aconselhado [a ocupação vinha de tempos atrás: quem o aconselhara?] preferiram-se os terrenos inclinados e os vales húmidos com depósitos aluviais. Também se estava ao facto de que a poda devia fazer-se na estação fria para que rebentasse uma grande quantidade (130) de folhinhas tenras das hastes novas (...) Depois do nosso regresso à Alemanha, nos fins de 1870, apenas ouvimos falar uma vez desse homem já morto [Ponta Delgada, 20 de Dezembro de 1820 — Ponta Delgada, 10 de Julho de 1898: portanto, esta carta é posterior a 1898. Todavia, há cartas posteriores a 1870 entre ambos, conforme arquivo José do Canto] (...).’ *Almanaque Açores*, 1928, Propriedade da Livraria Andrade, Angra do Heroísmo, 1927, pp. 125-130

¹⁵² cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx.156, in Carta de Vilmorin Andrieu & C.^a a José do Canto, Paris, França, 2 de Fevereiro de 1864, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx.156

¹⁵³ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155, in [Copiador de correspondência de José do Canto (Nov. 1865-Abril 1866)] Carta de José do Canto a Edmond Goeze, Paris, 10 de Abril de 1866, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155

¹⁵⁴ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155, in [Copiador de correspondência de José do Canto (Nov. 1865-Abril 1866)] Carta de José do Canto a James Veitch, Paris, 16 de Janeiro de 1866, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 155

¹⁵⁵ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 95, in [(...) plants that Mister Alexander Reith must receive in the months of April, May and June of 1866, sent by José do Canto from different nurseries in Europe] José do Canto a Alexander Reith, depois de Janeiro de 1866, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 95

Além do Japão, da China, vem também da Índia, 4 de Julho de 1867: '(...) *Paris Le 4 Juillet 1867/ Cher Monsieur/ J'accomplie un devoir des plus agréables, vous felicitations (...) Thea assamica Bohea (...)*'.¹⁵⁶

Em Setembro de 1867, Fouqué visita em São Miguel diversos jardins e mais tarde escreveria: '*Tea bushes grow extremely well in Ponta Delgada gardens. The culture is easy; they only have to know exactly the right conditions before dreaming of expanding it.*'¹⁵⁷

Ouvimos falar de '*teas and chinchonas*' antes de Novembro de 1867? Experiência fora da estufa da Grimaneza, em Ponta Delgada, no Pico da Pedra, nas Furnas e no Porto Formoso. É Reith a escrever de novo ao patrão José do Canto ainda em Paris: '(...) *I have marked the places for the chinchonas and teas, at Grimaneza in different parts of the garden not all in all place, which will give a better idea of which part they will grow the best beeing at different heights of the ground. The same with the teas and at Pico da Pedra in the same manner. At the Furnas at the Pico do Fogo near the Rhododendron, and one higher up and the tea likewise at the Lagoa do Rabaçal one in one of the valley which is planted with oaks; I have marked for (?) one and one much higher up to learn which will do the best, the same with the teas. Teas beeing a plant that grows in China on hilly ground where there is much rain, I have every reason to think that the hills at the Furnas will suit it well, and hope (?) the chinchonas will grow in some of the ravines where they are well shelter from the winds. At Porto Formoso I have marked the ground in the same way. I think the teas (fl. 1 v) will grow well here the soil beeing what they like, but I think it is rather high for the cinchonas, however i tis the only way to gain knowledge to try them on your different estates and at different hights above the sea level (...)*'.¹⁵⁸ Fiquemos por aqui.

Conclusão

Julgamos ter traçado de modo satisfatório o trajecto desta estimulante bebida não alcoólica que mudou a face da Terra. Seguimo-la do seu nicho inicial da China a toda a China, depois ao Japão e à Europa. No seu trajecto das montanhas ao Oceano Pacífico, ao Índico e ao Atlântico, decorreram vários séculos. Que apesar de os portugueses terem sido provavelmente os primeiros europeus a beberem e a transportarem o chá do Pacífico ao

¹⁵⁶ cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 156, 17000, in [Plantes –a José do Canto (?)], Paris, 4 Juillet de 1867, cf. UACSD/FAM-ABS-JC/Documentação não tratada/Cx. 156, 17000

¹⁵⁷ cf. BPARPD, JC.PP, Miscelânea Açoriana 9, p.1, in Fouqué, M. F., Voyages geologiques aux Açores, Paris, 1873, cf. BPARPD, JC.PP, Miscelânea Açoriana 9, p.1

¹⁵⁸cf. BPARPD, JC/CORR. Cx.Nova/1705 RES, in Carta de Alexander Reeth a José do Canto, Ponta Delgada, ? 1867?, cf. BPARPD, JC/CORR. Cx.Nova/1705 RES

Atlântico, foram os holandeses quem criaram o gosto do chá na Europa e os ingleses que exploraram a fundo o seu potencial económico. Foi contudo em solo colonial português, o Brasil, que pela primeira vez se experimentou com êxito o cultivo e a produção de chá. Que se começou a estudar o chá logo no século XVI.

Ficamos igualmente a saber que remessa de plantas de chá, em 1802, do Governador dos Açores em Angra para o reino poderia estar integrada num projecto mais vasto de conhecimento e de valorização económica de novas espécies que se estendeu do reino, a Goa, Brasil, Angola e demais possessões, incluindo os Açores. Tanto mais que em 1803, portanto, pouco depois, ser criado o Jardim Botânico de Goa justamente para aclimatar e experimentar novas espécies oriundas de todo o reino e possessões, incluindo os Açores. Que logo a seguir à fuga da corte para o Brasil, interrompendo aqueles projectos, no Brasil, são de imediato retomados. Àquela possessão da América do Sul, então centro do reino, chegam quatro práticos chineses (como no passado haviam chegado a outros pontos e para outras culturas, tal como viria a ser o caso para o chá nos Açores), para darem início à primeira experiência (conhecida) bem-sucedida de cultivo e produção de chá em território não asiático. Que a década de sessenta e José do Canto foram fundamentais para o arranque da cultura e da produção do chá na Ilha de S. Miguel nos Açores.

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FOLK BELIEF AND TRADITIONS OF THE SUPERNATURAL: A CASE STUDY OF SHIMLA HILLS IN WESTERN HIMALAYAS

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Abstract

This paper intends to highlight the belief in the existence of superhuman or supernatural power in the area of study, which has a rich stock of myths, legends, traditions and the sacred occasion which are explained by some myth or the other, having some mythology behind them. Shimla hills as a part of Western Himalayas has plenty of folk beliefs and legends associated with deities' heroes and cults, and these play an important role in the customary practice and behaviour of the masses. The region has several great deities drawn from historical traditions. These gods and heroes, and the folklore associated with them are the guardians of the traditional value system which governs the life of the people in this area. This unique amalgamation of good and evil spirits as gods has tremendous effect on the social and religious culture of the people residing in the region. Most of the gods have their family members as deities of various villages, which have given birth to strong connections within the region in terms of social and political relationships. While these project a sense of monolithic culture, it is also possible to read the sources and complexity of the cultural formation through an analysis of the conflicts and contestations within the tradition variation. These folk beliefs, traditions of the supernatural are the mirror of the cultural life of this area which can be described as animistic.

Keywords: Belief, Traditions, Sacred occasion and places, Supernatural.

Introduction:

The religious beliefs, institutions, practices and the spiritual life of the folk is a legendary tradition in Simla Hills. It's not; merely the reflection of the cultural but it exists in everyday life as a means of creating culture. Here folk beliefs constitute the traditions, legends, rituals, myths and customs of its society. They do not exist solely in the abstract but they actual exist as folk knowledge and are practiced as customary behavior, which is visible in their rites and rituals performed during the religious festivals and

day today life. Folk beliefs as narratives, customs, rituals, and rhymes gives detail that how these genres of folklore share the traditional elements with the religious and the heroic legend, which have given birth to a complex cultural practices followed in this remote corners of Western Himalayas.

The vast mountainous territory of the Indian union spread on both sides of the Greater Himalaya range between the Indus in the extreme west and Yamuna on the east by usage has been defined as the Western Himalaya region. Toward north and northeast, the spiny ridge and the snowy crest of the Trans Himalayan Karakoram range separates it from the highland of central Asia and Tibet. On the south, the undulating foothills of the Shiwalik define its natural boundary with the Indo-Gangetic plains in Punjab and Haryana. Thus the entire Western Himalayan region is approximately situated between 75 degree to 80 degree due east and 30 degree and 36 degree due north. Shimla Hills as a part of Himachal Pradesh is situated in the heart of the Western Himalayas, which is specifically known with the term '*Dev Bhoomi*' ('The Land of Gods'). Its divinity has also been elaborated in ancient Sanskrit literature. The whole of the region is full of mystic vibrations and it has been mythologically painted as the land of divine spirits. It is the tract of the country lying between the rivers Satluj and Yamuna which is geographically cut across with mountain ranges, rivers, and valleys, dividing the inhabitation into distinct cultural regions, which has given birth to several interesting socio-cultural practices, in which the institution of the village God is most remarkable one. These institutions have history behind them rooted in the mist of the past remembered in the form of oral narratives, traditions, religious beliefs and performances; perhaps this is the reason which makes this a richest region in Himachal in terms of cultural diversity. There is scarcely a spot in all of area where one cannot hear elaborate legendary tales which are the core of the cultural heritage of this region.

Historically the primitive inhabitants of the Western Himalayan region, the Austric (Nishad) and the Dravidian (Dasyu) have undeniably bequeathed a very rich religious- cultural tradition and self-sustainable symbiotic socio-economic system to the people, who followed them in the region. Nevertheless, those primitive people were subjected to repeated suppression and degradation by their dominating successors, and under those conditions, they formed the substratum of the multi-racial and multi-cultural *Pahari* society losing their separate identity. The major bulk of population in the Western Himalayan region belongs to the Khasha race which was later on brought under the Brahminical fold, but still their belief, that everything in the community was supposed to belong to the clan god and nothing could happen in the community without his indulgence and approval prevails.

Religious Beliefs And Practices:

There is no country in the world in which religion exercise more influence on social and political life than in India. Religion gives the keynote to most of the great changes that have occurred in the history of the race inhabiting this country from the earliest ages to the present day. In discussing the religion in this region of Himalayan we find a curious blending of pre-Brahmanical, Brahmanical and Buddhist practices. No doubt the prevailing religion is a form of Hinduism but to ascertain what the actual state of religion is, it is necessary to examine the forms and ceremonies observed in domestic and temple worship and the deities held in honour.

Shimla Hills have plenty of folk beliefs and legends associated to it, in which local deities play an important role in the customary practice and behaviour of the masses. This region has several great deities which includes protective spirits, benevolent spirits, evil or malevolent spirits and ancestral spirits. Beside these the bramanical gods and goddesses, sages etc are also worshiped. This galaxy of gods dwells in water bodies, in valleys and mountains, in stones and rocks, in fields and forests. They live every where and shrines and places are dedicated to them. Others who have no shrines or visible symbols are assigned special locality or habitat. The folklores associated to them which are also infinite, are the guardians of traditional value system, which is governing the life of the people in this area. This unique amalgamation of good and evil spirits as gods has tremendous effect on social and religious sentiments of the people residing in the region. The ceremonies associated with them confirm strong roots of collective lifestyles and team spirit of the people and these beliefs and traditions of the supernatural are the mirror of their cultural life. The supernatural is almost as pervasive in the minds of hill people as is the nature. They have established a kind of close relationship between themselves and the power by adjusting themselves to it in two ways, first by magic and secondly, by offering *puja* or worship. Nature of beliefs in supernatural powers in this part can be described as: Animism, Naturalism, Totemism, Magic, Demonism and Ancestor worship. On the basis of different beliefs and religious practices prevailing among the people of this region of Western Himalaya it can be summed up that, they practice polytheism. Most the villages in this region have a cluster of spirits and super beings and identification of different powers with different deities is made accordingly. All these deities have their own respective departments and areas of influence, effect and control, as well as nature of actions. The people here believe in many gods and goddesses and have diverse methods of worshipping, depending on their traditions which shows an attachment with polytheism. Different names, different forms and various responsibilities have been attributed to these gods and deities. Different gods and deities have different specific

jurisdictions and abodes. Animistic gods, nature and the ancestral spirits are their premise with which they are preoccupied.

Patters of worship:

The details of worship of various supernatural being in the hilly regions of Himachal vary. There is, however, a basic pattern underlying most worship in the villages. *Gur* (the oracle or shaman) is the intermediary between the devotee and the villager god. He conducts a short *puja* (ceremony), and to the beat of a drum he sings mantras and then meditates in honour of the god to whom he is a devoted. Gradually the god takes possession of him and he goes into trance. The medium while in trance, been possessed by the spirit, turns to be an oracle, or a god himself. Whatever he utters in the state of trance, is believed to be the assertion of god himself. Thus anything spoken by the oracle, is taken to be the direction of the supernatural spirit possessed by the energy of the deity. His words are listened to by the attending devotees and are obeyed being the prophecy or an order of the benevolent spirit, known as Gram Devta or village god. The god when in complete charge speaks and acts in the body of the *gur*. The god then singles out the various devotee one at a time and tells each what troubles he/she has had and what the cause is, that is what super natural being has been tormenting him, and what should be done to alleviate the trouble. The treatment recommended by the sharman is almost invariably performance of a *puja* in honor of the offending supernatural being, or exorcism if it is a ghost. Spell- casting (*jaddu*), witchcraft and evil eye are also the parts of the belief systems in the hilly terrains.

One of the most potent village institutions is of the village god. Interestingly, these gods or goddesses are not defined; they can be a divine spirit, a sage or saint, a *nag* (serpent), some animal or ancient monarch. The most important aspect here is that these village gods and the institutions are the center of the cultural life of the masses. Since people are under the awe of the god and since he/she has almost dictatorial authority, the attitude of the people towards nature and living and non-living being is governed by the dictates of the god through the *gur*. Discussing the power of the village gods B.R. Sharma states that this institution did not come up as a matter of chance; it has a long tradition that goes back to the hoary past though one cannot ascertain how and when it emerged. There are myriads of stories behind these gods. Sharma further elaborates: the village gods control all the villagers and direct social customs. When this custom of village deities started is not known for certain, but the villagers know only that their activities and destinies are governed by these gods and they cannot afford to disobey them at any cost. Thus it can safely be said that this institution is the major dictator of their activities, hopes and despairs, virtues and vices,

natural and created misfortunes in a village society. The village god is the symbol of village culture. (Sharma. 1990:133).

The institution of village gods is not a matter of chance. There has been a history behind each one of the gods and this practice has its roots in the mist of past. Right from the origin or manifestation of a particular god or goddess, the gur (medium) or the interpreter of the Devta, relates the whole story with his supernatural power, miracles and capability of curses inflicted by him, from time to time. The god dispensed edicts through oracles and the institution of oracle enjoyed a pious and important position in the society. The gur has always been chosen and appointed by the deity himself, and he has essentially been a person from any of the indigenous communities, may be even from the lower castes

According to the 2001 census there are more than 27,000 places of worship in nearly 20,000 villages throughout Himachal Pradesh and similar is the ratio and proportion in Shimla Hills. Among several interesting social practices prevalent in the hill society, especially in places of higher altitude, the institution of the village God is most remarkable. The Gods and Goddesses here are not sitting spectators but are expected to behave like common human beings with sentiments and pride. Most of the gods have their family members as deities of various villages which has given birth to strong relationship and understanding of the people in this region. The ceremonies associated with them confirm strong roots of collective lifestyles and team spirit of the people and they have preserved them in their memory and cultural practices. The people here worship Hindu gods and goddesses, but they are not orthodox Hindus, they have leaning to their own beliefs, institutions and practices, which is also the source of their socio-cultural life, visible in their oral narratives and belief system. They are not highly Sanskritized or Brahmanical and do not adhere closely to written prescription and proscription of the post-Vedic Hinduism. To understand the belief system of Shimla Hills we have to follow the concept of Sanskritization and the Great and Little tradition. Local traditions interacted with an influential Brahmanical one and successfully accommodated many of their principal beliefs and superimposed some of its own thinking upon the Brahmanical belief systems.

Nature of Folk believes and Traditions:

In Shimla Hills legendary tradition are contained in popular beliefs, institutions, practices, oral literature, arts and pastime of the mental and spiritual life of the folk, here folk beliefs are not merely a reflection of an abstract cultural but they exist in everyday life as a means of creating culture. What D.N. Majumdar had observed in connection with the Khasas of Jaunsar Bawar, Gharwal Himalayas, A.F.P. Harcourt in case of Kullu and

Gerald D. Berreman regarding Sirkanda (Kumaon) can be applied to this region also. Majumdar has elaborated: The Khasas (*Paharis* the local inhabitants) are Hindu as evident by their own profession of faith and by application of any realistic definition of that term, to observation of the behavior they exhibit and the beliefs they profess relating to the supernatural world. (Majumdar 1944, p. 139). “Their customary rites in temples, the manner and mode of offering sacrifices..... periodical festivals..... all indicate their Hindu origin....”. Though they are Hindus and they worship Hindu gods and goddesses, they have “partiality for ancestor spirits, queer and fantastic demons and gods and for the worship of stones, weapons, dyed rags and symbols. The sun, the moon and the constellation are their gods. Their social life as well as their beliefs and practices connected with their religion do not identify them with the Hindus of the plains. They re-marry their widows, practice levirate, sororate and polyandry, recognize divorce as legal, while inter-marriage between the various Khasa groups is not tabooed and the children born of such marriages do not suffer any social stigma. While they worship Hindu gods and goddess, they have a partiality for ancestor’s spirits, queer and fantastic demons and gods and for the worship of stones, weapons, dyed rags and symbols. (Majumdar 1944, 150), and it is clearly visible in the narratives and the belief system of this region. The argument of Srinivas can also be applied in this region too. The people are not orthodox Hindus and their belief systems are the source of their socio-cultural life which depicts its folk-history. They are not highly Sanskritized or Brahmanical, they do not adhere closely to written prescription and proscription of the post-Vedic Hinduism. (Srinivas, 1952, p. 30: 1956 *Alan Dundes* structural definition of folk beliefs can be related to this area to some extent. While *Butler* view regarding folk beliefs as, ‘narratives (memorates and legends), customs, rituals, and rhymes’ gives detail that how these genres of folklore share the traditional elements with the religious and the heroic legend, which gives birth to a complex cultural practices followed in the remote corners as Shimla Hills. ‘Folk beliefs are often part of complex cultural processes that involve not only belief but also values and other behaviours and that find expression in different genres of folklore’.

To understand the religious belief system we can follow the approach of Chetan Singh, who has rightly argued that, “one of the most useful instruments for understanding myth, legends and folklore of this region should be the concept of Sanskritization, and rather broad but relevant two-fold division that is usually made between the Great and Little tradition. ” Sanskritization was a process that enabled certain sections of the society to improve their position in the existing social order. The Great and Little Traditions, on the other hand, seemed to represent the entire ideological and religious spectrum with in which such improvement in status could take

place. One needs to emphasize, however, that even though Brahmanical culture provided the framework for the process of Sanskritization, it was not installed from popular customs. It synthesized and incorporated diverse aspects of folk belief, and in doing so it established a cultural continuity between the Great and Little traditions. Local traditions interacted with an influential Brahmanical one that successfully accommodated many of their principal beliefs and also provided an intelligentsia that mediated between regional diversities; yet it would be difficult to deny that there was also a tendency for the Brahmanical Great tradition to superimpose some of its own thinking upon non-Brahmanical belief systems.

Conclusion:

Although the present day cultural pattern of Shimla hills, is heavily burdened with the Brahmanic bias, yet the core content is still intact. Folklore of the legends, are true, to a large extent, with only some changes depending upon the individual narrators. Under the Brahmanic onslaught most of the ancient temples might have lost their actual identity and were adopted into the Brahmanical fold and re-christened after the name of the brahmanical gods, ancient heroes and sages, but in this process of cultural diffusion and assimilation, both the Great and the Little tradition affected each other to a large extent. Neither the indigenous culture was fully destroyed nor was the brahmanical culture able to establish its dominance. And this was only due to the rich folk tradition in the form of cultural memory which kept the core of the old culture intact and alive. The written tradition of the popular culture and the oral tradition of the indigenous culture have enriched each other and due to this, in this region they are in interface to each other, both of them are to be studied side by side to come to accurate conclusions. What all these legends and narratives depict is a question to be answered, but one thing is crystal clear that all of them are part and parcel of a single belief system, which have nurtured them, some facts and figures disclose some history behind them, but proving it is a tedious task. Folklore and history here are in interface to each other and to understand them both have to be studied side by side. All these legendary stories are the part of the culture of this region and all folk-believes and other legends are in one way or other related to this narratives and different temples, which is the pivotal point in the overall cultural heritage of this region. This folklore has given birth to the culture of this area and the culture has further enriched the folklore to a large extent.

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NEGOTIATING IDENTITIES AND FRIENDSHIPS WHILE LIVING ABROAD: EXPERIENCES OF LATVIAN MIGRANTS

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Abstract

By moving, a person loses at least some of their social contacts, causing not just psychological distress and anxiety, but also loss of support networks one can rely on in times of need. Latvia was one of the typical 'sending countries' in Europe, and since year 2000 about 10% of the population has emigrated. Here we would like to use the data gathered in the Latvian migrant survey to analyze how the migrants integrate into the local communities, and to what extent they still maintain close ties to their home countries; how does it change with time and what factors affect it. A special attention will be paid to how do emigrants' identities change with time – do they retain their national identity, do they integrate also in terms of belonging and identification with the host community, perhaps it is a mix of both, or they develop a new, global or European identity? These are just some of the questions this research tries to answer. The paper is based on a recent Web-based survey of more than 10 000 Latvian emigrants abroad, in all regions of the world (including USA, Europe and Asia). The study was conducted with the support of by the ESF research grant "The emigrant communities of Latvia: National identity, transnational relations, and diaspora politics" (Nr.2013/0055/1DP/1.1.1.2.0/13/APIA/VIAA/040) – the largest survey of emigrants from one country so far conducted in Europe.

Keywords: Migration, identity, migrant networks, migrant integration

Introduction

A new wave of migrants from East-Central Europe swept across Europe in 2000's following the EU accession of the new member states, and it was intensified even more by the recent global recession. Considering that Latvians are one of the most mobile European nations (Hazans 2003), the fact that Latvia was one of the countries hit hardest by the crisis (Mierina 2014) resulted in unprecedented rates of emigration from this small country

of about 2 million inhabitants. According to the Central Statistical Bureau (CSB), long-term emigration rates starting from 2008 significantly increased (see also Table 1), mainly driven by more attractive employment opportunities abroad (Krišjāne 2007). Since the crisis begun, every year more than 30 000 people left Latvia for some other country, mostly - some other country in the EU (usually Great Britain or Ireland)

Table 1. The net outflow of Latvian inhabitants, in thousands

	2000-2010	2000-2001	2002-2003	2004-2008	2009-2010
M.Hazans	200		40	80	80
O. Krasnopjorovs	177.6	10.7	11.1	65.3	90.6

Source: Hazans (2011), Krasnopjorovs (2012).

According to the OECD report since the beginning of the 21st century, Latvia has lost 9.1% of its population (OECD 2013: 66). 159. They are usually people with lower income and from less developed areas of Latvia (Krišjāne 2007; Hazans 2003). Most recent surveys show that more and more people choose to move abroad with all their families, and plan to stay there permanently. This, according to the authors of Latvian Human Development Report 2010/2011, points to the “importance of research on a sense of belonging of the people in exile, since the way how belonging to homeland and to country of residence is formed will influence choices of Latvian people in the future – whether to return home or stay in another country” (Latvija. Pārskats par tautas attīstību 2010/2011: 64).

From the perspective of host countries, an open identity of migrants and their sense of belonging to their new country and community is important for the integration of migrants. Successful integration of immigrants into the society and the labour market are considered a key for reducing xenophobia, and lessening anti-immigrant sentiments in the receiving countries, and creating a cohesive and better functioning society (Jackman & Volpert 1996; Golder 2003; Arzheimer 2009; Lubbers et al 2002). Nowadays, immigration and integration policies have been placed at the forefront of many Western European parties’ agendas, and occupy a significant place in the political landscape (Rydgren 2005; Yilmaz 2012).

At the backdrop of increasing skepticism as regards to the desirability or even possibility of a multicultural Europe (Etzinger 2003; Heath and Demirova 2014)¹⁶⁰, several policy initiatives have been put forward in the

¹⁵⁹ Migration statistics in Latvia is not very precise, since many of those who move abroad, especially at the beginning, do not report it to the authorities in Latvia. According to Hazans (2011) and Krasnopjorovs (2012) estimates, from 2000 till 2010 Latvia has lost close to 200 000 people due to emigration, and mainly – young people.

¹⁶⁰ According to Penninx (2005) in Europe the paradigm where immigrant principally is seen as an alien and outsider, one who is only temporarily part of that society is dominating, in contrast to the inclusionary paradigm is the Anglo-American one, in which immigrants

European Union to facilitate the integration of migrants (European Commission 2013). In 2010 core indicators (the so-called ‘Zaragoza indicators’) were approved that measure the results of integration policies. They measure integration outcomes in four areas: employment, education, active citizenship, and social inclusion (European Commission 2013).¹⁶¹ Recent evidence suggest that there is still a significant ‘gap’ between the migrant population in comparison with the total population in terms of employment, education, income and social exclusion still remains (European Commission 2013). In this paper we would like to focus on the social aspect of immigrant integration, mainly, identity and social networks. Building on a recent large-scale emigrant survey “Emigrant communities of Latvia: national identity, transnational relations, and diaspora politics”, we explore how well are Latvian emigrants integrating into their new host societies, how emigration affects their identity, and whether they keep in touch with the family and friends at home. We will also analyse which factors are associated with more successful integration outcomes.

A significant drawback of the existing quantitative studies is that they usually analyze the integration of immigrants from several countries of origin into one country (Vermeulen and Penninx 2000). The problem with this is that characteristics of immigrant groups differs from country to country, and a number of ecological factors could be responsible for the specific outcomes. The analysis is complicated by the fact that migration is selective, i.e., depending on socio-economic context countries are likely to attract different types of migrants from different countries (e.g., Alexander 2003). A cross-national comparative study of emigrants from one sending country in different receiving countries (e.g. Rath et al. 2001; Penninx and Roosblad 2000) such as the “Emigrant communities of Latvia” is needed to discover what factors facilitate integration of migrants.

Social networks are extremely important in regards to mobility, yet their role is still not fully understood. Existing diaspora in the receiving country serves for future emigrants as both a gate and a safety net, reducing all kinds of moving costs and risks by providing information channels and ensuring necessary help in terms of housing, money, logistical support and advice in times of need (Koroļeva and Mieriņa 2014). While some emigrants help their friends and family to move abroad, for others family and friends at home might become an obstacle to emigration or lead to re-emigration.

are also expected to have or take up citizenship individually. This has pervasive consequences for how immigrants are perceived, and what place they are attributed in society in general, and in the immigrant integration policies in particularly (Penninx 2005).

¹⁶¹ The fifth category „Welcoming society” is also sometimes added to account for the fact that the receiving society also plays a role in the integration of immigrants (e.g., via discrimination).

Emigration can create a bridge between countries and communities, facilitating economic ties, innovation and exchange of knowledge. On the other hand, strong bonding ties with an existing diaspora from one's home country might become a wall and prevent immigrants from successfully integrating into the local community.

Research on identity suggests that the identity of an individual is dynamic and is open to potential changes during the whole life. Young peoples' search for identity and identity choices play important role in research because these processes have effect on future life and characterize ability of young people to integrate into society. Importantly, three quarters of Latvian adult emigrants are below the age of 35 (OECD 2013), thus, very much in the process of identity formation. In the case of youth research we can speak about at least two different approaches to the study of identity: with emphasis on individual identity as a process of self formation, describing identity as personal integrity and continuity (Eriksons 1998) and with a focus on social identities that characterizes inclusion of young people into society, occupation of certain social status and position, understanding social identity as a part of individual self-image that results from their knowledge about belonging to a social group (or groups), and value and emotional significance that they give to such affiliation (Tajfel 1981). There are also approaches that emphasize both aforementioned aspects by extending the identity to notions of being and belonging, to the ways in which individuals make up an image of themselves. In this view, process of identity formation involved individual cognitive mechanisms, and political and economic forces that promote certain ideas about existence and belonging (Bisley 2007).

The concept of belonging is used to explore relationships between the self and society due to several reasons: it is oriented towards individual, it is used in daily life that's saturated with formal and informal relations, and it allows to establish a perspective on complex relations between the self and society while capturing changes (May 2011). Young migrants are at a stage in life when identity is being actively shaped, when it's important for a person to understand who he/she is and they aspire to achieve. During formation process identities are variable, they can still be unacknowledged and undefined, which is why it is easier for young people to comprehend the concept of belonging. Research on belonging helps to uncover the identification process, not so much identity itself, rather the result of it, but both these aspects are closely related and are hardly separable in daily thinking.

Within the context of aforementioned problems, we examine in this paper not just the questions on how emigrants preserve or build new identities, but we also analyse how they keep in touch with the people at

home or build networks in their new communities, thus facilitating more successful integration in their new community.

Data and methods

This paper is based on the European Social Fund project “Emigrant communities of Latvia: national identity, transnational relations, and diaspora politics”. 14 068 emigrants age 15+ from Latvia were quantitatively surveyed during August-October 2014 in 118 different countries. Most respondents – same as the Latvian diaspora in general - come from the UK, Ireland, the US, Germany, Norway, Sweden, Denmark, the Netherlands, Belgium, Russia, Canada, Finland, France and Austria. The survey was conducted as a Web-survey, using different sources of recruiting respondents: social networking sites facebook.com, draugiem.lv, vkontakte.com, odnoklassniki.ru, latviesi.com, the three largest news portals in Latvia delfi.lv, apollo.lv, inbox.lv, embassies, diaspora organizations, diaspora media, etc. The data was statistically weighted, using the most recent data from OECD, Eurostat, and The Office of Citizenship and Migration Affairs of Latvia, and the The Office for National Statistics (ONS) in the UK, in order to correctly represent the different country/ age/ gender/ ethnicity/ education proportions of Latvian emigrants.

Using the data from the aforementioned emigrant survey has several important methodological advantages. Thanks to a large sample, we avoid the limitations of a small size of the sub-group of immigrants typical for general surveys (ESS, SILC, etc). Due to the unique research design, we have a considerable number of migrants from one country in many different countries, thus limiting the effect of culture, and allowing to focus on what interests us most. In general surveys sometimes people who are unable to communicate in the survey language are not interviewed, excluding a significant proportion of migrants. This is not the case for our survey – questionnaire was offered in Latvian, Russian and English, and there are extremely few Latvian emigrants not being able to speak any of these languages. Harmonization of translations, methods, and weighting is often problematic in major surveys. In our case, the data collection and weighting are centrally coordinated, the questionnaire is mainly completed in Latvian, and careful procedures are applied in translating the Russian and English versions. The fact that Latvia has one of the most mobile populations in Europe ensures that different groups of society are represented among the migrants.

Results

Considering that identity and attachment to the local community depend on the time one has spent in the country, we must note that there

have been several waves of emigration from Latvia (Figure 1). A small proportion of Latvian diaspora are those who emigrated before Latvia regained independence from the Soviet Union in 1991 – mostly during 1940-50s, fearing Stalin’s repressions. Since then, several waves of emigration can be distinguished: 1) those who emigrated before Latvia joined the European Union; 2) those who emigrated after the country joined the European Union, but before the crisis begun (2004-2008); 3) Those who emigrated during the crisis (2008-2010), and 4) Those who emigrated afterwards (2011 or later). Overall, about 80% of Latvian emigrants have left the country in the last 10 years, and about a half – in the last 5 years (Figure 1).

We begin our analysis by exploring how embedded the Latvian migrants are in their new communities socially, i.e., whether they build networks with the local inhabitants or stick to their own ethnic or national group.

Figure 1. The year of leaving the country

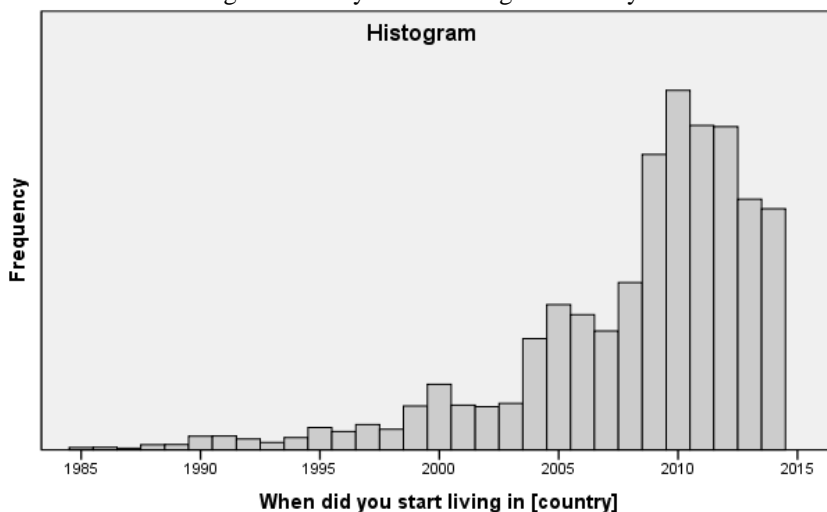
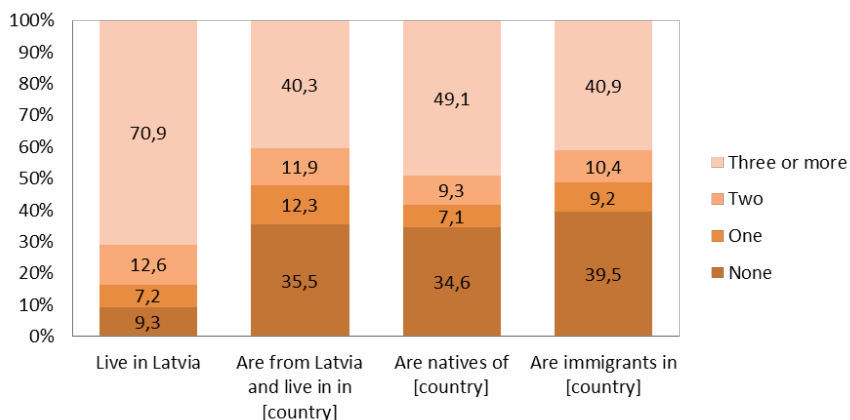


Figure 2 shows that Latvian emigrants still have most of their friends in Latvia. It means that friendship ties among Latvians are strong, and they are retained even after the person moves to live in another country. If we look at those who emigrated since 2009, more than 70% have three or more friends in Latvia, but the number does not significantly decrease even if we look at those who emigrated earlier (Table 1). 8% of respondents noted that they moved abroad together with friends, whereas for 23% a friend or friends were already there, when they moved abroad. The more widespread the immigration becomes, the easier it is for the others to move as well, considering that there is already someone who can help with housing, advice, etc.

Figure 21. Friendship networks of Latvian emigrants



It is common to meet socially and befriend other people from Latvia and other immigrants (usually from Eastern Europe) in the host country. Many of them work together, and sharing a common background and similar problems facilitates forming friendships. Interestingly, friendship bonds with Latvians abroad are formed similarly often, as with other immigrants, thus, no preference is given to people of one's own nationality. In the first few years, such friendships are seldom, but after that only about one third of the new Latvian diaspora (i.e., those who emigrated since 1991) have no friends abroad who are also emigrants from Latvia or from another country. It shows that emigrants tend to stick together and support each other. 9% actually live together with their friends or acquaintances from Latvia, and 8% - with some other friends of theirs. Friendships are often formed and maintained with the help of Latvian diaspora groups Online (about 25% are members of such groups) or Latvian diaspora organisations (11% are members of such organisations).

However, the data also shows that about 2/3 of Latvian emigrants have friends who are natives of their host country (Figure 2). Moreover, about a half (49%) of them have three or more such friends, which demonstrates a strong integration into the local society. The number of local friends steadily increases with time (Table 2), however, even among those who have just recently arrived (2012 or later) more than half have a friend who is a local in the country.

As regards to family networks, majority (81%) of emigrants still have some family members in Latvia. About a half mother and/or father lives in Latvia, about 15% have their spouse or boyfriend/girlfriend in Latvia, but most importantly, 7% have left their younger-than-school age children in Latvia, 8% - school age children, and 11% - adult children.¹⁶² Visiting

¹⁶² Table available on request from authors.

relatives in Latvia is often not that easy and, if the emigrant lives further from home, it might be expensive too. Hence, only 15% of Latvian emigrants visit their family and friends in Latvia at least 2-3 times a year, but 28% do it every 6 months. Nevertheless, migrants take advantage of the opportunities provided by technologies: 31% communicate with their friends or family in Latvia every day or almost every day, 40% - at least once a week, and 21% - one to three times a month. Less than 10% of Latvian emigrants do not communicate with their friends or family in Latvia at least once a month.

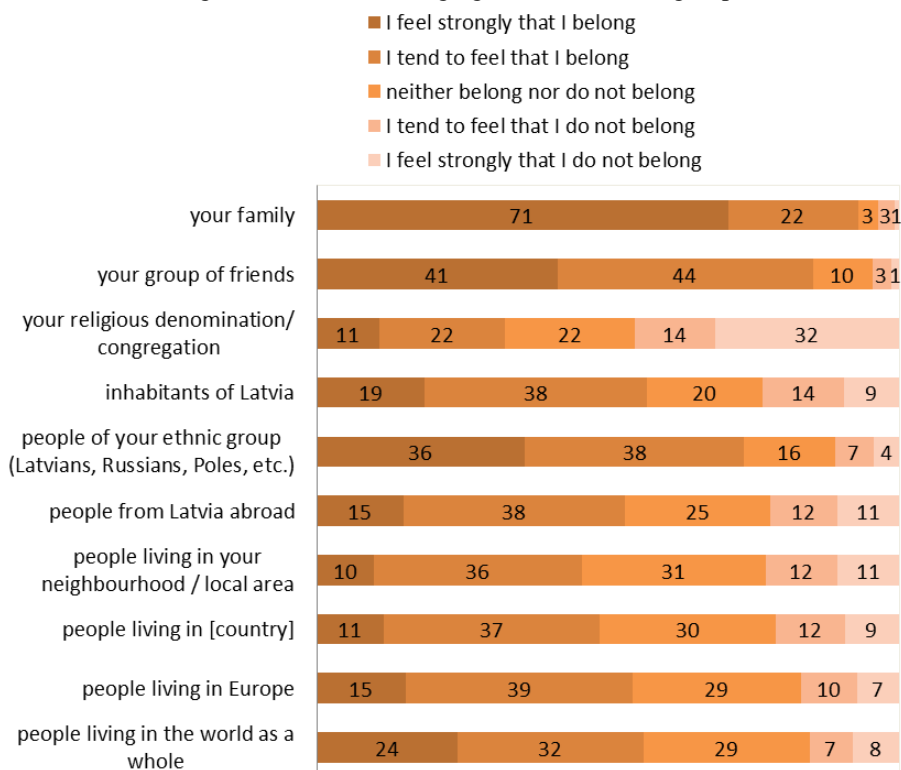
Table 1. Friendship networks depending on the year of arrival

		Up to 1990	1990- 2003	2004- 2008	2009- 2011	2012 or later
Live in Latvia	None	22,7	10,2	10,5	6,6	5,3
	One	7,4	8,4	9,4	8,4	3,7
	Two	9,9	12,8	14,3	13,1	11,7
	Three or more	60,0	68,6	65,8	71,9	79,3
Are from Latvia and live in in [country]	None	41,0	37,9	28,4	32,5	41,1
	One	8,6	9,9	13,9	12,7	13,6
	Two	7,2	11,1	11,5	13,1	13,0
	Three or more	43,3	41,1	46,2	41,7	32,4
Are natives of [country]	None	20,7	24,7	30,3	36,7	46,4
	One	1,4	4,7	8,5	8,3	8,1
	Two	5,4	5,6	8,9	10,6	11,6
	Three or more	72,5	65,0	52,3	44,4	33,9
Are immigrants in [country]	None	52,7	32,4	34,4	36,8	44,5
	One	6,3	7,7	9,1	9,5	11,1
	Two	10,6	7,6	9,8	11,6	10,2
	Three or more	30,4	52,3	46,7	42,1	34,2

Answering the question about identifying with various social groups, 71% of Latvian emigrants note that they feel very close to their family, and 41% feel very close to their friends (Figure 2). Overall, one can conclude that family and friends are the primary group that Latvian emigrants feel closest to.

Latvia is a very ethnically diverse country: Latvians compose only about 62% of the population, while 27% consider themselves Russian, and 11% belong to other ethnic minorities. Ethnic tensions from time to time escalate between the two main groups, related to differences in the perception of history, and different media discourse. As a result, emigrants too feel closer to their own ethnic group (Latvians, Russians, etc.) rather than 'inhabitants of Latvia' as a nation state. It shows that besides family and friends, the main domain of identity among Latvian emigrants is their ethnic group.

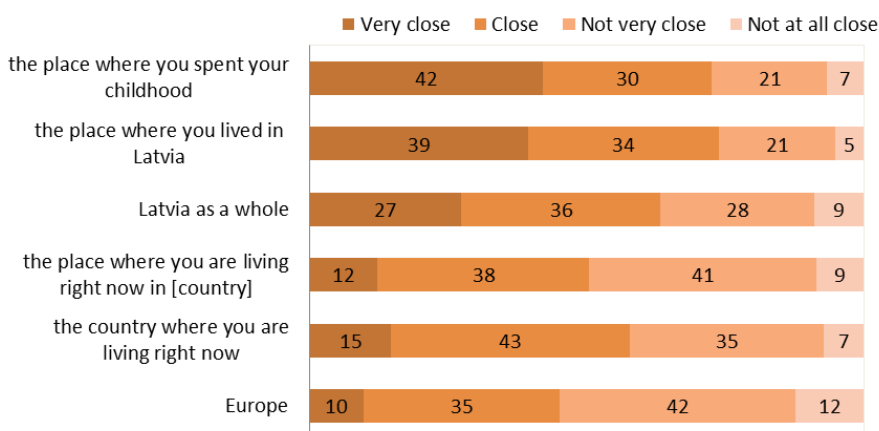
Figure 2. Sense of belonging to various social groups



Overall, 19% feel strongly, and 38% tend to feel that they belong to inhabitants of Latvia, yet every fourth emigrant does not see herself as belonging to the inhabitants of Latvia. It illustrates that some emigrants are disgruntled and disappointed with their countryman, and are trying to distance themselves from them. The sense of belonging to their current country of residence is just slightly weaker than the sense of belonging to the inhabitants of Latvia: 11% feel strongly, and 37% tend to feel that they belong to people living in their home country. Only 21% feel like they do not belong to the people living in their current country of residence. Interestingly, among emigrants the sense of belonging to all people of Europe or, even more so, people living in the world as a whole, slightly surpasses the sense of belonging to people in Latvia or their current place of residence. As the data suggests, the correlation between the sense of belonging to the global domains (Europe and the world) is positively correlated to belonging to the country of residence (correlation coefficient 0,3). On the other hand, correlation between the sense of belonging to Latvia and the new host country is extremely small (-0,06), which means that there is no ‘competition’ between these identities – they can co-exist.

The survey also asked emigrants to evaluate how close they feel to different geographic places, including their home country Latvia, and their current country of residence. In answers to these questions one can notice a certain nostalgia, as the place emigrants feel closest to is the place (city, town or village) where they spent their childhood and/or where they lived before moving abroad. Thus, local identities dominate over national identities, at least in the case of the country or origin. Overall, 27% of emigrants feel very close to Latvia as a whole, and 36% feel close to this country (Figure 3). At the same time, 37% say that they feel not very close or not close at all to their country or origin. In comparison, just slightly more, 42% of emigrants do not feel close to the country where they are currently living; 43% feel close to this country and 15% feel very close to it.

Figure 3. How close the emigrants feel to different geographical places?

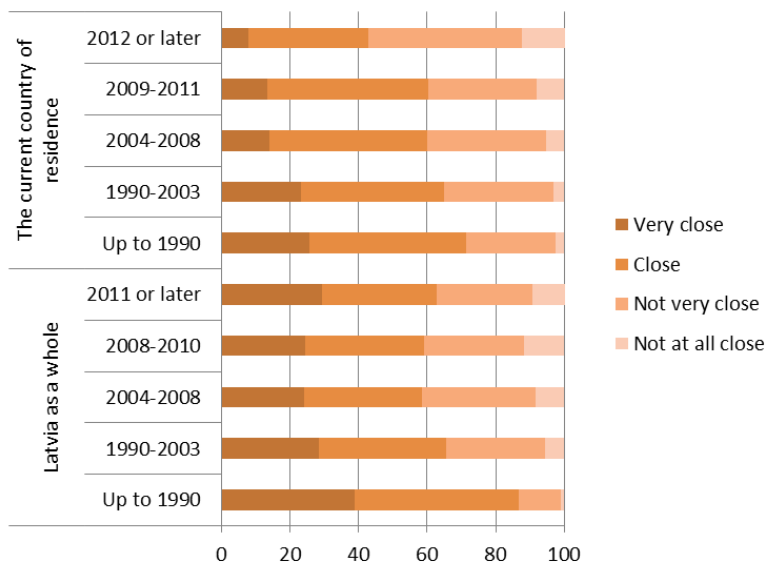


According to the data, attachment to the place where one spent the childhood and/or lived before leaving the country is something that does not change with time. Sometimes it can become even stronger, the longer the person lives abroad. Attachment to the current locality where the migrant lives requires a lot of time – only those who have lived abroad since 2003 or earlier start feeling attached to the place. Interestingly, those who left before Latvia joined the EU, feel comparatively less attached to Europe. As regards to country, attachment to the new host country increases gradually with time. However, attachment to home country, Latvia, does not decrease with time, but tends to remain rather stable (Figure 4). Moreover, those who left Latvia before 1991, ie, the ‘old diaspora’, feel closer to Latvia than those who emigrated later. The circumstances in which they left Latvia, are very different from those behind the more recent waves of emigration, resulting in more sentimental attitudes. The same conclusions can be made as regards to ‘people living in Latvia’.

Again, the analysis allows concluding that the fact that emigrants become more attached to their new host country does not mean that they will

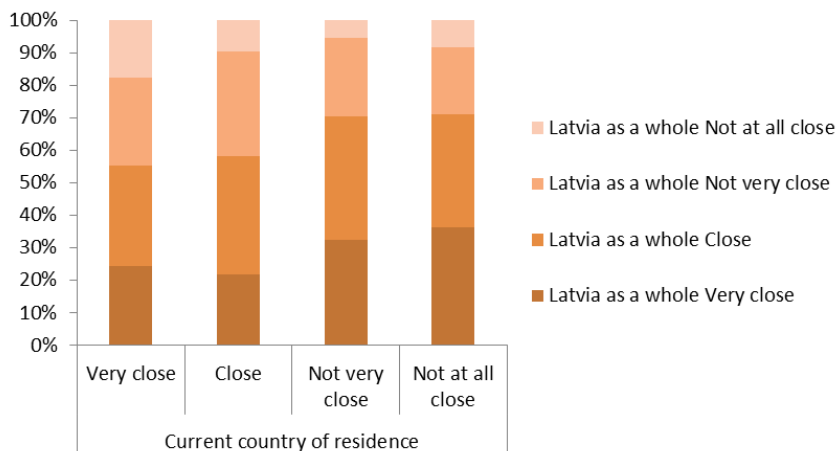
automatically lose attachment to their own country. The correlation is very weak, only -0.15. Still, some unlike in case of social groups, some visible, although small, differences can be observed (Figure 5). Those who feel very close to the current country of residence are also more likely to not feel any attachment to Latvia, whereas those who do not feel close to their current country of residence are more likely to feel close to Latvia.

Figure 4. How close the emigrants feel to different geographical places depending on the year of arrival



To answer which factors are responsible for more successful integration outcomes in terms of identity, we use multilevel regression analysis with 14 068 individuals nested within 118 countries. Unlike the ordinary multiple regression models, multilevel analysis accounts for the fact that the observations in the sample are not independent; individuals are nested within localities, thus, it provides correct standard errors and unbiased estimates of contextual effects, reducing the possibility of Type I error.

Figure 5. Attachment to Latvia depending on the attachment to current country of residence



We operationalize successful integration on the basis of a question on how strongly the emigrant feels he belongs to the people of the host country, and include a variety of potential individual level predictors such as age, gender, education etc. Since there are no strong theoretical arguments why the individual explanations of the sense of belonging to the host country's inhabitants should systematically vary across countries, we use random intercept models with fixed slopes

The estimates of covariance parameters (available on request) show that 20% of the variation in how strongly the person feels he belongs to the people in the current country of residence, can be found at the level of countries, whereas 80% are explained by differences between individuals. Including the individual level variables, allowed to decrease the individual level variation by 8%. Nevertheless, the likelihood ratio test (chi-square test of deviances) shows that the model is still significantly better than the empty or null model, thus, can be considered satisfactory.

By far the strongest predictor of identification with the host country's society is '*I feel a sense of belonging to the local community*'. It means that emigrants' identification with their new country of residence can primarily be increased by increasing their attachment to the community they reside in. People who 'know most people in their area' are more likely to feel a sense of belonging to their country's society in general.

. Identification with the local society is also associated with regularly, or at least sometimes, following the current news in the country. It means that media play an important role in the integration of migrants. An other extremely important factor are networks. Having friends who are natives in the country, is associated with much higher sense of belonging to the country's society (Sig.<0.001).

The relationship between attachment to the people living in the host country and attachment to one's own ethnic group and people living in the home country (Latvia) seems to be complicated. Whereas attachment to one's ethnic group is associated also with attachment to the inhabitants of the host country, the relationship with inhabitants of Latvia goes in the opposite direction (Sig.<0.1). This can be explain by psychological mechanisms: someone who is more 'outwardly' oriented and willing to identify with some group, might also be willing to identify with an other group

Table 2. Determinants of attachment to the host country's inhabitants

Parameter	Estimate	Sig.	Std. Error
Intercept	-2,981	***	,219
Lowest level of education	-,213	***	,038
Middle level of education	-,079	*	,035
Highest level of education	0 ^b		,000
The national capital city	,141	*	,061
Another major city	,029		,058
A small town	,034		,058
A village or a rural area	0 ^b		,000
1991-2003	,165	**	,053
2004-2008	,029		,040
2009-2011	,083	*	,035
2012 or later	0 ^b		,000
Working as a paid employee	,222	*	,108
An employer/entrepreneur	,065		,132
Self-employed / employed by your family business	,156		,121
Out of work and actively looking for a job	,213		,131
A student	,214	~	,118
On an internship, exchange programme, or professional training/development programme	,809	***	,185
On leave / out of work to take care of children or other family members	,092		,115
Retired / a pensioner	-,573	**	,195
Out of work for other reasons and not seeking employment	,451	**	,139
Voluntary work	0 ^b		,000
Household finds it easy to get by	,063	***	,013
Age	,002		,002
Gender (woman)	,085	**	,030
I like living in this area/neighbourhood	,004		,018
I feel a sense of belonging to the local community	,353	***	,016
People in this area/neighbourhood can be trusted	,004		,017
I know most people in this area/neighbourhood	,058	***	,012
Latvian	,066		,076
Russian	-,189	*	,075
Other	-,050	~	,088
Follows the current events in Latvia regularly	-,059		,083
Follows the current events in Latvia once in a while	,205	*	,083
Does not follows the current events in Latvia	0 ^b		,000
Follows the current events in [country] regularly	,536	***	,065
Follows the current events in [country] once in a while	,190	**	,064
Does not follows the current events in [country]	0 ^b		,000
Feels close to inhabitants of Latvia	-,023	~	,013
Feels close to people of own ethnic group	,056	***	,014
Number of friends who are natives of the country	,072	***	,011

***p<0.001, **p<0.01, *p<0.05, ~p<0.1, two-tailed tests.

Emigrants living in the capital city identify with the country's society significantly more than those living in villages or rural areas (Sig.<0.05).

Large cities are usually much more diverse both ethnically and culturally, which might help the migrants feel as if they belong. Rural areas, however, tend to be more closed to outsiders. It also matters how long the person has spent in the country. As we see from the model, the sense of belonging to the host society among those who just arrived in the country in 2012 or later is weaker than among those who arrived during the crisis, or a long time ago, before the EU accession.

An other aspect facilitating the sense of belonging is the financial situation of the household. Those who find it easy to get by, are much more likely to feel like they belong. Employment and education matter too, as identification with the host country's society is more common among those with higher education, who are employed, doing an internship or training, or economically inactive

Finally, as regards to standard demographic variables, women are more likely than men to feel like they belong in the host country's society, whereas age has no impact on it. Interestingly, Russians are least likely to identify with the host country.

Conclusion

In this paper we have demonstrated that Latvian emigrants tend to retain close friendship and family ties even after the person moves to live in another country. In addition, it is common to meet socially and befriend other immigrants from Latvia and other countries (usually from Eastern Europe), paying no attention to a person's nationality. This is facilitated by similar background and similar circumstances they often find themselves in, which facilitates the formation of friendship bonds.

Majority of emigrants still have some family members in Latvia too. Even if they cannot visit Latvia frequently, they regularly stay in touch with their friends and family via phone or Internet. 31% communicate with their friends or family in Latvia every day or almost every day, 40% - at least once a week.

However, the data also shows that about 2/3 of Latvian emigrants have friends who are natives of their host country, and about a half have three or more such friends, which demonstrates a strong integration into the local society. Moreover, the number of local friends steadily increases with time.

As regards to identity, the analysis shows that besides family and friends, Latvian emigrants feel the strongest sense of belonging to their ethnic group. The sense of belonging to their current country of residence is just slightly weaker than the sense of belonging to the inhabitants of Latvia. The fact that about a half of Latvian emigrants feel that they belong to the local society, demonstrates that Latvian emigrants have integrated in their

host country very well. Only 21% feel like they do not belong to the people living in their current country of residence. However, interestingly, among emigrants the sense of belonging to all people of Europe or, even more so, people living in the world slightly surpasses the sense of belonging to people in Latvia or their current place of residence. It shows that the emigrants develop a supra-national identity in addition to their local/national identities.

In terms of geographic places, emigrants feel very strongly about the place (city, town or village) where they spent their childhood and/or where they lived before moving abroad. As regards to countries, emigrants have almost as warm feelings towards their host country as towards their home country Latvia, even though they are rarely as strong. Overall, 42% of emigrants do not feel close to the country where they are currently living; 43% feel close to this country and 15% feel very close to it. While attachment to the host country tends to increase with time, attachment to one's home country seems to be a relatively stable disposition, ie, one of the core values that one learns in early life and that remains relatively stable throughout the lifetime.

The analysis of determinants of the sense of belonging to the host country's society reveals some very clear factors that facilitate the integration of migrants. First, emigrants' identification with their new country of residence can primarily be increased by increasing their attachment to, and embeddedness in the community they reside in. Related to that, having friends who are natives of the country, is also a very powerful tool of facilitating the sense of belonging among migrants. Getting familiar with the locals by participating in common social activities might be one of the most effective solutions to improving migrant integration.

The study also points to the importance of media in facilitating identification with the host country's society. This, however, means that it is important to improve the language skills of migrants, so that they can follow and (virtually) be a part of the events happening in the country.

Importantly, we find that attachment to one's ethnic group is associated also with attachment to the inhabitants of the host country. It means that at least in case of Latvian migrants, preserving one's national identity does not threaten successful integration. Attachment to people in one's home country, however, indicates a certain nostalgia which might hinder integration into the new country's community.

The social environment matters too. Emigrants living in the capital cities where the society is more diverse, feel a stronger sense of belonging to the country's society rather than those living in more 'closed' and tightly-knit villages or rural areas.

The attachment to the host society is also affected by the time and circumstances in which the migrant arrived. In case of Latvia, the strongest

sense of belonging to their new country of residence can be observed among those who left during the years of crisis (2009-2011) or before the EU accession in 2004, i.e., a long time ago. Overall, having a job and sufficient financial means is important for the migrants to feel like they belong in the country's society.

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HOW VALUABLE WAS MUSIC FOR CLOISTERED NUNS? A CASE STUDY IN SÃO BENTO DE CÁSTRIS (ÉVORA, PORTUGAL) ¹⁶³

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Abstract:

In the past, living together within a community was a form of isolating oneself from the world as well as a means to perfect oneself through the observance of several moral precepts. Generally speaking, what defined life within a convent, besides the reclusion from society and the solitary life that it entailed, was a very strict spiritual program that included not only prayer, but also attending to the Divine Offices. A careful reading of the expense books prepared by the treasurer nuns reveals the costs spent on musical practice, as well as other expenses with which it is compared in this article. This study, carried out by analyzing costs relating to Music in Benedictine and Clare monasteries and, in particular, in the Cistercian Monastery of St. Benedict of Cástris (Évora, Portugal) in the post Trento period, shows that a significant part of the monasteries budget was devoted to expenses with guest musicians, musical instruments, choir books, special food and "gifts" for the musician nuns as a recognition for their music.

¹⁶³ This study comes in the framework of the Project FCT EXPL/EPH-PAT/2253/2013, "ORFEUS Project – *The Tridentine reform and the music in the silence of the cloister: the monastery of S. Bento de Cástris*", coordinated by Antónia Fialho Conde and funded by FCT/MEC and co-funded by Fundo Europeu de Desenvolvimento Regional (FEDER) through the Programs COMPETE and QREN. The study puts together specialists in Modern History, Architecture, Codicology, Music, Musicology and Organology, treating the collection of Choir books and musical manuscripts from a Cistercian female monastery, St Benedict of Cástris, in the South of Portugal, officially founded in the 13th century. The main goal is to study the impact of counter-reformation measures in the musical praxis of the nuns, verifying the continuities and the differences in the texts and melodies that were sung and played.

Keywords: Female monasteries; Cistercians; Benedictines; Poor Clares; Music costs

Introduction

Since remote times that accountancy was used in the administration of Portuguese monasteries (Araújo, 2010: 47). However, the privileges and abuse of commendatory abbots¹⁶⁴, who in the majority of cases used the monasteries assets for their own benefit and for their relatives' advantage, many times led to the ruin of those institutions. It was during the last session of the Council of Trent (1545 - 1563) that a set of rulings was emanated – *Decree of Regulars and Nuns* – which put an end to this degrading, dilapidating situation and extinguished the commendatory abbot's position. Under the same logic, the position of Abbot and Abbess ceased to be perpetual and began to be voted every three years. From this point on, these functions included more duties, namely their co-responsibility for expenses and for their recording in proper books by the registrar or treasurer nun. Those were inspected every year or every three years by a male member of the same Order. The Council of Trent also instructed that monasteries should be gathered into provinces (as it happened with the Franciscan ones) or into congregations. Therefore, in Portugal, in 1567, happens the foundation of the Congregation of Saint Benedict of Portugal, with the mother - house located at the Monastery of Tibães, and the Congregation of Santa Maria de Alcobaça, whose mother-house was the Monastery of Alcobaça.

Today, and as a result of the Tridentine resolutions, which made feminine cloistered life much more rigorous and led to the recording of its daily economy, we have the means to study both and, in the latter's case, to focus on the relevance of music in that world.

I.

The register of expenses with music in feminine monasteries

Since the Council of Trent that feminine monasteries were not only obligated to have records of everything they earned and paid, but also to keep their Order/Congregation's hierarchy and the Apostolic Visitors informed of everything. The Abbess was responsible for the monastery's administration, both spiritual and material. She was the one who implemented discipline and she also assumed and signed all the economic acts and contracts in the monastery's name, in conjunction with the general chapter, a group constituted by the Superior Mothers of the Order, to whom

¹⁶⁴ *Commendam (or in commendam)* – in canon law, it was a form of transferring an ecclesiastic benefice in trust to the custody of a patron. Monks were dependent from the monastery's duties, a third part of the monastery's income; commendatory abbots were entitled to the abbey's duties, two thirds of the monastery's revenues.

she referred to in order to solve matters of greater responsibility for the monastery. Her decisions were always backed up by the superintendent nun of the House, the Vicar. Among the other positions to be voted every three years, we highlight the one of “Choir Master” (in Benedictine and Poor Clares monasteries) and of “Sacristan Mother” (in São Bento de Cástris and in the other Cistercian monasteries). These were the nuns responsible for the choice of repertoire for the Divine Office (the Liturgy of Hours), for the Masses and its expenses. This highlight is directly related to their connection to sacred music and to the various register books where this is documented.

The treasurer nun, also known as *Síndica* (a sort of administrator), had the obligation to create and keep the account books, the ledger books and/or the Treasurer Nun’s books, which contained the register of the majority of the acquisitions for the community. In the monasteries’ construction ledgers, we also have records of the costs of the extension and renovation of religious buildings and churches, including choir spaces and the purchase and repair of church organs. The Abbess had the help of another nun in the administration of the community’s daily life: the Depository Nun, who according to the case kept or managed the values and money that entered the “Archive” or “Deposit Chest” or “Community Chest”. Along with this, there were also other nuns that occupied other positions which varied according to the monastery and religious Family. There was the function of Grain Keeper, who controlled the inbound and outbound cereal, and the function of Cellarer, who provided for the feeding of the nuns. The expenses related to these functions could have their own register or they could be part of the treasurer’s accounts.

Having as an example the ledger books from the Benedictine monasteries of Santa Ana (Viana do Castelo), of Semide (Coimbra), and of Avé Maria (Porto), dating from the 17th, 18th and 19th centuries, we can list the type of recorded expenses which were related to musical practice: the purchase of organs; the payments to organ-builders for repairs and tuning throughout the times; the acquisition of other musical instruments, namely harpsichord, clavichord, double bass, viola, harp and strings; the buying and restoration of Choir Books; the payment to musicians that came to the monastery to participate in festive liturgical ceremonies; the payment to cantor priests who, during the Holy Week, sang the “Passion of Christ”, and to other cantors and performers, such as shawm players, bagpipe players and drummers, during festive celebrations. Monasteries also had costs with special presents to musician nuns, “pampering and flower arrangements”, special foods, and extra expenses with the purchase of candles for Christmas, when the nuns spent hours rehearsing *Vilancicos*, a poetic-musical genre which was a favorite of theirs and of the faithful from the 18th century and

which is musically similar to the baroque cantata, with multiple-voice choirs, solos, duets and instrumental parts.

Contrary to what happened in masculine monasteries, the celebration of masses and sermons in feminine monasteries involved costs, because it was necessary to resort to regular and secular masculine clergy and these services were paid. In this context, and when talking about economic initiative, we must particularly refer to the first Brazilian monastery, the one of the Poor Clares of Desterro (Salvador – Bahia). In order to spare some money and guarantee their permanence at that location, the nuns became tenants of the land where the convent was built and they agreed with the landowners that, in return, they would have “the responsibility to sing, every Saturday and forever more, the litany of Our Lady, [...] for which [the landowners] usually had to pay musicians the amount of 40 000 *réis* every year. [...] The nuns’ chant [...] paid for the land’s tenancy” (Nascimento, 1994: 219).

A common expense was the payment for the organist when, as it frequently happened, the monastery did not have anyone who knew how to play the organ. Therefore, we can find many cases in which this task is paid and assigned to an outsider or to a house nun. However, such circumstances sometimes created difficult situations: in the first case, there was great competition between monasteries when trying to attract an organist who was considered a good performer and who had an unblemished reputation (in this case, the negotiation could even lead to warranting the lady’s religious profession, with no dower delivery and with the right to vote, if she was a laywoman and single or a widow). In the second case, and as documented in some convents of St. Claire, there was the risk of such task becoming too demanding and permanent for the nun who performed this job. She could feel burdened, without conditions to practice her other tasks as a nun, and, although she could have been partially or totally exempted from the payment of the dowry (for being a musician, a characteristic of surmountable importance for the monastery), prefer to pay it and just stop being an organist. In the convents of Toledo, there is a similar situation: at the Monastery de la Concepción, there are records of organist nuns who were paid between the years of 1599 and 1801. (Baade, 2011b: 51)

Expenses with Music at the Monastery of São Bento de Cástris

The Cistercian monastery of São Bento de Cástris (Évora) is the oldest feminine convent located south of the Tagus River. Object of a detailed study by Antónia Fialho Conde, who brought us its daily life in its material and spiritual dimensions, today this monastery is also being studied under Project ORFEUS, of which we are a part of. Integrating its important musical estate, preserved at the Public Library of Évora, there is a collection

of Choir Books constituted by seven Antiphoners, one Sanctoral Antiphoner (recently studied by Isabel Cid da Silva from Project ORFEUS: cf. Conde & Silva, 2015), one Hymnal, two Invitatory Books and two Gradual Books, which result from a long-term investment by the nuns and which attest the choral practice of the monastery. Having as reference the years between 1726 and 1744, it is possible to see, on Table 1, a list of expenses related to musical practice at the monastery, which clearly shows the value and interest this had to this community where the Divine Offices and other liturgical festivities were celebrated with great dignity and beauty. As you can observe, in 1741, the monastery acquired a new organ. The organ-builder was Master Filipe da Cunha, who was paid the following amount in three installments: 96 000 *reis* (1st installment, 1741); 57 600 *reis* (2nd installment, also in 1741); 396 400 *reis* (3rd and last installment, 1744). The monastery paid him a total of 550 000 *reis*, but we do not know if this amount included the costs with materials, transportation and other expenses.

Table 1 – Expenses with Music at São Bento de Cástris from 1726 to 1744

Description	Value in <i>reis</i>	Date	Observations	Source
Main Singer	4800	October 1726	“paguei a pitaça da cantora-mor Dona Maria Elena”	CXXXII 1-4 fl. 13
Ministers	960	August 1726	“paguei aos Menistros que cantaram nestas duas festividades ”	CXXXII 1-4 fl. 9
Ministers	480	Nov. 1726	“paguei aos Menistros que cantaram a missa de dia dos santos”	CXXXII 1-4 fl. 15
Ministers	480	Dec. 1726	“paguei aos Menistros que cantaram na missa de nossa senhora da Conceiçam ”	CXXXII 1-4 fl. 17
Ministers	1920	Jan. 1727	“paguei aos Menistros que cantaram nas missas de Natal e Vespera , e no dia da circunsizao”	CXXXII 1-4 fl. 19v
Passions	6000	April 1727	“paguei aos Padres que cantaram as paixões todas da semana Santa”	CXXXII 1-4 fl. 27v
<i>Exultet</i>	2000	April 1727	“paguei a quem cantou o <i>exultet</i> ”	CXXXII 1-4 fl. 27v
Masses a)	1560	June 1727	“paguei ao Padre capelam doze missas rezadas e tres cantadas”	CXXXII 1-4 fl. 31v
Ministers	960	Feb. 1728	“paguei aos Menistros que cantaram nas festas da circuncizão e da purificação...”	CXXXII 1-4 fl. 42v
Ministers	960	March 1728	“paguei aos Menistros que cantaram na mesma festa”	CXXXII 1-4 fl. 44v
Organ Repair	8400	July 1728		CXXXII 1-4 fl. 50v
Organ Repair	720	Sep. 1728	“paguei de huas fechaduras para o órgão”	CXXXII 1-4 fl. 52v
<i>Exultet</i>	2000	April 1729	“paguei a quem cantou o <i>exultet</i> ”	CXXXII 1-4 fl.62
Passions	6000	April 1729	“ paguei aos Padres que cantaram as paixões”	CXXXII 1-4 fl. 62

Main Singer	4800	Dec. 1732	“paguei a Madre Cantora Dona Caetana de Sousa no primeiro anno”	CXXXII 1-5 fl. 12v
Main Singer	4800	Jan. 1736	“paguei a Madre Cantora mor a sua pitaça do anno de 1736”	CXXXII 1-6 fl. 10v
Fee (Franciscan)	2400	March 1736	“paguei a um Religioso de Sam Francisco que veio ajudar a cantar as Paschoas	CXXXII 1-6 fl. 14v
Fee (Dominican)	2000	April 1737	“paguei a hum Religioso de São Domingos que ajudou a cantar as Payxoes ”	CXXXII 1-6 fl. 30
Main Singer	9600	April 1738	“paguei a pitaça a Madre Cantora Izabel Candida de dous annos”	CXXXII 1-6 fl. 43
Description	Value in reis	Date	Observations	Source
Fee (Dominican)	2400	April 1738	“paguei a hum Religioso de São Domingos qua ajudou a cantar as Payxois ”	CXXXII 1-6 fl. 44
Main Singer	4800	Nov. 1738	“ pagouse de sua propina”	CXXXII 1-7 fl. 7
Ministers	1 440	Dec. 1739	“paguei aos Menistros em dia da Conceção noyte e dia de Natal de cantarem as empistolas e Evangelhos”	CXXXII 1-7 fl.21v
Main Singer	4800	Jan. 1741	“ paguey a Cantora mor de sua propina”	CXXXII 1-7 fl. 34
Ministers	480	March 1741	“paguei a dous clérigos de Hirem cantar as payxãos em dia de Ramos”	CXXXII 1-7 fl.36
Repairs (Organ, payment by installments) b)	96 000	August 1741	“pagouse a Filipe da cunha á conta do Orgão que está fazendo”	CXXXII 1-8 fl.11v
Repairs (Organ, payment by installments) c)	57 600	October 1741	“pagouse a Filipe da cunha á conta do Orgão que está fazendo”	CXXXII 1-8 fl.15
Ministers	960	March 1742	“pagouse aos Ministros que assistirão a duas Missas Cantadas”	CXXXII 1-8 fl.28v
Repairs (organ)	1 600	Sept. 1742	“pagouse hua tranqueta de ferro com parafuzos para as portas do organ”	CXXXII 1-8 fl. 47
Main Singer	4800	Jan. 1744	“ pagouse a propina a Madre Cantora-mor”	CXXXII 1-7 fl. 7
Repairs (organ) d)	396 400	March 1744	“pagouse a Filipe da cunha todo o resto do Orgão que fez”	CXXXII 1-8 fl.79
Masses e)	3 120	April 1744	“pagouse de nove Missas cantadas e oito Rezadas quando o Padre Capelão estava doente”	CXXXII 1-8 fl.81v

a) 3 sang Masses and 12 prayed

b) 1st installment

c) 2nd installment

d) 3rd installment (last one)

e) 9 sang Masses and 8 prayed

Source: Public Library of Évora, Catalogued Estate of São Bento de Cástris

The ledger books from the Monastery of Santa Ana (Viana do Castelo) also have records of payments to Cantors and Priests who sang the

Passion of Christ during Easter. In 1759, Father Matias de Brito received 2000 *reis* from the nuns of Santa Ana (Lessa, 1998: 343). The price list for this service in 1737 is the same which was used in Cástris. In the previous century, specifically in 1614, the Franciscan Monastery of Santa Isabel de los Reyes de Toledo paid 345 *reis* to the musicians who polyphonically sang, with organ, the *Passion of Christ*. (Baade, 2011b: 53)

The job of Main Singer was a very prestigious one. At the Monastery of Cástris in the 1740s, and according to Table 1, the Main Singer was paid 4800 *reis* per year. Some Benedictine monasteries offered presents and better meals to the Singers (sweet rice and fish). At the Monastery of Semide, near Coimbra, the Vestry Book has records from 1757 to 1782 of expenses with palm heart and flower arrangements; besides that, the Main Singer also received a fee of 4180 *reis*. The ledger book of the Convent of Avé Maria in Porto, from the beginning of the 19th century, has records from 1805 to 1807 of payments to the Main Singer of a total of 14 400 *reis* and to the Chapel Master of the amount of 57 600 *reis* (Lessa, 1998: 371; 381). Such high values are certainly connected with the high prestige and responsibility of a Chapel Master, who was responsible for the entire monastery's musical service, including the vocal musical direction of plainchant (or plainsong), of a *capella* polyphonic singing, and/or for the instrumental accompaniment. Meanwhile, the value received by the Main Singer, who assured the Choir, corresponds exactly to the value of three years at Cástris for 4 800 *reis* per year.

To have some notion of the relative value of the amounts spent with Music for religious festivities and Masses, we built Table 2. This works as an example, not as a comprehensive depiction of what happened. So, in an increasing order (from 100 to 8 000 *reis*), we have the expenses made with Music and food in five Portuguese feminine monasteries, during the period of which we have data on the payment of music in Cástris (1672 - 1744). The other four communities that we will briefly refer to are all part of the Order of St. Claire (Poor Clares), the one which, during the 17th and 18th centuries, was the most numerous and omnipresent in the Portuguese Empire. One of the houses, the one named Salvador, has the peculiarity of, just like São Bento de Cástris, being located in Évora. The second, the one of Nossa Senhora da Conceição (Our Lady of Immaculate Conception), is also located in Alentejo, but in Beja; the other two are located on the Portuguese archipelagos: the Azorean one, Nossa Senhora da Glória (Our Lady of Glory), in the town of Horta (island of Faial), and Madeira's one, Nossa Senhora da Encarnação (Our Lady of the Incarnation), in the city of Funchal.

By looking at Table 2, one may question oneself about the buying power of tangible amounts of money, without the need to adapt them to inflation or to other altering effects when referring to chronological time. For

example, in a certain period, 300 *reis* allowed buying two chickens, which were considered to be sophisticated and fortifying food; therefore, they were expensive and rarely consumed, being bought only for celebrations or for when someone was sick or recovering from an illness. In a different historical context, 300 *reis* permitted buying strings for a harp, something rapidly consumable and regularly substituted. For example, at the Convent of Glória (Horta), they bought strings six times per year, close to important liturgical festivities when they were easily broken. With this analysis, the enormous importance that the Cistercian monastic community of São Bento de Cástris gave to musical celebration is very clear. They considered it a supreme way of praising God and a means of sharing with society this exaltation of transcendence. Its expenses with external services of music and singing during the Holy Week, or with the annual salary of the Main Singer nun, are much higher than any others in the house and often correspond to figures two to eight times higher than the most expensive ones related to food.

In the 19th century, the expenses with the Divine Office at the Monastery of Cástris gradually decrease, a not so strange fact, having in mind the extinction plan for the Orders and the overall financial decadence. In 1814, the income map of Cástris, designed by Dona Anna Rita Peregrina do Desterro, states that the monastery *does not receive tithes of any sort* and that, in that same year, the annual expenditure with the Divine Office was of 208 800 *reis*; three decades later, ten years after the Interdiction to New Admissions' Law was published, the expenses with the Office were almost inexistent: a mere 120 *reis* (National Archives - Torre do Tombo, Cister, Mç.2 doc. 87).

Table 2 - Purchasing power of some amounts of money

AMOUNT IN REIS	YEAR	WHAT IT ALLOWS TO PAY	MONASTERY	CITY OR TOWN	SOURCE	OBSERVATIONS
100	1718	a week of food for a "fâmula" at the monastery's infirmary	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, December 1718, image 100	A "fâmula" was a monastery's maid. 100 "reis" were called a "tostão"
150	1689	a chicken	Nª Srª da Conceição	Beja	Alfredo Saramago, <i>Convento de Soror Mariana</i> , p.119	
200	1672	one harp	S.Bento de	Évora	CXXXII 1-2	

		string	Cástris		fl. 5	
300	1718	a week of food for a nun at the monastery's infirmary	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, December 1718, image 100	
AMOUNT IN REIS	YEAR	WHAT IT ALLOWS TO PAY	MONASTERY	CITY OR TOWN	SOURCE	OBSERVATIONS
300	1717	harp strings	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, December 1717, image 88	
320	1718	a "canada" (1,4 l) of butter	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, May 1718, image 95	
400	1720	harps strings	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, April 1720, image 111	400 "reis" were called a "cruzado"
400	1719	a "canada" (1,4 l) of butter	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, May 1719, image 104	
480	1726	one sang Mass	S.Bento de Cástris	Évora	CXXXII 1-4 fl. 15, 17	The same price in 1726, 1727, 1728, 1739, 1741, 1742
480	1719	monastery's monthly contribution to each nun that does not eat at the common refectory and pays for her own food	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, September 1719, image 107	
500	1673	harp strings	S.Bento de Cástris	Évora	CXXXII 1-2 fl. 18v	
700	1672	harp and viola strings	S.Bento de Cástris	Évora	CXXXII 1-2 fl. 11	
800	1720	one pound of English butter	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, February 1720, image 110	

900	1672	1 “arroba” (15kg) of beef	Nª Srª da Encarnação	Funchal	Eduarda Gomes, <i>O Convento da Encarnação</i> , p.216	Until the end of the 17th century, every 15 kg of beef was worth between 800 and 900 “reis”
900	1676	1 “arroba” (15 kg) of rice	Nª Srª da Encarnação	Funchal	Eduarda Gomes, <i>O Convento da Encarnação</i> , p.197	This same price in 1671, 1676, 1691, 1717, 1736, but the price of rice oscillated greatly here, from 325 “reis” to 1 500 “reis”
AMOUNT IN REIS	YEAR	WHAT IT ALLOWS TO PAY	MONASTERY	CITY OR TOWN	SOURCE	OBSERVATIONS
1000	1705	1 “arroba” (15kg) of beef	Nª Srª da Encarnação	Funchal	Eduarda Gomes, <i>O Convento da Encarnação</i> , p.216	Between 1700 and 1743, every 15 kg of beef was worth between 1000 and 1200 “reis”
1100	1689	1 “arroba” (15 kg) of rice	Nª Srª da Conceição	Beja	Alfredo Saramago, <i>Convento de Soror Mariana</i> , p.119	
1200	1741	1 “arroba” (15kg) of beef	Nª Srª da Encarnação	Funchal	Eduarda Gomes, <i>O Convento da Encarnação</i> , p.218	
1250	1701	harp strings (one package)	S.Bento de Cástris	Évora	CXXXII 1-3 fl. 102	
1280	1719	half “arroba” (7,5 kg) of rice	Nª Srª da Glória	Horta	Administração 1707-1809, cx. 5, Lº 1, February 1719, image 102	Price for a pound of rice: 4 “vinténs”. A “vintém” was 20 “reis”. So, 7,5 kg were equivalent to 320 pounds, and costed 64 “vinténs”.
1500	1699	harp strings (one package)	S.Bento de Cástris	Évora	CXXXII 1-3 fl. 17	
1500	1701	strings and pilar for a harp (a package)	S.Bento de Cástris	Évora	CXXXII 1-3 fl. 82v	
1600	1692	sing praises and the "Exultet"	Salvador	Évora	Lº 15, fl. 53	

2000	1672	bi-annual gift to the Main Singer	S.Bento de Cástris	Évora	CXXXII 1-2 fl. 11v, 18	The same price from 1672 to 1675, 1700 and 1701
2000	1727	sing the "Exultet"	S.Bento de Cástris	Évora	CXXXII 1-4 fl. 27v	The same price from 1727 to 1729
2400	1738	help sing the "Passion of Christ"	S.Bento de Cástris	Évora	CXXXII 1-6 fl. 44	
2500	1674	playing shawms	S.Bento de Cástris	Évora	CXXXII 1-2 fl. 41v	The same price from 1672 to 1674
4800	1744	annual gift to the Main Singer	S.Bento de Cástris	Évora	CXXXII 1-7 fl. 7	The same price in 1726, 1732, 1736, 1738, 1741, 1744
6000	1674	sing all the "Passions"	S.Bento de Cástris	Évora	CXXXII 1-2 fl. 31v	The same price in 1674, 1675, 1702, 1727 and 1729
8000	1701	sing the "Passions" and the "Exultet"	S.Bento de Cástris	Évora	CXXXII 1-3 fl. 89	

Conclusion:

The 17th and 18th centuries are known as centuries of great expression of monastic religiousness. At that time, monasteries were the stage for important artistic manifestations and, in the case of feminine monasteries, they had female musicians as protagonists. Musical practice in monasteries occupied a good portion of the convent's daily life. Music was present throughout the day in the celebration of Mass and of the Divine Office. Besides Divine Praise, music was also a part of leisure times.

The ledger books from Portuguese feminine monasteries are a relevant source for the economic and statistic study of religious orders in Portugal. However, the reading of these documents under a musicological perspective has a peculiar reach and requires a deeper study of the *expenses with music* of feminine monasteries in the modern period. Through the registered expenses, it is possible to identify a set of musical practices that took place inside the walls. There is important data about: the presence of instrumental music in monasteries, besides the usage of the organ; the presence of cathedral musicians in the liturgy services at monasteries; the celebration of festivities to honor patron saints and other festivities which had the presence of external musicians; the involvement with the local community in popular celebrations, also with the presence of musicians; the zeal in the acquisition and preservation of choir books and musical

instruments, focusing on the organ; and, finally, the status and admiration that *Musician Ladies* came upon in the monastic communities.

As for the Monastery of São Bento de Cástris, the records of *expenses with music* that we know today are particularly interesting. Considering the number of references and the amounts of money mentioned, we have the confirmation that this monastery was an extremely important center for musical activity, in what relates to Portuguese monastic sacred music from the 17th and 18th centuries. Music was, undoubtedly, of great value for the cloistered nuns at Cástris.

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NUMERICAL SOLUTION OF THIN FILM EQUATION IN A CLASS OF DISCONTINUOUS FUNCTIONS

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Abstract

In this paper, an original method has been suggested to find a numerical solution of initial value problem for a fourth order degenerate diffusion equation which models the thin film flow. For this, an auxiliary problem established in a special way and having some advantages over the main problem has been introduced. Advantages of the auxiliary problem allow us to apply one of the well-known methods in literature, and thus the numerical solution of the main problem can be calculated by using the obtained solution.

Keywords: Thin film equation, Weak solution, Numerical solution in a class of discontinuous functions

Introduction

Let R^2 be an Euclidean space of points (x, t) and let $G \subset R^2$ be a rectangular region as $G = I \times [0, T)$, where $I = [-a, a]$ and a, T are given constants.

In G , we consider the fourth-order double degenerate nonlinear thin film equation as

$$\frac{\partial u}{\partial t} = \frac{\partial}{\partial x} \left(u \frac{\partial^3 u}{\partial x^3} \right) \quad (1)$$

with the following initial

$$u(x, 0) = u_0(x) \quad (2)$$

and boundary

$$\frac{\partial^k u(\pm a, t)}{\partial x^k} = 0, \quad (k = 0, 1) \tag{3}$$

conditions. Here, the function $u_0(x)$ describes the finite mass, therefore, $u_0(x) \geq 0$ and the boundary conditions show that the fluid is permitted to drain over the edges $x = \pm a$.

An analysis of the solution obtained in [5], shows that $u(x, t)$, $\frac{\partial u(x, t)}{\partial x}$, $u(x, t) \frac{\partial u(x, t)}{\partial x}$, $u(x, t) \frac{\partial^2 u(x, t)}{\partial x^2}$ and $u(x, t) \frac{\partial^3 u(x, t)}{\partial x^3} \rightarrow 0$, but $\frac{\partial^2 u(x, t)}{\partial x^2}$, $\frac{\partial^3 u(x, t)}{\partial x^3}$ for $x \rightarrow 1^-$. On the basis of these estimates we can say that problem (1)-(3) does not have a classical solution.

Since equation (1) is degenerated at $u(x, t) = 0$, following [1] we consider the approximating equation as

$$\frac{\partial u^\varepsilon}{\partial t} = -\frac{\partial}{\partial x} \left((u^\varepsilon + \varepsilon) \frac{\partial^3 u^\varepsilon}{\partial x^3} \right) \text{ in } Q_T, \tag{4}$$

where ε is a positive parameter. In this situation, it is also necessary to approximate $u_0(x)$ in $H^1(\Omega)$ – norm by $C^{4+\alpha}$ functions $u_0^\varepsilon(x)$ satisfying the conditions (3), and replacing (2).

$$u(x, 0) = u_0^\varepsilon(x). \tag{5}$$

Under the assumption that $u^\varepsilon(x, t)$ is a solution of problem (4), (5) in Q_σ , for some $0 < \sigma < T$ we derive estimates to be used later.

Putting instead of u the u^ε we begin with

$$\int_I \left[\left(\frac{\partial u(x, t + \tau)}{\partial x} \right)^2 - \left(\frac{\partial u(x, t)}{\partial x} \right)^2 \right] dx = - \int_I \left[\frac{\partial^2 u(x, t + \tau)}{\partial x^2} + \frac{\partial^2 u(x, t)}{\partial x^2} \right] \left[\frac{\partial u(x, t + \tau)}{\partial x} - \frac{\partial u(x, t)}{\partial x} \right] dx,$$

since $\frac{\partial u(x, t)}{\partial x} = 0$ on the boundary. Dividing by τ and letting $\tau \rightarrow 0$ we get

for any $0 < t_1 < t_2 < \sigma$

$$- \int_{t_1}^{t_2} \int_I \frac{\partial u(x, t)}{\partial t} \frac{\partial^2 u(x, t)}{\partial x^2} = \frac{1}{2} \int_I \left(\frac{\partial u(x, t)}{\partial x} \right)^2 dx \Big|_{t_1}^{t_2}.$$

Multiplying (4) by $\frac{\partial^2 u^\varepsilon}{\partial x^2}$ and integrating over $Q_T (0 < T < \sigma)$ and using the last identity, we obtain

$$\frac{1}{2} \int_I \left(\frac{\partial u^\varepsilon(x, T)}{\partial x} \right)^2 dx \leq \frac{1}{2} \int_I \left(\frac{\partial u^\varepsilon(x, 0)}{\partial x} \right)^2 dx.$$

Now, integrating (4) over Ω_T we also obtain

$$\int_I \left(\frac{\partial u^\varepsilon(x, T)}{\partial x} \right)^2 dx \leq \int_I \left(\frac{\partial u^\varepsilon(x, 0)}{\partial x} \right)^2 dx. \tag{6}$$

Integrating (4) over Ω_T we obtain

$$\int_I u^\varepsilon(x, T) dx \leq \int_I u^\varepsilon(x, 0) dx. \tag{7}$$

Auxiliary Problem

Integrating equation (1) with respect to x from $-a$ until to x and using condition (3), we obtain

$$\frac{\partial}{\partial t} \int_{-a}^x u(\xi, t) d\xi = u(x, t) \frac{\partial^3 u(x, t)}{\partial x^3} - u(-a, t) \frac{\partial^3 u(-a, t)}{\partial x^3}. \tag{8}$$

Taking into consideration the equality

$$u(x, t) \frac{\partial^3 u(x, t)}{\partial x^3} = \frac{\partial}{\partial x} \left(u(x, t) \frac{\partial^2 u(x, t)}{\partial x^2} \right) - \frac{1}{2} \left[\frac{\partial}{\partial x} \left(\frac{\partial u(x, t)}{\partial x} \right)^2 \right]$$

and once more integrating equation (8) with respect to x from $-a$ until to x , and compensating relation of integration to zero, we get

$$\begin{aligned} \frac{\partial}{\partial t} \int_{-a}^x \int_{-a}^x u(\xi, t) d\xi d\xi &= u(x, t) \frac{\partial^2 u(x, t)}{\partial x^2} - u(-a, t) \frac{\partial^2 u(-a, t)}{\partial x^2} \\ &- \left[\frac{1}{2} \left(\frac{\partial u(x, t)}{\partial x} \right)^2 - \frac{1}{2} \left(\frac{\partial u(-a, t)}{\partial x} \right)^2 \right]. \end{aligned} \tag{9}$$

In accordance with

$$u(x, t) \frac{\partial^2 u(x, t)}{\partial x^2} = \frac{\partial}{\partial x} \left(u(x, t) \frac{\partial u(x, t)}{\partial x} \right) - \left(\frac{\partial u(x, t)}{\partial x} \right)^2,$$

from (9) it follows that

$$\begin{aligned} \frac{\partial}{\partial t} \int_{-a}^x \int_{-a}^x \int_{-a}^x u(\xi, t) d\xi d\xi d\xi &= u(x, t) \frac{\partial u(x, t)}{\partial x} - u(-a, t) \frac{\partial u(-a, t)}{\partial x} \\ &- \frac{3}{2} \int_{-a}^x \left(\frac{\partial u(\xi, t)}{\partial \xi} \right)^2 d\xi. \end{aligned} \tag{10}$$

Integrating again in last formula (10), we have

$$\frac{\partial}{\partial t} \int_{-a}^x \int_{-a}^x \int_{-a}^x \int_{-a}^x u(\xi, t) d\xi d\xi d\xi d\xi = \frac{1}{2} u^2(x, t) - \frac{1}{2} u^2(-a, t) + \frac{3}{2} \int_{-a}^x \int_{-a}^x \left(\frac{\partial u(\xi, t)}{\partial \xi} \right)^2 d\xi d\xi. \quad (11)$$

Using the Cauchy formula, we get

$$\frac{1}{3!} \frac{\partial}{\partial t} \int_{-a}^x (x-\eta)^3 u(\eta, t) d\eta = \frac{1}{2} u^2(x, t) - \frac{3}{2} \int_{-a}^x (x-\eta) \left(\frac{\partial u(\eta, t)}{\partial \eta} \right)^2 d\eta. \quad (12)$$

It is clear that if the functions $u(x, t)$ and $\frac{\partial u(x, t)}{\partial x}$ are differentiable continuous then the equations (12) or (11) and (1) are equivalent. By differentiating four times the last equation with respect to x , we prove this claim.

Numerical Algorithm

To approximate of equation (12) by the finite difference formulas, at first we cover the domain G by the grid $\Omega_{h_x, h_t} = \Omega_{h_x} \times \Omega_{h_t}$. Here

$$\Omega_{h_x} = \{x_i \mid x_i = a + ih_x, i = 0, 1, \dots, n\} \text{ and } \Omega_{h_t} = \{t_k \mid t_k = kh_t, k = 0, 1, 2, \dots\}.$$

The number $h_x = \frac{a}{n}$, $h_t > 0$ and h_t will be obtained from the condition of stability of the difference scheme.

Now, we construct a sub grid in Ω_{h_x} . For any i , we cover the interval $[x_i, x_{i+1}]$ with

$$\Omega_{h_\xi} = \{\xi_\nu \mid \xi_\nu = a + \nu h_\xi, \nu = 0, 1, \dots, np\}.$$

Here $p > 0$ is any constant. As it is seen, $\xi_{pi} = x_i$. Thus we get $\Omega_{h_\xi, h_t} \subseteq \Omega_{h_x, h_t}$. We now may present a finite difference scheme to equation (12). At first, using cubature formulas for example, the method of rectangles, the integrals

$$\int_{-a}^x (x-\xi)^3 U(\eta, t) d\eta \text{ and } \int_{-a}^x (x-\eta) \left(\frac{\partial u}{\partial \eta} \right)^2 d\eta \text{ are approximated as follows}$$

$$\int_{-a}^{x_i} (x_i - \xi)^3 U(\eta, t) d\eta \cong h_\xi \sum_{\nu=1}^{pi} (x_i - \tilde{\eta}_\nu)^3 U(\tilde{\eta}_\nu, t_k), \quad (13)$$

$$\int_{-a}^{x_i} (x_i - \eta) \left(\frac{\partial u}{\partial \eta} \right)^2 d\eta \cong \frac{1}{h_\xi} \sum_{\nu=1}^{pi} (x_i - \tilde{\eta}_\nu) [U(\tilde{\eta}_\nu, t_k) - U(\tilde{\eta}_{\nu-1}, t_k)]^2 \quad (14)$$

where $\tilde{\eta}_v = \frac{\xi_v + \xi_{v+1}}{2}$. Taking into consideration expressions (13) and (14), since $x_i - \tilde{\eta}_{pi} \neq 0$ for any i , integro-differential equation (12) can be approximated by the finite difference as follows

$$U(\tilde{\eta}_{pi}, t_{k+1}) = (x_i - \tilde{\eta}_{pi})^{-3} \left\{ - \sum_{v=1}^{pi-1} (x_i - \tilde{\eta}_v)^3 U(\tilde{\eta}_v, t_{k+1}) + \sum_{v=1}^{pi} (x_i - \tilde{\eta}_v)^3 U(\tilde{\eta}_v, t_k) + \frac{3h_t}{h_\xi} U^2(x_i, t_k) - \frac{9h_t}{h_\xi^2} \sum_{v=1}^{pi} (x_i - \tilde{\eta}_v) [U(\tilde{\eta}_v, t_k) - U(\tilde{\eta}_{v-1}, t_k)]^2 \right\} \quad (15)$$

($i = 0, 1, 2, \dots$) , where U_i , U_{i-1} and \hat{U}_i are approximate values of the function $u(x, t)$ at any point (x_i, t_k) , (x_{i-1}, t_k) and $(x_i, t_k + \tau)$ of the grid $\Omega_{\tau, h}$, respectively.

The initial and boundary conditions are

$$U_{i0} = u_0(x_i),$$

$$\left. \frac{U_{i+1} - U_i}{h} \right|_{i=n-1} = 0.$$

Note: To realize of our algorithm (14), at first, \hat{U}_0 is found at point x_0 by using Euler's method, then the unknown values are found time level $t_k = (k + 1)\tau$, ($k = 0, 1, 2, \dots$) from algorithm (15). The coefficients in (15) and other initial functions are calculated in time level t_k .

Now we will investigate the consistence and convergence of difference scheme (14) to solution (12).

Let $\varepsilon_{i,k}$, $\eta_{i,k}$ are the errors of approximation by the cubature formula of the integrals involving equation (12) by finite difference formulas.

Otherwise, let $\delta_{i,k}$, $\omega_{i,k}$ are errors of approximation of $\frac{\partial w(x, t)}{\partial t}$ and $\frac{\partial u(x, t)}{\partial x}$ by finite difference formulas, respectively.

Here

$$w(x, t) = \int_{-a}^x (x - \eta)^3 u(\eta, t) d\eta$$

and

$$\varepsilon_{i,k} = w(x, t) - h \sum_{j=1}^{m-i} (x_i - \eta_j)^3 U_j,$$

$$\eta_{i,k} = \int_{-a}^x (x-\eta) \left(\frac{\partial u(\eta,t)}{\partial \eta} \right)^2 d\eta - h \sum_{j=1}^i (x_i - \eta_j) \left[\frac{U_{j+1} - U_j}{h} + \omega_{j,k} \right],$$

$$\delta_{i,k} = \frac{\partial w(x,t)}{\partial t} - \frac{\hat{W}_i - W_i}{\tau},$$

$$\omega_{i,k} = \frac{\partial u(x,t)}{\partial x} - \frac{U_{i+1} - U_i}{h}.$$

Due to the fact that functions $u(x,t)$ and $\frac{\partial u(x,t)}{\partial x}$ are continuous, $\omega_{i,k} \rightarrow 0$, i.e.

$$\omega_{i,k} = \frac{\partial u(x_i, t_k)}{\partial x} - \frac{U_{i+1} - U_i}{h} = \frac{\partial u(x_i, t_k)}{\partial x} - \frac{\partial u(x_i^*, t_k)}{\partial x} = \pi \left(\frac{\partial u(x,t)}{\partial x} \right) \rightarrow 0,$$

(16)

$x_i^* \in (x_i, x_{i+h})$, where $\pi(f)$ is modulus continuity of any function $f(x)$ on any interval $[-a, a]$, that is,

$$\pi(f) = \sup_{|t-x|<h} |f(t) - f(x)|.$$

Let $\varphi(x,t) = (x-\eta)^3 u(x,t)$. It is easy to see that the functions $\varphi(x,t)$ and $\varphi'(x,t)$ are continuous. Then, for $\varepsilon_{i,k}$ we have

$$\varepsilon_{i,k} = ah\varphi'(z,t)$$

(17)

for some $z \in [-a, a]$. Let

$$\psi(x,t) = (x-\eta) \left(\frac{\partial u(x,t)}{\partial x} \right)^2.$$

Due to the fact that the function $\psi(x,t)$ is continuous for $\eta_{i,k}$, we get

$$\eta_{i,k} = \int_{-a}^x \psi(\eta,t) d\eta - h \sum_{j=1}^i (x_i - \eta_j) \frac{U_{j+1} - U_j}{h}$$

$$- h \sum_{j=1}^i (x_i - \eta_j) \omega_{j,k} = ah\psi'(z,t) - h \sum_{j=1}^i (x_i - \eta_j) \omega_{j,k}$$

(18)

$$\delta_{i,k} = \frac{1}{3!} \frac{\partial w(x_i, t_k)}{\partial t} - \frac{1}{3!} \frac{\hat{W}_i - W_i}{\tau}$$

$$= \frac{1}{2} U^2(x_i, t_k) - \frac{3}{2} \int_{-a}^{x_i} \psi(\eta,t) d\eta - \left[\frac{1}{2} U_i^2 - \frac{3}{2} h \sum_{j=1}^i \psi_j \right]$$

$$= \frac{1}{2} (U^2(x_i, t_k) - U_j^2) - \left[\frac{3}{2} \int_{-a}^{x_i} \psi(\eta, t) d\eta - \frac{3}{2} h \sum_{j=1}^i \psi_j \right] = \max_{(x_i, t_k)} u \cdot \pi(u) - \frac{3}{2} \eta_{i,k}. \tag{19}$$

As it is seen from (16)-(19) it follows that difference scheme (14) is consist to (12)

Numerical Experiments

In order to test the proposed method, we have used the data from paper [5]. The integral of u_0 is calculated as follows

$$u_0 = \begin{cases} (a - \Delta x - x)^3 (a - \Delta x + x)^3, & |x| \leq a - \Delta x, \\ 0, & |x| > a - \Delta x, \end{cases} \tag{20}$$

$$\int_{-a}^a u_0(x) dx = \lim_{\Delta x \rightarrow 0} \left\{ \int_{-a+\Delta x}^0 u_0(x) dx + \int_0^{a-\Delta x} u_0(x) dx \right\} = \frac{12a^7}{7}.$$

Using algorithm (15), within the limit of initial condition (20) some computer experiments are carried out. As it is seen, obtained results approach sufficiently enough to exact solution, giving in paper [5]. Theoretical investigation of convergence and stability of finite difference scheme (15) will be a matter of next research.

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A SUSTAINABLE APPROACH TO THE CONTROL OF PATHOGENS: THE FATE OF *STREPTOCOCCI* IN EQUINE COMPOST.

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Abstract

Streptococcus equi subspecies *equi* (*S. equi*), causes the potentially fatal respiratory disease called “strangles” in horses, while the closely related *Streptococcus equi* subspecies *zooepidemicus* (*S. zooepidemicus*) causes potentially fatal infections in humans. A study was undertaken to determine the survival of these two organisms in equine compost. Compost piles of equine bedding and feed waste were inoculated with 10×10^{10} c.f.u. of *S. zooepidemicus* and samples taken at 48, 96, 168 and 336 hours relative to samples placed in the pile at 0 hours. No *Streptococci* were isolated at 48 hours or subsequent time-points. Next, *S. equi* was similarly inoculated into equine compost, with samples taken at 2, 4, 8, 12, 24, 48, 168 and 336 hours later. No *Streptococci* were isolated at any time-point. To rule out killing of *S. equi* by microflora in equine waste, samples of soiled bedding, both autoclaved and un-autoclaved (with water added to match autoclaved moisture) were inoculated with 10×10^{10} c.f.u. of *S. zooepidemicus* and sampled at 0, 6, 12, 24, 48, 72, 120, 168 and 264 hours. In autoclaved bedding, *S. zooepidemicus* was isolated from 0 – 120 hours, but replaced by other flora at 264 hours. In un-autoclaved samples, *Streptococci* were not present after 48 hours. A repeated trial with *S. equi* yielded similar results. This data suggest that microbial activity of equine waste bedding may

eliminate streptococci within 24 - 48 hours, indicating that normal microflora may provide sustainable methods for the control of human and animal pathogens.

Keywords: Equine compost, *Streptococcus equi*, *zooepidemicus*, Bioremediation

Introduction

Strangles is a highly contagious respiratory infection of horses, caused by *Streptococcus equi* subspecies *equi* (*S. equi*), a Lancefield group C gram-positive non-motile bacterium. An outbreak of *S. equi* on a farm may last up to 4 to 6 months (Taylor et al., 2006), and outbreaks occur every year in the U.S. Infected horses may continue to shed the organism for over a year after clinical signs resolve, the longest documented shedding being 39 months (Taylor et al., 2006). Preventing spread of disease is imperative because *S. equi* has a 4-8% mortality rate (Taylor et al., 2006). While *S. equi* has been seen to persist in the environment on different materials from 63-72 days (Jorm, 1992; Skorobohach et al., 1994), a follow up study showed *S. equi* surviving only 1-3 days (Weese et al., 2009).

Outbreaks cause serious economic hardship, such as loss of riding activities, veterinary expenses, and cost of horse disposal (Weese et al., 2009). Concern exists regarding infectivity of both manure and animals that have died from the illness. In addition, *Streptococcus equi* subspecies *zooepidemicus* (*S. zooepidemicus*) is an equine commensal closely related to *S. equi* and has been reported to cause serious infection in humans exposed to horses or horse manure (Lee and Dyert, 2004; Pelkonen et al., 2013; Mincec et al., 2010; Yi et al., 2014).

In the United States, there has been an increase in organic farming (Greene, 2015), and the use of compost as a soil amendment (Martínez-Blanco et al., 2013). Horse bedding is used as a compost feedstock (Swinker et al., 2009; Romano et al., 2006). A case was reported in which a 79 year old man contracted a fatal infection of *S. zooepidemicus* from the fresh, un-composted manure he spread onto his garden (Lee and Dyert, 2004). Other fatal cases have been reported where people contracted *S. zooepidemicus* following contact with horses and/or horse manure (Pelkonen et al., 2013; Mincec et al. 2010).

Effective management of equine waste is needed to prevent spread of strangles. The number of people that come in contact with horses and horse byproducts is high. Infected manure is handled daily and is spread by shovels, wheel barrows, pitch forks, clothing, and shoes (Sweeney et al., 2005; Pelkonen et al., 2013). Many farmers spread fresh manure on their fields (Swinker et al., 2009; Powell et al., 2005). According to the

American College of Veterinary Internal Medicine “manure from infectious animals should be composted in an isolated location” (Sweeney et al., 2005) . However, there is limited research to support whether disease abatement occurs in compost.

Care must be taken when disposing of strangles fatalities to prevent spread of *S. equi* to other horses or farms. Burial is a common disposal option for many horse owners, but can be difficult, especially in winter months, and may be banned in some municipalities (Gwyther et al., 2011). Composting is increasingly recognized as an environmentally sound and economical way to dispose of dead horses (Gwyther et al., 2011). In particular, with ready access to horse manure, composting may be an economically viable and bio-secure option for disposing of strangles cases on horse farms. However, data on the survival of *S. equi* in compost is lacking. Therefore a study was performed to determine if *S. equi* and *S. zooepidemicus* would survive in equine compost, as a step towards improving practices for equine manure handling.

Methods and Materials:

Experimental Overview

The present study evaluated abatement of *S. zooepidemicus* inoculated into compost piles of 3 different C:N ratios, over a two week period. Dacron bags containing approximately 400g of compost inoculated with *S. zooepidemicus* were placed at 1 and 3 foot depths in three evenly spaced holes on each side of the piles. To provide samples at various time-points, 4 bags were placed at each location, a bag being withdrawn for analysis at 2, 4, 7 and 14 days. The field trial was repeated using *S. equi*, in which only one pile of the highest C:N ratio was used and samples were taken at 2, 4, 8, 12, and 24 hours and then at 2, 4, 7 and 14 days.

To determine the impact of endogenous microflora on survival of *Streptococci* in compost, a second study was performed to determine survival of *S. equi* in sterile versus non-sterile compost feedstock. Because feedstocks were sterilized using steam at 15 p.s.i., non-autoclaved samples were tested at three moisture levels to account for any water up-take by the autoclaved samples.

Composting

Three piles of decreasing C:N ratios were prepared for the *S. zooepidemicus* trial, using compost feedstocks of soiled equine bedding and feed waste at ratios 3:1, 1:1 and 1:4 respectively. Composting was conducted at Highmoor Farm in Monmouth, Maine, USA, which has an isolated composting pad. Compost feedstocks were agitated using a mechanical mixer to ensure homogeneity. Each of the three ratios were piled into an individual windrow 4ft high and 20ft long. Analog and digital thermometers

where placed at 3ft and 1ft depths and pile temperature was recorded daily. For the *S. equi* trial a single pile of a 3:1 ratio of soiled equine bedding to feed waste was used.

Bacterial Growth

Stock cultures of *Streptococci* in this study were propagated in tubes containing 1 mL of fresh heparinized horse blood rotated end over end at 37 °C (Causey et al., 1995). To prepare streptococcal inocula for compost, two flasks containing 125 mL of Todd-Hewitt broth with 10% horse blood were inoculated with 30µL of the streptococcal stock culture and incubated in 20% CO₂ for 12 hours. The flasks were then checked for purity by streaking on blood agar, stored at 4 °C and used within 24 hours.

Inoculation of piles

One heaped tablespoon (approximately 400 g) of compost of each feed-stock ratio was placed into a 5 cm x 10 cm Dacron bag of 50 µm pore size, for a total of 48 bags per feedstock ratio (12 sites per pile x 4 time samplings per site = 48 bags). Each bag contained at least one rayon swab. One mL of the *S. zooepidemicus* culture in Todd Hewitt with 10% horse blood was pipetted directly over the swabs in the compost in the Dacron bag. Each bag was closed with 5ft of non-biodegradable baling twine, labelled to indicate depth, and location in the pile. One bag for each site had two rayon swabs for sampling immediately post inoculation and at 2 days. The remaining 3 bags had one swab for the subsequent time points (4, 7 and 14 days). Compost pile construction, and burial of bags in the pile, occurred 24 hours after inoculating the Dacron bags.

Sample Plating

At each sampling, using the attached twine, one bag was pulled from each site and taken to the laboratory, where the swabs were removed from the bags and put into the matching micro centrifuge tubes, each containing 1 mL of Phosphate-buffered saline (PBS). The swabs were rotated rapidly by hand 10 times in the PBS solution to disperse the *Streptococci*. With a 10 µL-inoculating loop, a sample was taken from each micro centrifuge tube and plated onto a blood agar plate containing 5% sheep blood. When all 12 plates were streaked from each time point, they were incubated at 37 °C for 24h. After 24h, streptococcal colony counts on the plates were assessed according to +++++ = continuous lawn of *Streptococci*, ++++ = partly lawn, partly individual colonies, +++ > 100 individual colonies, 1-99 colonies were counted, and - = no *Streptococci* detected (Causey et al. 1995). Photographs were taken of each plate to record appearance of the plate and to help differentiate endogenous microflora from *Streptococci*. Compost which was

not inoculated with *Streptococci* was sampled in the same way, and plated and documented to show the endogenous background of normal microflora.

Sterilized Feedstock Trials

To determine the impact of endogenous microflora on survival of *Streptococci* in compost, compost feedstocks of varying moisture content were prepared as follows. For the sterilized feedstock, a tablespoon of compost was placed in each of 27 Dacron bags (3 replicates of 9 time periods) and the bags were weighed and autoclaved for 50 minutes at 15 PSI. The bags then were re-weighed and the weight difference before and after autoclaving to determine any uptake of water by compost during the sterilization process. Three non-autoclaved samples of the same feedstock were prepared of various water contents. The first was prepared with no water added, a second with water added to match the weight increase of the autoclaved compost, and a third which was saturated with added water. For each, 1 tablespoon of compost was also placed in each of 27 Dacron bags, giving a total of 27 bags for each stock, and a total of 81 bags overall (27 X 3) of non-sterile compost samples. Moisture content of all 4 stocks was determined by gradual dehydration in a microwave, to the point at which weight reduction no longer occurred as the sample was heated.

Each Dacron bag represented a time point for sampling and contained at least one rayon swab. Bags were sampled using the same method immediately post inoculation and at 6, 8, 12, 24, 48, 72 hours, and 5, 7, 11 days, yielding a total of ten time points from the nine bags (and two swabs from the first bag). Bags were placed in sealed plastic bags to maintain moisture and were stored at room temperature (21-23 °C) during the sampling period. Each sample was plated and read using the plating technique described above.

Results:

In the first study examining the survival of *Streptococci* in compost, *S. zooepidemicus* was below detectable levels within the first 48 hours (Table 1) in all 3 compost piles. A follow - up study with *S. equi* indicated that death of *Streptococci* was occurring while the samples were being stored immediately prior to burial in the compost pile (Table 2). In the second study to determine the role of endogenous microflora in killing *Streptococci*, all *S. zooepidemicus* was eliminated by 24 hours in non-sterile equine waste, whereas in sterilized equine waste *S. zooepidemicus* persisted until 120 hours (Figure 1) at all the moisture contents tested. In a follow up trial with *S. equi*, no bacteria were detected after 36 hours in non-sterilized compost. In the sterilized material, *Streptococci* persisted for 72 hours, but appeared to be

eliminated with the emergence of other flora in the previously sterile feedstock.

Table 1 – Persistence of *Streptococcus zooepidemicus* in 3 compost piles of decreasing C:N ratio.

Compost pile	Streptococcal Growth				
	Post inoculation *	48h **	96h	168h	366h
1	++++	-	-	-	-
2	++++	-	-	-	-
3	++++	-	-	-	-

* Sample taken immediately post inoculation, 24 hours prior to pile construction

** hours after construction of pile

- = no *Streptococci* detected

++++ = partly lawn and partly individual colonies of *Streptococci*

Data recorded at each time point represents summary of 12 replicates for each pile

Table 2 – Persistence of *Streptococcus equi* in a compost pile of the same composition as pile 1 in the previous table

Pile	Streptococcal Growth								
	Post inoculation *	2h **	4h	8h	12h	24h	48h	168h	366h
1	++++	-	-	-	-	-	-	-	-

* Sample taken immediately post inoculation, 24 hours prior to pile construction

** hours after construction of pile

- = no streptococci detected

++++ = partly lawn and partly individual colonies

Data recorded at each time point represents summary of 12 replicates

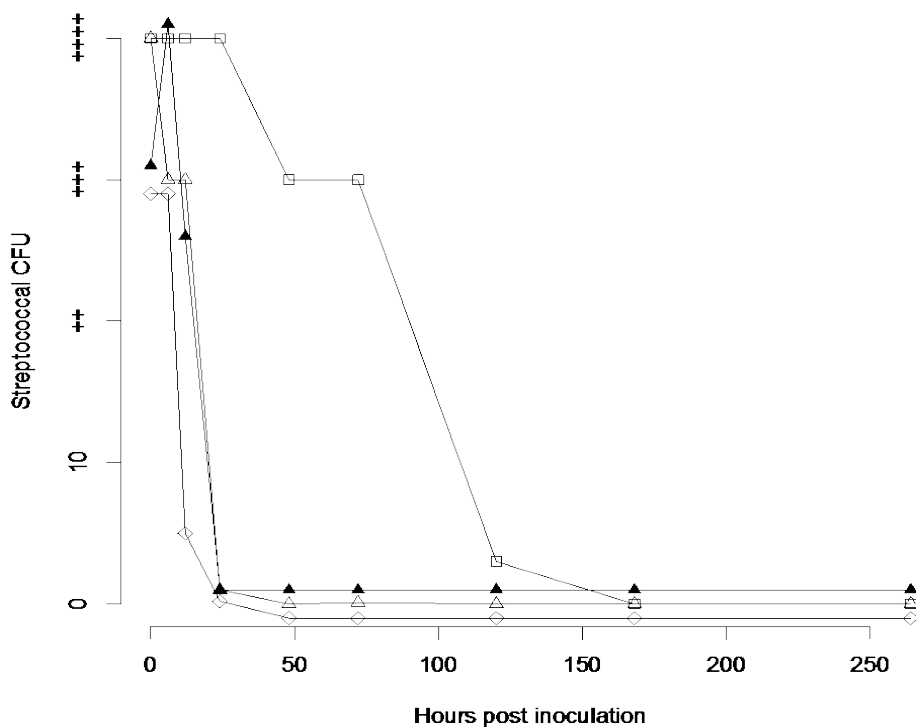


Figure 5: Decline in streptococcal numbers in sterile (box) and non-sterile (triangles and diamond) horse waste.

Discussion

In the present study, composting was examined as a method to reduce the spread of an important horse pathogen, *S. equi*. It was shown that the endogenous microflora found in horse manure apparently killed *S. equi* and *S. zooepidemicus*, with important implications for the disposal of manure, bedding and cadavers of infected patients. This study, while limited to horses, nevertheless has some relevance to broader issues of sustainability and disease control.

Composting is a managed aerobic decomposition of decaying plant and animal matter, generating material similar to humus, the organic substrate of soil (Dougherty, 1999). The decomposition occurs through microbial activity which releases heat, causing the temperature of compost to increase. Finished compost has many beneficial uses, such as soil improvement in fields, greenhouses, and gardens, and for water retention in land reclamation (Dougherty, 1999). Compost may also be used for control of plant pathogens and for bio-control of human and animal pathogens in

contaminated waste materials (Nobel and Coventry, 2005; Guan et al. 2004). Composting systems can exist at any scale. They do not cause a significant increase in the emission of greenhouse gases, and produce a beneficial product that contributes to global sustainability. In the present study we focused on the ability of compost to control a specific pathogen of horses, with a view to addressing the possible role of compost in the control of antibiotics and antibiotic resistant bacteria.

Several studies have analyzed bioremediation of antibiotics through composting. Dolliver et al. (2008) examined antibiotic degradation in manure composting of 3 systems: static piles, aerated piles, and in vessels. Specifically, the degradation of chlortetracycline, monensin, tylosin, and sulfamethazine in composted turkey litter were studied. After 35 days it was concluded that chlortetracycline was more than 99% degraded, whereas monensin and tylosin were 54-76% degraded. No degradation of sulfamethazine was detected. In addition, Kim et al. (2012) found that tetracyclines, sulphonamides, and macrolides in composted swine manure compost resulted in all the antibiotics being degraded to within Korea's acceptable daily intake rate in 85 days. Similarly, Ho et al. (2013) showed that doxycycline, trimethoprim, sulfadiazine, norfloxacin, tilmicosin, erythromycin, enrofloxacin, flumequine, fell below detectable levels after 40 days of chicken manure composting. All of these studies conclude that composting can be a valid method for degrading antibiotics, but that further study is required to determine differences between each antibiotic.

There is a risk to human health of antibiotic resistant bacteria entering the food supply through animal manure. Heringa et al. (2010) determined that *E. coli* can be present in compost and that 7% of the isolates were resistant to two or more antibiotics, raising the concern that compost could potentially spread antibiotic resistant *E. coli* into the environment. However, if the process is managed appropriately, with adequate temperature attained, composting could become a widespread practice to remove pathogens in manure, including antibiotic resistant bacteria. Guan et al. (2004) showed that multi-drug resistant *E. coli* could not be detected in chicken manure during composting when temperatures reached 50 °C or above.

Singh et al. (2012) conducted a study looking at the effect of moisture content and thermal inactivation of *Salmonella spp.* in poultry litter compost. This study used optimum composting conditions and looked at a moisture content of 40 and 50%. In both trials *Salmonella* was abated, however, it took longer in the 40% moisture content with the longest abatement taking 11 days at 50 °C. This study concluded that optimum composting can kill *Salmonella spp.* using moisture content for microbiological activity.

In some jurisdictions in the USA, composting is an acceptable method of disposing of animal carcasses. The compost results in a stable, environmentally-beneficial product that solves many of the problems of large carcass disposal. In 1999, a Northern Right Whale which died on the shore in New Jersey was composted using horse manure. The bones were collected and used in a museum, and the residual organic material was free from noxious odors and presented no biohazard (Bonhotal et al. 2007). It appears possible that composting may be a sustainable and cost-effective method of animal disposal.

Conclusion:

The balance between the microbiome and pathogens is a delicate one. We have co-evolved with diverse lineages of microorganisms which may help or harm us in our mutual struggle for survival. When exposed to potentially harmful bacteria on door handles we touch, fruit we eat, animals we own, waters in which we swim, we don't automatically contract an illness. The microflora on our skin and mucus membranes is now recognized as a defense against invasion by these pathogens. However, disruption of local flora by antibiotics can disrupt this delicate balance, and promote disease, especially by antibiotic resistant bacteria. In this paper we have shown that the general concept of beneficial microflora may be extended to the control of pathogens in the environment.

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THE MONASTERY OF ST. BENEDICT OF CÁSTRIS AS A SPACE OF ASSERTION AND POWER: FROM THE *MYSTIC MARRIAGE* TO *MUSICAL PRAXIS*¹⁶⁵

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Abstract

The life in contemplative female communities was characterized by the ideal of purity fostered in the monasteries and based on the vows of chastity, poverty and obedience, reinforced by the cloistered life. Especially from the Council of Trent, in Portugal as in Europe, its compliance underlines the paradigms of virtue: the religious woman should be unique in patience, humility, mortification, piety and charity. In this environment, increasingly demanding since the late Middle Ages, betting on valorization of spirituality (based on prayer and silence, in asceticism and liberation of the soul), the leadership capacity of some nuns or, by the other side, the artistic expressions of music, singing or writing, became special, demonstrating the power or the creative liberation in the female monastic universe, as it happened in the Cistercian monastery of St. Benedict of Cástris (Évora, Portugal), whose peculiarities are presented here compared to other cloistered women houses.

¹⁶⁵ This study comes in the framework of the Project FCT EXPL/EPH-PAT/2253/2013, “ORFEUS Project – *The Tridentine reform and the music in the silence of the cloister: the monastery of S. Bento de Cástris*”, coordinated by Antónia Fialho Conde and funded by FCT/MEC and co-funded by Fundo Europeu de Desenvolvimento Regional (FEDER) through the Programs COMPETE and QREN. The study puts together specialists in Modern History, Architecture, Codicology, Music, Musicology and Organology, treating the collection of Choir books and musical manuscripts from a Cistercian female monastery, S. Bento de Cástris, in the South of Portugal, officially founded in the 13th century. The main goal is to study the impact of counter-reformation measures in the musical praxis of the nuns, verifying the continuities and the differences in the texts and melodies that were sung and played.

Keywords: Évora, Cistercian female monasteries, Council of Trent, Musical *praxis*

Introduction

Feminine monasteries dedicated to contemplative life flourished in Catholic Europe, between the 16th and 18th centuries. Due to its detachment from worldly life and complete dedication to God with the purpose of achieving salvation for all society, the monastic model was very attractive for more than one reason. Primarily, we have the importance of religion and social recognition of the whole clergy at the time, two characteristics that generated numerous genuine callings for nun. Secondly, we have pragmatic issues related to social, economic and political strategies. For the families of a higher social status, the placement of some of their daughters in convents guaranteed, on one hand, the latter's chastity and the intercession, on their behalf and of their relatives, with God, while on the other hand, it increased the value of the ones available at the "matrimonial market" of alliances amongst the same social group. Moreover, families with increasing political or economic importance tried not only to imitate the behaviour of the most prestigious ones, but also to establish connections with these and be present, by lawful right, in the same spaces and worlds.

These convents possessed two identity features: perpetual seclusion, since the profession of vows until death, and religious life (an exemplary one, preferably), indissociable from the vows of poverty, obedience and chastity.

I.

Seclusion, a model of life and power

From the moment a young lady was accepted into a convent to become a nun, and after negotiations between her family and the convent's authorities pertaining the entry dowry and successor rights, she lived in seclusion, which meant she wasn't allowed to leave the premises. Physical separation from the other inhabitants of the surrounding village or city was assured not only by the high walls and window bars that prevented looking from the outside, but also through the enforcement of a severe policy of access conditions by outsiders along with prohibitions and severe punishments applied to the nuns who broke the rules of seclusion. By the middle of the 17th century, following the ruling of the Council of Trent, the latter became mandatory in all feminine monastic houses of every Order.

For too long, it was believed that feminine religious life in seclusion meant an absolute rupture between the nuns consecrated to the service of God, in conjunction with the convent's remaining community, and the people, ways of living, matters and practices of a secular life to which they

had belonged until professing. It would be like living a collective hermit life or being buried alive. Fortunately, and thanks to emergent studies, this wrong idea, devoid of historical, theological, social or logical fundamentation, has been abandoned in the last few years while current historiography has been getting closer to what we believe was the concept of “seclusion” from those days: the delimitation of a partial, restrict and well-defined space amidst the architectural ensemble of the monastery’s buildings, and not a complete and insurmountable barrier which started right behind the entrance doors and which would sever all the links with the exterior, namely with the nuns’ families and society.

After being admitted into the convent, for the period of a full year (the so-called “novitiate”) and along with other novices, a young lady had to get fully acquainted with all the requirements for becoming a nun. This happened in spaces separated from the ones allotted for seclusion and under the supervision of a teacher (a nun appointed for this position for a period of three years, due to the superior acknowledgement of her competence, exemplary life, mature age and good physical condition). They had to learn about: the Christian doctrine; the identity Rule of the spiritual family they were joining (Order of St. Claire, Order of Cistercians, Order of St. Dominic, Order of St. Benedict, Order of St. Augustine...); the continuous practice of prayer and obedience, humiliation, silence, meditation, chastity, poverty, frugality, piety, charity, community life, service to others, mortification of the body; the reading and writing of texts; and musical execution, sometimes solely by singing (in its plainsong variant), other times by playing instruments (organ, harp, viola), adding to what many of these novices had already learned at their parents’ houses.

At the end of these demanding twelve months of learning, the novice could only become a nun, by making the public profession of living as a religious nun and in seclusion, following the perpetual solemn vows of obedience, chastity and poverty, if all the following formal requirements simultaneously existed according to this exact verification sequence: first, the existence of true will in becoming a nun; second, the celebration of the final registrar contract and the delivery of her dowry; third, the approval in an oral examination, made by two nuns, of her knowledge and preparation pertaining the prayers and chants of the Divine Office (a.k.a. Liturgy of the Hours) and her understanding of the Rule; fourth, the written consent of the monastery’s masculine guardian (someone in charge of the same Order or the bishop); fifth, the novice’s public oral presentation of the Christian doctrine to the community gathered in the refectory; sixth, the collection of the majority of secret votes favourable to her profession, by all the nuns with full capacity to state their positions, under the supervision of the friar in charge.

The profession was the solemn symbolic moment of “entering the religion”, which implied the new nun’s rejection of worldly values by replacing them with the ones of the Rule of her new family, the sisters of that Congregation or Order. Her hair was cut close to the head, marking her rejection of vanity, and it was covered with a white cloth which symbolized purity and chastity, similar to the one which had covered her hair since the beginning of the novitiate. Over that white cloth, they would place the black veil, which would stay there forever, symbolizing the penitence that would mark her life from then on, and which would be permanently associated to the path of humbleness and obedience that she would take towards her personal and spiritual improvement. Some monasteries had created specific rites, such as an additional oath of profession or a mystical marriage between the novice and Christ, when she entered the novitiate. These were always celebrated with chants by the monastic community and, sometimes, accompanied by musicians specifically hired by the novice’s relatives.

From the day of the profession, the length of service of a nun started being recorded for purposes of seniority, which was indispensable for the performance of several duties related to the proper functioning of community life. Those related to education and schooling (of novices or younger girls, students and interns), to the surveillance of behaviours pertaining the access to the exterior (doors, window bars, foundling wheel, inner and outer parlour, stockrooms, pantries, yards), and to dealing with outsiders (confessors, preachers, other religious men, beadle, doctor, barber-surgeon, surgeon, delivery boys, relatives), could only be appointed by the Abbess or Mother-Superior, or elected by the nuns with voting capacity, amongst the nuns with a confirmed flawless life, of a certain age and with a certain (variable) number of profession years. Justifiably, similar requirements were needed for the main positions of each house, namely for Abbess and Mother-Superior, who were elected every three years. It was frequent for the formation of internal groups (named “factions” or “parties”) to happen, in order to support a certain candidate against others and, many times, these were connected to powerful relatives or clergymen, in a clear example of how valued and desired was power, both inside and outside of the monasteries of consecrated women.

Musical practice and affirmation

By affirmation, we are no longer referring to the power of command, but to the confirmation of a personal gift (or even of an acknowledged competence of a particular monastery due to the presence of one or more highly valued executants), when analysing the appreciation for certain spiritual, intellectual or artistic practices inside the convents of that period. It is recognised that all these practices actively contribute to the service and

proximity to God through the exaltation of Its works, namely through the beauty and creative capacity of the human creature, the usage of their gifts, the service to others, the useful occupation of the hands, the liberation and elevation of the spirit of those who perform these activities and of those who enjoy them. We are referring to the so-called edifying reading and to writing, to the numerous and appreciated manual arts (also known as “monastic arts”), to theatre and to music. We are going to focus on the latter, as the amount of books and data collected, referring to such art at the Monastery of St. Benedict of Cástris, in Évora, of the Autonomous Congregation of Alcobaca of the Order of Cistercians, is remarkable.

At Cástris, the number of singers and *tangedoras* (instrument players) is easily confirmed after the records of their dowries, which were inexistent or much smaller than the others. The Council of Trent, which dramatically renewed the Catholic world around the middle of the 17th century, made of the delivery in advance of an individual dowry to the religious house, chosen by the postulant or her relatives, a *sine qua non* condition to her admittance. The only exception to this practise was the acknowledgment by the house of the relevance of services rendered or to render by the candidate or by next of kin. Following this same logic, the Council recommended the exemption of dowry for the musicians, allowing each community to decide case by case if they could, or would, dispense with it or, at least, decrease it. The community of St. Benedict of Cástris assumed as essential the prerogative of being able to count among its members with young ladies that could perpetuate the function of music and chant and, as a result of its dowry policy, managed to attract many girls who were mainly from the region around the monastery.

During one hour per day, nuns taught plainsong to novices and newly- professed nuns. The organ, the mandatory musical instrument at convents in those days, required special skills; therefore, and if needed, a superior authorisation allowed for executants from outside the convent to go there and teach how to play it, along with other instruments. They could be relatives of the nuns and novices, and could be paid or not. In account books, there are records of several payments related to the musical practice of the community (which will be addressed in another presentation in this colloquium).

Besides its daily use in mass and in other divine offices, at this monastery, music and chants were also heard in internal processions (e.g. solemn moments or other celebrations whose joyfulness varied according to the event), in holy days, at requiem masses (yearly or *in memoriam* of late nuns), at the ceremonies of the Abbess’ election, at the novices’ admission and profession ceremonies, and also as entertainment, during sacred theatrical events. On the way to the refectory, they sang psalms, blessings

and memorialisations. It should be highlighted that, during masses, the simplicity of the hymns and the silence during the most important part, the Eucharist, symbolised the purity and sanctity of the nuns, of which the plainsong was a reflex.

With or without musical instruments, chant and even dance were normally practiced at Cástris, before being forbidden in the dormitories, in the infirmary (unless some sick nun wanted to listen to someone sing), and in the balcony by the Choir, on which they were performed by maids, during the liturgical ceremonies of the nuns. The prohibition did not spread to other locations. As they were specific to the religious life inside the walls of the convent, they were kept away from the window bars and from the outer parlours, where relatives were welcomed and where the secular and monastic worlds touched each other.

Conclusion

The power exerted inside a feminine monastic community, like the one of St. Benedict of Cástris in Évora, is a direct consequence of the conjugation of one of the identity features of religious profession - *obedience* - with the specific way of living of these communities - *seclusion*. The latter - *feminine religious seclusion* -, which was experienced between the Council of Trent and the Enlightenment period, has increasingly been revealed and understood as connected to the concept of “permeability” (in what pertains communication between the monastery and the exterior), with clear rules, and more widely linked to the concept of “negotiation” (power of nuns over their private and family spheres, besides the one they undeniably exert inside their own monastery and, sometimes, within their Order or Congregation).

As the relations of power and government inside the monastery and in the surrounding society are permeable, so is the affirmation and worth of some nuns and of the religious community itself, which also occur inside and outside the monastery’s walls, resulting from the appreciation of musical executions by nuns or by expert laymen. For pedagogical or entertainment reasons, direct relatives of the nuns entered Cástris to teach chant, organ and other instruments, while local or neighbour executants participated in the festivities dedicated to the reformer saint of the Order, St. Bernard, which happened in August. They played while horsemen performed in bullfights which took place in the monastery’s yard.

In this way, we open our horizons to a better understanding of what was to live in “seclusion” and to the great importance that was given to music as an aid, not only in daily spiritual life, in daily masses and with the Divine Office, but also during festive occasions, as a companion for life.

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SOME OBSERVATIONS ON FISHES AND THEIR PARASITES OF DARBANDIKHAN LAKE, KURDISTAN REGION IN NORTH IRAQ

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Abstract

A total of 255 freshwater fishes, belonging to 17 species, namely: *Barbus barbulus*, *B. grypus*, *Capoeta trutta*, *Capoeta umbla*, *Carasobarbus luteus*, *Carassius auratus*, *Chondrostoma regium*, *Cyprinion macrostomum*, *Cyprinus carpio*, *Garra rufa*, *Hemiculter leucisculus*, *Hypophthalmichthys molitrix*, *Luciobarbus esocinus*, *Squalius lepidus* (Family Cyprinidae), *Mystus pelusius* (Bagridae), *Silurus triostegus* (Siluridae) and *Mastacembelus mastacembelus* (Mastacembelidae), were collected from Darbandikhan Lake, southeast of Sulaimani city, Kurdistan region, Iraq, from March 2012 to the end of October 2012. The fishes were examined for ectoparasites and endoparasites. The study revealed the existence of 45 species of parasites including: seven species of protozoans, 29 species of monogeneans, two species of trematodes, one species each of cestode and nematode, two species of acanthocephalans and three species of crustaceans. The present study revealed that *Dactylogyrus suchengtaii* and *D. carassobarbi* were the most parasites prevalent (100% and 90.90%, respectively) in the lake, while *Scyphidia arctica* was scarce (1.44%). The fish *C. trutta* was highly infected with parasites (nine species), followed by *S. lepidus* (eight species) and both *C. luteus* and *M. mastacembelus* (six species each), while *G. rufa* and *H. molitrix* were less infected (one species each). The ciliated protozoan *Ichthyophthirius multifiliis* was recorded on seven species of fishes with prevalence ranged between 2.89% and 23.52%, followed by the crustacean *Lernaea cyprinacea* which was recorded on four species of fishes (5% - 27.27%).

Keywords: Fishes, Parasites, Darbandikhan Lake, Kurdistan Region, Iraq

Introduction

With the increases of interest in fish population and the farming of fishes, there has been an increased interest in parasites of fishes and the diseases associated with them (Shotter, 1972). Therefore, any attempt to increase the productivity of pond farms or to improve the stocks of valuable commercial fisheries in the natural waters, requires detailed knowledge of the parasites inhabiting the localities involved (Shul'man, 1961).

This paper is a continuation in the series of trials done by the same authors (Abdullah and Abdullah, 2013a; b) in which they dealt with major groups (Protozoa, Monogenea, Trematoda, Cestoda, Nemetoda, Acanthcephala and Crustacea) of parasites which infecting fishes in Darbandikhan Lake, Kurdistan region in north Iraq. The present investigation deals to knowledge by describing the distribution and abundance of fishes in the Darbandikhan Lake and with infections of these fishes with different parasites.

Materials and methods

Description of the Sampling Area: Darbandikhan Lake is located at about 60 km southeast of Sulaimani City. It is situated between 35°-36° north latitude and 45°-46° east longitude, with the altitude of 511 meters of the sea's level. The surface area is about 121km² and the lake capacity is 3 million m³ (Al-Saudi, 1976).

Collection and Examination of Fishes: A total of 255 freshwater fishes were collected from Darbandikhan Lake, from March 2012 to the end of October 2012. The fish specimens were collected by gill netting, cast netting and electro fishing by local commercial fishermen. In the laboratory, the fish was identified according to Coad (2010) and their scientific names were checked according to Froese and Pauly (2014). The fishes were examined externally and internally for parasites. Smears from skin, fins and buccal cavity were prepared by slight scraping and examined under a light compound microscope at 40-100X magnification. The gill arches from both sides were separated, placed in Petri dish containing tap water and then examined for ectoparasite under dissecting microscope at 40-100X magnification. Whole eyes were removed, then the lens was dissected out and then inspected under dissecting microscope for parasites. To study of the internal parasites, the fishes were dissected from the ventral side. The body cavity, stomach, intestine, spleen, liver, kidneys, heart, muscles, swim bladder and gonads were separated and examined carefully under a dissecting microscope for the presence of parasites or cysts (Amlacher, 1970). Parasite fixation and preservation was done according to Hoffman (1998). Parasite identification was done according to major taxonomic

accounts (Bykhovskaya-Pavlovskaya *et al.*, 1962; Gussev, 1985; Hoffman, 1998; and Pugachev *et al.*, 2010).

The ecological terms were used here based on terminology of Margolis *et al.* (1982):

1- Prevalence of infection: The percentage of number of individuals of a host species infected with particular parasite species per number of host examined.

2- Mean intensity of infection: Mean number of particular parasite species per infected host in a sample.

Results and discussion

A total of 255 specimens of fishes were collected from Darbandikhan Lake during the period from March to the end of October 2012. Table (1) shows different species of fishes and their abundance in this lake. The fish fauna of this lake included four exotic species namely *Carassius auratus*, *Cyprinus carpio*, *Hemiculter leucisculus* and *Hypophthalmichthys molitrix*. The native species belong to families Cyprinidae (10 species), Bagridae, Siluridae and Mastacembelidae (one species for each family). Coad (2010) mentioned that there are thirteen species of exotic fishes in the Tigris-Euphrates Basins including the four recorded species in the present study.

It appears that most species recorded in this study belong to Family Cyprinidae (14 species), followed by other families (Bagridae, Siluridae and Mastacembelidae) with one species for each family. It was clarified that the fish *Capoeta trutta* is the most abundant and wide spread, followed by *Cyprinion macrostomum*, then in the third rank *H. leucisculus* while *Mystus pelusius* and *H. molitrix* were scarce. Abdullah (2005) indicated that *B. grypus* and *C. carpio* were the most abundant species in Darbandikhan Lake. Also, Abdullah *et al.* (2007) showed that *Capoeta damascinus* was the most abundant species followed by *C. carpio* and *B. grypus* in Darbandikhan Lake

It seems from the present study that the distribution of fish populations in the Darbandikhan Lake is changing, due to the period, place, and way of fishing, besides the nature of the lake itself which is characterized by changing its water level from year to year and season to season, thus affecting the fishes distribution (Abdullah *et al.*, 2007). Moreover, the reason might belong to the introduction of some fish (*C. auratus*, *C. carpio* and *H. molitrix*) into this environment at the end of seventies of the previous century and still there culturing process continues leading to their quick spread that affects the density of the rest of species. The evidence supporting this idea is the increase of their fishing and marking into the local markets nearby the lake. It is inevitable that the increase of these fishes is at the expense of the other species that are similar in their

nutrition to the carp like *B. grypus* and *Luciobarbus xanthopterus* (Al-Saadi *et al.*, 1986; Abdullah *et al.*, 2007).

As it is shown in Table (2), the parasitological examination of the fish species in the present study indicated that these fishes were infected with 45 species of parasites which included seven species of protozoans, 29 species of monogeneans, two trematodes, one species each of cestode and nematode, two acanthocephalans and three crustaceans.

It seems that parasites with direct life cycles (Protozoa and Monogenea) were the most prevalent in this lake in comparison with parasites with indirect life cycles (Trematodes, Cestodes and Acanthocephalans). This can be attributed to the closed environment which leads to the accumulation of eggs and larval stages of parasites, especially these organisms have a short life-span and high rate of reproduction (Hoffman, 1998). This fact helps their accumulation especially in a closed environment and their infection to new fish in the same location, whereas in the open environment (river), the water flow and the fish diversity lead to the reduction in infection prevalence. This fact is confirmed by Amin (1986a; b), Paperna (1996) and Hoffman (1998).

The same Table (2) shows that *C. trutta* was more infected with parasites (nine species), followed by *S. lepidus* (eight species) and both *C. luteus* and *M. mastacembelus* (six species each). However, *G. rufa* and *H. molitrix* were less infected (one species each), if we neglected *M. pelusius* as it was not infected with any parasites. Also, the present study revealed that *Dactylogyrus suchengtaii* and *D. carassobarbi* were the most prevalent parasites (100% and 90.90%, respectively) in the lake, while *Scyphidia arctica* was scarce 1.44% (Table 2). Generally, the parasitic infection in fishes depends on many factors which are ideal for the propagation and development of parasitic population. These factors are: the density of fish population, differences in the environmental factors, physical condition, genetic resistances as well as fish age and sex which also play a part in determining the susceptibility of fishes to diseases (Dogiel, 1961). Also, the appearance of new fish parasites, along with their host species, has resulted in increasing the parasite fauna of the lake. The new species composition has affected both ichthyofauna and parasitofauna. The above facts indicate that comprehensive studies are absolutely necessary before the introduction of any new fish species to any lake. In addition, sanitary methods for the transfer of fish should be precisely taken account of otherwise new parasites can be transmitted to lakes causing the possibility for a mass outbreak of parasitic diseases, especially among native fishes which are often more sensitive to introduced parasites than the exotic ones (Jalali and Barzegar, 2006).

Table (2) also shows that the ciliated protozoan *I. multifiliis* was recorded on the skin and gills of seven species of fishes (*B. grypus*, *C. trutta*, *C. luteus*, *C. regium*, *L. esocinus*, *S. lepidus* and *M. mastacembelus*) with the prevalence ranged between 2.89% - 23.52%, followed by the crustacean *L. cyprinacea* which was recorded on the gills of four species of fishes (*B. barbulus*, *C. carpio*, *H. leucisculus* and *L. esocinus*) with the prevalence ranged between 5% - 27.27%. However, many parasites (especially monogeneans) were recorded on one or two species of fishes for example, *D. barbioides* on the gills of *B. grypus*, *G. molnari* on the skin of *C. carpio* and *M. heteranchorus* on the gill of *M. mastacembelus*. It is known that many of the fish parasites, including monogeneans, have strict host and site specificity, but in protozoans and crustaceans, they lack this trait (Shul'man, 1961).

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Table (1): Scientific names of fishes collected from Darbandikhan Lake, and their numbers.

Family and scientific name	Number
Cyprinidae	
<i>Barbus barbulus</i> Heckel, 1847	10
<i>Barbus grypus</i> Heckel, 1843	10
<i>Capoeta trutta</i> (Heckel, 1843)	69
<i>Capoeta umbla</i> (Heckel, 1843)	12
<i>Carasobarbus luteus</i> (Heckel, 1843)	11
<i>Carassius auratus</i> (Linnaeus, 1758)	13
<i>Chondrostoma regium</i> (Heckel, 1843)	14
<i>Cyprinion macrostomum</i> Heckel, 1843	22
<i>Cyprinus carpio</i> Linnaeus, 1758	13
<i>Garra rufa</i> (Heckel, 1843)	6
<i>Hemiculter leucisculus</i> (Basilewsky, 1855)	20
<i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)	4
<i>Luciobarbus esocinus</i> Heckel, 1843	11
<i>Squalius lepidus</i> Heckel, 1843	17
Bagridae	
<i>Mystus pelusius</i> (Solander, 1794)	2
Siluridae	
<i>Silurus triostegus</i> Heckel, 1843	7
Mastacembelidae	
<i>Mastacembelus mastacembelus</i> (Banks and Solander, 1794)	14
Total	255

Table (2): The distribution of parasites in different sites of fish hosts from Darbandikhan Lake.

Parasites	Hosts	No. of fishes		Prevalence (%)	Mean intensity	Site of infection
		examined	infected			
<i>Chilodonella cyprini</i>	<i>Capoeta trutta</i>	69	2	2.89	5.5	Gill
	<i>Carassius auratus</i>	13	1	7.69	3	Gill
<i>Ichthyophthirius multifiliis</i>	<i>Barbus grypus</i>	10	1	10	5	Gill, Skin
	<i>Capoeta trutta</i>	69	2	2.89	3.5	Gill, Skin
	<i>Carasobarbus luteus</i>	11	1	9.09	8	Gill, Skin
	<i>Chondrostoma regium</i>	14	1	7.14	5	Gill, Skin
	<i>Luciobarbus esocinus</i>	11	1	9.09	3	Gill, Skin
	<i>Squalius lepidus</i>	17	4	23.52	7.25	Gill, Skin
	<i>Mastacembelus mastacembelus</i>	14	2	14.28	5.5	Gill, Skin
<i>Scyphidia arctica</i>	<i>Capoeta trutta</i>	69	1	1.44	3	Skin
<i>Tetrahymena pyriformis</i>	<i>Silurus triostegus</i>	7	1	14.28	3	Skin
<i>Trichodina</i>	<i>Silurus triostegus</i>	7	2	28.57	8	Gill

<i>pediculus</i>						
<i>Myxobolus amurensis</i>	<i>Squalius lepidus</i>	17	2	11.76	5	Skin, Gill, Caudal fin
<i>Myxobolus pfeifferi</i>	<i>Carasobarbus luteus</i>	11	1	9.09	3	Gill
	<i>Cyprinion macrostomum</i>	22	1	4.54	4	Gill
<i>Dactylogyrus anchoratus</i>	<i>Carassius auratus</i>	13	4	30.76	8	Gill
	<i>Luciobarbus esocinus</i>	11	1	9.09	5	Gill
<i>Dactylogyrus barbioides</i>	<i>Barbus grypus</i>	10	2	20	3.5	Gill
<i>Dactylogyrus baueri</i>	<i>Carassius auratus</i>	13	4	30.76	6	Gill
<i>Dactylogyrus carassobarbi</i>	<i>Capoeta trutta</i>	69	5	7.24	7	Gill
	<i>Carasobarbus luteus</i>	11	10	90.90	5.7	Gill
<i>Dactylogyrus deziensoides</i>	<i>Barbus barbulus</i>	10	5	50	4.2	Gill
<i>Dactylogyrus deziensis</i>	<i>Barbus barbulus</i>	10	2	20	7.5	Gill
	<i>Luciobarbus esocinus</i>	11	5	45.45	8.6	Gill
<i>Dactylogyrus dyki</i>	<i>Squalius lepidus</i>	17	1	5.88	3	Gill

Table (2): Continued

Parasites	Hosts	No. of fishes		Prevalence (%)	Mean intensity	Site of infection
		examined	infected			
<i>Dactylogyrus elegantis</i>	<i>Chondrostoma regium</i>	14	12	85.71	9	Gill
	<i>Squalius lepidus</i>	17	2	11.76	2.5	Gill
<i>Dactylogyrus formosus</i>	<i>Carassius auratus</i>	13	4	30.76	8.75	Gill
<i>Dactylogyrus inutilis</i>	<i>Luciobarbus esocinus</i>	11	1	9.09	5	Gill
<i>Dactylogyrus lenkorani</i>	<i>Capoeta trutta</i>	69	2	2.89	5	Gill
	<i>Capoeta umbla</i>	12	10	83.33	12	Gill
<i>Dactylogyrus macrostomi</i>	<i>Cyprinion macrostomum</i>	22	10	45.45	13	Gill
<i>Dactylogyrus mascimai</i>	<i>Cyprinion macrostomum</i>	22	2	9.09	2.5	Gill
<i>Dactylogyrus microcirrus</i>	<i>Capoeta trutta</i>	69	17	24.63	9	Gill
<i>Dactylogyrus pavlovskyi</i>	<i>Barbus grypus</i>	10	8	80	21	Gill
<i>Dactylogyrus persis</i>	<i>Carasobarbus luteus</i>	11	3	27.27	3.33	Gill
<i>Dactylogyrus pulcher</i>	<i>Capoeta trutta</i>	69	46	66.66	18	Gill
	<i>Capoeta umbla</i>	12	2	16.66	6.5	Gill
<i>Dactylogyrus rectotrabus</i>	<i>Garra rufa</i>	6	1	16.66	5	Gill
<i>Dactylogyrus suchengtaii</i>	<i>Hypophthalmichthys molitrix</i>	4	4	100	25	Gill
<i>Dactylogyrus</i>	<i>Squalius lepidus</i>	17	4	23.52	4.5	Gill

<i>vistulae</i>	<i>Mastacembelus mastacembelus</i>	14	1	7.14	2	Gill
<i>Dogielius mokhayeri</i>	<i>Capoeta trutta</i>	69	22	31.88	10.45	Gill
	<i>Carasobarbus luteus</i>	11	1	9.09	7	Gill
<i>Dogielius molnari</i>	<i>Cyprinion macrostomum</i>	22	1	4.54	3	Gill
<i>Dogielius persicus</i>	<i>Barbus grypus</i>	10	1	10	3	Gill
<i>Mastacembelocleidus heteranchorus</i>	<i>Mastacembelus mastacembelus</i>	14	10	71.42	17	Gill

Table (2): Continued

Parasites	Hosts	No. of fishes		Prevalence (%)	Mean intensity	Site of infection
		examined	infected			
<i>Thaparocleidus vistulensis</i>	<i>Silurus triostegus</i>	7	5	71.42	6.8	Gill
<i>Gyrodactylus molnari</i>	<i>Cyprinus carpio</i>	13	1	7.69	17	Gill
<i>Gyrodactylus sprostonae</i>	<i>Carassius auratus</i>	13	2	15.38	14.5	Gill
	<i>Cyprinus carpio</i>	13	1	7.69	27	Gill
<i>Paradiplozoon leucisci</i>	<i>Hemiculter leucisculus</i>	20	2	10	3.5	Gill
	<i>Squalius lepidus</i>	17	4	23.52	4	Gill
<i>Paradiplozoon pavlovskii</i>	<i>Chondrostoma regium</i>	14	2	14.28	3.5	Gill
<i>Clinostomum complanatum</i>	<i>Capoeta umbla</i>	12	3	25	4.66	Branchial cavity
	<i>Carasobarbus luteus</i>	11	1	9.09	2	Branchial cavity
<i>Diplostomum spathaceum</i>	<i>Chondrostoma regium</i>	14	10	71.42	12	Eye
	<i>Mastacembelus mastacembelus</i>	14	2	14.28	8.5	Eye
<i>Senga sp.</i>	<i>Mastacembelus mastacembelus</i>	14	3	21.42	3.33	Intestine
<i>Procamallanus viviparus</i>	<i>Mastacembelus mastacembelus</i>	14	1	7.14	1	Intestine
<i>Neoechinorhynchus zabensis</i>	<i>Capoeta trutta</i>	69	7	10.14	2.62	Intestine
<i>Pomphoryhnchus spindlitruncatus</i>	<i>Squalius lepidus</i>	17	2	11.76	6.5	Intestine
	<i>Silurus triostegus</i>	7	1	14.28	11	Intestine
<i>Ergasilus mosulensis</i>	<i>Squalius lepidus</i>	17	2	11.76	3	Gill
Copepodal satge of <i>Lernaea cyprinacea</i>	<i>Barbus barbulus</i>	10	1	10	3	Gill
	<i>Cyprinus carpio</i>	13	2	15.38	2.25	Gill
	<i>Hemiculter leucisculus</i>	20	1	5	2	Gill
	<i>Luciobarbus esocinus</i>	11	3	27.27	2.33	Gill
<i>Pseudolamprolgena annulata</i>	<i>Cyprinion macrostomum</i>	22	1	4.54	1	Gill

EVALUATION OF CHILDREN GROWTH PARAMETERS – A MULTIDISCIPLINARY ISSUE

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Abstract

Growth is a complex process; starting in utero and continuing until the end of puberty. Being a marker of children health, growth evaluation is an important tool. A positive secular trend of height was noticed in the last century. On the other side, geographical differences in height have been noticed, suggesting the necessity of local growth charts. We evaluated growth parameters in the Eastern part of Romania. Study group included 1,949 children (987 girls and 962 boys) aged between 7-16 years, living in the same city, with no chronic illness. The evaluation was performed with the help of the school authorities, and parents' consent. Anthropometrical parameters (height, weight, and puberty stage) were recorded. Results were

compared to the last Romanian growth charts, dating from 1971, and the European Prader standards, from 1989. Mean differences were +5.3 cm in boys and +5.9 cm in girls vs. Romanian charts, and +4.3 cm in boys and +3.6 cm in girls vs. Prader charts, higher at 10-11 years, probably correlated with earlier puberty onset. Weight had the same tendency of growing in boys (+1.43 kg) and in pre-pubertal girls (+1.1 kg), but after 11 years, girls' weight was lower, is probably correlated with the more or less anorectic beauty ideal of nowadays. There is a significant increment of height in both boys and girls, suggesting the necessity of new, actualized standards. Assessing children health can be done only with an interdisciplinary team, medical and non-medical.

Keywords: Growth, growth charts, secular trend, interdisciplinarity

Introduction

Growth is a complex process, depending on several factors such as genetic predisposition, general health, hormonal functions and environment. Impaired growth illustrates a deficiency in one of these parameters, and its prompt and correct diagnostic is crucial for the public health (Bonthuis, 2012). More than that, with so many determinants, children growth may be considered as an image of both individual and socio-economic conditions. The secular trend, noticed 150 years ago, is therefore a parameter of the evolution of a society – economical development, health policy, nutrition, human condition in general. Starting from the positive aspect of enhanced growth, Tanner, a pioneer of auxology, (quoted by Gohlke & Woelfie, 2009) defined secular trend as a “mirror of the condition of the society”.

Growth charts are an essential tool to monitor a child's development and detect growth disorders. They generally result from extensive populational studies. When properly done, this is the result of a team work, with an approach from several fields, as we cannot consider that there is only one “appropriate discipline” to handle the complexity of the problem (Lingner, 2011).

There is still a debate considering the more appropriate growth charts to be used in a defined population. Two main points of view are defining this approach. First, there is the recommendation of using international charts, which would globalize the results. National Center for Health Statistics and World Health Organization (NCHS/WHO) had provided in 1977 growth references, which have been recommended for general use (WHO, 1995). Given the fact that secular trend in growth implies an increase in adult height of 1-3 cm/decade (Cole, 2000), these charts have been revised in the last deceny. Another general chart used especially in Europe is that established by Prader 25 years ago (Prader, 1989).

Taking into account the considerable variations across different populations, the second tendency is the use of national or at least regional growth charts. One important issue considering is represented by the time period of these charts realization (many of them dating from more than 2 – 3 decades ago). In Romania the national standards were established in 1971 (Zbranca, 1977).

We wanted to estimate the growth status in the Eastern region of Romania (Moldavia), in order to evaluate the opportunity of establishment of new national growth charts and/or to use the international ones. A multidisciplinary team designed the study, which was a pilot one, performed in the largest city of the region (Iasi). A representative sample was established by an epidemiologist. A team of endocrinologists with expertise in the pediatric endocrinology, nurses and medical students performed the measurements. The screening was possible thanks to the collaboration of the school's officials.

Study presentation

Iasi is a city with a recent defined population of 350,000 stable inhabitants, with 19.02% children between 5 and 18 years old, with an equal sex distribution. An epidemiologist established a representative variety of children, and selected the schools for the examination. Since there was not interventional study, but measurements which are periodically performed in children, we did not need a written but only a verbal consent of children tutors (family and school). A teacher explained on periodic meetings our goals to the parents and the accord for the measurement was taken. Since there were no invasive methods, practically all the parents permitted their children to enter in the study.

Table 1. Mean height and weight values in girls

Age (years)	Weight (kg)		Height (cm)	
	Average	SD	Average	SD
7	24.09	4.195	127.3	5.681
8	26.19	5.019	132.1	6.78
9	28.88	5.544	137.4	6.655
10	32.43	6.622	141.2	6.674
11	38.79	8.425	151.4	7.20
12	40.44	8.285	154.0	7.91
13	45.94	9.552	159.6	6.97
14	49.95	9.151	162.4	6.06
15	52.04	8.011	163.8	6.29
16	52.34	6.448	164.5	6.15

Study group included 1,949 children (987 girls and 962 boys) aged between 7-16 years, born and living in the same area, examined in 2005. Excluding criteria were personal and family antecedents of growth disorders and any chronic disease. Morphological parameters were recorded: height, weight, cranial perimeter, and puberty stage. Average height and weight were compared to the European standard (Prader, 1989) dating from 1989 and with 2 Romanian parameters – 1971 standards (Zbranca, 1977) and personal data from 1998 (Vulpoi, 2005). Mean values were compared and differences between the groups were analyzed. Mean values and standard deviations in height and weight distribution on age and sex groups are shown in table 1 and 2.

Table 2. Mean height and weight values in boys

Age (years)	Weight (kg)		Height (cm)	
	Average	SD	Average	SD
7	25.42	4.282	128.6	5.869
8	27.56	5.188	134.1	5.861
9	31.04	5.852	138.9	6.433
10	32.70	6.263	141.3	5.994
11	37.33	8.036	150.0	7.274
12	41.50	9.404	155.4	6.983
13	45.02	9.934	160.5	9.565
14	51.34	9.955	168.8	8.498
15	58.85	11.01	174.9	6.846
16	60.42	9.968	175.4	6.658
17	63.76	10.01	179.4	6.700
18	66.23	10.52	179.0	6.546

Results

In both boys and girls, and at every age, height values were significantly higher than in 1971 Romanian charts. Mean differences were 5.9 cm in girls, and 7.4 cm in boys. Compared with the European values of 1989, height values in our group were also higher, with a mean of 3.6 in girls and 4.3 cm in boys. The highest differences were at 11 years in girls (8.9 cm vs. Ro 1971, 7.7 cm vs. Prader 1989) and in boys vs. Ro 1971 - 8.7 cm 7.7 cm, and at 12 years in boys vs. Prader 1989 – 6.1 cm. This difference diminished after puberty to 0.5 cm in girls and 1.8 cm in boys at 16 years. (Figure 1 and 2)

The differences between the 2 measurements performed in the same population at 7 years distance showed a persistent but somehow diminished tendency of secular growth: mean difference of 0.86 in girls and 2.36 cm in

boys: weight and BMI values had a more peculiar evolution. Weight had the same tendency of growing in pre-pubertal girls (with a mean of 1.1 kg), and in boys (mean 1.43 kg). In girls, after the age of 11, weight is lower than in the last decades, tendency that was more significant after 15 years of age. BMI was influenced by the different tendencies of height and weight: higher in younger children, after puberty it became practically equal in boys and smaller in girls compared with both control groups.

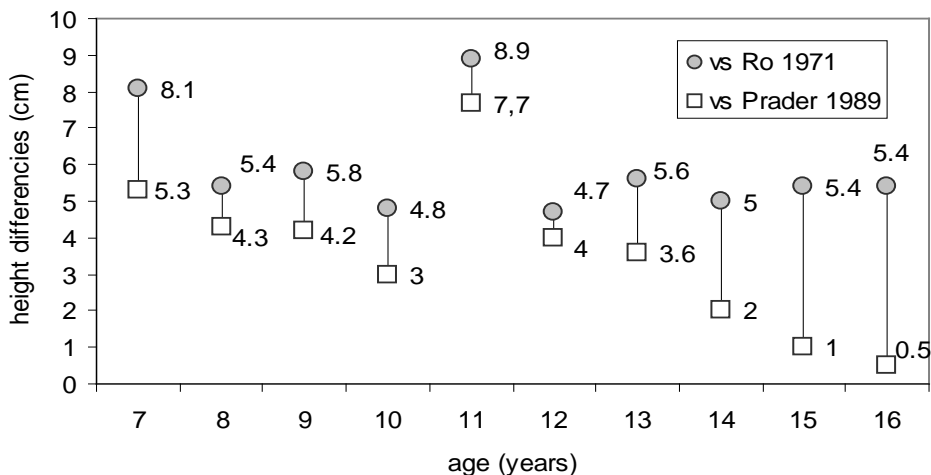


Figure 1 Height differences in girls

Differences between mean heights in girls on age groups comparing with Romanian standards from 1971 and Prader standards from 1989. Prader standards are more close to the actual data, with a 16 years height practically the same.

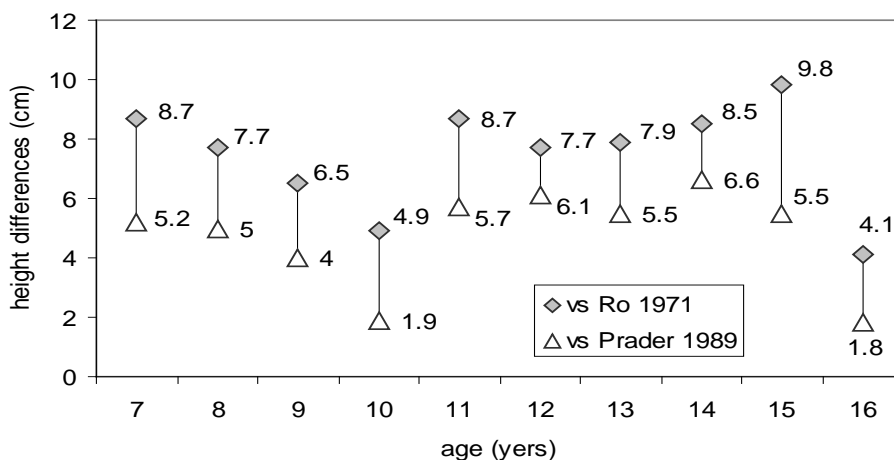


Figure 2. Height differences in boys

Differences between mean heights in girls on age groups comparing with Romanian standards from 1971 and Prader standards from 1989. Prader standards are more close to the actual data, however, on the contrary to girl's values, a higher difference persists at 16 years of age (1.8 cm).

Discussions

We found a significant increment of height values in both boys and girls, suggesting the necessity of establishment of new, actualized standards. Like in other countries, this increment can be correlated with a better life standard. Even in families with lower income, the improved quality of life positively affected growth, narrowing height differences (Li, 2004). Puberty onset (with consecutive growth peak) was earlier in both girls and boys, confirming the secular puberty trend, which is also view as an image of the improvement of general socio-economic conditions. Weight tendency in girls, with lower values after puberty compared with previous data, may be related to the actual thinner beauty standards.

As in other studies, our results showed significant differences between actual growth parameters and those of older standards. There are two probable reasons: first, both standard charts used for comparison are from more than 25 years ago. Continuous secular trend did modify mean adult height and the patterns of growth (e.g. earlier puberty onset, with earlier growth peak). This emphasizes the necessity of actualizing growth charts. Second, differences between ethnic groups should be considered, emphasizing the utility of regional growth charts.

There is no consensus regarding which standard may be used in literature. Analyzing national and international growth data, emphasizing significant differences toward international references, some authors consider the necessity of country growth charts and even a renewal every 10 to 15 years (Kulaga, 2011, Sanchez Gonzales 2011). On the other side, comparing recent growth data with national reference data and with WHO references, a national multi-institutional French study (Scherdel, 2015) concluded that WHO growth charts appear to be more adequate. An intermediary opinion, analyzing chart data from several European countries and considering populations differences, founded significant differences between children from Northern and Southern Europe, Northern European children being taller, and developed new height-for-age charts for these two European regions (Bonthuis, 2012). They postulated the utility of using national (preferable, when available) or European growth charts, instead of WHO data (which describe mainly the growth of US children).

Considering literature data and our own results, we believe that we need to actualize Romanian growth charts. Establishing growth charts is an important task and cannot be performed by an isolated discipline. An

interdisciplinary work, view as an integration of particular aspects of knowledge with connexion of different methodology (Zaman & Goschin, 2010) is necessary in order to realize this kind of national health assessment.

Conclusion

Growth pattern is an important parameter for child health. When growth deficiencies are detected, appropriate diagnostic investigations are needed, in order to detect the cause and to provide, if necessary, the adequate treatment. This emphasizes the necessity of accurate growth charts, which permit a proper evaluation. A pertinent analyze cannot be made without an interdisciplinary team, which can realize integrative standards and guidelines.

Contribution of the authors: study design - CV, DA, CP; meeting with the parents - IVN, MCU; subjects examination - MCU, MA, IA, RK; data analyze and interpretation- CV, CP, DA, IVN, MCU, MA, IA, RK; paper writing: - CV, CP

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FIBROMYALGIA: A SEARCH FOR MARKERS AND THEIR EVALUATION THROUGHOUT A TREATMENT

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Abstract

Fibromyalgia syndrome (FM) is a complex chronic pain disorder of unknown causation associated with debilitating fatigue, unrefreshing sleep, cognitive and affective symptoms. There is no biological markers to monitor FM progression and no permanent cure for FM. Our aim was to identify markers associated with FM and its progression and to evaluate the efficacy of a battery of treatments. The study is a treatment trial, open label and single centre, with 27 women (41 ± 2 years) diagnosed with FM using the Widespread Pain Index (WPI), the Symptom Severity (SS) Scale and the Fibromyalgia Impact Questionnaire (FIQ). Anthropometric parameters, plasma cytokines values and clinical progression were measured before and after two months of a multi-approach treatment. A significant improvement was observed after two months of treatment as shown by WPI, SS Scale and FIQ. No significant variations were observed, except for the intracellular body water parameters, in anthropometric and body composition characteristics. Food-induced histaminosis release was observed to cow's milk, egg, fruit, wheat and oily fish. Interleukin-1 β (IL-1 β) and interleukin-6 (IL-6) plasma cytokine values were significantly higher in FM. A strong positive correlation was observed between the percentage of reduction of cytokine levels and the improvement of health status. We propose: i) the

existence of different subsets of FM patients; ii) the use of intracellular body water and plasma cytokine values as positive markers for FM progression; iii) that food-sensitisation could be an important mechanism for FM pathogenesis and iv) the use of a multidisciplinary approach for FM treatment.

Keywords: Fibromyalgia, body composition, food intolerance, cytokines

Introduction

FM is a common chronically painful, frequently disabling disorder of unknown origin. Patients have a low pain threshold, stiffness and tenderness, fatigue, impaired memory, and depression. Some of them also have gastrointestinal problems. Recent epidemiological studies estimate its global prevalence at 2–8% with a female/male ratio predominance (Clauw; 2014). In Spain, the prevalence of fibromyalgia is approximately 2.4%, being more frequent in rural (~4.1%) than in urban settings (~1.7%) (Mas et al., 2008).

There is no permanent cure for FM, therefore, adequate symptom control should be goal of treatment. The problem is that FM patients respond differently to treatments. This is probably due to the different pathogenic mechanisms involved in FM. The pathophysiological hallmark is a sensitized or hyperactive central nervous system that leads to an increased gain on pain and sensory processing (Clauw; 2015). In addition, other pathophysiological mechanisms such as mitochondrial dysfunction, oxidative stress, an inflammatory component (Sanchez-Dominguez et al., 2015) and neuroendocrine disturbances (Neeck, 2002) should be added. Moreover, overweight or obese has been associated with an increased risk of FM especially among those who also reported low levels of physical activity (Mork et al., 2010). For this reason, different medical treatments are used to treat FM and the recent guidelines suggest that the optimal treatment consists in a multidisciplinary approach with a combination of pharmacological and non-pharmacological treatment modalities (Rossi et al., 2015).

Another problem is that nowadays FM diagnosis is made solely on clinical basis, as no validated biological markers associated with the disease have been identified. Thus, identification of markers persistently associated with FM will help to effectively diagnose the illness, follow its progression and more importantly, to monitor the effects of therapeutic approaches.

The aim of this study is to identify markers associated with FM and its progression and to evaluate the efficacy of a battery of treatments.

Materials and Methods

Study sample and characteristics

This study is an interventional clinical trial (treatment trial) open label and single centre, that included 27 women aged 41 ± 2 years (range: 19-67 years) who were diagnosed with FM by an internist from the FM Unit of Viamed Santa Ángela de la Cruz Hospital and met the American College of Rheumatology Criteria for FM. Exclusion criteria for patients were not having other rheumatic disease and/or sever somatic or psychiatric disorders such as cancer, sever coronary disease, or schizophrenia. Other exclusion criteria were cardiac pacemaker, electrically conductive implants in the brain, pregnancy and being younger than 18 years old. All patients were assessed by the same researchers to reduce interexaminer error. All the participants were informed about the study aims and methodology. In addition, all of them signed a written informed consent to participate. The study was approved by the Ethics Committee of the University Pablo Olavide (Seville, Spain).

During the first visit to the FM Unit, FM diagnosis was made, together with all tests and studies. This procedure was carried out on two separate days, with at least 48h between each session. This was done in order to prevent fatigue and flare-ups. Then the treatment was prescribed and patients returned to the FM Unit after 66 ± 2 days. Afterwards, FM severity was assessed and all tests were performed again, following the same procedure as in the first visit.

The treatment prescribed consisted on (table 1): i) Ubiquinol (the fully reduced form of coenzyme Q₁₀; ii) Nutritional complex containing amino acids, vitamins and mineral; iii) Palmitoylethanolamide (PEA); iv) Synbiotic health supplement; v) Repetitive transcranial electromagnetic stimulation (rTMS); vi) Food exclusion and vii) Physical activity.

Concerning rTMS, stimulation sessions occurred once per week for eight consecutive weeks. Sessions were scheduled along the day and lasted 20 min. They occurred inside a Faraday cages to reduce environmental electromagnetic interference. Stimulation was delivered via a custom-built magnetic stimulator. Briefly, a flexible electroencephalography (EEG) cap with 33 stimulation coils was placed over the patient's head. A digital electronic generator fed the same oscillating current of intensity to all coils. The current amplitude was 545 μ A. Each coil produces a magnetic field of approximately 43 nT at a distance of 1 cm and 0.9 nT at a distance of 4 cm. A low-frequency (8 Hz) square function was used. The relative fluctuations in voltage (noise) around the theoretical square function to be applied were approximately 3%.

Table 1. Treatment prescription details.

Treatment	Characteristics
Ubiquinol	200 mg/day single-dose oral during 60 days
Nutritional complex	Single-dose oral, during 60 days. It contains amino acids (arginine, methionine and glycine), vitamins (D3, E, C and B12) and minerals (magnesium, potassium, phosphorus, calcium and chromium)
PEA	400 mg/day single-dose oral during 60 days
Synbiotic	It contains probiotics (<i>Bifidobacterium lactis</i> , <i>Lactobacillus acidophilus</i> , <i>Lactobacillus plantarum</i> and <i>Lactococcus lactis</i>) and prebiotics (inulin)
rTMS	1 session/week for 8 consecutive weeks, 20 min duration, 545 μ A current amplitude, 43 nT at 1 cm, 8 Hz frequency
Food exclusion	Milk (100%), Egg (61%), fruit (37%), wheat (32%) and oily fish (26%) of patients
Physical activity	45-minutes walking/twice a week at 60% VO_{2max}

Anthropometrics measurements

Height (in centimeters) and weight (in kilograms) were measured using a mechanical patient weighing scale with a stadiometer (Seca 711, Hamburg, Germany). Total body fat (%), trunk fat (%), total body water (Kg), intracellular body water (kg) and phase angle (degrees) were measured by means of an eight-polar multifrequency bioimpedanciometer (BIA) (Promis Cardiofitness, Cadiz, Spain). Body Mass Index (BMI) was calculated by dividing patients' weight (in kilograms) by their height (in meters) squared.

Fibromyalgia diagnosis and severity

FM diagnosis and severity was assessed using the WPI, the SS Scale (Wolfe et al.; 2011) and the Spanish version of the FIQ (Rivera and Gonzalez, 2004).

Food-induced histaminosis release test

Patient's heparinized blood was incubated with different food allergen extracts (cow's milk, pork, chicken, beef, white fish, oily fish, egg, legumes, wheat, rice, tomato, orange, banana, apple, almond and hazelnut) for 30 min, at 37°C. Then, specific histamine release was stopped by adding PBS/Tween at 4°C. Samples were centrifuged for 15 minutes at 5,000 rpm using a refrigerated centrifuge. Extraction and purification of histamine from plasma was performed by dialysis (dialyzer membrane C12-24, Axflow, Madrid, Spain) and subsequent condensation with O-phthalaldehyde solution. Finally, histamine fluorometric measurement was performed at 640 nm. The threshold of histamine release was defined as the minimum concentration of food antigen to induce a 7% net histamine release.

Cytokine measurements

Whole blood cell was collected into commercially available anticoagulant-treated tubes (EDTA-treated). Then, cells are removed from plasma by centrifugation for 15 minutes at 2,000 g using a refrigerated centrifuge. The resulting supernatant was immediately transferred into clean polypropylene tubes and stored at -20°C.

Cytokines were determined from plasma using Multiplex Luminex assay (Human Cytokine 10-Plex Panel, Life Technologies, Madrid, Spain) according to manufacturer instructions.

Statistical analysis

All data are presented as means \pm standard error of the mean (SEM). All secondary analysis was performed using GraphPad InStat software (GraphPad, La Jolla, CA, USA). Analysis of variance (ANOVA) was performed to data. Thereafter, a paired and unpaired *t*-test was undertaken. $P < 0,05$ was considered significant. Pearson Product Moment correlation was also calculated.

Results

Table 2 shows that a very significant improvement was observed after two months of treatment. In fact, the three outcomes measured, widespread pain index, health status (FIQ) and current pain intensity (SS scale) were extremely significant ($p < 0.001$) after two months of intervention. However, due to the complexity of the treatment and the study design, it was not possible to really understand the meaning and the contribution of the different components of the treatment.

Table 2. Values of FM diagnostic tests before and after the treatment.

FM diagnostic tests	Before treatment	After treatment
WPI	9.7 \pm 0.6	5.7 \pm 0.6*
SS Scale	7.6 \pm 0.3	4.5 \pm 0.4*
FIQ	61.6 \pm 2.7	39.6 \pm 4.0*

* $P < 0.001$ before treatment vs after treatment.

When looking at anthropometric and body composition characteristics of the study sample (table 3), before and after treatment, no significant variations were observed, except for the intracellular body water parameters ($p < 0.05$). In addition, it was observed that: i) patients' BMI index was within normal range; ii) all patients had a severe intracellular dehydration and iii) patients didn't have cellular damage (measured by phase angle).

Table 3. Anthropometrics characterizes before and after the treatment.

Anthropometrics characterizes	Before treatment	After treatment
BMI	24.3 ± 1.1	23.2 ± 1.0
Total body fat (%)	34.4 ± 1.8	33.6 ± 1.6
Trunk fat (%)	34.6 ± 1.7	33.4 ± 1.6
Total body water (Kg)	30.3 ± 0.5	29.5 ± 0.5
Intracellular body water (Kg)	15.1 ± 0.3	14.1 ± 0.3*
Phase angle (degrees)	4.3 ± 0.1	4.2 ± 0.3

* $P < 0.05$ before treatment vs after treatment.

Food-induced histaminosis release tests showed that patients were above threshold values for cow's milk (100%), egg (61%), fruit (orange, banana and apple, 37%), wheat (32%) and oily fish (26%). Due to the fact that food exclusion was included within the whole treatment design, it was difficult to evaluate the real effect of food exclusion in patients' improvement.

Plasma cytokine levels (IL-1 β , IL-6 and TNF- α) was performed to determine the pathophysiological role of pro-inflammatory cytokines in FM treatment and progression. As it is observed in table 4, patients with FM had IL-1 β and IL-6 plasma values higher than those reported in the literature for control subjects (Togo et al., 2009). Moreover, the treatment significantly ($p < 0.001$) decreased both cytokines plasma values. When comparing the improvement of health status (FIQ) with interleukins percentage of reduction, the Pearson's correlation between the two variables showed a positive Pearson Product Moment correlation of 0.59 between FIQ and IL-1 β reduction and of 0,62 between FIQ and IL-6 reduction (data not shown). Both data indicated a fairly strong relationship between health status improvement and cytokines plasma values.

Table 4. Plasma cytokines values before and after treatment.

Plasma cytokines levels (pg/ml)	Before treatment	After treatment
IL-1 β	24.2 ± 1.4	11.5 ± 0.3*
IL-6	5.4 ± 0.4	2,2 ± 0.1*
TNF- α	5.6 ± 0.4	5.3 ± 0.3

* $P < 0.001$ before treatment vs after treatment.

Discussion

Since 2010, FM is diagnosed according to the criteria established by The American College of Rheumatology (Wolfe et al.; 2011), while patients generally have a normal laboratory profile (Yunus, 2002). In addition, the pathophysiological mechanisms of FM are not well understood and several mechanisms have been proposed. However, the existence of different subtypes of FM patients with different etiology, clinical characteristics and biological markers could help to understand the situation and therefore, to

design more appropriate treatments for distinct subgroups. The existence of subpopulations of FM patients was already proposed by Caro (1989).

In this regard, looking to table 3, we observed that our patients' group has a BMI index within normality. However, it has been described that women with a BMI greater than or equal to 25 had a 60% to 70% greater risk of developing fibromyalgia, when compared with their thinner counterparts. In addition, for a women population, aged 40 years and over, the co-occurrence of FM with having chronic diseases, such as obesity, were strongly related (Rusu et al., 2015). In addition, our group of patients showed a severe intracellular dehydration. We do not know the pathophysiological meaning of this finding, however, a significant reduction of dehydration was observed after treatment and after patients' clinical improvement. This raises the possibility of using intracellular dehydration as a marker of FM progression.

Our group of patients also has higher plasma levels of IL-1 β and IL-6. These cytokines values were significantly reduced after treatment and after clinical improvement, with a strong correlation. This suggests that, within this subgroup of patients, the presence of an inflammatory response highlighted a parallel between the clinical symptoms and biological markers.

Among the factors suspected of promoting FM are food sensitivities and intestinal hyperpermeability (Werbach, 2000). The food-induced histaminosis release test showed that the majority of FM patients showed sensitisation to cow's milk, egg, fruit, wheat and oily fish. This sensitisation could be increased in the presence of increased intestinal permeability. In this regard, central sensitisation has been proposed to contribute to FM pathogenesis (Nijs et al., 2012).

Finally, the FM patients significantly improved with the treatment, as shown by the FM diagnostics tests (table 2). The treatment was composed by seven items and we still don't know the importance and effects of the different components of the treatment in our group. Additional research is necessary to further elucidate this aspect.

Conclusion

Our data indicate the existence of different subsets of FM patients. In addition, intracellular body water and plasma cytokine values could be used as positive markers for FM progression. Food-sensitisation could be an important mechanism for FM pathogenesis. Finally, due to the complexity of FM a multidisciplinary approach should be the goal of treatment.

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SOME MATRIX MODELS

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Abstract

In this paper we present three matrix models that express the relevance of studying Linear Algebra, trying to answer the question *Why study Linear Algebra?*, often asked by students. Linear Algebra is fundamental within the mathematical modelling of phenomena, so we explore examples of models in which it is applied, in a simple manner as possible appropriated to the students' knowledge. The models presented are Leontief Economic Model, Leslie Population Growth Model and Rating Web Pages Model.

Keywords: Leontief matrix; Leslie matrix; PageRank

Introduction

As mathematics teachers in study programmes whose scientific area is not Mathematics, but have Mathematics as a required curricular unit, we are faced with the question: *Why study Linear Algebra?* To answer it we feel the need to demonstrate to the students the relevance of studying Linear Algebra.

An important reason to study Linear Algebra, as is referred in [4], is “Linear Algebra allows and even encourages a very satisfying combination of both elements of mathematics – abstraction and application.” Also, Linear Algebra is essential in multiple areas of science in general. Indeed there are many references addressing elementary Linear Algebra applications. For example, in [3] the authors present 20 applications of linear algebra “drawn from business, economics, engineering, physics, computer science, approximation theory, ecology, sociology, demography, and genetics.”

In this paper we describe three well known models and how they are worked in the classroom.

The choice of the models was made according to the required math concepts: matrix operations, methods to solve systems of linear equations,

matrix inversion, eigenvalues and eigenvectors, matrix diagonalization which are all listed in syllabus of the curricular unit. Furthermore the chosen models: Leontief Economic model, Leslie population growth model and Rating Web pages model, are associated with phenomena of the scientific area of the study programmes we teach, that generally is Biology, Informatics, Economics or Managements.

Usually, in classes, after introducing the mathematical abstract concepts, we describe and explore the models with examples.

Leontief Matrix - Economic model

W. Leontief was awarded the Nobel Prize for his work in 1973. The model we present, based on his idea, is called input-output model.

In this model the economy of a country, region or industry, is divided into n sectors. Each of these sectors uses input from itself and other sectors to produce a product. In addition the sectors must satisfy an outside demand of their goods.

Suppose that there are n sectors, S_i , $i=1,2,\dots,n$ producing goods or services, which are consumed, marketed or invested; each sector produces a unique and exclusive good, that is, there is a one to one relationship between goods and sectors; each sector produces the corresponding good through the consumption of goods in fixed proportions.

Let us denote by $A=[a_{ij}]$ the *technical coefficients matrix*, where a_{ij} is the value of the output of S_i needed to produce one unit of S_j and by d_i the output of S_i needed to satisfy the outside demand.

The purpose of this model is to find the total output, x_i , of each sector, S_i , $i=1,2,\dots,n$, in order to satisfy the intermediate and the outside demand, that is

$$x_i = a_{i1} \cdot x_1 + a_{i2} \cdot x_2 + \dots + a_{in} \cdot x_n + d_i, \text{ for } i = 1, 2, \dots, n.$$

This system of equations can be written in matrix form:

$$\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} + \begin{bmatrix} d_1 \\ \vdots \\ d_n \end{bmatrix} \Leftrightarrow X = AX + D$$

Thus, given A and D , the objective is to find X , production vector, that satisfies $X=AX+D$, with $x_i \geq 0$.

After describing the goal of the model, we explore with the students an example.

Example 1.1

Consider a simple economy with three sectors: manufacturing, agriculture and services. Suppose that:

- i. the production of one unit of manufacturing requires 0,1 units of its own, 0,3 units of the agriculture sector and 0,3 units of the services sector.
- ii. the production of one unit of agriculture requires 0,2 units of its own, 0,6 units of the manufacturing sector and 0,1 units of the services sector.
- iii. the production of one unit of services requires 0,1 units of its own, 0,6 units of the manufacturing sector.

If there is an outside demand of 18 units of manufacturing, we are going to calculate the total output necessary to satisfy it.

The students when constructing the technical coefficients matrix

$$A = \begin{bmatrix} 0,1 & 0,6 & 0,6 \\ 0,3 & 0,2 & 0 \\ 0,3 & 0,1 & 0,1 \end{bmatrix}$$

recognize the importance of placing the matrix entries in the correct position.

To obtain the total output we have to solve the system $X=AX+D$ with

$$D = \begin{bmatrix} 18 \\ 0 \\ 0 \end{bmatrix}.$$

To solve this system of linear equations the students can use one of these methods: Gaussian Elimination, Cramer's rule and Matrix inversion. In the class the system is solved using the previous methods.

Using matrix inversion we have:

$X = AX + D \Leftrightarrow X - AX = D \Leftrightarrow (I - A)X = D \Leftrightarrow X = (I - A)^{-1}D$, if $I-A$ is invertible.

In this case $I - A = \begin{bmatrix} 0,9 & -0,6 & -0,6 \\ -0,3 & 0,8 & 0 \\ -0,3 & -0,1 & 0,9 \end{bmatrix}$, which inverse is $(I - A)^{-1} =$

$$\begin{bmatrix} \frac{20}{9} & \frac{50}{27} & \frac{40}{27} \\ \frac{5}{6} & \frac{35}{18} & \frac{5}{9} \\ \frac{5}{6} & \frac{5}{6} & \frac{5}{3} \end{bmatrix}.$$

Will be obtained $X = (I - A)^{-1}D = \begin{bmatrix} 40 \\ 15 \\ 15 \end{bmatrix}$.

Thus the output of the manufacturing sector will be 40 units (4 for its own, 9 for agriculture, 9 for services and 18 for the outside demand); the output of the agriculture sector will be 15 units (12 for manufacturing and 3 for its own) and the output of the services sector will be 15 units (12 for manufacturing, 1,5 for agriculture and 1,5 for its own).

After we suppose that the outside demand is 60, 20 and 20 units of manufacturing, agriculture and services, respectively.

Then students conclude that, to obtain the new outputs, it is enough to multiply $(I - A)^{-1}$ by the new D , since we already have calculated $(I - A)^{-1}$.

So the total output X required will be

$$\begin{bmatrix} \frac{20}{9} & \frac{50}{27} & \frac{40}{27} \\ \frac{5}{6} & \frac{35}{18} & \frac{5}{9} \\ \frac{5}{6} & \frac{5}{6} & \frac{5}{3} \end{bmatrix} \begin{bmatrix} 60 \\ 20 \\ 20 \end{bmatrix} = \begin{bmatrix} 200 \\ 100 \\ 100 \end{bmatrix}.$$

Naturally some questions arise:

- is $I - A$ always invertible?
- is the production vector X nonnegative?

In order to answer this question we present the next result.

Theorem 1.1 *If A is a square matrix with nonnegative entries whose entries in each column sum less than one then $(I - A)^{-1}$ exists and $(I - A)^{-1} \geq 0$.*

Proof: Let λ be the largest column sum in A . By hypothesis $0 < \lambda < 1$. Therefore each column sum is less than or equal to λ .

We need to show that $(I - A)^{-1}$ exists and $(I - A)^{-1} \geq 0$. To do so we are going to prove that the inverse of $I - A$ is $I + A + A^2 + \dots$.

The j^{th} column of A^2 is a linear combination of the columns of A with coefficients the entries of the j^{th} column of A . Therefore, since each column sum in A is less than or equal to λ , we conclude that each column sum in A^2 is less than or equal to λ^2 . Similarly, each column sum in A^m is less than or equal to $\lambda^m, m \in \mathbb{N}$. Hence, since A^m has nonnegative entries, we can conclude that every entry of A^m is less than or equal to λ^m .

Since $0 < \lambda < 1$ then $\lambda^m \rightarrow 0$ as $m \rightarrow \infty$ therefore $A^m \rightarrow 0$ (zero matrix).

In addition, we have $I - A^{m+1} = (I - A)(I + A + A^2 + \dots + A^m)$, consequently $I = (I - A)(I + A + A^2 + \dots + A^m)$ as $m \rightarrow \infty$ that is that $(I - A)^{-1}$ exists and furthermore $(I - A)^{-1} \geq 0$.

□

Being the technical coefficients matrix A a nonnegative matrix with each column sum less than one, then $(I - A)^{-1}$ exists, $(I - A)^{-1} \geq 0$ and the production vector $X \geq 0$ since $D \geq 0$.

Given a technical coefficients matrix A , whose entries in each column sum less than one, the matrix $(I - A)^{-1}$ is called the *Leontief inverse matrix*, which allows us to calculate the total outputs, X , of each sector for any outside demand D .

Remark: This proof suggests another way to calculate the approximate value of the production vector X doing $X \cong D + AD + A^2D + \dots + A^mD$ for m sufficiently large.

2. Leslie Matrix – Population Model

In the study of the growth of a given population it is essential having in account the survival and reproduction rates of the individuals of that population. It is known, however, that these characteristics differ according to the age of the individuals, their size body or any other individual characteristics influencing survival and fertility.

The Leslie matrix model was invented by P. H. Leslie and describes the growth of the female portion of a human or animal population. In this model, the population is divided into groups based on age classes of equal duration.

The purpose is to project the population from time t to time $t+1$, in years or some other time unit, assuming that the unit of time is the same as the age class width (*projection interval*). A model with projection interval of one year will differ from one that projects from month to month or decade to decade.

Supposing that the individuals of the population are classified into k age classes, the *population projection matrix*, often referred as a *Leslie matrix*, is:

$$L = \begin{bmatrix} R_1 & R_2 & R_3 & \dots & R_{k-1} & R_k \\ S_1 & 0 & 0 & \dots & 0 & 0 \\ 0 & S_2 & 0 & \dots & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & \dots & S_{k-1} & S_k \end{bmatrix}$$

Where R_i is the reproduction rate and S_i is the survival rate, of age class i , for $i=1, \dots, k$.

In some models the last age class is assumed to be removed from the population after a time unit, so the entry, S_k , is 0 in the matrix L .

If the population at time t , distributed into the k classes is:

$$X^{(t)} = \begin{bmatrix} x_1^{(t)} \\ x_2^{(t)} \\ \vdots \\ x_k^{(t)} \end{bmatrix} \text{ where } x_i^{(t)} \text{ is the population, at time } t, \text{ in age class } i=1, \dots, k,$$

then the population at time $t+1$, in age class $i=1, \dots, k$ will be:

$$x_1^{(t+1)} = R_1 x_1^{(t)} + R_2 x_2^{(t)} + \dots + R_k x_k^{(t)},$$

that is, the population in age class one must have originated from reproduction, and not be survivors of any other age class, between times t and $t+1$.

$$x_{i+1}^{(t+1)} = S_i x_i^{(t)}, \text{ for } i=1, \dots, k-1,$$

that is the population in age class $i+1$ will be the survivors of class i , between times t and $t+1$.

Using matrix notation the previous equations can be written as $X^{(t+1)} = LX^{(t)}$.

After describing the model, we explore with the students an example.

Example 2.1

Suppose that a female population has three age classes and the unit of time is five years. Assume that the reproduction rate in the second age class is 4 and in the third age class is 3. In addition suppose that the survival rate in the first class is 0,5 and 0,25 in the second class.

With this information the students can obtain the Leslie matrix for this population:

$$L = \begin{bmatrix} 0 & 4 & 3 \\ 0,5 & 0 & 0 \\ 0 & 0,25 & 0 \end{bmatrix}.$$

Assuming that the initial population is 10 in all age classes, when we ask the students to calculate the population in the next 15 years they do:

$$\begin{aligned} X^{(1)} = LX^{(0)} &= \begin{bmatrix} 0 & 4 & 3 \\ 0,5 & 0 & 0 \\ 0 & 0,25 & 0 \end{bmatrix} \begin{bmatrix} 10 \\ 10 \\ 10 \end{bmatrix} = \begin{bmatrix} 70 \\ 5 \\ 2,5 \end{bmatrix} \\ X^{(2)} = LX^{(1)} &= \begin{bmatrix} 0 & 4 & 3 \\ 0,5 & 0 & 0 \\ 0 & 0,25 & 0 \end{bmatrix} \begin{bmatrix} 70 \\ 5 \\ 2,5 \end{bmatrix} = \begin{bmatrix} 27,5 \\ 35 \\ 1,25 \end{bmatrix} \\ X^{(3)} = LX^{(2)} &= \begin{bmatrix} 0 & 4 & 3 \\ 0,5 & 0 & 0 \\ 0 & 0,25 & 0 \end{bmatrix} \begin{bmatrix} 27,5 \\ 35 \\ 1,25 \end{bmatrix} = \begin{bmatrix} 143,75 \\ 13,75 \\ 8,75 \end{bmatrix} \end{aligned}$$

Thus, since the unit of time is 5 years, after 15 years there are, nearly 143 females in age class one, 13 in age class two and 8 in age class three.

After we observe that since $X^{(n)} = LX^{(n-1)} = L(LX^{(n-2)}) = \dots = L^n X^{(0)}$ we can calculate the population after n projection intervals knowing the initial population and powers of the Leslie matrix.

So, if we want to project the population after, for example 30 years, since the unit of time is 5 years, we can calculate $L^6 X^{(0)}$.

To calculate L^6 we propose to use Cayley-Hamilton Theorem¹⁶⁶ that states that any matrix satisfies its characteristic equation.

The characteristic equation of L is:

$$\det(L - \lambda I) = 0 \Leftrightarrow \begin{vmatrix} -\lambda & 4 & 3 \\ 0,5 & -\lambda & 0 \\ 0 & 0,25 & -\lambda \end{vmatrix} = 0 \Leftrightarrow -\lambda^3 + 2\lambda + 0,375 = 0.$$

By Cayley-Hamilton Theorem $-L^3 + 2L + 0,375I = 0$, where I is the identity matrix of the same size of L , that is, $L^3 = 2L + 0,375I$.

¹⁶⁶ See, for exemple, [2], page 86

We have

$$L^6 = 4L^2 + 1,5L + 0,140625 I = \begin{bmatrix} 8,140625 & 9 & 4,5 \\ 0,75 & 8,140625 & 6 \\ 0,5 & 0,375 & 0,140625 \end{bmatrix}.$$

Then $X^{(6)} = L^6 X^{(0)} = \begin{bmatrix} 216,40625 \\ 148,90625 \\ 10,15625 \end{bmatrix}$, that is after 30 years there are, nearly

216 females in age class one, 148 in age class two and 10 in age class three.

Following we observe that since we know $X^{(3)}$ and $X^{(6)} = L^6 X^{(0)} = L^3(L^3 X^{(0)}) = L^3 X^{(3)}$, another way to obtain $X^{(6)}$ is:

$$X^{(6)} = (2L + 0,375 I)X^{(3)} = \begin{bmatrix} 0,375 & 8 & 6 \\ 1 & 0,375 & 0 \\ 0 & 0,5 & 0,375 \end{bmatrix} \begin{bmatrix} 143,75 \\ 13,75 \\ 8,75 \end{bmatrix} = \begin{bmatrix} 216,40625 \\ 148,90625 \\ 10,15625 \end{bmatrix}.$$

After we suppose we want to project the population after a long period of time

To do this we introduce the following result.

Given a square matrix A we define the positive real number $\rho(A) = \max\{|\lambda|: \lambda \in \sigma(A)\}$ where $\sigma(A)$ is the set of the eigenvalues of A .

Theorem 2.1 *If A is a nonnegative square matrix, then $\rho(A)$ is an eigenvalue of A , often called the dominant eigenvalue of A , and there is a positive vector X such that $AX = \rho(A)X$.*

The proof can be found in [2] page 503.

Since a Leslie matrix, L , is always nonnegative then $\rho(L)$ is the dominant eigenvalue of L , and exists a positive vector V such that $LV = \rho(L)V$.

Assuming that L is diagonalizable, then exists P and D such that $L = PDP^{-1}$, where D is a diagonal matrix whose entries are the eigenvalues of L and P is a matrix whose columns are the eigenvectors, therefore $L^n = (PDP^{-1})^n = PD^nP^{-1}$.

Suppose L is a Leslie matrix, 3×3 , with eigenvalues $\lambda_1 = \rho(L)$, λ_2, λ_3 and the corresponding eigenvectors v_1, v_2 and v_3 .

Then

$$X^{(n)} = L^n X^{(0)} = [v_1 \quad v_2 \quad v_3] \begin{bmatrix} \lambda_1^n & 0 & 0 \\ 0 & \lambda_2^n & 0 \\ 0 & 0 & \lambda_3^n \end{bmatrix} [v_1 \quad v_2 \quad v_3]^{-1} \begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \end{bmatrix}.$$

Dividing by $(\lambda_1)^n$ we have:

$$\frac{1}{\lambda_1^n} X^{(n)} = [v_1 \quad v_2 \quad v_3] \begin{bmatrix} 1 & 0 & 0 \\ 0 & \left(\frac{\lambda_2}{\lambda_1}\right)^n & 0 \\ 0 & 0 & \left(\frac{\lambda_3}{\lambda_1}\right)^n \end{bmatrix} [v_1 \quad v_2 \quad v_3]^{-1} \begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \end{bmatrix}$$

Since $\left|\frac{\lambda_2}{\lambda_1}\right|, \left|\frac{\lambda_3}{\lambda_1}\right| < 1$ then $\lim_{n \rightarrow \infty} \left(\frac{\lambda_2}{\lambda_1}\right)^n = \lim_{n \rightarrow \infty} \left(\frac{\lambda_3}{\lambda_1}\right)^n = 0$, therefore

$$\lim_{n \rightarrow \infty} \frac{1}{\lambda_1^n} X^{(n)} = [v_1 \quad v_2 \quad v_3] \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} [v_1 \quad v_2 \quad v_3]^{-1} \begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \end{bmatrix} \Leftrightarrow$$

$$\Leftrightarrow \lim_{n \rightarrow \infty} \frac{1}{\lambda_1^n} X^{(n)} = [v_1 \quad 0 \quad 0] [v_1 \quad v_2 \quad v_3]^{-1} \begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \end{bmatrix} \Leftrightarrow$$

$$\Leftrightarrow \lim_{n \rightarrow \infty} \frac{1}{\lambda_1^n} X^{(n)} = [v_1 \quad 0 \quad 0] \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} \Leftrightarrow \lim_{n \rightarrow \infty} \frac{1}{\lambda_1^n} X^{(n)} = c_1 [v_1].$$

Thus

$$X^{(n)} \cong \lambda_1^n c_1 [v_1].$$

Also $X^{(n)} \cong \lambda_1 \times \lambda_1^{n-1} c_1 [v_1] \cong \lambda_1 X^{(n-1)}$, that is, for large values of time, the population is directly proportional to the preceding population, at each age class.

According to the value of λ_1 , the dominant eigenvalue of the Leslie matrix, we can observe:

If $\lambda_1 > 1$ the population is eventually increasing.

If $\lambda_1 < 1$ the population is eventually decreasing.

If $\lambda_1 = 1$ the population eventually stabilizes.

Returning to our example, the eigenvalues of L are the solutions of the characteristic equation:

$$-\lambda^3 + 2\lambda + 0,375 = 0 \Leftrightarrow \lambda = 1,5 \vee \lambda = \frac{-3 \pm \sqrt{5}}{4}$$

and the dominant eigenvalue of L is 1,5.

Since $\lambda_1 = 1,5 > 1$ the population is increasing, about 50%, in each of the three age classes, as well the total number of females.

In addition the eigenvectors are

$$v_1 = \begin{bmatrix} 18 \\ 6 \\ 1 \end{bmatrix} \quad v_2 = \begin{bmatrix} 7 + 3\sqrt{5} \\ -3 - \sqrt{5} \\ 1 \end{bmatrix} \quad v_3 = \begin{bmatrix} 7 - 3\sqrt{5} \\ -3 + \sqrt{5} \\ 1 \end{bmatrix} \quad \text{and} \quad [v_1 \quad v_2 \quad v_3]^{-1} = \begin{bmatrix} \frac{1}{38} & \frac{3}{38} & \frac{1}{19} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}^{167}$$

$$\text{Since } \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix} = \begin{bmatrix} \frac{1}{38} & \frac{3}{38} & \frac{1}{19} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix} \begin{bmatrix} 10 \\ 10 \\ 10 \end{bmatrix}, \text{ therefore } c_1 = \frac{30}{19}.$$

$$\text{So } X^{(n)} \cong 1,5^n \frac{30}{19} \begin{bmatrix} 18 \\ 6 \\ 1 \end{bmatrix}.$$

If, for example, $n=20$ we have $X^{(20)} \cong \begin{bmatrix} 94500 \\ 31500 \\ 5250 \end{bmatrix}$, that is, after 100 years there are, nearly, 94500 females in age class one, 31500 in age class two and 5250 in age class three.

Furthermore since $X^{(n)} \cong k \begin{bmatrix} 18 \\ 6 \\ 1 \end{bmatrix}, k \in \mathbb{R}$, for a long period of time we have:

$$\begin{aligned} \frac{18}{25} &= 72\% \text{ of the females are in age class one} \\ \frac{6}{25} &= 24\% \text{ of the females are in age class two} \\ \frac{1}{25} &= 4\% \text{ of the females are in age class three} \end{aligned}$$

3. Rating Web Pages Model

In order to measure the relative importance of web pages, Sergey Brin and Larry Page proposed in 1998 a method, *PageRank*, for computing a ranking for every web page based on the graph of the web. To test the utility of PageRank, they built a web search engine called Google.

The purpose of this model is to calculate the importance score (PageRank) of each web page. So the higher is the PageRank of one page, the higher is its chance of being found on Google.

Suppose we have a *strongly connected web* (that is, you can get from any page to any other page in a finite number of links) with n pages, $P_i, i=1, \dots, n$.

Denote by x_i , the importance score of page $P_i, i=1, \dots, n$, in the web.

¹⁶⁷ We only present the first row of the inverse of the eigenvectors matrix, since the remaining entries are not used in calculations.

If page P_j contains n_j links, one of which links to page P_k , then page P_j contributes for the importance score of page P_k with $x_j \frac{1}{n_j}$.

Therefore $x_k = \sum_{P_j \in L_k} \frac{x_j}{n_j}$ where L_k is the set of the pages which links to page P_k , $k=1, \dots, n$.

Using matrix notation the previous equations can be written as $X=AX$, where $A = [a_{ij}]$ with

$$a_{ij} = \begin{cases} \frac{1}{n_j}, & \text{if } P_j \text{ links to } P_i \\ 0, & \text{otherwise} \end{cases}, \text{ for } i, j=1, \dots, n.$$

This matrix is called the *link matrix* for this web.

Notice that the j^{th} column of A has n_j non-zero entries, each equal to $\frac{1}{n_j}$, thus, the entries in each column of A sum to 1. Furthermore, since all its entries are nonnegative, A is a *column-stochastic matrix*, and therefore has 1 as an eigenvalue. In fact if we consider the column vector v with all its entries equal to one, we have $A^T v = v$, that is 1 is an eigenvalue of A^T and therefore also an eigenvalue of A . Also if we denote by $V_1(A)$ the eigenspace for eigenvalue 1 of A then $\dim V_1(A)=1$, since the web is strongly connected.[1]

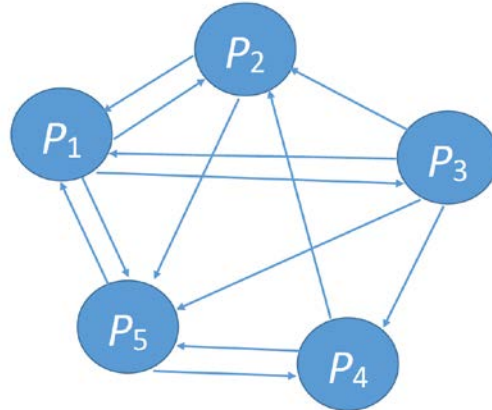
Then we are sure that the system, $X=AX$, has non-zero solutions, the eigenvectors associated to the eigenvalue 1, producing a unique ranking.

Then we ask the students to represent in a directed graph a web with five pages (the vertices of the graph) and where an arrow from page P_i to page P_j , $i=1, \dots, 5$, indicates a link from page P_i to page P_j .¹⁶⁸

Example 3.1

Suppose, for example, we have a web with five pages P_i , $i=1, \dots, 5$, illustrated in the graph:

¹⁶⁸ The students have some knowledge of graph theory obtained in another curricular unit.



In this example we have $n_1 = 3$, $n_2 = 2$, $n_3 = 4$, $n_4 = 2$ and $n_5 = 2$ (in graph language n_i is the out-degree of vertex P_i).

In first place we verify that the web (graph) is strongly connected, that is for every pair (P_i, P_j) of vertices there is a path from P_i to P_j .

To calculate $x_i, i=1, \dots, 5$, the importance score of page P_i in this web, we have to solve the system of linear equations.

$$\left\{ \begin{array}{l} x_1 = \frac{1}{2}x_2 + \frac{1}{4}x_3 + \frac{1}{2}x_5 \\ x_2 = \frac{1}{3}x_1 + \frac{1}{4}x_3 + \frac{1}{2}x_4 \\ x_3 = \frac{1}{3}x_1 \\ x_4 = \frac{1}{4}x_3 + \frac{1}{2}x_5 \\ x_5 = \frac{1}{3}x_1 + \frac{1}{2}x_2 + \frac{1}{4}x_3 + \frac{1}{2}x_4 \end{array} \right. \Leftrightarrow \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{4} & 0 & \frac{1}{2} \\ \frac{1}{3} & 0 & \frac{1}{4} & \frac{1}{2} & 0 \\ \frac{1}{3} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{4} & 0 & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{2} & \frac{1}{4} & \frac{1}{2} & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

We already know that the system has more than one solution, so we can't use Cramer's Rule neither matrix inversion. The solutions of the previous system are

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = k \begin{bmatrix} \frac{10}{33} \\ \frac{11}{33} \\ \frac{2}{3} \\ \frac{10}{33} \\ \frac{19}{33} \\ 1 \end{bmatrix}, k \in \mathbb{R}.$$

Since the eigenvectors are just scalar multiples of each other, we can choose any of them to be our PageRank vector.

If we choose $k = \frac{33}{114}$ we obtain $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} \cong \begin{bmatrix} 0,26 \\ 0,19 \\ 0,09 \\ 0,17 \\ 0,29 \end{bmatrix}$, the unique

eigenvector with the sum of all entries equal to 1.

In this web the ranking is: P_5 (29%), P_1 (26%), P_2 (19%), P_4 (17%), P_3 (9%) .

Remark

If the web is not strongly connected, that is, there is, at least, one page P_k such that, there is no other page linking to P_k , the link matrix has, at least, one null line, and therefore yields non unique rankings.

If the web has *dangling nodes*, that is, there is, at least, one page with no links, then the link matrix has one or more columns of zeros.

In order to solve these problems, the model described is adapted, using, instead of A the matrix $M = (1 - p)A + pB$, with $0 < p < 1$ (usually $p = 0,15$), A the link matrix and B the matrix whose entries are all equal to $\frac{1}{n}$. [1]

Conclusion:

From our experience as mathematics teachers in Economics, Natural Sciences and Computer Science programs, we noticed that the students understand the mathematical concepts through the exploration of mathematical models, illustrated with examples of the respective study areas. In particular the students:

- recognize the importance of placing the matrix entries in the correct position when constructing the matrix models of the examples ;
- understand the meaning of matrix operations;
- identify properties of a matrix just “looking” at its entries;
- understand that eigenvalues are not only roots of characteristic equation;
- admit the importance of knowing different ways of solving linear equation systems;
- recognize the usefulness of matrix inversion;
- realize the potential of matrix diagonalization;
- apply matrix theory and graph theory creating connections between two curricular units, combining abstraction and application.

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THE ISSUE OF OBSERVANCE OF SAFE FOLLOWING DISTANCE BETWEEN VEHICLES IN GERMANY

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Abstract

This technical article discusses the issue of observance of safe following distance between vehicles on motorways in the Federal Republic of Germany. It contains an analysis of accident frequency on roads in Germany, with a particular focus on traffic accidents caused by the failure to observe a safe following distance behind another vehicle. Next, it describes legal requirements on the observance of a safe distance in particular countries and, in respect thereof, it presents results of an analysis of the observance of a safe following distance between vehicles on German motorways containing two and three traffic lanes per carriageway in one direction.

Keywords: Safe distance; vehicle; traffic accident; cause of an accident

Introduction

A traffic accident is usually a direct result of the failure of one or more basic interacting factors, including vehicle safety, safety of road itself and its surroundings and behaviour of road users.

One of the objectives of individual countries of the world is to prevent or at least to reduce the risk of traffic accidents and their consequences, which are linked to losses as regards health, human lives as well as economy and others. Statistics of traffic accidents show one of the most common causes of traffic accidents to be the “failure to observe a safe distance behind another vehicle”. Introducing measures related to traffic accidents arising from this particular cause can contribute to reducing traffic accidents. One of the ways forward is the exact definition of a safe following distance in legislation, setting of effective penalties for the breach thereof, and so on.

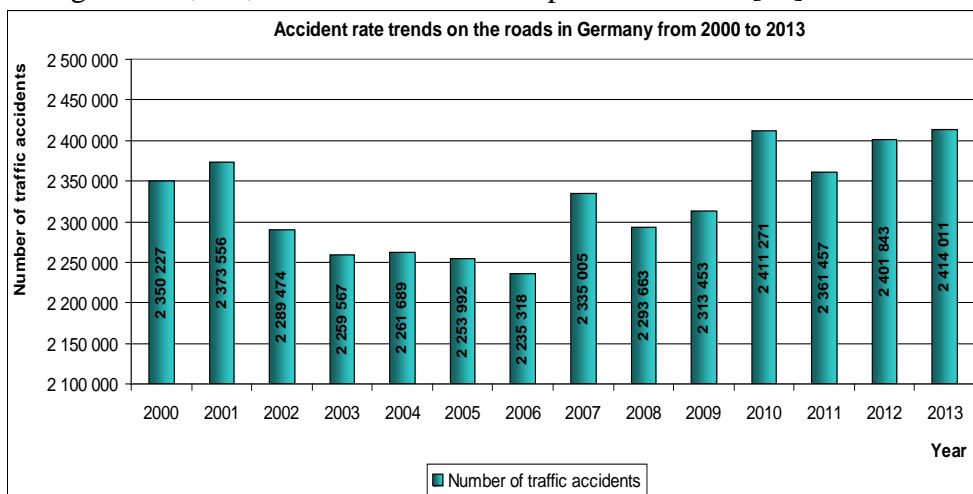
This contribution deals with the issue of a safe following distance between vehicles on roads in Germany, with a focus on the analysis of its observance on motorways with two or three traffic lanes in one direction.

Accident rate on the roads in germany

Number of traffic accidents

According to UNECE statistical data, there occurred a total of 32,554,526 traffic accidents on the roads in Germany from 2000 to 2013 (see the following chart), which represents an average of 2,325,323 traffic accidents per year. [11]

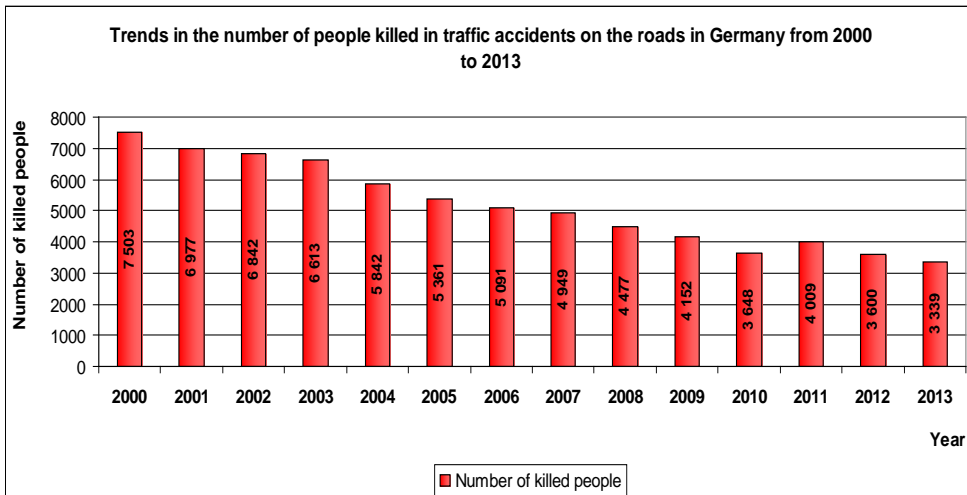
From 2001 to 2006, there was a significant drop in the number of these accidents, namely to 2,235,318 accidents. The significant decrease by more than a half could have been influenced by amendments to legislation and a number of factors, which included, for example, developing active and passive vehicle safety, increasing transport infrastructure safety, campaigns focused on increasing prevention in the field of road safety, innovations concerning driver education, increasing the number of road checks etc. By contrast, from 2007 to 2013, the number of traffic accidents increased on average with 2,414,011 traffic accidents reported in 2013. [11]



Graph 1: Accident rate trends on the roads s in Germany from 2000 to 2013 [11]

Consequences of traffic accidents

According to UNECE statistical data, the number of people killed in traffic accidents on the roads in Germany gradually decreased from 2000 to 2013 (see the following chart). In 2013, the number of people killed reached approximately 45% of the figure of 2000, namely with 3,339 people killed. A person is considered killed in a traffic accident if they died as a result of a traffic accident within 30 days. [11]

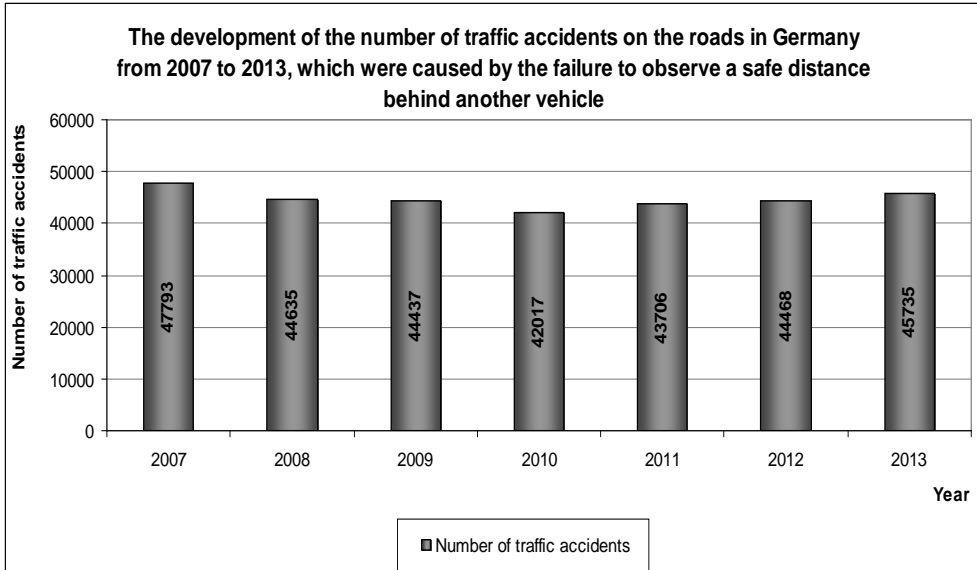


Graph 2: Trends in the number of people killed in traffic accidents on the roads in Germany from 2000 to 2013 [11]

Causes of traffic accidents

According to UNECE statistical data, 2,414,011 traffic accidents occurred in Germany in 2013, of which there were 291,105 accidents involving injury or death, while altogether 350,381 causes of the accidents were recorded by the German Statistical Office. Out of these, 55,480 accidents were caused by incorrect turning or reversing, 51,055 by failure to give right of way, 48,730 were down to speeding, 45,735 to failure to observe a safe distance behind another vehicle, and 13,327 accidents were caused by driving under the influence of alcohol, etc. [11, 3, 4]

The following chart shows the development of the number of traffic accidents on the roads in Germany from 2007 to 2013, which were caused by the failure to observe a safe distance behind another vehicle with the cause being related to traffic accidents, which resulted in injury or death.



Graph 3: The development of the number of traffic accidents on the roads in Germany from 2007 to 2013, which were caused by the failure to observe a safe distance behind another vehicle [3,4]

Methodology

Safe following distance behind another vehicle:

From a technical point of view, a safe following distance between vehicles, where two vehicles follow each other in a lane, consists of three basic components. They include the speed of each car, the maximum attainable braking rate of each vehicle and the reaction time of the driver of the second vehicle. The safe following distance behind another vehicle can be described by the following formula [2, 12]:

$$b \geq v_2 \cdot t_{r2} + \frac{v_2^2}{2 \cdot a_2} - \frac{v_1^2}{2 \cdot a_1}$$

Where:

- b*..... safe following distance between two vehicles [*m*],
- v*₁..... speed of the first vehicle [*m/s*],
- v*₂..... speed of the second vehicle [*m/s*],
- t*_{*r*2}..... reaction time of the driver of the second vehicle [*s*],
- a*₁..... braking rate of the first vehicle [*m/s*²],
- a*₂..... braking rate of the second vehicle [*m/s*²].

If both vehicles following each other have the same speed and the same maximum attainable braking rate, the safe distance between the vehicles corresponds to the reaction time of the second driver. Research has been carried out to assess driver's reaction time with the time depending on the driver's age, their mental state and a number of other factors.

The length of the safe distance is determined by the fact that upon a sudden stop of the first vehicle the vehicle travelling behind it can be safely brought to a halt. From a technical point of view, a sudden stop is to be understood as braking involving the maximum attainable deceleration regarding adhesive and design conditions until the vehicle fully stops. In the case the first vehicle is overtaken by the second one in such a way that there is no safe distance between the vehicles, the driver of the overtaken vehicle should not be forced to perform deceleration of its vehicle higher than deceleration prescribed for such vehicle by law. [2]

In terms of legislation, the driver of the vehicle travelling behind another vehicle must leave sufficient safe distance behind the first vehicle so as to be able to avoid a collision in the event of a sudden reduction in speed or sudden stop of the vehicle travelling in front. In the legislation of some countries there is a direct definition of a minimum distance behind another vehicle, which the driver must observe, otherwise they face sanctions.

The German road traffic regulation, *Straßenverkehrs-Ordnung*, amending the Road traffic act, *Straßenverkehrsgesetz*, the latest amendment of which entered into force on 1 April 2013 and was valid during following measurements, includes in its first part, in Section 4 entitled "Abstand", a definition of a safe distance between vehicles. In Clause 3 of the above Section the minimum safe distance is defined for lorries with weight exceeding 3.5 t or for buses, which have to observe the minimum following distance of 50 m behind another vehicle, when driving on motorways at a speed exceeding 50 km/h. [5, 6]

The primary legislation including penalties for violations of the regulations by drivers in road operations is the German list of offences, named *Bußgeldkatalog*. Penalties for non-observance of a safe distance behind another vehicle are graded according to gravity of the driver's offence, namely from 35 to 400 €, adding up to 4 penalty points or withdrawing the driver's licence for up to three months. The gravity of the offence is classified according to the speed of the vehicle, where the speed limits are 80 km/h and 130 km/h, and further by the degree of non-observance of a safe distance. The following table shows individual penalty categories, for which distances behind vehicles are converted to a time unit. [7]

Table 1: Conversion of the basic penalties in relation to the non-observance of a safe distance behind another vehicle [7]

Gravity	Distance [m]	Distance [s]
1	< 5/10 of half of speedometer speed	< 0,90
2	< 4/10 of half of speedometer speed	< 0,72
3	< 3/10 of half of speedometer speed	< 0,54
4	< 2/10 of half of speedometer speed	< 0,36
5	< 1/10 of half of speedometer speed	< 0,18

Measurement procedure

Measurements were carried out in Germany. The first speed measurements were carried out on the A8 motorway with two traffic lanes per carriageway, in particular in the vicinity of Exit No. 109, in the direction of Salzburg, near the village of Winkl. Next, speed measurements were carried out on the A9 motorway with three traffic lanes per carriageway, in particular in the vicinity of Exit No. 64, in the direction of Nuremberg, near the village of Au A. Aign.

All measurements were made under relatively fine weather conditions and in good visibility. When recording, the camcorder was hidden from the drivers' sight so as to pass unnoticed and not to affect their behaviour. Video recordings were taken using a digital camcorder with 1920 by 1080 pixel-resolution with 50 frames per second.



Fig. 1: Camcorder station - measuring near the village of Winkl



Fig. 2: Camcorder station - measuring near the village of Au A. Aign

Prior to the start of video recording, distances were measured using a surveying total station between motorway verge marker posts, broken markings separating the individual lanes in corresponding carriageway, or vertical traffic signs and so on. These values obtained through measurements were then fed into the video recording to be used in subsequent analysis. In order to avoid systematic distortion of values caused by vehicle height, the corresponding distance from the relevant part of the vehicle was taken from the border of the vehicle shadow.

When analyzing individual pictures, the following data about vehicle columns were recorded:

- Type of lane, in which a vehicle moves in a traffic column (values: left, right, or middle),
- Type of vehicle moving in a traffic column (values: passenger car, van, lorry up to 12 t, tractor with semi-trailer),
- Framing coefficient determined according to the frame rate of the video recording taken (values: 0.02),
- Time of the front of the vehicle at the beginning of the section (values: frame number of the video recording),
- Time of the rear of the vehicle at the beginning of the section (values: frame number of the video recording),
- Time of the rear of the vehicle at the end of the section (values: frame number of the video recording),
- Length of the measured section (values: distance in meters).

From these variables were consequently calculated the average speed of the vehicle and the distance between vehicles in the measured section, from which mean values of these figures were then calculated. Those vehicles were regarded as vehicles moving in a column if spacing between them was less than 110 metres. The following tables show resulting values of measurements taken, while values of the average speed and average distance between vehicles in a column may fluctuate by no more than about 5 %.

Results of measurement

Measurement of following distance between vehicles near the village of Winkl on 14 November 2013

The measurements were carried out from 14.55 to 16.25 hours on Wednesday, 13 November 2013, when in the area the outdoor temperature was 4.5 °C, with clear skies, no precipitation, light wind, and the motorway surface was dry.

Average speeds of individual vehicle types in the measured section in the right lane of the A8 motorway ranged from 83 to 109 *km/h* on the average, with the average distance behind vehicle being in the range from 45 to 52 *m*. Regarding the average vehicle speed in the section in question and the distance behind another vehicle, the shortest distance behind another vehicle in the right motorway lane was kept on average by drivers of passenger cars, namely 1.62 *s*. In contrast, the longest distance was kept by drivers of tractors with semi-trailers, namely 2.06 *s*.

Tab. 2 The measured values in the right lane of the A8 motorway near the village of Winkl in the direction of Salzburg.

Vehicle category	Number of vehicles	Average vehicle speed in the given section	Average distance between vehicles in the given section
Passenger cars	142	109 km/h	49 m (1.62 s)
Vans	46	100 km/h	52 m (1.87 s)
Lorries up to 12 t	36	83 km/h	45 m (1.95 s)
Tractor with semi-trailer	80	84 km/h	48 m (2.06 s)

In regard to observing a safe distance between vehicles, the situation in the left lane was significantly worse. Average speeds of individual vehicle types in the measured section in the left lane of the A8 motorway ranged from 115 to 119 km/h on the average, with the average distance behind vehicle being in the range from 38 to 39 m. Regarding the average vehicle speed in the section in question and the distance behind vehicle, the shortest distance behind another vehicle in the left motorway lane was kept on average by drivers of passenger cars, namely 1.18 s, but this value is almost identical with van drivers, who observed an average distance between vehicles of 1.19 s.

Tab. 3 The measured values in the left lane of the A8 motorway near the village of Winkl in the direction of Salzburg.

Vehicle category	Number of vehicles	Average vehicle speed in the given section	Average distance between vehicles in the given section
Passenger cars	347	119 km/h	39 m (1.18 s)
Vans	47	115 km/h	38 m (1.19 s)

Measurement of following distance between vehicles near the village of Au A. Aign on 14 November 2013

The measurements were carried out from 12.00 to 13.30 hours on Thursday, 14 November 2013, when the outdoor temperature in the area was 4.5 °C, cloudy with mild rainfall, light wind, and the motorway surface was slightly wet.

Average speeds of individual vehicle types in the measured section in the right lane of the A9 motorway ranged from 94 to 125 km/h on the average, with the average distance behind vehicle being in the range from 53 to 68 m. Regarding the average vehicle speed in the section in question and the distance behind another vehicle, the shortest distance behind another vehicle in the right motorway lane was kept on average by drivers of

passenger cars, namely 1.67 s. In contrast, the longest distance was kept by drivers of lorries up to 12 t, namely 2.26 s.

Tab. 4 The measured values in the right lane of the A9 motorway near the village of Au A. Aign in the direction of Nuremberg.

Vehicle category	Number of vehicles	Average vehicle speed in the given section	Average distance between vehicles in the given section
Passenger cars	23	125 km/h	58 m (1.67 s)
Vans	10	122 km/h	68 m (2.01 s)
Lorries up to 12 t	49	94 km/h	59 m (2.26 s)
Tractor with semi-trailer	111	94 km/h	53 m (2.03 s)

In regard to observing a safe distance between vehicles, the situation in the middle lane was significantly worse. Average speeds of individual vehicle types in the measured section in the middle lane of the A9 motorway ranged from 101 to 136 km/h on the average, with the average distance behind vehicle being in the range from 44 to 52 m. Regarding the average vehicle speed in the section in question and the distance behind another vehicle, the shortest distance behind a vehicle in the middle motorway lane was kept on average by drivers of vans, namely 1.33 s. In contrast, the longest distance was kept by drivers of lorries up to 12 t, namely 1.64 s.

Tab. 5 The measured values in the middle lane of the A9 motorway near the village of Au A. Aign in the direction of Nuremberg.

Vehicle category	Number of vehicles	Average vehicle speed in the given section	Average distance between vehicles in the given section
Passenger cars	198	136 km/h	52 m (1.38 s)
Vans	42	133 km/h	49 m (1.33 s)
Lorries up to 12 t	10	110 km/h	50 m (1.64 s)
Tractor with semi-trailer	21	101 km/h	44 m (1.57 s)

In regard to observing a safe distance between vehicles, the situation in the left lane was even worse. Average speeds of individual vehicle types in the measured section in the left lane of the A9 motorway ranged from 157 to 164 km/h on the average, with the average distance behind vehicle being in the range from 46 to 51 m. Regarding the average vehicle speed in the section in question and the distance behind another vehicle, the shortest distance behind another vehicle in the left motorway lane was kept on average by drivers of vans, namely 1.05 s. The situation was slightly better in regard to drivers of passenger cars, namely 1.12 s.

Tab. 6 The measured values in the left lane of the A9 motorway near the village of Au A. Aign in the direction of Nuremberg.

Vehicle category	Number of vehicles	Average vehicle speed in the given section	Average distance between vehicles in the given section
Passenger cars	295	164 km/h	51 m (1.12 s)
Vans	28	157 km/h	46 m (1.05 s)

Results of the analysis in regard to penalties and findings

It follows from the executed measurements that have been mentioned above that the driver travelling in the right traffic lane observe on average a bigger distance behind vehicle than those in other lanes. The distances observed towards vehicles travelling in front get shorter on average towards the left lane. On average, drivers of passenger cars and vans drive in the shortest distance behind vehicles.

The results of the analysis of the first measurements of the observance of following distance between vehicles on the A8 motorway near the village of Winkl show that out of 699 analyzed vehicles travelling in columns 522 vehicles had a vehicle in front of them, from which they kept a certain distance, with 133 vehicles violating the relevant regulation referred to in Table 7. The relevant regulations were most frequently and most gravely violated by drivers of passenger cars. The prescribed minimum distance behind a car was most frequently violated in the left motorway lane.

Taking into account penalties in relation to lorries of weights exceeding 3.5 t or buses, while riding at speeds in excess of 50 km/h on motorways have failed to observe the minimum following distance of 50 m behind another vehicle, penalties would have been awarded to a total of 48 lorries travelling in the right traffic lane.

Tab. 7 An overview of the number of violations of the regulation by drivers travelling on the A8 motorway near the village of Winkl.

Gravity	Number of violations of the regulation	Number of violations by vehicle type				Number of violations by traffic lane	
		Passenger cars	Vans	Lorries up to 12 t	Tractor with semi-trailer	Right	Left
1	63	53	8	1	1	16	47
2	42	38	3	0	1	5	37
3	21	18	2	1	0	1	20
4	7	5	1	0	1	1	6
5	0	0	0	0	0	0	0
Σ	133	114	14	2	3	23	110

The results of the analysis of the second measurements of the observance of following distance between vehicles on the A9 motorway near the village of Au A. Aign show that out of 789 analyzed vehicles travelling in columns 547 vehicles had a vehicle in front of them, from which they kept a certain distance, with 138 vehicles violating the relevant regulation referred to in Table 8. The prescribed minimum distance behind a car was most frequently violated in the left motorway lane.

Taking into account penalties in relation to lorries of weights exceeding 3.5 t or buses, while riding at speeds in excess of 50 km/h on motorways have failed to observe the minimum following distance of 50 m behind another vehicle, penalties would have been awarded to a total of 34 lorries travelling in the right traffic lane and to 10 lorries travelling in the middle traffic lane.

Tab. 8 An overview of the number of violations of the regulation by drivers travelling on the A9 motorway near the village of Au A. Aign

Gravity	Number of violations of the regulation	Number of violations by vehicle type				Number of violations by traffic lane		
		<i>Passenger cars</i>	<i>Vans</i>	<i>Lorries up to 12 t</i>	<i>Tractor with semi-trailer</i>	<i>Right</i>	<i>Middle</i>	<i>Left</i>
1	58	45	9	1	3	4	16	38
2	48	38	6	0	4	5	16	27
3	27	19	5	0	3	3	4	20
4	5	2	2	1	0	0	4	1
5	0	0	0	0	0	0	0	0
Σ	138	104	22	2	10	12	40	86

Critical situations recorded in photographs

Continuous video recording time for each measurement in a given direction was approximately 1.5 hours, of which approximately 45 minutes were analyzed in the case of the first measurement and approximately 30 minutes of the second one. Even during these periods, some frequently repeated drivers' failings were markedly shown. Captions under the following pictures describe the place of measurement, vehicle speed and its distance from the vehicle in front in metres as well as in seconds.



Fig. 3 The A8 motorway near Winkl, 125 km/h, 10 m (0.30 s)

Fig. 4 The A8 motorway near Winkl, 137 km/h, 12 m (0.32 s)

Many of the monitored vehicle drivers failed to observe a safe distance, which, for example, should be approximately 72 m at 130 km/h (in the case of the so-called “two-second rule”). Some drivers even got near the vehicle in front of them up to a distance in the order of individual metres, as can be seen in the following pictures. At 130 km/h, a vehicle will cover the distance of 10 m in about 0.28 s, which is well below the mean value of the driver’s standard reaction time.



Fig. 5 The A8 motorway near Winkl, 114 km/h, 9 m (0.28 s)

Fig. 6 The A9 motorway near Au A. Aign, 100 km/h, 13 m (0.46 s)

In some cases, dangerous reduction of the following distance between vehicles could be observed, when a vehicle suddenly moved in front of another vehicle when overtaking.

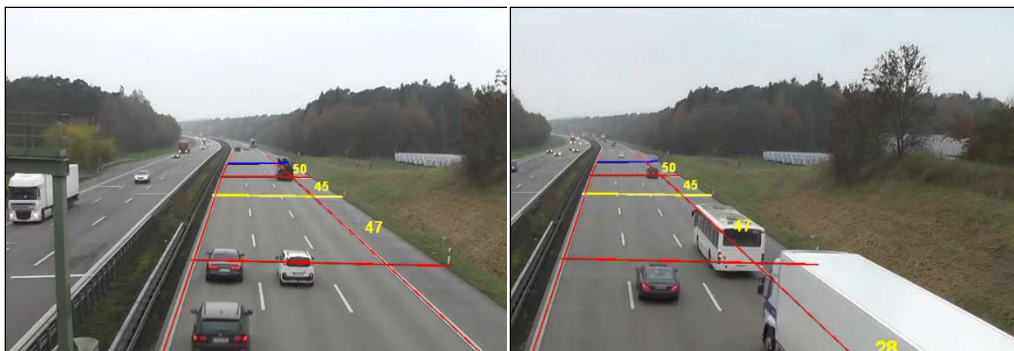


Fig. 7 The A9 motorway near Au A. Aign, 152 km/h, 8 m (0.20 s)

Fig. 8 The A9 motorway near Au A. Aign, 86 km/h, 13 m (0.54 s)

Conclusion

Next to a vehicle and traffic infrastructure, the most critical factor in the traffic system is the driver, in particular. Traffic accident statistics show that road users present the highest share of causes of road accidents. With the developments in science and technology a number of new assistance systems increasingly appear in vehicles, also designed to assist drivers when driving in columns or when critical situations arise during driving behind another vehicle. These assistance systems include brake assist, in particular adaptive cruise control, emergency brake assist, etc [1, 10]. With their help, it is possible to reduce to at least a certain extent the number of traffic accidents caused by non-observance of a safe following distance behind another vehicle.

Statistics of traffic accidents on German roads show that the “failure to observe a safe following distance behind another vehicle” is one of the most common causes of traffic accidents.

The video recordings made show that a significant proportion of drivers travelling in a column do not observe the following distance behind another vehicle, for example in the form of the “two-second rule”, but often even the minimum following distance behind another vehicle required by law, or the distance equalling the length of the usual reaction time of the driver and apparently they fail to realize the risk of such behaviour. It follows from the recordings that on average, the drivers in the right lane observe longer following distance behind another vehicle, than drivers in the middle or left lanes. It has also been shown that to a great extent it is professional drivers or career drivers that fail to observe the safe following distance behind other vehicles.

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THE FLIPPED-BROADCAST LEARNING SYSTEM, APPLICATION ON AZORES

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Abstract

On this work we suggest a teaching solution that can be implemented in Azores, an archipelago of nine islands of Portugal, based in already known system of e-learning, with a twist based on the flipped method. Structured in a cooperative way, the organization of the system allows to isolated groups of people to have access to a certain level of teaching, if they cannot have the possibility to have physical presence in school due to problems emerging from territory discontinuity. Our suggestion can be elaborate in a model that can be adapted to any level of education, and can be adapted also in cases that a cut of budget exists. We suggest the name of fb-learning: Flipped Broadcast Learning.

Keywords: E-learning, b-learning, long distance teaching, flipped learning methods

Introduction

The University of Azores consists of three poles located on the islands of São Miguel, Terceira and Faial, and integrates university and polytechnic organizational units. Their teaching, research, service and cultural extension covers the most diverse areas of Exact Sciences and Technology, Natural Science and the Environment, Medical Sciences and Health, Agricultural Sciences, Social Sciences and Humanities.

Fruit of their framework and of regional, national and international priorities, the University of Azores explore these distinctive areas of training and research, as the sea, including fisheries and aquaculture, and natural hazards, notably volcanology and seismology, climatology and meteorology.

Also worth mentioning other areas, in particular, the level of biodiversity, biotechnology and biomedicine, agriculture and livestock, geological and energy resources, economics and marketing, sociology and geography, pedagogy and psychology, language and communication, history and philosophy, archaeology, political science and new technologies, in particular the information and communication technologies and the material technologies.

The University of Azores is a young institution in the framework of higher education institutions and their growth potential is proportional to the motivation and commitment of its teachers, researchers, technicians and students, who are striving to ensure a close link of the institution to society and the business sector as a contribution to the economic development of the region, the country and the world.

Nowadays, the University of Azores is trying to explore the e-learning and b-learning systems, due to the dispersion of Azores Islands, its most common provider of students. More than 90% of students come from all islands of Azores, and almost half of them are dislocated students from another island. The Azores islands are indeed a natural laboratory where researchers can develop some new ideas and techniques about long distance teaching. The proof of that is the continuous interest of the Open University in maintaining a pole in one of Azores islands with the main centre in Lisbon, and the cooperation protocols that this specialized long distance teaching university has with the University of Azores. This way they can improve the quality of their own courses, receiving the proper feedback from long distance students that live in Azores Islands.

Our work intends to be a contribution, the first step, to improve the actual method of e-learning used by Azores University, based in the old but efficient method of “Telescola” and the modern method of Flipped Classroom, mixing them both in a method that we call the Flipped-Broadcast Method, fb-learning. So, to support our idea, we describe the main characteristics of *Telescola*, we also provide a theoretical framework for long distance teaching, exploring the Learning Process and its foundations, and present the main aspects of our fb-learning model. Due to its own properties we believe it can be an excellent improvement to the already classical e-learning and b-learning methods.

The Telescola

Taking the information provided in [1], the “Telescola”, education via television system, started in Portugal on 6 January 1965, with programming produced in the studios of the Portuguese Radio Television of Mount Virgin in the city of Porto, in Portuguese mainland. The students were accompanied in reception centres by monitors. The intention was to allow

the fulfilment of compulsory education students at the time made up of four years of primary school and the two “Preparatory Cycles”. Geographically *Telescola* intended to serve remote rural areas and suburban areas with overcrowded schools. At that time, there were about a thousand students enrolled, but the entire population had access through television emissions occupying part of the RTP afternoon programming. RTP was the main and only TV channel in Portugal until the beginning of the last decade of the 20th century. The Portuguese *Telescola* was one of the most successful in Europe.

In the early 70s, education reform dictated the extension of compulsory education to eight years. Where it was not possible to provide in presence teaching to students this could be replaced by *Telescola*. This system was also applied to the High School level in Portugal, on the year known as “Ano Propedêutico”, that was intended to be a preparation year to students that wished to apply to the University. In the 80s, with the arrival and extension of VCRs, *Telescola* no longer was televised, thus freeing those hours for other programs. The contents of the videotapes had further clarification provided by a tutor. In the 90s, the use of new communication and multimedia technologies led to distance learning passing to function simultaneously as a complementary form of regular education and as an alternative mode of education. At this point, it was addressed mainly to those who do not have the possibility to attend school in the normal age.

Over the years, the *Telescola* was changed from its initial designation *Telescola Unified Course*, to TV Preparatory Cycle and to Mediated Basic Education (MBE). In July 2003, it was announced that from the 2003/2004 school year the MBE schools would begin to be extinct, at that time about 320, dedicated to teaching the 5th and 6th years. In 2001/2002 there were about 5200 students enrolled in MBE, with a success rate of around 90 percent.



Fig.1. 1968, *Telescola* class – from RTP Archive

Models of learning

Models help us to make sense of our world. They provide a framework or structure to help us understand a large or complex concept, and break it down into discrete, manageable units. Learning models provide teachers with an organized system for creating an appropriate learning environment, and for planning instructional activities. Learning models affect what the teacher does, what the student does, the organization of the classroom, the nature of the procedures, materials, and the instructional tasks.

Adapting some ideas from Brain Compatible Learning for the Block, by Williams and Dunn, [3] and taking the summary elaborate in [2], we have that: 1- Learning becomes relevant through personal context. Students need to understand how this new information relates to their “real life”; 2 - Learning is dependent upon motivation. Students need to be motivated in order to commit the new information to memory; 3 - Learning is reinforced through hands-on experience. This experience enables the student to put a concept or theory in context and examine the parts that make up the whole; 4 - Learning requires linking new information to prior knowledge. The brain has a much greater capacity to take in and store new information that it can relate to something already learned. Teachers need to help students make these connections; 5 - Learning is achieved more efficiently when information is chunked. By grouping together related information, the brain forms a schema, or concept, and assigns meaning; 6 - Learning is enhanced with time for reflection. Reflection, or thinking about what was just learned, helps put the new information in long-term memory. Activities such as group discussions, questioning, and writing in a journal all aid in this process; 7 - Learning is retained longer when associated with senses and emotions. The more senses that are involved in the learning experience, the more stimuli have a chance of reaching long-term memory; 8 - Learning occurs in an environment that fosters and accommodates various ways of being smart. We all have multiple intelligences that need to be accommodated and strengthened. We will discuss this in depth in the next lesson; 9 - Learning is a high-energy activity. If not rehearsed, new information will begin to fade after 30 seconds. It is essential that instructors cover new information several times and in a variety of ways.

In models of learning we can identify some variables that are connected to environment, to emotions, to physical characteristics, to sociological behaviour or to psychological aspects.

When building a model of learning each one of this group of variables have their own importance and must be study separately or together when interacting in order to improve the accuracy of the learning model. When collecting information about the environment we can analyse if the

student likes to study with music or silent, if he prefers dim or bright light, if the room temperature must be cool or warm, or even if the furniture arrangement must be in a certain order. Regarding to the emotional state, motivation is an important factor, as persistence, responsibility and task structure demands. Sociologically, we must see if the student prefers working alone, in pairs, with a team, and if he likes to work with the teacher and work with the same activities using repetitive processes, creating routines, patterns, or if he likes to have a variety of procedures to engage activities. Related with the physical, the mobility aspect is important since the student can love to move during a task, or can prefer to stand still in some place. The time of the day when the task is completed can also disturb the learning process, since studying at night or during the day is completely different, since can affect the biological rhythm. Finally, the variables that have psychological nature, like the student being impulsive/reflective, making quick decisions or taking some time in order to consider all options, or a detailed student that likes to observe every aspect of a mathematical algorithm in confrontation to a more global point of view finding generic conclusions. All these variables can generate their own contribution to dynamics of the learning process.

Flipped Classroom Model

As described in [5], the Flipped Learning model of instruction, although virtually unknown a few years ago, is gaining attention and adherents among teachers and administrators in American K-12 and in postsecondary classrooms. In this model, some or most of direct instruction is delivered outside the group learning space using video or other modes of delivery. Class time, then, is available for students to engage in hands-on learning, collaborate with their peers, and evaluate their progress and for teachers to provide one-on-one assistance, guidance and inspiration. The shift is from a teacher-centred classroom to a student-centred learning environment.

The flipped classroom inverts traditional teaching methods, delivering instructions online outside of class and moving “homework” into the classroom. Mainly, replaces old style live lectures by new fresh live activities. The students watch lectures at home at their own pace, communicating with peers and teachers via online discussions and the comprehension of the concept takes place in the classroom with the help of the instructor.

Educational technology and activity learning are two key components of the flipped classroom model. They both influence student learning environments in fundamental ways.

Usually the structure of this learning model has three main support ideas: 1 – Teachers create videos, or another similar multimedia material; 2 – Students watch the videos at home, or at School; 3 – Class time are spent doing labs or interactive activities to illustrate concepts. With this simple structure the method allows students to receive instant feedback, since teachers have more time to help students and explain difficult concepts. Students don't get so frustrated, since the difficulties that arise in solving some problems are solved in class room. Teachers revisit concepts students don't understand. After students watch lessons, they write down any questions they have. Teachers review those questions with students individually. And finally, teachers can support students in class helping them to use properly the technological tools. This method is proving to be so effective that can change a rate of 44% tax rate of failing in math to a 13%, results obtained in surveys done by the Khan Academy, see [4].

The student at home

When student is participating on the learning process at home, all the variables that can contribute to a learning model style, like the Dunn & Dunn model explains in [2], can be controlled by the student.

The environmental preferences like sound, light, temperature and design, can be adjusted by student to converge to as maximum comfort as possible. Student can choose if he likes to study with background music, or be in silence, having a quiet studying. He also can adjust the light to a bright one or dim, in order to improve his own power of concentration. The room temperature also can be adjusted by student, in order to adapt to the climate of each place on the islands, as the arrangement of furniture can be adapted to cause more comfort to student. He can sit at a desk, or use a couch or bed to study, or even on the floor, lying down and spread all the sheets of study support around him. This last image is the most common one that the student has as reference, when he sees movies that have some "genius" working.

The emotional preferences like motivation, persistence or responsibility can be controlled by the student, but the one related with structure needs extra support, by a teacher, so it is not so controlled by student. The student can be self-motivate and not need a adult feedback to motivate him, or any kind of reinforcements, but we all know that after a while, the student needs to knows if he is going on the right track or no. But persistence is a factor that is related to the ability to stay on task and this characteristic can be only controlled by student, since to do one task or multiple tasks at the same time is more a personal choice than induced by teachers. Of course, when the student works alone at home, the supervision of the work is not so demanding, cultivating the degree of responsibility that student must carry. When studying alone, at his home, the way to organize

the study is far the most weak aspect that we can find in students. If the student doesn't have a plan in order to structure the study then he can skip some important objectives and disregard valuable items that could help to improve their own way of reasoning.

The sociological preferences like working alone or in group, or creating routines, patterns of study, when the student is working at home are converging mostly to the "alone" case, using a personal routine and very own pattern of work. But this handicap can be easily trespassed if the student as some way of connection to the internet or any kind of mobile communication. Of course, these kinds of variables are the ones that are reinforced through the use of e-learning methods. Using the new technologies the student have the opportunity to work with his pairs, participating in working groups, and also have the guidance of teachers, since the materials are available at a repository that can be accessed by the student. The advantage of being at home is that study can have more time to understand other ways of working in some subject, adapting other patterns of behaviour from other students, without being afraid of criticism from others. He can do a progressive study at his own pace and rhythm. The student has the tendency of sharing his knowledge only he has sure that he is capable of defending the structure of reasoning at least. The self-confidence can be worked without the interference of others.

The Physical preferences also can be totally controlled by student at home, since he can adapt the perceptual variables, like vision, audition, tactile, etc, connected with the human senses, to his own environment. He can drink at the same time while studying if he wants, or chew gum, that is formal forbidden in regular school. He can choose the time of the day to start and end study, that he feels more comfortable. The student also, when at home, does not need to stand seated all day long, since he can move around a place and interact with it when he feels appropriate to do so. Humans like to have a very wide range of free mobility, so to enjoy it during the process of study can improve the "like" process during some hard aspects of learning. It is not in vain that the most common social networks have a "like" switch that the users can interact. It mimics the process of touching, and moving around the neighbourhood place of the user. Rarely when we study something we are stopped and quiet... we need to move, to have some movement during the process of learning.

The psychological variables are the ones that benefit most when the student studies at home, because in case of some kind of handicap, the student doesn't need to share it with others. He can be analytic or global during the study, orientating the study in order to adapt his own capacity of learning. Also, when it is needed to share opinions, it can be done without

the hurry and stress factors that we can find in a regular class room, at schools.

The existing system

At University of Azores, most teachers follow a traditional teaching model in classroom mode, based on copies of the lectures content being made available to students through the Moodle learning management system. This system is also used to support activities such as the reception of home works and answering to quizzes.

Separately, there is the possibility of synchronous transmission to other *campi*, or poles of the Azores University, of the classes taking place in one of the *campus* with the use of a video conferencing system with terminal equipment located in appropriated rooms distributed by the three *campi*. The number of lessons simultaneously transmitted by video conference is reduced due to the very limited bandwidth provided by the ISDN connection, used by this system. At present, these classes cannot be recorded for later release to interested students.

It is not institutionalized the use of web conference, between the teacher and a small group of students, to support the implementation of learning activities. The access of students and teachers to the Moodle system through the Internet, outside the local network of a *campus*, is very conditioned to the reduced bandwidth available in the interconnection of the University of Azores network to the Internet.

Architecture of the fb-learning system

Our proposal is an integrated flipped-broadcast learning system that combines synchronous (or live) and asynchronous (or deferred) video communications and a learning management system in a central location (*campus*) to which other node locations (*campi*) are connected and communicate with via a network infrastructure.

The symmetric group or multipoint video conference system will enable student classes in a remote location to synchronously attend lectures transmitted from another location and to interact with the teacher.

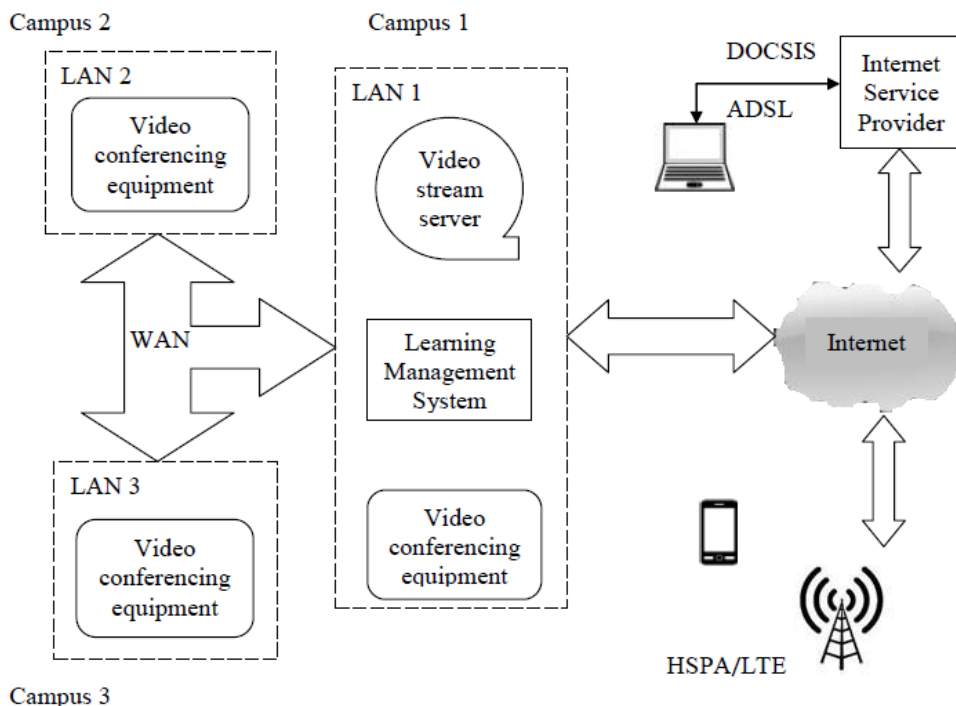


Figure 2: Flipped-Broadcast Learning Model

With the potential of this system we will have at our disposal the means necessary to implement the flipped learning method, figure 2: early disclosure to students of lectures, conducting online tutorials sessions for the whole class or small groups of students and the delivering of supporting materials to completion of learning activities.

The previously recorded lectures and tutorials transmitted by video conference sessions will be placed in a stream server become available for viewing by students that not had the opportunity to watch online or to review the content covered.

These videos will be available through the used learning management system (Moodle) in conjunction with the other resources of a curricular unit.

The various streams can be played on desktop computers or mobile devices connected to the LAN campus, using the players compatible with the formats of video files and suitable for standard delivering systems available for free.

In their homes, students also have access to videos with recorded lessons by choosing the appropriate stream according to the bandwidth available through existing Internet connection.

At each *campus* there will be an optical fibre backbone that will connect the networks of the various buildings, which uses an Ethernet technology at 1 Gbps.

To obtain the maximum efficiency between the various network *campi* and to the outside public network, it is necessary connections with bandwidth up to 1 Gbps, like the ones proportionate to other national universities, which could be obtained with the use of optical fibre ring that already connects the islands of the Azorean archipelago.

The bandwidth needed for video transmission over data communication network is conditioned by three factors: 1- the number of still images (frames) transmitted per second; 2- the resolution of each image (the number of pixels); 3- the number of possible colours for each pixel (colour depth). For medium-quality video transmission, with a resolution of 640×480 pixels, 16-bit colour, 20 frames per second (fps), it is necessary a bandwidth approximately equal to 100 Mbps (640×480×16×20). This previous values would have to be multiplied by the number of simultaneous connections and would originate a very high bandwidth consumption, would result in unaffordable values that could hardly be supported by the capacity of today's networks with existing technology.. To reduce the required bandwidth, the video will be compressed decreasing the colour depth or the number of frames per second, or both, until values are obtained compatible with the characteristics of the networks used.

The bandwidth values typically required for synchronous multipoint video conferencing systems are around 2 Mbps, multiplied by the number of links from one point to all others.

For transmission by streaming the requested bandwidth is 1Mbps for each connection because it is not necessary to support two-way communications, as in the case of video conferencing.

These bandwidths are within the amounts provided by broadband ADSL and DOSIS connections from homes to the Internet, Wi-Fi offered by public hotspots and through the 4G mobile networks, in the latter case, with considerable costs.

This way, we could implement the fb-learning process, supported with a network infrastructure presenting these characteristics.

Conclusion

Our proposal of a learning support system is suitable for modalities of classroom learning and long distance, with it have foundations in the flipped learning method, supported by learning management software and taking advantage of the communication facilities provided by modern computer networks. It was demonstrated that combining these various components we can meet the needs of students scattered throughout the islands of the archipelago using innovative methods that make more efficient learning, motivate students and lead to better results. The teachers, who have some preparation in the e-learning methods, have skills to implement the

proposed method, since it is a possible upgrade of them. The latest technologies that equip the modern networks with strong video transmission capability permit communications between stakeholders in the learning process, which facilitates the integration of interdisciplinary knowledge and learning in the various systems.

The strategic decision making to allocate the material resources to support the feasibility of this distance teaching proposal is conditioned, in a way, by the high implementation costs. So, with these high costs that the University of Azores cannot afford because of other costs resulting from its condition of insular university, prevents to take advantage of the resources that are available to other Portuguese universities because of a political decision. A modification of mentalities is required to change this situation. There are resources available and already implemented in other enterprises that could be available and shared with the Azores University.

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COMPATIBLE TOTAL ORDERS ON $BR(G, \theta)$, WHERE G IS THE GROUP OF POLYNOMIALS WITH USUAL ADDITION

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Abstract:

In this paper we define a compatible total order on the set of all polynomials with real coefficients and finite degree. We use the order defined on the Bruck-Reilly extension $BR(G, \theta)$ for that purpose.

Keywords: Bruck-Reilly extension, Compatible total order, Polynomials

Introduction

We shall assume that the reader is familiar with the basic definitions and results concerning semigroups. In particular, we shall assume familiarity with the basic results on regular and inverse semigroups. These results and other undefined terminology can be found in [2].

Let G be a group and θ an endomorphism of G . Let $BR(G, \theta)$ be the Bruck-Reilly extension of G defined by θ . The elements of $BR(G, \theta)$ have the form $b^r g a^s$, with $g \in G$ and $r, s \in \mathbb{N}^0$. The multiplication is defined by $b^r g a^s \cdot b^u h a^v = b^{u \vee s - s + r} \theta^{u \vee s - s}(g) \theta^{s \vee u - u}(h) a^{s \vee u - u + v}$, with $\theta(g) = agb$, for all $g \in G$.

The relation \leq_G

Let $P(x) = \{a_0 + a_1x + a_2x^2 + \dots + a_nx^n, a_n \neq 0\}$ be the set of all polynomials with real coefficients and finite degree. The set $P(x)$ with the usual addition is a group that we will call G . Define the function $\theta: P(x) \rightarrow \mathfrak{R}$, that transforms each $f \in P(x)$ in $\beta(f) = a_n$, with $a_n \neq 0$ and $a_j = 0, j > n$.

Let us define on G the relation $f \leq_G g \Leftrightarrow f = g$ or $\beta(g - f) > 0$.

Theorem: *The relation \leq_G is a compatible total order on G .*

Proof.

We will begin by showing that \leq_G is a partial order.

It is trivial to show that the relation is reflexive and symmetric. To prove transitivity, suppose that $f \leq_G g$ and $g \leq_G h$. We will study the different cases that can occur:

1) $f = g = h$

In this case transitivity is trivial.

2) $f = g$ and $\beta(h - g) > 0$

Since $f = g$ and $\beta(h - g) > 0$, then $\beta(h - f) > 0$ which implies that $f \leq_G h$, by the definition of \leq_G .

3) $\beta(g - f) > 0$ and $g = h$

The proof of this case is analogous to case 2.

4) $\beta(g - f) > 0$ and $\beta(h - g) > 0$

Let

$$g - f = a_0 + a_1x + a_2x^2 + \dots + a_nx^n, \text{ with } a_n > 0, \text{ and}$$

$$h - g = b_0 + b_1x + b_2x^2 + \dots + b_mx^m, \text{ with } b_m > 0.$$

Suppose that $n > m$. Then,

$$h - f = (h - g) + (g - f) = (a_0 + b_0) + (a_1 + b_1)x + \dots + (a_m + b_m)x^m + \dots + a_nx^n,$$

where $a_n > 0$ by hypothesis. Then $\beta(h - f) > 0$, which implies that $f \leq_G h$.

If, on the other hand, $n < m$, we have

$$h - f = (h - g) + (g - f) = (a_0 + b_0) + (a_1 + b_1)x + \dots + (a_n + b_n)x^n + \dots + b_mx^m,$$

which implies that $\beta(h - f) > 0$, since $b_m > 0$. Then $f \leq_G h$.

If $n = m$, we have

$$h - f = (h - g) + (g - f) = (a_0 + b_0) + (a_1 + b_1)x + \dots + (a_m + b_m)x^m.$$

Since $a_m, b_m > 0$, then $a_m + b_m > 0$, i.e., $\beta(h - f) > 0$, and then $f \leq_G h$.

So the relation is transitive.

Consequently \leq_G is a partial order relation on G .

To show that is a total order suppose that $f >_G g$. Then $f \neq g$ and $\beta(g - f) < 0$. Therefore $\beta(f - g) > 0$, which implies that $g \leq_G f$ by the definition of \leq_G .

To show that \leq_G is compatible, suppose that $f \leq_G g$, i.e., $f = g$ or $\beta(g - f) > 0$. We have to show that $f + h \leq_G g + h$.

If $f = g$ the proof is trivial since $f + h = g + h$.

If $\beta(g - f) > 0$ then $\beta[(g + h) - (f + h)] = \beta(g - f) > 0$, therefore we have that \leq_G is a compatible total order on G .

Using the Bruck-Reilly extension $BR(G, \theta)$

Define on G the endomorphism θ , such that $\theta(f) = \frac{df}{dx}$ and consider the Bruck-Reilly extension $BR(G, \theta)$ such that the morphism $\phi: BR(G, \theta) \rightarrow Z$, defined by

$$\phi(b^r g a^s) = s - r$$

is isotone, using the usual order on integers.

In [1], we have that the relation

$$b^r g a^r \leq_N b^s h a^s \Leftrightarrow \begin{cases} \theta^{s-r}(g) \leq_G h & , \text{if } s \geq r \\ g < \theta^{r-s}(h) & , \text{if } s < r \end{cases}$$

defined on $N = Ker\phi = \{b^r g a^r, r \in \mathbb{N}^0\}$ is a compatible total order on N .

We also have in [1], the compatible total order on $BR(G, \theta)$ defined by:

$$b^r g a^s \leq_N b^m h a^n \Leftrightarrow s - r < n - m \text{ or}$$

$$\begin{cases} s - r = n - m & \text{and } r > m \text{ and } g <_G \theta^{r-m}(h) \cdot \\ & \text{or } r \leq m \text{ and } \theta^{m-r}(g) \leq_G h \end{cases}$$

We will translate this relations to the set $P(x)$.

Let

$$g = a_0 + a_1x + a_2x^2 + \dots + a_nx^n, a_n \neq 0,$$

and

$$h = b_0 + b_1x + b_2x^2 + \dots + b_mx^m, b_m \neq 0,$$

be two polynomials of degree n and m , respectively.

On the case $s \geq r$, we have

$$\theta^{s-r}(g) = \frac{d^{s-r}}{dx^{s-r}}(a_0 + a_1x + a_2x^2 + \dots + a_nx^n)$$

$$= \begin{cases} 0 & , \text{if } s - r > n \\ \sum_{j=0}^{n-(s-r)} \frac{(s-r+j)!}{j!} a_{s-r+j} \cdot x^j & , \text{if } s - r \leq n \end{cases}$$

Using the compatible total order defined on G , we have:

$$\theta^{s-r}(g) \leq_G h \Leftrightarrow \begin{cases} \frac{d^{s-r}}{dx^{s-r}} g = h \\ or \\ b_m > 0 & , if m > n - (s - r) \\ or \\ b_m > \frac{n!}{[n - (s - r)]!} \cdot a_n & , if m = n - (s - r) \\ or \\ a_n < 0 & , if m < n - (s - r) \end{cases}$$

Analogously, in case $s < r$:

$$\begin{aligned} \theta^{r-s}(h) &= \frac{d^{r-s}}{dx^{r-s}}(b_0 + b_1x + b_2x^2 + \dots + b_mx^m) \\ &= \begin{cases} 0 & , if r - s > m \\ \sum_{j=0}^{m-(r-s)} \frac{(r-s+j)!}{j!} b_{r-s+j} \cdot x^j & , if r - s \leq m \end{cases} \end{aligned}$$

and using again the order on G , we have:

$$g \leq_G \theta^{r-s}(h) \Leftrightarrow \begin{cases} g = \frac{d^{r-s}}{dx^{r-s}} h \\ or \\ a_n < 0 & , if n > m - (r - s) \\ or \\ \frac{m!}{[m - (r - s)]!} \cdot b_m > a_m & , if n = m - (r - s) \\ or \\ b_m > 0 & , if n < m - (r - s) \end{cases}$$

The order on $N = Ker\phi$ is

$$b^r ga^r \leq_N b^s ha^s \Leftrightarrow \begin{cases} s \geq r \begin{cases} \frac{d^{s-r}}{dx^{s-r}} g = h \\ or \\ b_m > 0 & , if m > n - (s - r) \\ or \\ b_m > \frac{n!}{[n - (s - r)]!} \cdot a_n & , if m = n - (s - r) \\ or \\ a_n < 0 & , if m < n - (s - r) \end{cases} \\ s < r \begin{cases} g = \frac{d^{r-s}}{dx^{r-s}} h \\ or \\ a_n < 0 & , if n > m - (r - s) \\ or \\ \frac{m!}{[m - (r - s)]!} \cdot b_m > a_m & , if n = m - (r - s) \\ or \\ b_m > 0 & , if n < m - (r - s) \end{cases} \end{cases}$$

that we will call (i).

Now we can define the compatible total order on Bruck-Reilly extension $BR(G, \theta)$. Therefore

$$b^r ga^s \leq b^u ha^v \Leftrightarrow \left\{ \begin{array}{l} v-u > s-r \\ v-u = s-r \text{ and } \left\{ \begin{array}{l} \theta^{u-r}(g) \leq_G h \text{ , if } u \geq r \\ g <_G \theta^{r-u}(h) \text{ , if } u < r \end{array} \right. \end{array} \right. ,$$

Which we can translate by:

$$b^r ga^s \leq b^u ha^v \Leftrightarrow v-u > s-r$$

or

$$v-u = s-r \text{ and } u \geq r \text{ and } \left\{ \begin{array}{l} \text{or } \frac{d^{u-r}}{dx^{u-r}} g = h \\ \text{or } b_m > 0 \text{ , if } m > n - (u-r) \\ \text{or } b_m > \frac{n!}{[n-(u-r)]!} a_n \text{ , if } m = n - (u-r) \\ \text{or } a_n < 0 \text{ , if } m < n - (u-r) \end{array} \right.$$

or

$$v-u = s-r \text{ and } u < r \text{ and } \left\{ \begin{array}{l} \text{or } g = \frac{d^{r-u}}{dx^{r-u}} h \\ \text{or } a_n < 0 \text{ , if } n > m - (r-u) \\ \text{or } \frac{m!}{[m-(r-u)]!} b_m > a_n \text{ , if } n = m - (r-u) \\ \text{or } b_m > 0 \text{ , if } n < m - (r-u) \end{array} \right. ,$$

where n and m are the degrees of g and h , respectively. We shall call this expressions (ii) and (iii), respectively.

Example

For a better understanding of the order relation we shall consider the polynomials g and h :

$$g = 1 + 3x - x^2 + x^3 + x^4 \text{ and } h = 1 + 2x - x^2 + 5x^3,$$

with degrees $n = 4$ and $m = 3$, respectively.

Using the compatible total order defined on G , we have that $h \leq_G g$, since $\beta(g-h) = 1 - 0 > 0$.

Consider the elements of $N = \ker \phi$, $b^3 ga^3$ and $b^5 ha^5$. We have $b^3 ga^3 \leq_N b^5 ha^5$ because, using (i) defined on N , $s = 5 > r = 3$ and $b_3 = 5 > 0$.

Let us consider now two elements of $BR(G, \theta)$, $b^3 ga^2$ and $b^4 ha^3$.

It is easy to show that $b^3ga^2 \leq b^4ha^3$, since $v - u = 3 - 4 = s - r = 2 - 3$ and $u > r$. Therefore, using (ii), $m = 3 = n - (u - r) = 4 - (4 - 3)$ and $b_3 = 5 > \frac{4!}{[4 - (4 - 3)]!} \cdot a_4 = 4.1$.

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THE NEED OF INTERDISCIPLINARITY APPROACH ON LANDSLIDES RESEARCH IN ROMANIA

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Abstract

According to the World Atlas of Natural Hazards (McGuire et al., 2004), the landslides are the most frequent and worldwide developed natural hazard. It can occur on any type of terrain where exist the proper conditions concerning the soil or bedrock, groundwater and slope. The landslides usually occur accompanying the other natural hazards like heavy rainfall, floods and earthquakes. In time, all subgroups of natural hazards (cosmic, geological, hydro-meteorological and biological) have been recorded in Romania. Types of natural hazard are very numerous (over 67). But five from the most important hazards, regarding the number of dead or affected persons, or economic damages, are the earthquakes, floods, droughts, excessive temperatures and landslides (Marinescu et al., 2010). Actually, the landslides affect strong many country's regions. The high frequency of

landslides on land have great importance in the evolution and shaping of the landscape. Large areas of agricultural land suffered from landslides which also damaged various buildings both in villages and cities, and destroyed roads, railways, etc. Damage in industrial areas is also important. Landslide terrains could seal some running rivers causing partial or total blocking of leakage. The landslide research involves considerable human and financial efforts. Being on very complex process, its survey implies the using of many scientific disciplines. The need for interdisciplinary approach within the landslides, who to conduct at better knowledge and, finally at more adequate stabilization solutions, is the main objective of this paper.

Keywords: Landslides, approach methods, mapping, interdisciplinarity, Romania

Introduction

The processes represent a succession of states, stages, phases and mechanisms generated by factors or agents specific to the slope system or external, which are manifested at a certain moment in time, as a result of a surplus of energy and matter, determining the evolution, transformation or even shifting into another system, in the tendency to reach a level of balance. In the case at hand, what is important is represented by the geomorphologic, hydro-geological and anthropogenic processes. The geomorphologic processes (geomorphic processes) are mechanisms generated by shaping agents (internal or external) which lead to the shaping of the landform thru gravitational processes: landslides, rock-falls, settlements and hydrodynamics: erosions – accumulations, and climatic. Hydrogeological processes: infiltrations, suffusions, pollution and anthropogenic processes: fillings, excavations, slope cu, anthropogenic settlements, terrain overload, lack of drainage, seepage damage.

Romania is one of the countries whose territory is exposed to geomorphologic processes landslide type. The researchers investigate from their perspective, different aspects of landslides, but the landslides are most complex systems with a special dynamic.

Depending on the specific methods to each environmental research areacanbe identified only certain aspects of movement mass or in a wider perspective, of slope system shaped by landslides researched.

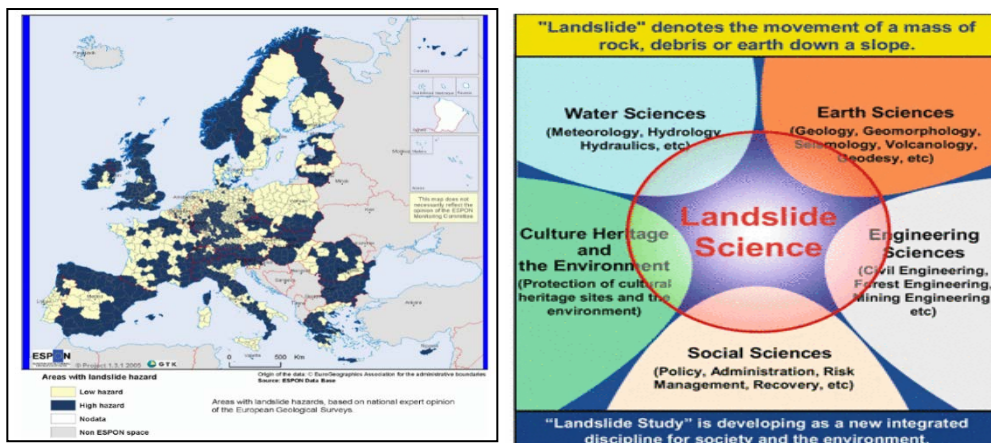


Fig 1 Area with landslide hazard (left), Source: EPSON (European Spatial Planning Observation Network) project <http://www.gtk.fi/projects/espon/Landslides.htm>; Landslide science as a new integrated discipline(right) (Sassa, 2007)

An attempt above landslides interdisciplinarity approach (which he considered as a new scientific discipline) is made by Sassa (2010), indicating five groups of scientific area which do contribute: earth sciences, water sciences, engineering sciences, heritage cultural and environmental, social sciences (fig 1). Many of the disciplines that contribute to landslides study are presented below. The need for interdisciplinary approach within the landslides is the main objective of this paper, because cases were identified in which they were less durable improvement on exposed slopes of sliding, in conditions which were investigated only a few aspects of land or the environment.

Interdisciplinary research lies in the multitude of peculiar aspects of landslides related to the shape, size, intensity of displacement mechanisms, which highlighted the diversity and regionalization of landslides types in Romania. This country has a great diversity of landform units arranged in the form of concentrically tiered steps, the highest steps – the Romanian Carpathians in the center, then the Sub-Carpathians towards the exterior, the plateaus and plains on the periphery of the territory. The Carpathians appear not as a compact structure, but in the shape of an arc (Carpathians Arc), composed of three branches, the Eastern, Southern and Western Carpathians, which comprise within them a great depression area, the Transylvanian Plateau (Andra-Toparceanu, 2015). In the regions with high potential for slipping 50% of the total slope surface is affected by gravitational movement mass (Posea, Popescu, Ielenicz, 1974), some of them old (Pleistocene), others actual.

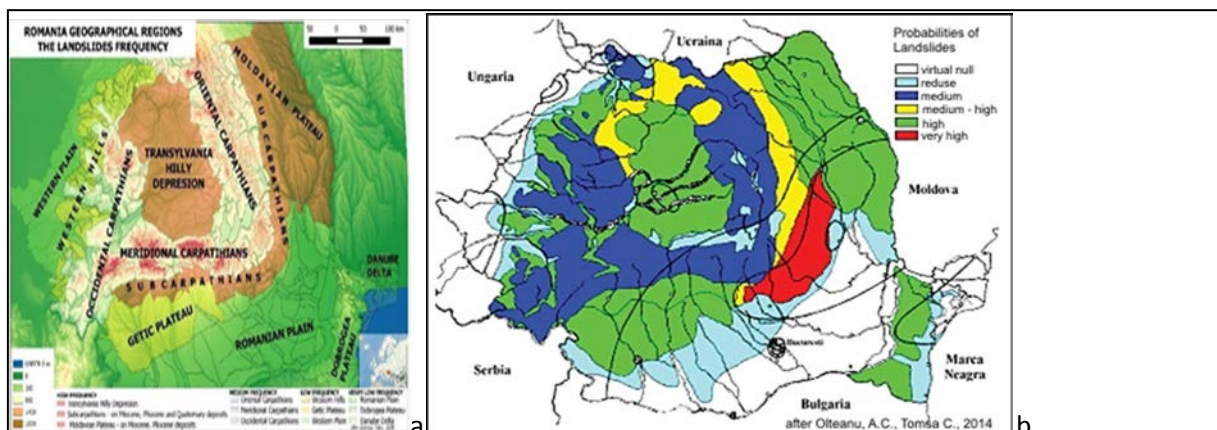


Fig 2. Geographic regionalization after landslide densities and frequency map (a) (modified Ielenicz, Patru, 2005) and probabilities of landslides in Romania map (b) (Olteanu, Tomsa, 2014)

The deep landslides are common in Transylvania Hilly Depression with regional name „glimee“, triggered in Sarmatian and Pliocene deposits (layer, diapiric dome structure) and extending over large areas, with 5 – 6 km lengths and 2 - 4 km widths: Saschiz (6,15 km²), Movile, Saes (15,50 km²). In Moldavia Plateau region the landslides with a strong structural character have different shapes furrows, lenticular or sliding shaped in “nest”, stepped in waves, mixed or complex, earthflow (Bacauanu, 1968). In the Eastern Carpathians flysch and Subcarpathians a lithological variety of folded structure cause massive landslides, block slides and rockfalls. In the Subcarpathians the most common are linear slides and the earthflow or mudflow (Chirilesti) and furrows.

The complementarity of methods in landslide science

Every applied method can bring new specific knowledge data, contributions at better research of the landslides, finally at better stabilization solutions. The multidisciplinary approach to solve problems connected with landslides is one of the most difficult but it is also the most suitable for planning a correct land use (Squarzone et al., 2006).

Remote Sensing and air-photogrammetric methods

Geographical and superficial geological data can be retrieved and processed with the help of aerial photographs, orthophotoplans, satellite images, regarding the landslides micro-morphology, morphological surface roughness, texture, soil moisture or deposits, by their reflectance, type, land cover and phenophases vegetation. Through GIS data about geographical

viewed, the measurements and the interpretations geographical data (analyzed vector and raster type) generates new data (Mihai, 2007) that can be combined with surveying and mapping geomorphologic and geological investigations to identify aspects that characterize the slope slide system.

Topographic measurements

First base in geomorphologic and geological mapping is composed of topographic maps 1: 25,000 topographic plans or 1:10000 and 1:5000, but landslides are earth or rock mass that slide on slope, accordingly to the move mechanisms product that trigger or reactivate the morphological surfaces and topographical data of land no longer correspond to those recorded on maps and plans edited. Consequently, topographic survey are needed to identify the extent, distances that have moved some volume masses, scale vertical steps or movements of the waves, the relative altitude of micro-depression sliding or lakes slipping, sliding contour and configuration in general and specific sectors in detail.

Geomorph indices / parameters geomorphologic methods

The important parameters analyzed in order to investigate landslides and the type of vulnerability for an efficient technical solution of landslides consequences are the hypsometry or the depth of the fragmentation / the vertical fragmentation of the landform, and slopes / geo-declivity, drainage density / horizontal fragmentation, the landform's curvature etc., which usually have high values in such cases; other geomorphometric indices: aspect, analytical hill-shading; plan curvature; profile curvature; convergence index; wetness index; LS-factor; potential incoming solar radiation; terrain ruggedness index, etc.

The vertical fragmentation expresses the intensity or profundity that the linear or vertical erosion has reached, generated by the flowing water agent and is equivalent with the difference of altitude between the points from within a territory, situated in different positions one in relation to the other (unit of measurement: m/km^2).

Basically, this parameter highlights the limits from which the landform energy intervenes in the landform's breaking of the balance; to the same extent, it is responsible in relation to the lithostructural nature for the triggering and maintenance of the morphodynamics, and for the intensity of the geomorphological processes (Grigore, 1979).

The slope / geo-declivity is a geometrical notion pertaining to topographical surfaces and the parameter that quantitatively expresses the value of the angle created by the morphological surface with the horizontal axis of the place: it represents the potential factor upon which the genesis, dynamics and evolution of geomorphological processes all depends, [°, % or

‰). The relationship between density drainage, vertical fragmentation depth and geo-declivity projecting surface morphology, the last parameter is the potential factor of which depend triggering, dynamics and evolution of geomorphological processes (Grigore, 1979). Certain values of the slopes are considered as critical thresholds for certain processes, including the sliding type. In the above example can be remarked favoring sliding, Momaia, AG. , by the 7 - 20° range values slopes (Fig 3, b).

Density drainage parameter reveals the discontinuity degree of morphological surfaces, into horizontal plan, modeling as a result of external agents (Grigore, 1979). Horizontal fragmentation consists, in fact in alternating valleys and interfluvial spaces, and its value can be calculated by total length of the river system per unit of measurement [km / km^2]

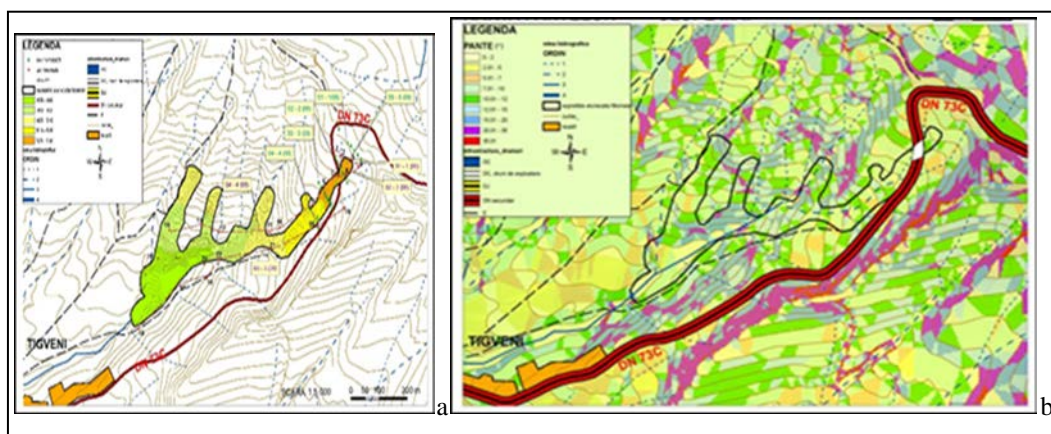


Fig 3. Hypsometry (a) and slope maps (b) of Momaia landslides (Andra, Maftciu, 2007, 2008)

Geomorphological processes like landslides are in relationship with the degree of density drainage, being favored by its high values, while revealing dynamic intense hydrodynamic processes including them on the hydrogeological processes. Density drainage map may underliethe morphological surfaces forecasting with intense morphodynamics(fig 4.b). Geomorphological maps are transmitters of information about the form, origin, relative age and distribution of landforms together with their formative processes, rock type and surface materials (Brunsdn et al., 1975). The geomorphological mappings are based on topographic maps of scale 1:25000, topographical plans of scale 1:10000 and orthophotoplans. They aimed to highlight the specific features of the landforms and their dynamics.

The geomorphologic mapping can be divided into the following stages:

a.Acquisition and pre-processing of maps: consulting and mapping landform features and processes based on topographic maps at 1:25 000 scale and 1:10 000, 1:5.000, 1:2000 scale plans or historical maps.

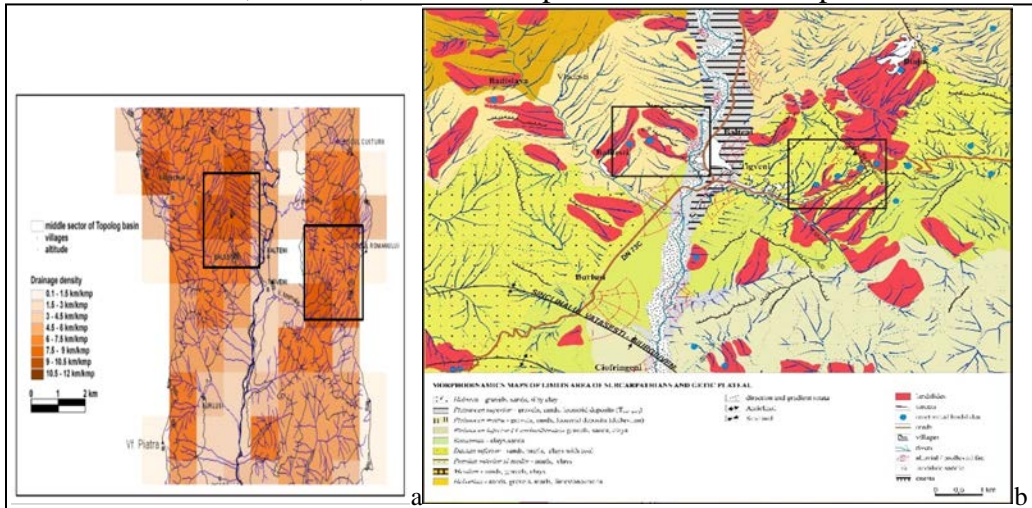


Fig.4.The relationship between drainage density, (a) (Andra, 2009) and the morphodynamic of slope and density of landslides (map) of middle sector of Topolog basin (b) (Andra, Maftciu, 2007)

b.Field investigation topo- and geomorphological survey, filling up of perception questionnaires about slides rockfalls and site degradation, morphodynamics monitoring, mapping of human impact.

c.From data interpretation, mapping the geomorphological attributes, processes and their evaluation will be made morphometrical, morphographical, superficial deposits and morphodynamical maps and also geomorphological cross sections (profiles).

d.The mentioned source data will be combined in an ArcGIS / QGIS, Saga GIS project, and interpretation data will be made in separate layers.

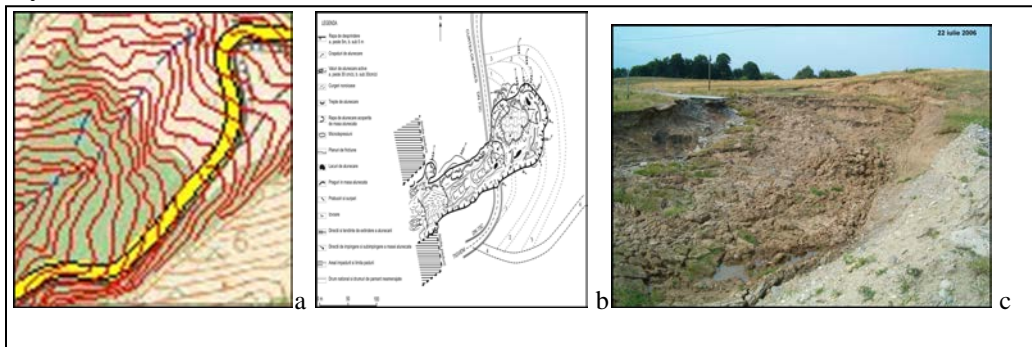


Fig.5 Topographical a) and geomorphological maps b) of a landslide upper sector from Subcarpathians, and foto c) (Andra, Maftciu, 2007)

The results are one or more geomorphological map(s) that can be integrated with information from other disciplines (geological data and maps from historical studies, archeological surveys, social attributes and will be used for further vulnerability and hazard analyses). The gravitational and hydrodynamic processes on the slope (landslides, mudflow, earthflow, debris flow, rockfalls) are generated as a result of the geomorphological conditions (of geo-declivity, fragmentation), geological, hydrogeological, bio-geographical (land cover, deforestation) meteorological. It should be noted that the same processes can also be prepared and triggered due to anthropogenic intervention. The incidence of gravitational processes is wherever lithology imposes weak resistances to mechanical forces, either through the structure or physical properties of rocks, or through the degree of decay or moistening. Furthermore, the processes can also be triggered in superficial deposits and fillings. From this point, we are reminded again about the inherence of the anthropogenic intervention and impact on the morphological surfaces. The landslide processes have preliminary causes, largely natural, imposed by the lithostructural characteristics, the slope gradient, precipitations, lines of springs. To these, in most cases, we can also add the anthropogenic factors that fulfill the role of trigger factors for the landslides: water seepage, the raising of the ground water level, the absence of measures for the control and accumulation of water, traffic, the existence of overloads on the land (buried bodies like walls) which allow differentiated movements of the terrain (Andra, 2007). Geomorphological mapping consists in representation of landforms (their genesis, type, size, etc.) and processes in their spatiality and even identify their relative age, representing thus a cartographic document on which can make forecasts on morphodynamics.

Meteorological contribution

In Romania it was estimated that the overall trend is lowering (-10%) of the annual quantities of rainfall (1901-2010), with an increase in their intensity, due to an increase in mean annual temperature values in the decade from 2000 to 2010 with 0.4- 0.5°C, over each decade from the period 1961-2010 (Sandu, 2013). Estimating climate change predicted for 2021 – 2050, the average annual rainfall in Romania, reported the range 1961 - 2010 is – 20 %. In these hypothetical conditions, rainfall intensity will increase, because it induces the idea of possible reactivation or new triggers of mass movements in the coming years. Annually, the most landslides occur in periods of maximum rain like spring and also when the snow melts or in summer period during the rapid rainfall. More important is to identify the conditions of rainfall events thresholds responsible for landslides (Mellilo et al., 2014)

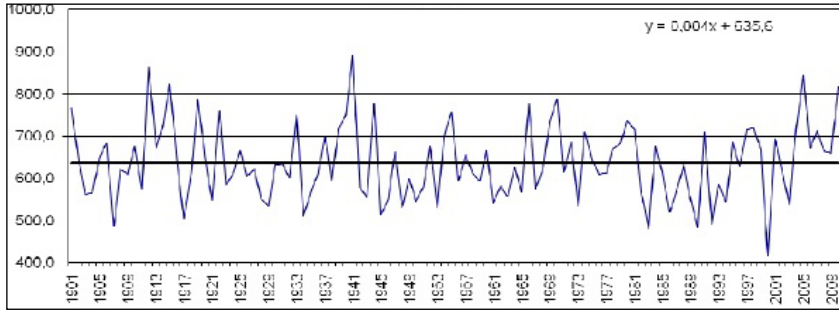


Fig. 6. Evolution of annual among rainfalls (mm) in Romania, 1901 – 2010 (Sandu, 2013)

Bio-geographic aspects

The bio-geographic agent and so much more the anthropogenic one have favored the release of the process, taking into account the deforestation, so that the landslides mass intercept the whole quantity of fallen precipitations. On the other hand, the different land cover and constructions are favoring factors of triggering and reactivation of landslides. Superficial erosion is the first installed one after deforestation, and combine with linear erosion effects which prepares the slip. The role of research on the land-use and land-cover is to identify the coverage degree, different vegetation associations, degree of

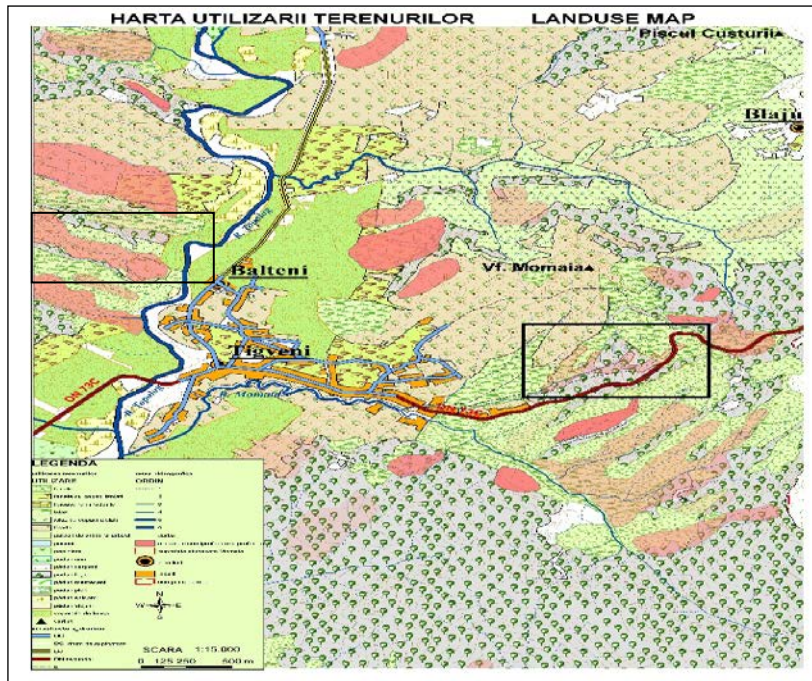
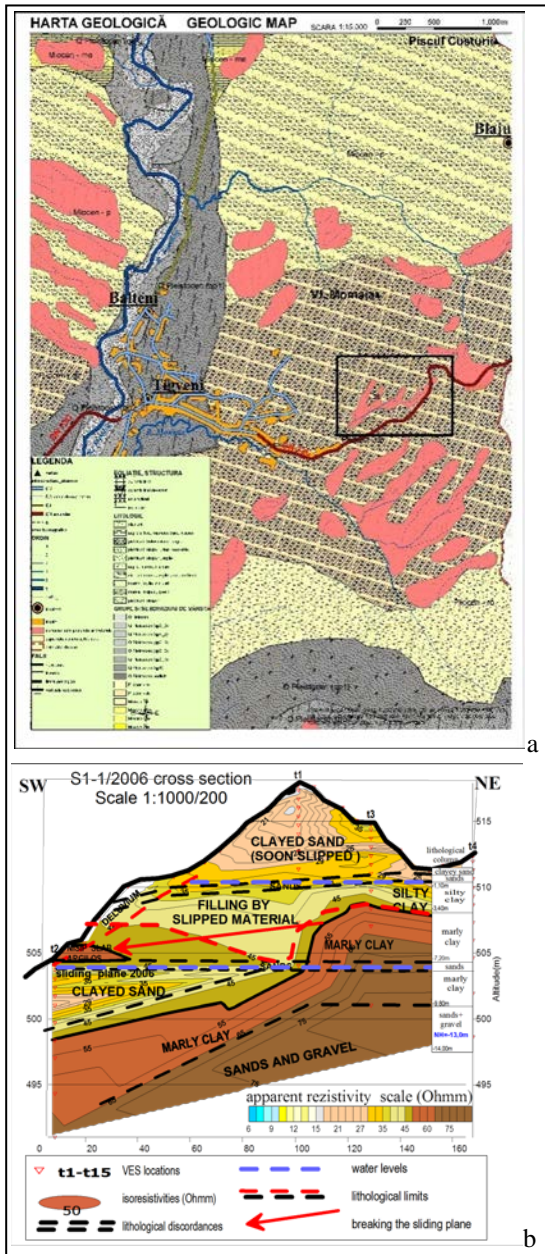


Fig.7. Land-use map and large landslides in contact area of GeticSubcarpathians and Getic Plateau (Andra, Mafteiu, 2008)

artificiality factor, type and surface area built. Such areas can be identified and potential production slips and any types of material damage in case of onset or reactivation.

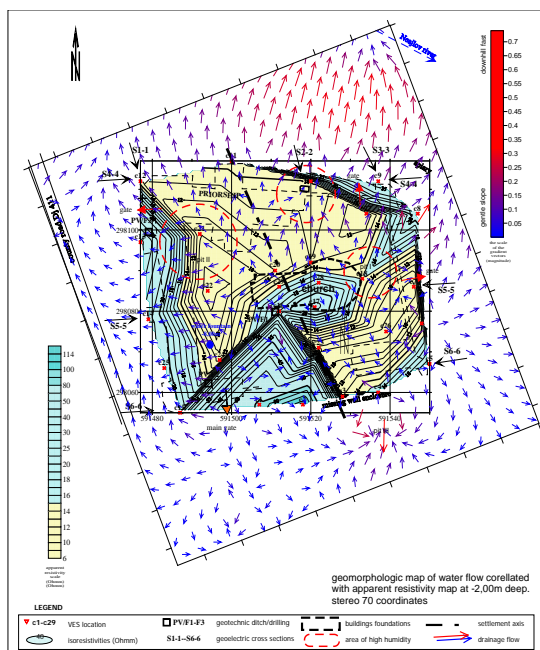
1.6. Geological methods and results



Geological settings, in surface and in depth reveal the lithological and structural peculiarity of landslides. Mapping rock strata, types of natural deposits and fillings, thickness and spatial variation, the method is interposed between morphological surface mapping and geotechnical data analysis and geophysical research.

The lithology causes in the same extend the type of slip and specific mechanisms of sliding. Lithological strata tilt is one factor that separates different categories of landslides or may accelerate the slide process.. Slips are consistent with the structure consistent lithology (Subcarpathians, Getic and Moldavia Plateau) tending to extend laterally along the line of springs.

Fig 8. Geological map and variation of landslides frequency, a) and break lithological strata and their consequences, b). (Andra, 2009, Andra-Toparceanu, Maftciu, 2015)



Slips developed subsequent layer perpendicular to the surface and in conditions of favorable hydro-geological parameters they either can have a tendency to stretch and asymmetric upstream side or often can be reactivated in case of cracks lithology less resistant layers (Balteni) (Fig 8b.). The subsequent landslides develop on the heads of lithological strata and have more roughness morphology.

1.1. Hydro-geological parameters and methods

Groundwater levels, by their action manifested in various forms (infiltration, seepage, dissolution, capillarity or hydrodynamic - suffusion, hydraulic fracture) prepare and triggers, sometimes reactivate most landslides, especially in geographical units developed on sedimentary rocks. Thus, for non-cohesive sedimentary rocks, their action is manifested by variation of pore water pressure, pressure filtration, suffusion process, modification of physical and mechanical properties, reducing pore water mineralization and nefarious raising their level. (Florea, 1978), or even liquefaction. Mapping springs, groundwater levels and vacuum

Fig.9. The infiltration direction of the groundwater flow, indicated by arrows are based on results of detailed topographic measurements, hydrogeological and geophysical survey (Andra, Maftciu, 2009, 2014).

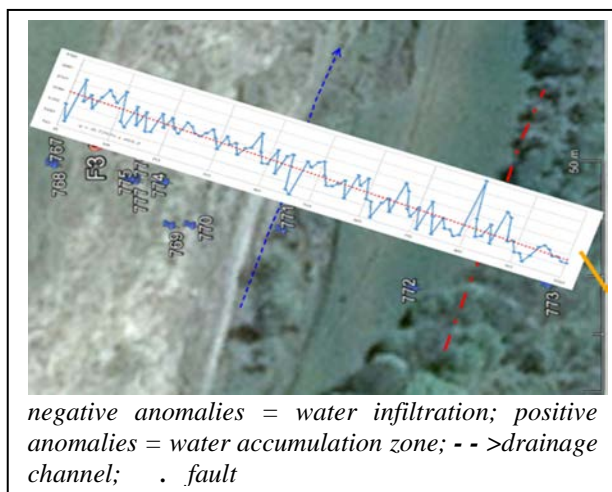
free level of overload conditions, execution of boreholes and installation of measuring instruments even identify groundwater flow gradients can be major survey hydro-geological practices and methods. Because hydro-geological measurements are local or pointed, hydro-geological methods efficiently combine with geophysical methods

1.2. Geophysical methods and their relevance

Geophysical methods are increasingly being applied to geotechnical investigations in landslides research, as they can identify material properties

and their boundaries, as well as variations in space and time of relatively large volumes of soil. Another advantage is that many of these methods are non-intrusive. The combination of several methods and the verification of their results by sampling and correlating with geotechnical methods are advisable in order to improve the reliability of geophysical investigations. In this case are commonly used the following geophysical methods; combined resistivity and time domain induced polarization (IP) two-dimensional imaging (CVES), seismic refraction plus multi-channel analysis of surface waves (MASW). (Parrales, 2003)

Sliding mass has different physical and mechanical properties of the bedrock in which, the nature, the resistance, the relationship moisture - plasticity, the degree of fissuring, etc. Highlighting these differences through different methods is an important way for understanding and tracking landslides. Geophysical measurements can outline the area with landslides and cause mass thickness and shape of the plane sliding slip. Useful results on the thickness of the aquifer, groundwater flow direction, coefficient and rate of filtration, humidity variation in mass sliding, slipping and changes the dynamic elastic properties of rocks near the sliding plane can be obtained also by geophysical methods (Radulescu, 2008).



Using also *IP and seismic measurements* one and two dimensional shear wave velocities profiles can be efficiently estimated by this method. These data are useful for landslide hazards analysis in terms of ground response prediction at ground surface and soil column. Two seismic methods could be applied, seismic refraction and the multi channel analysis of surface

Fig.10. Self-potential effect of water movement in a landslide, Balteni, Subcarpathians, (Andra-Toparceanu et al. 2015)

waves (MASW) method. These tests are performed exactly over the same line where resistivity profiling is carried out. A 24-channel Geode seismograph with 4.5 Hz - geophones is used. The effect of water movement appears also in Self-potential measurements, from source (negative anomalies) to the accumulation zone (positive anomalies). Ex. Balteni self-

potential profile, where is the accumulation of the water towards the fault from SV.

1.3. Geotechnical methods

Geotechnical mapping of landslides is done for determination of its elements, in order to gather the necessary information in order to take measures to stabilization.

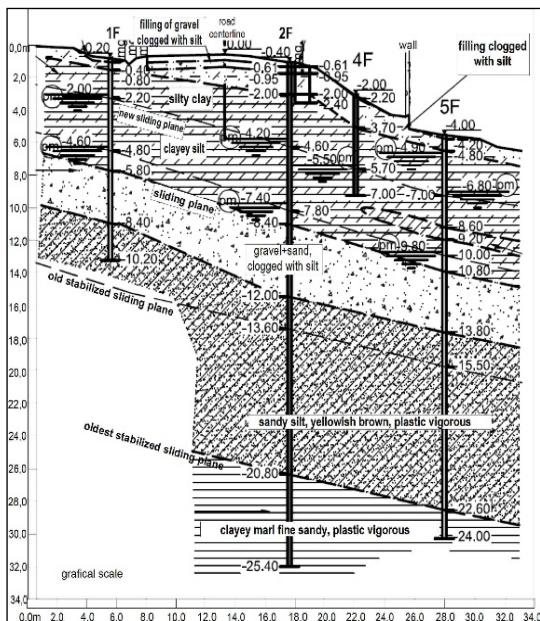


Fig. 11. Geotechnical cross-section on landslide (national road DN 10) (1F – 5F = drills)

Mapping is done through both representation on the map of mudslides and knowing all that is generate (geological formations present, lithology, tectonics, groundwater, etc.) and provides information (front of detachment, sliding terrace, sliding table, the presence of cracks, the edges of the base and sliding, sliding) on their (Florea, 1978). If in the area are numerous outcrops, the following can be solved:

estimating depth of surface slip, deciphering regional and local distribution of the sliding, the database valuable insights into setting of exposure and erosion of slip processe, establishing the causes of landslides, estimate the degree of rock alteration and alteration possibility etc.

If mapping for knowledge is made usually from sliding scales 1:10.000 or 1:5.000, measures to stabilize the sliding must benefit from a mapping at scales 1:2.000 scale 1:500 or 1:100. Geotechnical boreholes with continuous coring allow the interception of instability surfaces, water tables, faults, fissures, friction planes etc. Disturbed and undisturbed samples are taken from the boreholes for laboratory analyses. Based on data obtained from the investigation program (boreholes and field observations) and laboratory results will be realized geological – technical profiles with drawing of potential surfaces of failure (see figure.11). Based on these and making use of geotechnical parameters there are performed the stability calculus. The final result of a geotechnical research is represented by the assessment of factors that led to instability phenomena together with recommendations and design of some appropriate solutions to stabilize the affected area.

Discussions

The interdisciplinary research of landslides is imposed by heterogeneous properties (geological, hydro=geological, geo=morphological and bio-pedo-geographical) of this system. Therefore, we believe that each method adds information about morpho-dynamic system and it is essential to use specific results of each scientific field in the context of implementation of the other.

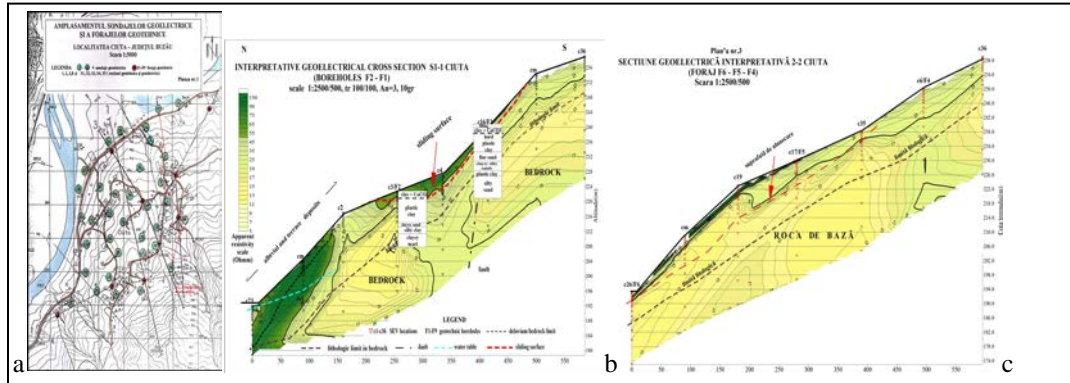
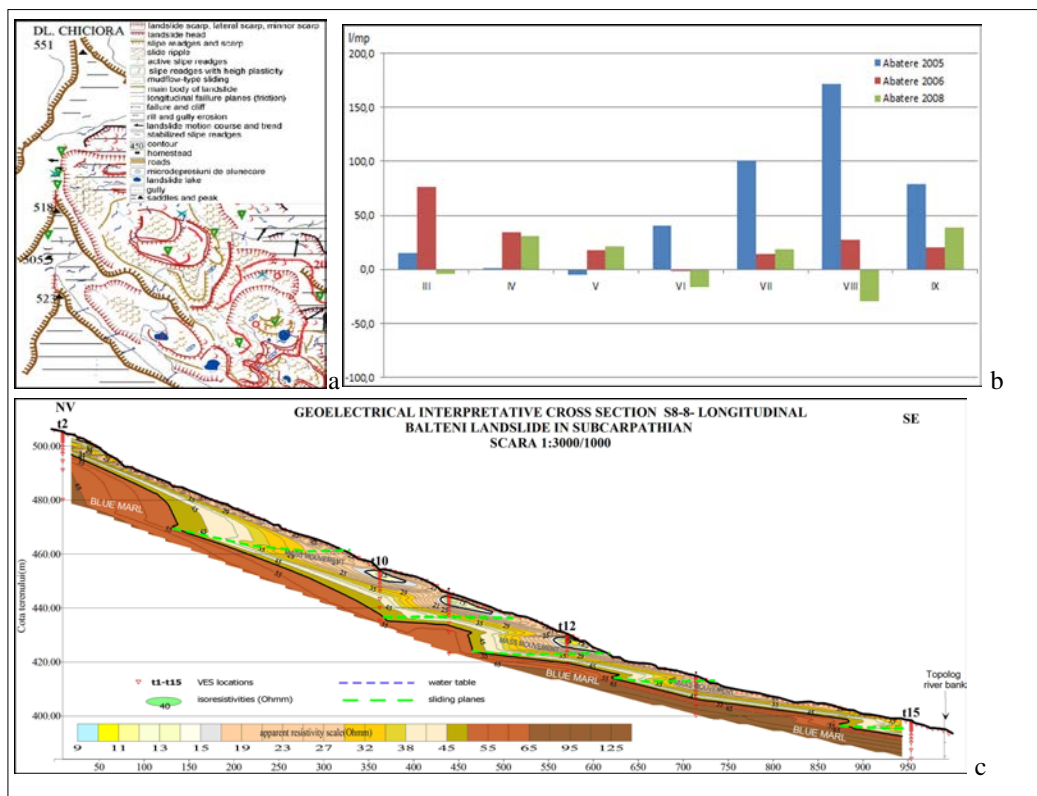


Fig.12 Topographical plan a) and geophysical cross section set on topographical profile b) and geophysical cross section set on geo-morphological direction c), Ciuta landslide

Technical measures for land rehabilitation, to repair roads damaged by landslides or other types of construction must take into account the geographical and geological information regarding landslides, but also the surrounding area. Using different methods (in the case below geophysics, geotechnical and topographical) generates at first view relevant results for a landslide (Ciuta landslide), but finds a more thorough analysis that went topographical profile of a secondary interfluvium and broke into another slip (so profile indicates two systems of sliding and not just one). Revealing morphology imposed by the slide process, showing its boundaries and its dynamics sectors is thus required, using geo-morphological profiles (and geo=morphological maps) showing the landslide micro=morphology imposed by the manifestation and evolution process to achieve of geophysical cross-sections, geological and geotechnical profiles. In case the geological data, geophysical and geotechnical with the topographical, geo-morphological, climatic, aerial survey, bio-geographic are concomitant imbricated, the landslides are usually well understood. However, there may be some issues that cannot be understood only by applying certain methods.

Fig.13. Interdisciplinary research for a landslide from Sub-Carpathians: a) from topographical measurements, remote sensing and mapping, result a very detailed geomorphological map; b) statistic rainfall data, c) geophysical and geotechnical profiles(Andra-Toparceanu et al. 2015)



For example, a landslides monitored since 2006 slipping relatively independent of rainfall variation, even that other factors remain somewhat constant. Detailed morphology of landslide and adjacent areas showed morphological aspects (rupture of slope erosion witnesses, small saddles) which determined the need of SP survey (Fig. 10, 13). The results of these measurements revealed local faults in bedrock sliding and on sliding limit, which have an important role in the circulation of groundwater and springs.

Acknowledgement

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Conclusion

The landslide, being on very complex process, its survey implies the using of many scientific disciplines. The multidisciplinary approach to solve

problems connected with landslides is one of the most difficult but it is also the most suitable for planning a correct land use.

The need for interdisciplinary approach results from many cases in which they were less durable improvement on exposed slopes of sliding, in conditions which were investigated only a few aspects of land or the environment. Every applied and analyzed method (remote sensing and air-photogrammetric, topographic, geomorphologic, meteorological, biogeographic, geological, hydro-geological, geophysical, geotechnical) can bring new specific knowledge data, contributories at better research of the landslides, finally at better stabilization solutions.

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GOLDBACH CONJECTURE: METHOD TO DETERMINE PRIME PAIRS

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Abstract

Being the Goldbach Conjecture considered the most famous conjecture unsolved, concerning prime numbers, this paper is dedicated to prime numbers, seeking to create a method to determine prime pairs for a given even number. This method, described in the paper, allows to determine a Goldbach partition for an even number, sometimes even all, in a practical and effective way, without using complex algorithms.

Keywords: Goldbach Conjecture; prime numbers; even number; Goldbach partition

Introduction

Goldbach Conjecture is a topic that had always aroused curiosity through the centuries for its apparent simplicity. However, 273 years after its first appearance in a letter sent by Christian Goldbach to Leonhard Euler in June 1742, the conjecture has not yet been proved. Neither Goldbach nor Euler could prove it, and as them, many others tried, with no result. To be fair, mainly in the last century, Number Theory has evolved due to many mathematicians, whom, in seeking to prove Goldbach Conjecture, were able to grant results also important in Number Theory.

In this paper is described a method to determine Goldbach partitions of an even number, based on the concept of prime number and prime factors.

Goldbach Partition

Goldbach Conjecture is one of the oldest problems in number theory and in all mathematics. It states:

“Every even integer greater than 2 can be expressed as the sum of two prime numbers”.

In other words:

Let a be an even number greater than 2. Then, there exist p , prime number, such that $a - p$ is a prime number.

The pair $(p, a - p)$ is called a **Goldbach partition** of a .

The following are examples of Goldbach partitions for some even numbers:

$$4 = 2 + 2$$

$$6 = 3 + 3$$

$$8 = 3 + 5$$

$$24 = 5 + 19 = 7 + 17 = 11 + 13$$

...

The method we are going to present in this paper is based on a well-known primality test and in the prime factorization of an integer.

Proposition 1: *If a positive integer $a > 1$ has no prime divisor lower or equal to \sqrt{a} , then a is prime number.*

Proof: By contraposition we must prove that: if a positive integer $a > 1$ is composite then a admits at least one prime factor $p \leq \sqrt{a}$.

Let $a > 1$ be a composite number, then it is possible to write $a = bc$, for some positive integers b and c , both higher than 1. Suppose, without loss of generality, that $b \leq c$. Then,

$$b^2 \leq bc = a \Rightarrow b \leq \sqrt{a}$$

Since $b > 1$, the Fundamental Theorem of Arithmetic assures that b has at least one prime divisor p , with $p \leq b \leq \sqrt{a}$. Given that p divides b and b divides a , we must conclude that p divides a , i.e., $p \leq \sqrt{a}$ is a prime divisor of a . Thus, a admits at least one prime factor lower than \sqrt{a} .

□

Every positive integer $a \geq 2$ can be written, in exactly one way, as a product of prime powers,

$$a = p_1^{s_1} p_2^{s_2} \dots p_n^{s_n} \tag{1}$$

where p_i is a prime factor, s_i a natural number, for $i = \{1, 2, \dots, n\}$, and $p_1 < p_2 < \dots < p_n$, by convention. This factorization is called *prime decomposition* of a .

Remark: Notice that, given a positive integer $a \geq 2$, with prime decomposition defined by (1), for any prime number p , such that $p \neq p_i$, $i = \{1, 2, 3, \dots, n\}$ and $p < a - 1$, we have that $a - p$ is not divisible by p_i , $i = \{1, 2, 3, \dots, n\}$. In fact, suppose, by reduction to the absurd, that exists p_i such that p_i divides $a - p$, then p_i divides $(a - (a - p))$, that is p_i divides p , which is an absurd, since p and p_i are distinct prime numbers.

Example 1: Consider $a = 30 = 2 \times 3 \times 5$. Calculating $a - p$, for each prime number $p < 29$, distinct of 2, 3 and 5, we have:

$$30 - 7 = 23$$

$$30 - 11 = 19$$

$$30 - 13 = 17$$

$$30 - 17 = 13$$

$$30 - 19 = 11$$

$$30 - 23 = 7$$

We observe that $a - p$ is not divisible by 2, 3 or 5.

In this case, $a - p$ always results in a prime.

Example 2: Consider $a = 70 = 2 \times 5 \times 7$. Calculating $a - p$, for each prime number $p < 69$, distinct of 2, 5 and 7, we have:

$$70 - 3 = 67$$

$$70 - 11 = 59$$

$$70 - 13 = 57$$

...

$$70 - 67 = 3$$

We observe that $a - p$ is not divisible by 2, 5 or 7.

Moreover, we can verify that, in this case, $a - p$ is a prime number or multiple of 3.

The next result is the foundation of the method to determine Goldbach partitions.

Proposition 2: Let $a \geq 8$ be an even number, which prime decomposition is written as,

$$a = p_1^{s_1} p_2^{s_2} \dots p_n^{s_n}, \text{ with } p_i \text{ prime, } i \in \mathbb{N}, p_1 < p_2 < \dots < p_n, s_i \in \mathbb{N} \quad (2)$$

and let A and B be sets defined by $A = \{p_1, p_2, \dots, p_n\}$ and $B = \{t \text{ prime} : p_1 < t < p_n \wedge t \notin A\}$.

If exists a prime number p , with $p \notin A$, such that $p \in]a - p_{n+1}^2, a - 3]$ and, for each prime $t \in B$, $a - p$ is not divisible by t , then $a - p$ is prime.

Proof: Let p be a prime number in the conditions defined.

The upper limit, $a - 3$, only limits superiorly the value of p , since if $p = a - 3$, then $a - p$ assumes the lower possible value, 3. For the lower limit, we have:

$$p > a - p_{n+1}^2 \Leftrightarrow a - p < p_{n+1}^2 \Leftrightarrow \sqrt{a - p} < p_{n+1}$$

So, $a - p$ will be a prime number if $a - p$ is not divisible by any prime number lower or equal to $\sqrt{a - p} < p_{n+1}$.

Since $a - p$ is not divisible by $p_i \in A, i = \{1, 2, \dots, n\}$, as we already observed, and by hypothesis, $a - p$ is not divisible by any prime number $t \in B$, then $a - p$ is not divisible by any prime number lower or equal to $\sqrt{a - p}$, leading to conclude, according to **proposition 1**, that $a - p$ is necessarily a prime number.

□

In case the prime decomposition of a include all prime numbers lower or equal to p_n , i.e., $B = \emptyset$, then $a - 3, a - 5, \dots, a - p_n$ are divisible by 3, 5, ..., p_n , respectively, then we can set the upper limit of the interval defined above to $a - p_{n+1}$.

We use this result to find Goldbach partitions of an even integer in the next examples.

Example 3: Consider $a = 220 = 2^2 \times 5 \times 11$. We have $A = \{2, 5, 11\}$, $B = \{3, 7\}$, $p_n = 11$ and $p_{n+1} = 13$. Therefore, $a - p_{n+1}^2 = 220 - 13^2 = 51$; $a - 3 = 217$.

In the interval $]51, 217]$, we can find the following prime numbers:

53	59	61	67	71	73	79	83	89	97	101	103	107	109	113	127
131	137	139	149	151	157	163	167	173	179	181	191	193	197	199	211

For each p in the previous list, $a - p$ is:

167	161	159	153	149	147	141	137	131	123	119	117	113	111	107	93
89	83	81	71	69	63	57	53	47	41	39	29	27	23	21	9

Removing the multiples of 3 and 7, i.e., 161, 159, 153, 147, 141, 123, 119, 117, 111, 93, 81, 69, 63, 57, 39, 27, 21 and 9, the remaining numbers are necessarily prime numbers: 23, 29, 41, 47, 53, 71, 83, 89, 107, 113, 131, 137, 149 and 167. Therefore, the following pairs:

(197,23)	(191,29)	(179,41)	(173,47)	(167,53)	(149,71)	(137,83)
(131,89)	(113,107)	(107,113)	(89,131)	(83,137)	(71,149)	(53,167)

are Goldbach partitions for 220.

Notice that some partitions are repeated: (167,53), (149,71), (137,83), (131,89) and (113,107).

Clearly, in case $a - p_{n+1}^2 < \frac{a}{2}$, we must consider the interval $]\frac{a}{2}, a - p_{n+1}]$, if $B = \emptyset$, and $]\frac{a}{2}, a - 3]$, if $B \neq \emptyset$.

In this case, all partitions of 220 were found. However, often not all the partitions of an even number are found using the interval $]a - p_{n+1}^2, a - 3]$.

Example 4: Consider $a = 60 = 2^2 \times 3 \times 5$. We have $A = \{2, 3, 5\}$, $B = \emptyset$, $p_n = 5$ and $p_{n+1} = 7$. Therefore, $a - p_{n+1}^2 = 60 - 7^2 = 11$, $\frac{a}{2} = 30$ and $a - 7 = 53$.

Since $B = \emptyset$ and $11 < 30$, the interval to consider is $]30, 53]$, which enables to determine all partitions of 60:

(31,29)	(37,23)	(41,19)	(43,17)	(47,13)	(53,7)
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Example 5: Consider $a = 3150 = 2 \times 3^2 \times 5^2 \times 7$. We have $A = \{2, 3, 5, 7\}$, $B = \emptyset$, $p_n = 7$ and $p_{n+1} = 11$. Therefore, $a - p_{n+1}^2 = 3150 - 11^2 = 3029$ and $a - p_{n+1} = 3150 - 11 = 3139$.

In this case, since $B = \emptyset$, all prime numbers in the interval $]3029, 3139]$ will give a Goldbach partition, and thus, the following pairs are Goldbach partitions of 3150:

(3037,113)	(3041,109)	(3049,101)	(3061,89)	(3067,83)	(3079,71)
(3083,67)	(3089,61)	(3109,41)	(3119,31)	(3121,29)	(3137,13)

Obviously, not all Goldbach partitions were found with the interval. For instance, 1571 and 1579 define a Goldbach partition for 3150.

In previous examples, the considered interval contained at least one prime number. In case the interval contains no prime numbers, we must set a new interval, with greater range, which contains at least one prime number p , such that $a - p$ is also prime.

Proposition 3: Let $a \geq 8$ be an even number, with prime decomposition defined by (2), and consider the associated sets A and B . Let also $k \in \mathbb{N}$.

If exists p prime, with $p > p_n$, such that $p \in]a - p_{n+1+k}^2, a - p_{n+1+k}]$, $a - p$ is not divisible by $p_{n+1}, p_{n+2}, \dots, p_{n+k}$ and, for each prime $t \in B$, $a - p$ is not divisible by t , then $a - p$ is prime.

Proof: Analogous of Proposition 2.

Example 6: Consider $a = 2048 = 2^{11}$. We have $A = \{2\}$, $B = \emptyset$, $p_n = 2$ and $p_{n+1} = 3$. Therefore, $a - p_{n+1}^2 = 2048 - 3^2 = 2039$ and $a - p_{n+1} = 2048 - 3 = 2045$.

In the interval $]2039, 2045]$, there are no prime numbers. So, according to the proposition above, one must define a new interval, with a bigger range, that contains prime numbers.

For example, assuming $k = 1$, we have $p_{n+2} = 5$ and the new interval is $]2023, 2043]$, which contains two prime numbers, 2029 and 2039. Then $a - p$ is 19 or 9. Therefore, we can define two possible Goldbach partitions: (2029,19) and (2039,9). Since 19 is not divisible by 3, the pair (2029,19) is a Goldbach partition for 2048.

As we verified, in the examples presented previously, sometimes all Goldbach partitions of an even number are determined, while in others, only a few are determined.

Given an even number $a \geq 4$ with prime decomposition defined by (2), $g(a)$ is the number of Goldbach's partitions determined by the interval $]a - p_{n+1}^2, a - 3]$ and $G(a)$ is the number of Goldbach's partitions admitted by a .

Example 7: Consider $a = 300 = 2^2 \times 3 \times 5^2$. We have $A = \{2, 3, 5\}$, $B = \emptyset$, $p_n = 5$, $p_{n+1} = 7$ and therefore, the interval to consider is $]251, 293]$. The partitions determined by the interval are:

(257,43)	(263,37)	(269,31)	(271,29)	(277,23)	(281,19)	(283,17)	(293,7)
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The missing partitions are:

(151,149)	(163,137)	(173,127)	(191,109)	(193,107)	(197,103)	(199,101)
(211,89)	(227,73)	(229,71)	(233,67)	(239,61)	(241,59)	

The missing partitions correspond to the interval $]150, 251]$.

In this case, 8 of 21 partitions were determined with the interval, so $g(300) = 8$ and $G(300) = 21$.

Clearly, if $a - p_{n+1}^2 > \frac{a}{2}$, there is no warranty that all the partitions are determined, missing the correspondent to $[\frac{a}{2}, a - p_{n+1}^2]$.

However, it is possible to indicate the upper limit of the number of partitions an even number can admit. Indeed, setting $\pi(a)$ the number of prime numbers lower than a , $\pi(a) - \#A$ represents the number of primes lower than a that are not prime factors of a , therefore, exists $\pi(a) - \#A$ prime numbers candidates to define a partition, which can determine, at most, $\frac{\pi(a) - \#A}{2}$ different partitions of a . Then, we have:

$$g(a) \leq G(a) \leq \frac{\pi(a) - \#A}{2} \quad (3)$$

The method we described, to determine Goldbach partitions of an even number, can be summarized in the following diagrams:

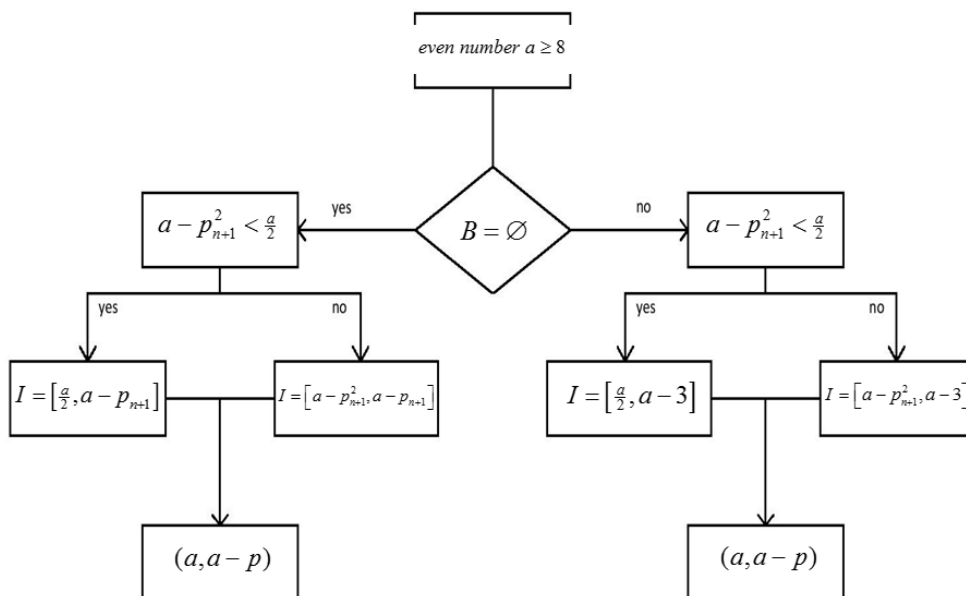


Figure 6 - Method to determine a Goldbach Partition for a given even number.

If no prime pair was found with the previous diagram:

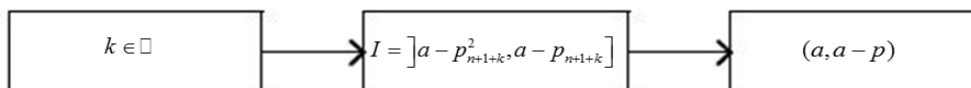


Figure 7 - Alternative interval to determine a Goldbach Partition.

We will now present examples to illustrate the different paths in the diagrams.

Example 8: Consider $a = 252 = 2^2 \times 3^2 \times 7$. We have $A = \{2, 3, 7\}$, $B = \{5\}$, $p_n = 7$ and $p_{n+1} = 11$. Therefore, $a - p_{n+1}^2 = 252 - 11^2 = 131$, $a - 3 = 252 - 3 = 249$ and $\frac{a}{2} = \frac{252}{2} = 126$.

Since $131 > 126$, the interval to consider is $]131, 249]$, where we can find the following prime numbers:

137	139	149	151	157	163	167	173	179	181	191
193	197	199	211	223	227	229	233	239	241	

For each p in the previous list, $a - p$ is:

115	113	103	101	95	89	85	79	73	71	61
59	55	53	41	29	25	23	19	13	11	

Removing the multiples of 5, i.e., 115, 95, 85, 55 and 25, the remaining numbers are necessarily prime numbers: 11, 13, 19, 23, 29, 41, 53, 59, 61, 71, 73, 79, 89, 101, 103, and 113. Therefore, the following pairs:

(139,113)	(149,103)	(151,101)	(163,89)	(173,79)	(179,73)	(181,71)	(191,61)
(193,59)	(199,53)	(211,41)	(223,29)	(229,23)	(233,19)	(239,13)	(241,11)

are Goldbach partitions for 252.

Example 9: Consider $a = 308 = 2^2 \times 7 \times 11$. We have $A = \{2, 7, 11\}$, $B = \{3, 5\}$, $p_n = 11$ and $p_{n+1} = 13$. Therefore, $a - p_{n+1}^2 = 308 - 13^2 = 139$, $\frac{a}{2} = 154$ and $a - 3 = 305$.

In this case, since $139 < 154$, the interval to consider is $[154, 305]$, where we can find the following prime numbers:

157	163	167	173	179	181	191	193	197	199	211	223	227
229	233	239	241	251	257	263	269	271	277	281	283	293

For each p in the previous list, $a - p$ is:

151	145	141	135	129	127	117	115	111	109	97	85	81
79	75	69	67	57	51	45	39	37	31	27	25	15

Removing the multiples of 3 and 5, i.e., 145, 141, 129, 135, 117, 115, 111, 85, 81, 75, 69, 57, 51, 45, 39, 27, 25 and 15, the remaining numbers are

necessarily prime numbers: 31, 37, 67, 79, 97, 109, 127, and 151. Therefore, the following pairs:

(157,151)	(181,127)	(199,109)	(211,97)	(229,79)	(241,67)	(271,37)	(277,31)
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are Goldbach partitions for 308.

Example 10: Consider $a = 30 = 2 \times 3 \times 5$. We have $A = \{2, 3, 5\}$, $B = \emptyset$, $p_n = 5$ and $p_{n+1} = 7$. Therefore, $a - p_{n+1}^2 = 30 - 7^2 = -19$, $\frac{a}{2} = 15$ and $a - p_{n+1} = 30 - 7 = 23$.

In this case, since $-19 < 15$, the interval to consider is $[15, 23]$, where we can find the following prime numbers: 17, 19 and 23. Therefore, $a - p$ is: 13, 11 or 7.

Since $B = \emptyset$, $a - p$ is prime for any p . Therefore, the following pairs:

(17,13)	(19,11)	(23,7)
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are Goldbach partitions for 30.

Example 11: Consider $a = 390390 = 2 \times 3 \times 5 \times 7 \times 11 \times 13^2$. We have $A = \{2, 3, 5, 7, 11, 13\}$, $B = \emptyset$, $p_n = 13$ and $p_{n+1} = 17$. Therefore, $a - p_{n+1}^2 = 390390 - 17^2 = 390101$, $\frac{a}{2} = 195195$ and $a - p_{n+1} = 390390 - 17 = 390373$.

In this case, since $390301 > 195195$, the interval to consider is $[390101, 390373]$, where we can find the following prime numbers:

390107	390109	390113	390119	390151	390157	390161	390191	390193
390199	390209	390211	390223	390263	390281	390289	390307	390323
390343	390347	390353	390359	390367	390373			

For each p in the previous list, $a - p$ is:

283	281	277	271	239	233	229	199	197	191	181	179
167	127	109	101	83	67	47	43	37	31	23	17

Since $B = \emptyset$, $a - p$ is prime for any p . Therefore, the following pairs:

(390107,283)	(390109,281)	(390113,277)	(390119,271)	(390151,239)	(390157,233)
(390161,229)	(390191,199)	(390193,197)	(390199,191)	(390209,181)	(390211,179)
(390223,167)	(390263,127)	(390281,109)	(390289,101)	(390307,83)	(390323,67)
(390343,47)	(390347,43)	(390353,37)	(390359,31)	(390367,23)	(390373,17)

are Goldbach partitions for 390390.

Example 12: Consider $a = 995328 = 2^{12} \times 3^5$. We have $A = \{2, 3\}$, $B = \emptyset$, $p_n = 3$ and $p_{n+1} = 5$.

Therefore $a - p_{n+1}^2 = 995328 - 5^2 = 995303$, $\frac{a}{2} = 497664$ and

$a - p_{n+1} = 995328 - 5 = 995323$.

Since $995328 > 497664$, the interval to consider is $[995303, 995323]$, where is not possible to find a prime number. Assuming $k = 2$, we have $p_{n+3} = 11$ and the new interval to consider is $[995207, 995317]$. In this interval we can find the following prime numbers:

995219	995227	995237	995243	995273	995303
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For each p in the previous list, $a - p$ is:

109	101	91	85	55	25
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Removing the multiples of 5 and 7, i.e., 91, 85, 55 and 25, the remaining numbers are necessarily prime numbers: 109 and 101. Therefore, the following pairs:

$$\overline{(995219, 109) \quad (995227, 101)}$$

are Goldbach partitions for 995328.

Conclusion

At first contact with Goldbach Conjecture, it appears like a problem that is simple to verify. Euler, in response to a Goldbach letter, affirmed the conjecture was probably true, but he was unable to prove it at that point. Certainly, Euler realized, before Goldbach, the apparent simplicity inherent to the conjecture, and probably thought Goldbach or other mathematician would, sooner or later, prove the conjecture, since it was reasonably simple to find a partition for a given even number. Still, despite the apparent simplicity, trying to prove has been fruitless, for several reasons, being the most relevant, the unpredictability and irregularity of prime numbers. Thus, Goldbach Conjecture has a hidden complexity, increased because an even number, with its prime factors, hinders any attempt to create a method or an algorithm, or even an approach to the problem, that could allow someone to prove the conjecture.

At last, the most important feature of the method described is that, for a given even number and a prime number lower to it, to verify if the difference is also a prime number, it is only necessary to verify if this difference is divisible by a set of prime numbers, which is a lot easier and faster than to verify if it is a prime number.

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SMOOTH TEMPERATURE DECREASING FOR NITROGEN REMOVAL IN COLD (9-15° C) ANAMMOX BIOFILM REACTOR TESTS

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Abstract

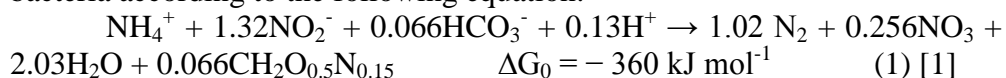
For N-rich wastewater treatment the anaerobic ammonium oxidation (anammox) and nitrification-anammox (deammonification) processes are widely used. In a deammonification moving bed biofilm reactor (MBBR) a maximum total nitrogen removal rate (TNRR) of $1.5 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.6 \text{ kg N m}^{-3} \text{ d}^{-1}$) was achieved. During biofilm cultivation, temperature was gradually lowered by 0.5° C per week, and a similar TNRR was sustained at 15° C . qPCR analysis showed an increase in *Candidatus Brocadia* quantities from 5×10^3 to 1×10^7 anammox gene copies g^{-1} TSS despite temperature lowered to 15° C . Fluctuations in TNRR were rather related to changes in influent NH_4^+ concentration. To study the short-term effect of temperature on the TNRR, a series of batch-scale experiments were performed which showed sufficient TNRRs even at $9\text{-}15^\circ \text{ C}$ ($4.3\text{-}5.4 \text{ mg N L}^{-1} \text{ h}^{-1}$, respectively) with anammox temperature constants ranging $1.3\text{-}1.6$. After biomass was adapted to 15° C , the decrease in TNRR in batch tests at 9° C was lower (15-20%)

than for biomass adapted to 17-18° C. Our experiments show that a biofilm of a deammonification reactor adapted to 15° C successfully tolerates short-term cold shocks down to 9° C retaining a high TNRR.

Keywords: Deammonification, reject water, intermittent aeration, nitrite inhibition

Introduction

The anaerobic ammonium oxidation (anammox) is a efficient method for the treatment of NH_4^+ -rich and low organic content reject water coming from anaerobic treatment occurring with the participation of anammox bacteria according to the following equation:



Anammox process can be used in moving bed biofilm reactors (MBBRs) as anammox bacteria are able to form a stable biofilm. According to [2] anammox process-based MBRRs have achieved a high total nitrogen removal rate (TNRR) ($>5 \text{ kg N m}^{-3} \text{ d}^{-1}$ ($\sim 1\text{-}2 \text{ g N m}^{-2}\text{d}^{-1}$)) at temperatures above 20°C. Also, an anammox MBBR can have up to 5 times higher TN removal efficacy than deammonifying systems [3].

Suitability of anammox biofilm system for autotrophic nitrogen removal at low temperatures has been shown through the TNRRs achieved at 10°, 15° and at 20°C (0.06, 0.1 and 0.18 $\text{kg N m}^{-3} \text{ d}^{-1}$, respectively) [4]. Most studies on temperature effect on anammox process have been done with anammox-suspended systems and they have shown that it was most efficient to treat reject water in a temperature range of 25-40 °C ([5]). Regarding these facts, we define temperatures below 20° C as moderate temperatures for nitrogen removal similarly to other authors ([4]). The optimal temperature for most mesophilic anammox organisms was 40 ± 3 °C [6]. Also, [7] showed that at temperatures below 15°C the anammox process was stopped. Studies conducted with suspended anammox systems at 20-22 °C [8] and at 15-19 °C [9] have shown high TNRRs of $8.1 \text{ kg N m}^{-3} \text{ d}^{-1}$ at 20 °C and $0.5 \text{ kg N m}^{-3} \text{ d}^{-1}$ at 17 °C. [10] have accomplished the TNRR of $6.6 \text{ kg N m}^{-3} \text{ d}^{-1}$ at only 9.1 °C by adding 10 mL highly active anammox sludge to the reactor after every 2 days. Moreover, [11] performed anammox process in an upflow anaerobic sludge blanket reactor at 30 °C and 16 °C and achieved TNRRs of $5.72 \text{ kg N m}^{-3} \text{ d}^{-1}$ and $2.28 \text{ kg N m}^{-3} \text{ d}^{-1}$, respectively yielding a value of temperature constant $K=1.93$. The growth rate of anammox bacteria is much lower (0.04 d^{-1}) at 20° C than above this temperature [4]. The latter studies with low-strength wastewaters showed an abrupt decrease in TNRR when temperature was decreased hastily.

A deammonification system- comprising partial nitrification (ammonium oxidation to nitrite) and anammox consortiums in a single process tank [12]) has typically lower building costs since two-stage systems require separate process tanks for both- nitrification and anammox processes [13]. Additional savings, comparing to a conventional nitrification-denitrification process, can be gained from less aeration (ca 60%), from the lack of demand for an organic carbon source (100%), and from decreased amount of excess sludge requiring handling. Also the emission of greenhouse gases (CO_2 , NO_x etc.) is decreased [14].

Among deammonification systems, [13] started SBR at 25 °C and then gradually lowered the operation temperature down to 12 °C during 10 days remaining stable TN removal efficiency of 90% during 300 days. De Clippeleir et al. have achieved high TNRRs at low temperature of 15 °C [15]. Lotti et al. proved that low temperature effect increased when temperature was decreased [16].

On the whole, most temperature decreasing methods have been abrupt ([9]; [13]) not gradual. By means of gradual temperature lowering anammox biomass could be adapted to a lower temperature better, although there could be problems with the elevated propagation of nitrite oxidizing bacteria (NOB) as they have higher growth rate at low temperature compared to ammonium oxidizing bacteria (AOB) ([17]; [18]). Higher NH_4^+ concentrations would inhibit NOB activity through free ammonium [14] even at low temperatures, ensuring sufficient NO_2^- in the process and NO_2^- not being oxidized into non-usable form for anammox bacteria- NO_3^- .

The anammox process is affected by substrate limitation below 10 mg TN L^{-1} as studied earlier in biofilm systems [19]. Furthermore, the anammox process can lose half of its efficiency at nitrite concentration as high as 400 mg N L^{-1} [20] and/or by low temperatures.

This research had the following aims: cultivation of biomass for efficient running of a deammonifying biofilm reactor at lower temperatures (~15 °C) by using gradual temperature lowering (0.5 °C per week) in the treatment of high-strength undiluted wastewater. To determine the effect of adapting the biofilm to different cultivating temperatures and in order to mimicry short-term cold shocks, batch-scale experiments were conducted. This research aimed to find out the low temperature at which the TNRR was still sufficient for wastewater treatment in colder regions. Also, the temperature constants of Arrhenius equation were calculated in order to quantify the temperature dependency of the anammox reaction.

Materials and methods

Continuous reactor

A 20 L plexiglass MBBR filled ~50% with polyethylene carriers (specific surface $800 \text{ m}^2 \text{ m}^{-3}$) (Aquamyc, Germany) was continuously fed with diluted reject water coming from the methane digester of the Tallinn municipal wastewater treatment plant (Estonia) having $\text{NH}_4^+\text{-N}$ content of $680 (\pm 76) \text{ mg N L}^{-1}$ and COD of $600 (\pm 200) \text{ mg L}^{-1}$ [21]. Intermittent aeration cycles with 45 min. aeration (air flow rate 665 mL min^{-1})/ 45 min. non-aeration were applied. Within aerobic cycle DO concentration fluctuated between $0\text{-}1.5 \text{ mg L}^{-1}$. HRT of 0.5-2 d was applied. A detailed description of the start-up and operation of a single-step deammonification preceding experiments (before 400 days of operation) is given in [12, 22].

The reactor was started up and operated at a temperature of 26 ± 0.5 °C for 2 years [14], then the temperature was set at 20° C for a year (see Fig. 1a, b). From 1420th day on, temperature was decreased by 0.5° C per ~week until reaching 15° C. Gradual temperature decreasing was done to adapt biomass smoothly to lower temperatures as abrupt temperature decrease ([13], [4]) causes more instabilities and lengthens biomass cultivation time.

Batch tests

60 batch tests were performed in 0.8-L volume three-necked glass bottles, which were filled with 200 biofilm carriers and placed on a magnetic stirrer located in a thermostated room. Firstly, during reactor operation period (before 600 days) 9 tests together with parallels were done at nitrite concentration of $30 \text{ mg NO}_2^-\text{-N L}^{-1}$. Secondly, during reactor operation days 1500-1570, 33 tests together with parallels were done at nitrite concentration of $100 \text{ mg NO}_2^-\text{-N L}^{-1}$ using biomass adapted at 17-18° C. Thirdly, on reactor operation days 1570-1600, 12 tests together with parallels were done at nitrite concentration of $30 \text{ mg NO}_2^-\text{-N L}^{-1}$ using biomass adapted at 15° C.

$\text{NO}_2^-\text{-N}/\text{NH}_4^+\text{-N}$ ratio of 1.32/1 was maintained as a suitable anammox process stoichiometrical ratio [23]). The substrate concentrations used were $100 \text{ mg NO}_2^-\text{-N L}^{-1}$ and $80 \text{ mg NH}_4^+\text{-N L}^{-1}$ (or $30 \text{ mg NO}_2^-\text{-N L}^{-1}$ and $23 \text{ mg NH}_4^+\text{-N L}^{-1}$), respectively. In addition, the reaction mixture contained micro- and macroelements as given in [21]. Anoxic conditions in the reaction cell were maintained by argon purging for 20 min after solutions preparation and reaction cell filling with biofilm carriers.

Batch tests were performed right after one another in a temperature range of 9–30 (± 0.5) °C after reactor adaption temperature was maintained for one month. Temperature was maintained in separate tests by a thermostated water bath. Sampling was done 0, 2, 4 and 6 h after the start of the test. TNRRs were calculated from the linear decrease of the summary

nitrogen concentrations during 6 h and calculated per hour and a gram of biofilm's wet weight.

pH in the range of 7.5-8 was maintained as optimum for the anammox process [5] by adding 0.4 g $\text{HCO}_3^- \text{L}^{-1}$.

Biofilm total suspended solids (TSS) of 2.62 g L^{-1} (6.55 g m^{-2}) was maintained in the test cell as concentration present on 200 carriers. Triplicate TSS measurements were done gravimetrically before the batch experiment using 3 × 20 carriers: the carriers were rinsed with distilled water and dried at 105 °C for 24 h. After drying the carriers were weighed and the biomass was removed using chromic acid. The carriers were washed, dried and weighed again after 24 h at 105 °C. TSS was calculated as the difference between the biomass of the dried and washed biofilm carriers.

Analytical methods

Nitrogen forms ($\text{NH}_4^+\text{-N}$, $\text{NO}_2^-\text{-N}$, $\text{NO}_3^-\text{-N}$) as well as COD were determined spectrophotometrically according to [24]. Hydroxylamine (NH_2OH) was measured spectrophotometrically according to [25]. Hydrazine (N_2H_4) was determined by the Hach Lange HydraVer 2 reagent (containing *p*-dimethylaminobenzaldehyde) and 0.5% solution of sulphamic acid was added to eliminate interference from nitrite and nitrate. pH and conductivity were measured by Jenway (Germany) and dissolved oxygen by Marvet Junior (Estonia) electrodes, respectively. FA was calculated according to equilibrium constant between $\text{NH}_4^+/\text{NH}_3$ ([26]).

Homogeneity of group variances and the difference between group means were checked using *f*-test and the two-way *t*-test, respectively. The level of significance was set at $\alpha < 0.05$. The MS Excel 2010 Analysis ToolPak software was used.

Temperature constant calculation

Temperature constants were calculated according to Van't Hoff's rule to evaluate the temperature constant at different temperatures [27]:

$$\frac{d(\ln K)}{dT} = \frac{\Delta H}{RT^2} \quad \text{or} \quad \frac{d(\ln K)}{d(1/T)} = -\frac{\Delta H}{R}, \quad (2a, 2b)$$

where:

$\ln K$ - natural logarithm of temperature constant K ;

T - absolute temperature °K;

ΔH - activation energy Jmol^{-1} ;

$R = 8.314462(75) \text{ J.K}^{-1}\text{mol}^{-1}$ - universal gas constant

Polymerase chain reaction (PCR) methodology, sequencing and

Biomass was mechanically removed using vortex mixer, followed by DNA extraction by MoBio Powersoil DNA isolation kit (USA) according to the manufacturer's instructions. 5 biomass carriers were taken from the reactor. The PCR products were purified with the JETquick Spin Column Kit (GENOMED GmbH) and then sequenced. 25-50 mg of biomass was applied for DNA extraction.

Representatives of NOB *Nitrospira spp.* and *Nitrobacter spp.* were analysed according to [28]. To identify *Nitrospira* strains the primer sets NSR1113f / NSR1264r were used.

Pla46f / Amx368r primers were used for targeting anammox bacteria. Nested PCR was carried out according to the thermocycling parameters described by by manufacturer. PCR-DGGE for detecting diversity of the most abundant microorganisms was conducted using the eubacterial primer set GC-BacV3f / 907r as described previously by manufacturer.

DGGE was performed using INGENY the PhorU System (INGENY, the Netherlands). PCR products were loaded on a 30–65% denaturing gel and run for 17 h at 90V at a constant temperature of 60°C. The gels were stained with an ethidium bromide solution in an 1× Tris- acetate- acetic acid- ethylenediaminetetraacetic acid (TAE) buffer to observe the bands by UV transillumination, subsequently the bands were excised for further reamplification and sequencing.

Sequencing

The gene sequences were amplified in a Mastercycler Personal thermocycler (Eppendorf, Germany). The PCR reaction products were applied to agarose gel electrophoresis of a 1% agarose (SeaKem® GTG® Agarose, FMC Bioproducts, Rockland, Maine, USA) gel, which was stained with ethidium bromide and visualized under UV transillumination.

PCR for sequencing was performed with the BigDye® Terminator v3.1 Cycle Sequencing Kit (Life Technologies Corporation, USA) [21]. The acquired sequences were compared to the available database sequences via a BLAST (Basic Local Alignment Search Tool) search and the related sequences were obtained from the GenBank.

For pyrosequencing universal 8F and 357R sequences were used for the PCR amplification of V2–V3 hypervariable regions of 16S rRNA genes.

Phylogenetic analysis

In order to determine the phylogenetic position of the anammox 16S rRNA gene sequence acquired, it was compared with the available database sequences via a BLAST search, obtaining the related sequences

from the GenBank. Further analysis was carried out with the MEGA software version 5.0 with the neighbour-joining method.

Quantitative polymerase chain reaction (qPCR)

QPCR was conducted with primer sets Amx694F(GGGGAGAGTGGAACCTTCTG) and Amx960R(GCTCCACCGCTTGTGCGAGC), which amplify about 285 bp fragments from most anammox bacteria 16S rDNA [29].

Cloning for the standard was performed using the Thermo Scientific InsTAclone PCR cloning kit according to the manufacturers' instructions. JM109 cell line was used. Plasmid was purified from selected colonies using the GeneJET Plasmid miniprep kit (Thermo Scientific). Dilutions of purified plasmid were used as standard in the qPCR reaction.

PCR amplification and detection were performed in optical 96-well reaction plates. The PCR temperature programme was initiated during 12 min at 95°C, followed by 45 cycles of 10 sec at 94°C, 20 sec at 58°C, and 20 sec at 72°C. Each PCR mixture (10 µL) was composed of 2 µL of 5x HOT FIREPol Eva Green qPCR Supermix (Solis BioDyne, Estonia), 0.25 µL of forward and reverse primers (100 µM) and 1 µL of template DNA.

Results and discussion

The biomass in the MBBR was adapted to 17°–18° and 15° C after which batch tests were performed at various temperatures to determine the accelerating effect of low temperature adaption on short-term low-temperature tests and rate losses at higher temperature adaption in short-term tests. Long-term temperature effect on continuous MBBR operation (Fig. 1) and a short-term temperature effect on batch tests were studied. Also, the effect of different NO₂⁻ concentrations (100 mg N L⁻¹ and 30 mg N L⁻¹) on batch tests' TNRRs was assigned to determine substrate concentration effect [20].

Periods of operation of the continuous reactor

Deammonifying biofilm cultivation was started up at 26° C using nitrifying biofilm carriers [12, 14] and the reactor was operated long-termly (1600 days). The operation of the reactor can be divided into three main periods based on operation temperature: >20° C, 20° C and below 20° C. The behaviour of the MBBR was clearly different at 26° C and 20° C (days 1-1100 and 1100-1419, respectively) compared to period when temperature was maintained below 20° C.

On days 400-616, the increase of the TNRR was from 0.1 g N m⁻² d⁻¹ (0.04 kg N m⁻³ d⁻¹) to 0.6 g N m⁻² d⁻¹ (0.24 kg N m⁻³ d⁻¹). Before the start of

the temperature decreasing the reactor had achieved a relatively high average TNRR of $1.7 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.68 \text{ kg N m}^{-3} \text{ d}^{-1}$) at $26 \text{ }^\circ\text{C}$ and $1.5 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.60 \text{ kg N m}^{-3} \text{ d}^{-1}$) at $15\text{-}20 \text{ }^\circ\text{C}$ (from the 1420th day on), respectively. After the temperature was decreased for 0.5°C per week, there were small decreases in the TNRR, but the rate stabilized shortly after biomass adaptation (Fig. 1). When the TNRR was $1.65 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.60 \text{ kg N m}^{-3} \text{ d}^{-1}$), on day 1500 it decreased within a week to $1.3 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.52 \text{ kg N m}^{-3} \text{ d}^{-1}$) when the temperature was decreased from 17°C to 16.5°C . It can be noted that when the temperature was decreased more during a short time interval, a larger decrease in the TNRR caused greater instabilities in the system and higher effluent NH_4^+ concentrations, latter could be removed through post-treatment by nitrification-denitrification process as there was residual COD present in the effluent ($>300 \text{ mg L}^{-1}$). It would confirm that gradual temperature decreasing could be beneficial to sustain a sufficient TNRR by cultivated biofilm, and as in practice temperature normally does not decrease that abruptly lower than 15°C , cultivated biomass can be used for treatment of wastewater having temperatures $15\text{-}30^\circ \text{C}$. Moreover, the general trend of the TNRR during the third operation period when temperature was lowered from 20°C to 15°C was rather increasing (Fig. 1) as also proven by statistical analysis.

Strategy for suppression of the NOBs

As selecting ammonia oxidizing bacteria (AOB) instead of nitrite oxidizing bacteria (NOB) is challenging at temperatures below 20°C [17], elevated free ammonium (FA) was used. FA spiking (influent FA concentration periodically increased to 7.5 mg N L^{-1} through feeding) in combination with short HRT (0.5 d) applied in reactor between days 0-700 enabled low NOB activity and maximum sufficient TNRR of $0.7 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.28 \text{ kg N m}^{-3} \text{ d}^{-1}$).

Nevertheless, representatives of NOB *Nitrospira spp.* present in the reactor system are known for their fairly high tolerance for low dissolved oxygen concentrations [30] and are responsible for higher NO_3^- production than stoichiometric ratio. Lower NO_3^- production after 700 days was achieved when the maintained FA concentration in the reactor was increased to $23 \text{ mg NH}_3\text{-N L}^{-1}$. Higher FA spikes can be achieved by feeding system with elevated pH (>8) and elevated $\text{NH}_4^+\text{-N}$ concentration ($600\text{-}1000 \text{ mg N L}^{-1}$) wastewater having temperatures above 20°C . Apparently, high effluent $\text{NH}_4^+\text{-N}$ concentrations were present in the effluent, which could be solved through increasing air flow rate shortly after NOBs permanent outcompetition or decreasing TN loading rate.

Similarly to batch tests, no obvious increase in the ratio of effluent $\text{NO}_3^-\text{-N}_{\text{produced}}/\text{NH}_4^+\text{-N}_{\text{consumed}}$ (that in reactor was on average 0.27/1) during

temperature lowering was present in reactor operation. It showed that gradual temperature lowering still enabled NOB out-competition even at lower temperatures and, on the other hand, non-inhibitory FA concentrations (according to [31] 13-80 mg N L⁻¹) for mature anammox biofilm were present.

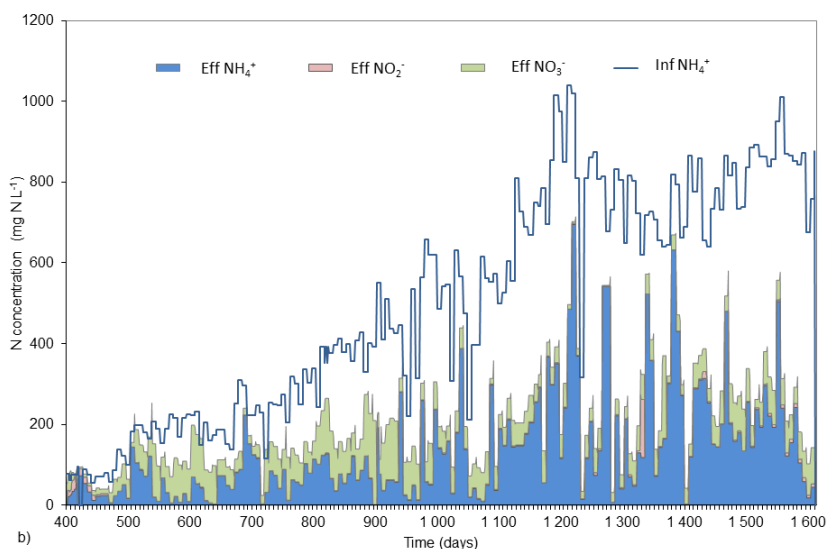


Figure 1. N species concentrations in biofilm reactor within 400 – 1600 days.

Anammox stoichiometric ratio

NO_2^- and NH_4^+ decrease and NO_3^- formation of the cultivated biofilm typical of the anammox process are shown on Fig. 2. NO_2^- concentration decreased averagely 1.35 times faster than NH_4^+ concentration in a temperature range of 15-30° C (Table) being similar to earlier propositions ([23]; [7]).

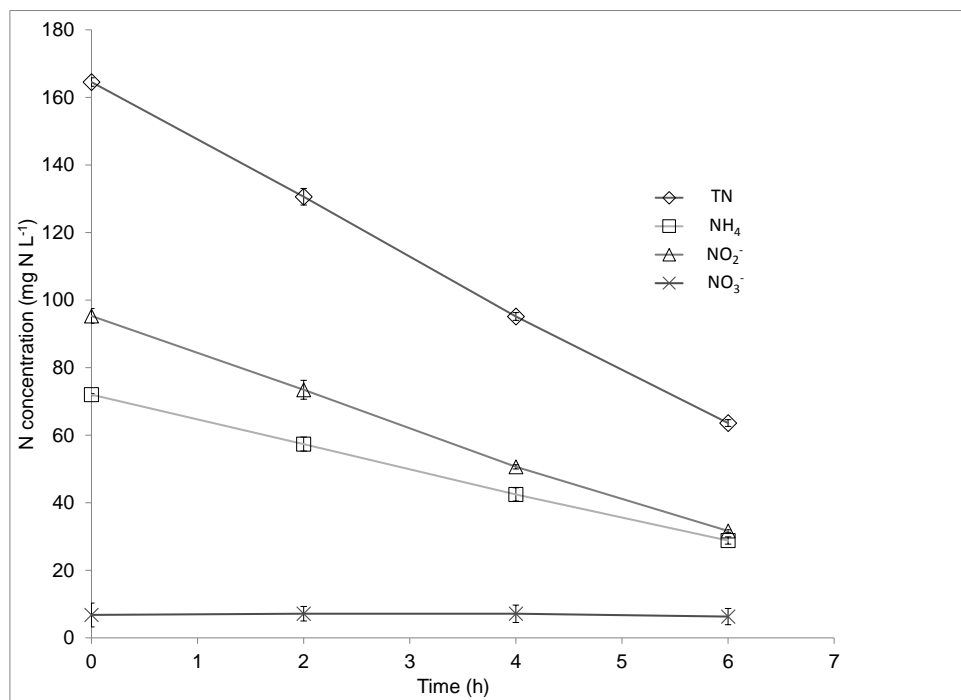


Figure 2. TN and nitrogen species concentration decrease in biofilm carriers with different applied temperatures at 100 mg NO₂⁻-N L⁻¹ at adaption temperature of 17-18 °C. Error bars represent standard deviation of 3 parallels of independent tests.

NO₃⁻ concentration decreased by temperature lowering (NO₃⁻-N_{produced}/NH₄⁺-N_{consumed}<0.1/1) being smaller than characteristic of anammox process (NO₃⁻-N_{produced}/NH₄⁺-N_{consumed}<0.26/1). In earlier studies, [4] has found that, lower temperature has brought along higher NO₃⁻-N_{produced}/NH₄⁺-N_{consumed} ratio, indicating efficient NOB outcompetition at a lower temperature in our study.

The nitrogen conversion rates and temperature constant calculations in batch tests

Batch tests were done with MBBR carriers before 600 days and during 1500–1600 days (Fig. 2, 3) within 3 periods: At adaption temperature of 26° C (before 600 days), at 17–18° C (from 1500th day on) and on the third period (from day 1570 on) at 15° C. TNRRs achieved for the performed batch tests at the highest temperature (30° C) were not significantly higher (*p*-value >0.05 in all cases) than at other temperatures as shown in Table.

Table. TNRR of the reactor and batch tests biomass and significant differences (*p*-values) compared with the highest test TNRR. Other authors' temperature constants and respective parameters were added.

Reactor temp. (°C)	Reactor TNRR (g N m ⁻² d ⁻¹)	Batch temp. (°C)	Batch [NO ₂] (mg N L ⁻¹)	Batch TNRR (mg N L ⁻¹ h ⁻¹)	<i>p</i> -values of batch TNRR	Batch temp. coefficient	NO ₂ ⁻ -N _{consumed} /NH ₄ ⁺ -N _{consumed}
26	0.5	25	30	4.1	0.2	1.3	1.29
26	0.5	21	30	2.9	0.3	1.2	1.26
26	0.5	15	30	2.7	0.2	1.4	1.23
17-18	1-1.3	30	100	8.6	Reference	1.5	1.39
17-18	1-1.3	25	100	7.1	0.3	-	1.49
17-18	1-1.3	22.5	100	6.5	0.3	1.4	1.35
17-18	1-1.3	20	100	6.0	0.2	1.4	1.36
17-18	1-1.3	15	100	5.1	0.2	1.4	1.34
17-18	1-1.3	12	100	4.0	0.4	1.6	1.27
17-18	1-1.3	9	100	3.6	0.2	1.5	1.24
15	1.2-1.6	30	100	7.3	0.2	-	1.29
15	1.2-1.6	22.5	100	6.3	0.3	1.5	1.22
15	1.2-1.6	15	100	5.4	0.4	1.4	1.35
15	1.2-1.6	9	100	4.3	0.2	1.4	1.24
15	1.2-1.6	30	30	7.3	0.2	1.0	1.35
15	1.2-1.6	22.5	30	6.3	0.2	1.6	1.05
15	1.2-1.6	15	30	5.4	0.4	1.3	1.48
15	1.2-1.6	9	30	4.2	0.2	1.4	1.39
16-30	5.7 **	-	<5	-	-	1.93 [15]	1.24
10-19	1.7	-	9-19	-	0.001*	12.7 [31]	1.11-1.32
20	0.26**	25	<5	2		3.24 [15]	1.11-1.54

Temperature effect on biomass adapted to temperature of 26° and 17–18°C

During the first period reactor temperature was 26 °C the TNRRs were the lowest and quite highly dependent on temperatures maintained in the batch tests. After biomass adaption to lower temperatures its tolerance to lower temperatures increased as well as TNRR.

During the second period (cultivation at 17–18 °C), the TNRR was the highest at 30 °C, decreasing with lowered temperature (Fig. 3). At 22.5 °C the TNRR had decreased approximately 25%, when comparing it to the value measured at 30 °C. At the applied temperature of 9 °C, the TNRR measured in a batch test was still 3.58 mg N g⁻¹ TSS h⁻¹ or approximately 40% of the value measured at 30 °C, showing low temperature tolerance of the biomass applied in tests.

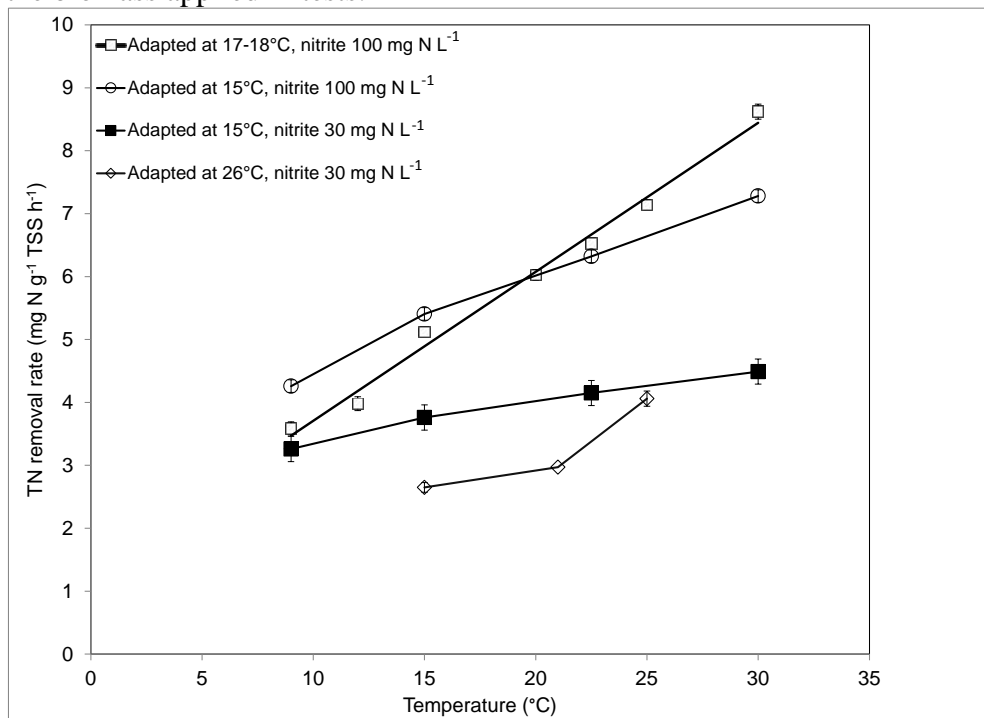


Figure 3. TN removal rates of biofilm carriers with different applied temperatures at NO₂⁻ concentrations of 100 mg NO₂⁻-N L⁻¹ and 30 mg NO₂⁻-N L⁻¹ with different applied temperatures in the reactor. Error bars represent standard deviation of 3 parallels of independent tests.

In a temperature range of 9–30 °C, a decrease in the TNRR was linear without an abrupt rate drop - a fact that is in disagreement with the results reported by [7] who observed decrease in the TNRR almost to zero below 15 °C. We can conclude that a slow, gradual lowering of temperature down to 17 °C is beneficial from the point of view of practical applications since anammox biomass adapted to lower-temperature has an ability to perform autotrophic nitrogen removal in a short term at a temperature as low as 9 °C. This has been considered unfeasible in the earlier studies ([9]) as long as cryoprotectants have not been applied [13]). By comparison, [32] operated a nitritation–anammox MBBR at 19–10 °C, when lowering of the temperature was done relatively abruptly by 3 °C in each period, TNRR remained stable

in a temperature range of 19–13 °C ($1.67\text{--}0.55\text{ g N m}^{-2}\text{ d}^{-1}$) using low NO_2^- concentrations (Table). However, at 10 °C TNRR has been low (average TNRR was $0.17\text{ g N m}^{-2}\text{ d}^{-1}$), which eventually have led to a failure of reactor work when the NO_2^- concentrations reached 200 mg N L^{-1} [32].

Temperature constants calculated by us for deammonification biofilm in the temperature range of 9–30 °C were 1–1.6 being close to the temperature constant of 1.93 in the temperature range of 16–30 °C achieved by [11]. Surprisingly, compared to our results, the data from [32] leads to a higher value of the temperature constant within the temperature range of 10–19 °C. Differences on constants could be explained by using different biomass (biofilm/granules) as well as different applied conditions during the tests.

Temperature effect on reactor adapted to lower temperature of 15 °C

On the third test period the MBBR was adapted to 15 °C. In batch experiments at 9 °C the TNRR of the adapted biomass was $4.3\text{ mg N g}^{-1}\text{ TSS h}^{-1}$, whereas at the same temperature it was 15% lower for the biomass adapted to a temperature of 17–18 °C.

The obtained results indicated that the biomass adapted to 15 °C in reactor showed higher TNRRs on a relative scale at a lower temperature (9 °C) rather than at a higher temperature (30 °C). TNRRs for the biomass adapted to lower temperatures (15 °C) in the MBBR were higher in batch tests at 9–15 °C as compared with the rates achieved with the biomass cultivated at 17–18 °C. Respective lower-temperature-adapted biomass showed lower TNRRs in batch tests at a higher temperature range of 20–30 °C. Short-term back-adaption to a higher temperature was not observed, proving permanent biomass adaption at a low temperature by the applied strategy.

These experimental results indicate that slow, gradual temperature lowering is substantial for efficient operation of the reactor at a lower temperature [7].

Due to adaption of biomass to low temperature, increased TNRRs in the batch tests occurred using biomass adapted to a lower temperature (15 °C) in the MBBR even at 9 °C when TNRRs decreased less compared to the biomass adapted to a higher temperature (17–18 °C) in comparison with [7].

In cold regions ocean floor sediment anammox bacteria strains different from which are present in wastewater treatment have been shown to be able to adapt to temperatures as low as to 9 °C. Mostly, anammox process has been observed, *in-situ* in estuary deposits in a temperature range of 15–19 °C [33], which was one of the reasons for adaption temperature choice in our case. After adaptation to temperatures $\sim 15^\circ\text{C}$, with the temperature exceeding 20 °C TNRRs, however, had decreased [33]. It showed that

anammox bacteria *Planctomycetales Scalindua* strains do not adapt back to high temperatures and there could be assumed that *Candidatus Brocadia* strains have same mechanism.

Nitrite concentration effect

A series of batch-scale experiments were performed in a period when the MBBR biomass was adapted to lower temperature (15 °C) to determine the effects of nitrite concentration on the TNRR. The biomass in the MBBR system was able to tolerate high concentrations of nitrite (100 mg N L⁻¹) in the batch assays, whereas in the tests with lower nitrite concentrations (30 mg N L⁻¹) TNRR was lower. High NO₂⁻ tolerance could be achieved for thick biofilm cultivation by a long-term operation whose findings are contradictory to previous studies [7]. Among TNRRs for both concentrations at different temperatures significant differences between tests were not observed (*p-values* >0.05) (Table).

Low activation energies of 17.7 and 29.7 kJ mol⁻¹ for NO₂⁻ concentrations of 30 and 100 mg N L⁻¹, respectively, were determined. Earlier, activation energies of the anammox process have reached much higher values-in a range of 67 to 86 kJ mol⁻¹ [4] than our results, probably because of different systems applied: they used suspended biomass instead of biofilm system used by us. Literature data agreed with the values of 70 kJ mol⁻¹ obtained by [34] and [4], which were close to 63 kJ mol⁻¹ obtained by [7]. It could be assumed that in our case less energy (water treatment at lower temperature) was needed for efficient and more economical water treatment process making it applicable to low temperature mainstream wastewater treatment.

Based on experimental results, we conclude that during reactor operation, the biomass in the MBBR system had developed a high degree of NO₂⁻ tolerance and, in disagreement with most literature sources [20], had shown the highest TNRR at a high NO₂⁻ content (100 mg N L⁻¹) and a lower TNRR at a low NO₂⁻ (30 mg N L⁻¹) content.

Quantitative anammox 16S rRNA analysis

In the reject water (TSS 0.75 g L⁻¹) from which anammox organisms were enriched, anammox quantities of 1×10⁴ copies g⁻¹ TSS were present. Quantitative 16S rRNA analysis showed an increase in anammox organisms' quantities from 5×10³ anammox gene copies g⁻¹ TSS from the start of the operation to 1×10⁷ anammox gene copies g⁻¹ TSS at the end of reactor operation (day 1660) (Fig. 4). Abrupt increase in the anammox gene copy number at the end of operation despite temperature lowering could show a good adaptation of anammox organisms to low temperature after a certain gene copy numbers have been exceeded (10⁵ copies g⁻¹ TSS) in the system.

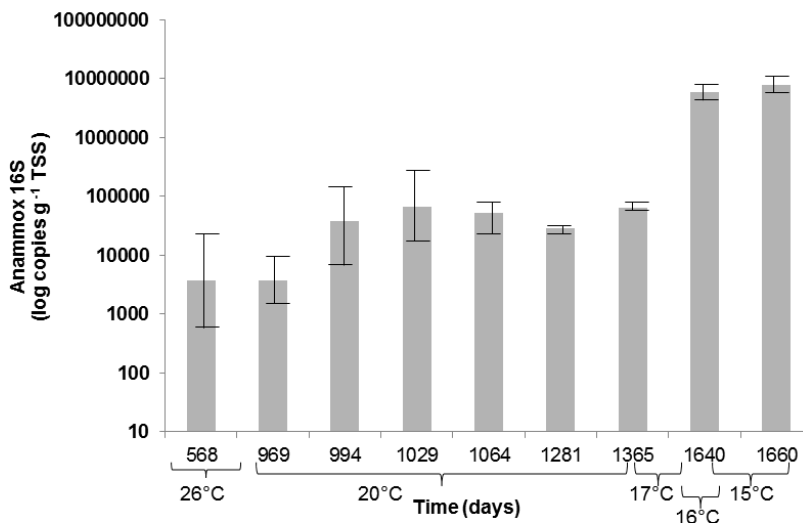


Figure 4. Logarithmic values of *Planctomycetes* gene copies in the biomass of MBBR dependent on reactor temperature. Error bars represent standard deviation of 3 parallels of independent tests.

Conclusion

The effects of low temperature on the deammonification the maximum total nitrogen removal rate (TNRR) of the deammonification reactor of $1.5 \text{ g N m}^{-2} \text{ d}^{-1}$ ($0.60 \text{ kg N m}^{-3} \text{ d}^{-1}$) at a low temperature ($15 \text{ }^{\circ}\text{C}$) was shown.

TNRR at $9 \text{ }^{\circ}\text{C}$ with the biomass cultivated at $17\text{--}18 \text{ }^{\circ}\text{C}$ was only 40% as compared with that of for highest temperature of $30 \text{ }^{\circ}\text{C}$ applied. The adaptability of biomass to lower temperatures by gradually lowering the reactor's temperature from $18 \text{ }^{\circ}\text{C}$ to $15 \text{ }^{\circ}\text{C}$ was studied in batch tests. The biomass adapted to $15 \text{ }^{\circ}\text{C}$ showed a quite sufficient TNRR ($3.6 \text{ g N g}^{-1} \text{ TSS h}^{-1}$) in the batch tests even at $9 \text{ }^{\circ}\text{C}$. The results showed that if the MBBR was adapted to $17 \text{ }^{\circ}\text{C}$, the batch experiment at $30 \text{ }^{\circ}\text{C}$ had a high TNRR ($8.6 \text{ mg N g}^{-1} \text{ TSS h}^{-1}$) whereas at a low temperature of $9 \text{ }^{\circ}\text{C}$ the batch experiment showed a loss in the TNRR ($3.6 \text{ mg N g}^{-1} \text{ TSS h}^{-1}$) as compared with the biomass adapted to $15 \text{ }^{\circ}\text{C}$.

In order to quantify the temperature and substrate dependency of the anammox reaction, the calculated activation energies were 17.7 and 29.7 kJ mol^{-1} for NO_2^- concentrations of 30 and 100 mg N L^{-1} , respectively, showing that a high NO_2^- concentration increased TNRR. Nitrite concentration of (30

mg N L⁻¹) limited the TNRR of the anammox process in comparison with the highest one (100 mg N L⁻¹).

Anammox bacteria *Planctomycetales* clone P4 and *uncultured planctomycetes* clone Amx_P055-8 sequences, which were the closest (98 and 99% similarity, respectively) relative to *Candidatus Brocadia fulgida* increased till day 1600 of reactor operation to 1×10⁷ anammox gene copies g⁻¹ TSS despite the temperature decreasing to 15 °C.

Regarding to practical applications, biofilm deammonification system could be set up at colder regions for treatment of mainstream wastewater when developing biomass with gradual temperature adaption methods.

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GAMIFYING ENERGY USER PROFILES

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Abstract

Smartege is an educational application which aims in educating users in the basics of electrical energy consumption and production and engage them in energy saving behavior, techniques and technologies. This is accomplished through the virtual, and eventually actual, management of residential and office buildings equipped with virtual devices and renewable energy sources, with energy specifications borrowed from actual commercial devices, towards the ultimate target of transforming the buildings into net Zero Energy Buildings. Ultimately, Smartege is a gamified application targeting the behavior modification of the users. Its content development follows the persuasive model and uses cognitive learning for the educational component and game mechanics for user motivation and triggering.

Keywords: Smartege, electricity user, behavior modification, cognitive model, gamification

Introduction

“We ought to be able to obtain the energy we need without consumption of material” affirmed Nicola Tesla in his visionary 1900 article (Tesla, 1900). Nowadays, his words are reverberating in the ever present struggle and challenge of energy resource control and management. The constantly increasing energy needs of our civilization and the emerging

trends in electricity grids and markets converge in the need for demand side management, in which the end user has a pivotal role. However, the rapid and spectacular advances in technology along with poor design and funding, have left mass educational systems lagging behind and most of technology end users in awe, misinformed, alienated, and easy to manipulate.

Over the last decades, the deregulation of electricity markets and the Renewable Energy Sources (RES) technology have accelerated the emergence of distributed generation which together with advances in ICT technology led to the smart grid and demand side management paradigm as opposed to the conventional transmission grid and supply side management. In the new paradigm, the electricity user interacts in real-time with the provider, the grid and the markets. The electricity user behavior is therefore of fundamental importance in the future grid design and control as well as the EU energy targets (European Commission).

In dealing with these contemporary problems, the behavior modification approach is a powerful tool towards achieving technological literacy and shaping savvy electricity end users. Gamification is a promising educational methodology which can be used in behavioral modification. Gamification, coming from the field of digital media and marketing, first appeared in 2008 (Deterding et al., 2011), but became widely known in mid-2010. Figure 1 shows the position of gamification in the Gartner Hype cycle for 2014. From being at the end of 'innovation' triggering period (2012) and the peak of 'inflated expectations' (2013), it approaches the 'trough of disillusionment' (2014) and the 'plateau productivity' region faster than other emerging technologies.

In view of the current applications of gamification and the different interpretations that have been given, the definitions given vary and are directly related to the practices used. As a relatively new concept, it has been a controversial topic, especially concerning its application in the educational process, but has already been applied in many educational environments such as e-learning platforms, or as a teaching method, as well as in commercial applications in order to emotionally commit and engage users (Dominguez, et al, 2013; McCombs and Vakili, 2005; Lee and Hammer, 2011).

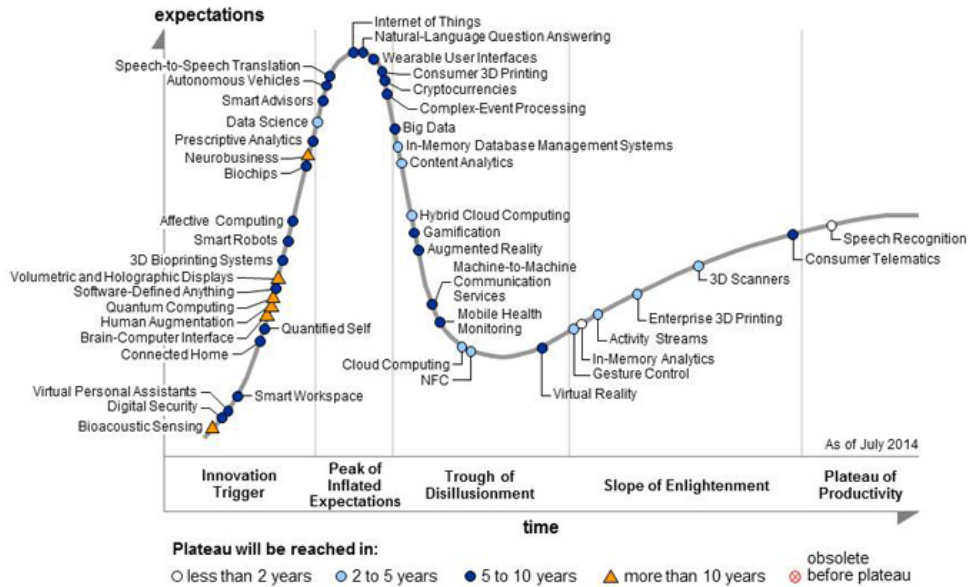


Figure 1 - Gartner Hype cycle for 2014

The gamified application proposed in this work does not intend to replace conventional teaching methods, nor be a commercial application for attracting users - clients. *Smartege* aims at combining the educational and commercial potential of gamification, in a new application development methodology that will lead the users, through education and increased involvement, to engage in activities and actions associated with electricity consumption, production and energy saving that they will perform on a daily basis. The ultimate goal is to engage the student/user and make them interact with a community in which inevitably they will negotiate with their cultural environment, traditions, history and customs and will be triggered to adjust their behavior and assume roles that will make them conquer the basic as well as overall concept of the subject in question.

Methodology

Gamification methodology is already applied in many educational environments such as e-learning platforms, or as a teaching method, but also in commercial applications in order to emotionally commit and engage users.

Although gamification classification literature is rather limited, the Behavior Change Gamification model, which was developed by Werbach and Hunter (Werbach, & Hunter, 2012) following a detailed analysis, aims at behavior transformation among a group of people. Behavior modification is also the 'raison d'être' of the persuasive technology as in Fogg's behavior model – FBM (Fogg, B.J. 2009),

Smartege is based on FBM according to which for a person to be convinced to change his behavior on an issue, he/she must satisfy three conditions: sufficient motivation, adequate capacity and efficient activation (Figure 1).

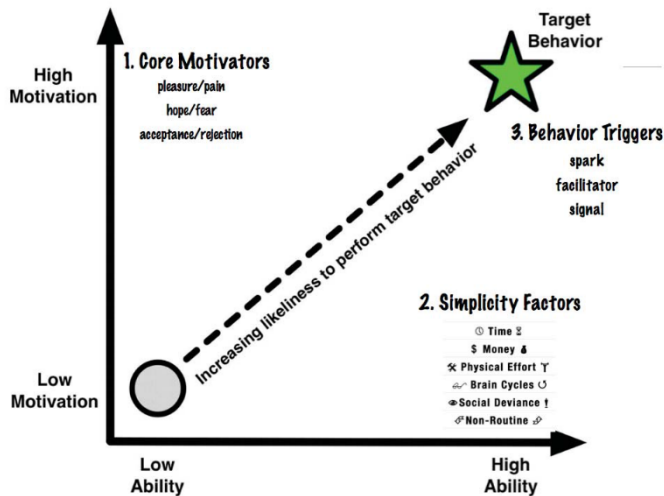


Figure 8 - The Fogg model is determined by three parameters: ability, motivation and activation (trigger) (Fogg, B.J. 2009)

According to FBM, the right time for intervention (activation) is when the point determined by the capacity (horizontal axis) and the motivation (vertical axis) of the individual, has a value greater than the value of the threshold needed for achieving the modification of behavior. In plain terms, it is the point when the person is at an appropriate level to accept a change and the only thing missing is the trigger that will activate it.

The capacity or ‘ability’ A of an individual (horizontal axis of Figure 1) is determined by the simplicity of the steps required to accomplish a task. An individual’s ability is a function of six variables: money, m , time, t , physical effort, pe , mental effort, me , social deviance, sd , and non-routine, nr . At any given moment, the value of A is determined by the variable with the lowest value at the time of activation or triggering.

$$A = \min(m, t, pe, me, sd, nr) \quad (1)$$

Users’ ability may be increased through education as the latter can significantly reduce the complexity involved in implementing behavioral change. For example, understanding the electricity bill, monitoring the electricity consumption of one’s house or evaluating the energy profile of an electricity user, may become trivial tasks through proper education and familiarization with the process.

Therefore, in developing educational applications, we propose that the ability A is increased through education. The cognitive learning process, on which student centered learning is based, can be readily applied to gamified applications since it is a non-linear process and the student from passive knowledge receiver becomes an active partner in the process, employing actions, rational thinking, and interaction with others and the environment, in an effort to give meaning to the subject matter that he/she attempts to understand or conquer. Making meaning resolves the contradiction between what we know with certainty and what we think that others know on the one hand and what else we want to know or what we think we should know on the other (Wiltshire, 1990). In this content, knowledge acquisition is a user defined process. Cognitive learning follows the learning pyramid of six consecutive levels (Bloom & Krathwohl, 1956): know, understand, apply, analyze, evaluate, create. These six levels are used for the development of the educational content, the texts, the quizzes, the missions etc.

Engaging the user is of paramount importance in gamification. According to the flow model (Csikszentmihalyi, 2000), the indisputable model of most successful games, the user must be kept engaged, active, in 'flow state' through increase in skill or challenge (Figure 2). Game mechanics such as levels, badges, awards, counters, leaderboards *etc* are used in gamified applications to increase the users' engagement.

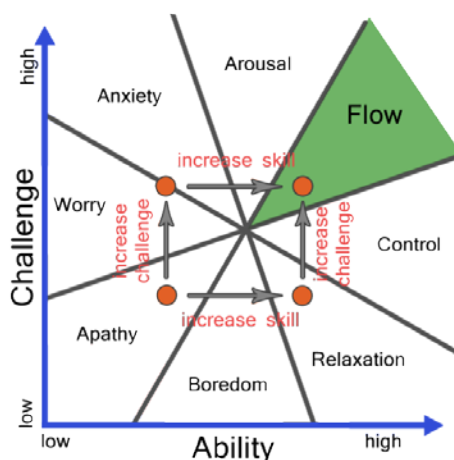


Figure 2 - The flow model (Schlutter, 2013)

We propose the use of such mechanics, in the spirit of the flow model, to increase user's motivation M (perpendicular axis of Figure 1) and to activate the user through appropriate triggering.

According to FBM, motivation revolves around three dipoles: a) the pleasure/pain dipole which has an immediate effect on the user, *e.g.*

gaining/losing points b) anticipated hope/fear has a long-term effect, *e.g.* moving towards/away from mastering a level c) social acceptance/rejection, *e.g.* score high/low on the leaderboard.

Triggers are categorized into: a) sparks for unmotivated individuals, *e.g.* messages triggering any of the three motivators described above b) facilitators for individuals of low ability, *e.g.* tips c) signals, for individuals of sufficient motivation and ability, *e.g.* notifications for the right timing.

Successful gamified learning should also observe other principles encountered in student-centered learning and/or gamification taxonomy (Ivetic & Petrovic, 2012), such as: feedback to the user must be ensured, *e.g.* in the form of counters, awards and notifications; the social dimension of the application should be served by both user-system and user-user interaction, *e.g.* in the form of messages, invitations, interactive content development; self-competition, *e.g.* in the form of achievements and competition against the other users, *e.g.* in the form of leaderboards, badges and use of social media, should be allowed; progression should be guaranteed through the transparent profiling of each user and the well-defined ultimate goal; graphics, colour and a narrative pertaining to real world situations should be used.

Smartege: not just another energy app

Most existing energy related games or gamified applications aim at raising ecological awareness at relatively young ages or allow the calculation of the energy consumption and CO₂ emissions of appliances or devices. Certain applications, such as Electrocitiy, Power Matrix, Energy Ville, are adult strategy games employing energy related narratives. *Smartege*, on the other hand, aims not only at educating or entertaining but also modifying the behavior of adult electrical energy users. In this sense, potential *Smartege* users are all electricity users, regardless of age, race, sex, or economic background. Electricity users can be defined in the following broad categories with specific traits in their attitude towards the use of electrical energy: 1) domestic users who are responsible for paying the electricity bill of their residence 2) domestic users who are not responsible for paying the electricity bill of their residence, *e.g.* children financially dependent on their parents 3) users at the workplace or school who are not responsible for paying the electricity bill of the facility, *e.g.* employees in an office or students in a classroom 4) users at the workplace who are responsible for paying the electricity bill of the facility, *e.g.* building managers.

Smartege aims at enabling electricity users implement behavioral change and shift from being passive consumers in the conventional supply side management electricity grid and market paradigm to being active agents in the emerging demand side management grid and deregulated electricity

markets. To accomplish that, *Smartege* relies heavily on its educational component intended to inform, educate and train users on the basics of electricity generation, distribution, consumption and saving.

Smartege is at the same time a game of:

- ✓ Simulation: because it simulates the consumption and production of electricity based on actual building requirements (residential or professional)
- ✓ Strategy: because it requires the user to set objectives and use optimally the tools and resources provided to him
- ✓ Learning & training: because there is material provided for the user's training to electricity issues through the application
- ✓ Quizzes: because many of the 'tasks' of the application are multiple choice questions based on the above material.

As explained in the previous section, the application's content addresses the cognitive, emotional and social area of the user (Constantos et al, 2014).

The cognitive content follows Bloom's taxonomy (Bloom et al, 1956) starting from simple definitions and tips and escalating to more complex explanations and tasks requiring deeper understanding and insight.

Feedback is continuously given in various forms: it can be points earned from accomplishing a variety of tasks (such as reading suggested material or answering a quiz), personalized comments on quiz results, badges rewarding successful completion of tasks and hints or tips on critical points during user's journey in the application.

The user may create his/her individual path to the top, selecting the specific objectives and activities offered.

The emotional content employs counters, badges (Figure 3) and awards to motivate the user and appropriate triggering based on the three dipole FBM motivators. The 'Smartege' user is expected to experience positive emotions such as curiosity, satisfaction, optimism as well as negative ones such as frustration and failure. Using game mechanics such as levels, rewards, leaderboards and missions we seek to transform the negative emotions to positive ones, such as succeeding, thus keeping the user in the 'flow' zone of the game. The 'Smartege' leaderboard is called 'Tesla's Followers' (Figure 4) and the user's ranking in it depends on the points earned through the progress of the game.

The social content includes missions and tasks intended to shape the social profile of the user, to allow the user to form an identity, by triggering him/her to invite friends, share knowledge and tips, perform actions like "like" or "comment". The leaderboard also appeals to the social area of the user since it displays the user's ranking relative to others'.

In a later version, the user will also be allowed to form synergies with other users and compete against other teams, thus emulating a competitive

electricity market where the application moderator/coordinator has the role of the energy market regulation authority.

Finally, personalized communication is used for higher user involvement. For this, personalized data is needed which is accumulated through the user's actions as well as data entered by the user at various stages during the game as the user enriches his/her profile upon appropriate triggering.



Figure 3 Indicative Smartege badges: The Effective, the Newcomer, Gone... with the wind



Figure 4 TESLA's Followers: the Smartege leaderboard

The game mechanics, design and elements

The game has the following four counters:

- 'Wallet points' which are accumulated when tasks and missions are accomplished; spent when new higher energy class or energy generating devices are acquired; lost when electricity is managed poorly
- 'Electrical Energy counter' which emulates the energy meter recording net energy consumption and production in kWh
- 'Green bar' which monitors the virtual building's energy class

d) ‘Comfort bar’ monitoring the level of comfort in the building, following the user’s actions, according to existing standards and design specifications (Constantos et al, 2014).

The user’s main quest is to maintain the values of three counters at levels that can ‘unlock’ the next level and progress in the game.

There are 4 levels in the application:

The first level is a tutorial which is intended to engage and activate the user in using the application. In this level, the user is introduced to the application’s environment and logic via a virtual ‘tour’. It provides the first impression to the user and, since it addresses most of the issues to be dealt with later on, is of high educational value and therefore mandatory.

Throughout the game, to accumulate points, the user is asked to answer a set of quizzes, the level of complexity and difficulty of which, is increasing with the user’s progress in the application. If the user fails at such a test he/she is prompted to read respective educational material available in the ‘library’ and take the test again. The user may proceed to the next level only if he/she has completed a full tour of the tutorial at least once.

Next, the user is called to select from the application’s “inventory” of typical home electrical and electronic appliances such as refrigerators, stoves, washing machines, dishwashers, TVs and computers, and position them in the 3D Flat he/she is going to manage.

This second level, the Flat (or Residential) level (Figure 5) is unlocked once the Tutorial Level is completed. When the user touches the appliances and devices that are selected and placed in the Flat, tips and in context information appears concerning their electrical characteristics and respective energy consumption. With the help of timely triggering and use of proper educational material, such as recommendations, explanations and definitions, the user is led to schedule the operation of the selected appliances in order to optimize the electricity consumption as well as the comfort level in the Flat. The user may increase the energy class of all buildings under his/her control by replacing existing appliances and devices with others of higher energy performance. This costs ‘Wallet points’ that are accumulated through the successful completion of tasks and missions.

The third level is the Office (or Professional) level (Figure 6) and concerns the energy management of an office complex. It is unlocked after the user has managed to reach A+ efficiency in Residence level, utilizing the experience and knowledge gained so far. To attain the ultimate goal of net zero energy consumption buildings (nZEB), electricity microgeneration is necessary and therefore allowed from this level on. The user first learns to optimize the electricity use and consumption of all his/her buildings, residential or professional, and then is allowed to use ‘Wallet points’ to acquire and install electricity generation components. The concept of

electricity production is a very important one in the game, since it allows the user to think of electricity as a resource and not simply as a costly comfort enabler. The user is also given access to educating material concerning electricity generation and storage devices, such as photovoltaics, wind turbines and batteries, as well as the relevant legal framework.

The next and last level is the ‘My Home’ level, through which the user can a) simulate the electricity use of an actual installation, *eg* his/her house b) with the acquisition of appropriate hardware, monitor the electricity use of the actual installation per appliance or electricity line, and have full control of it, setting operating points and allowing remote on/off. At this last level, the user is given the opportunity to relate what he/she has learned to the real world and implement change in his real life.

All the above mechanics are combined with progression metrics that calculate the user's progress in the game depending on the motivation of the phase in which he is. The Motivation Matrix (Figure 7) is one of the major instruments used in gamification to present the ways that attract users, encourage them to remain active in the application and attract new users in turn, through the social mechanisms of the game.

The users, depending on the phase of the motivation matrix are divided into the 4 main categories, such as guest, registered, social and devoted. Thus, the users of each main category depending on the actions that they are interested in doing are treated with a different approach though the motivation matrix (Constantos et al, 2015).



Figure 5 The 3D graphic user interface of the Flat level



Figure 6 The 3D graphic user interface of the Office level

The following phases are discerned in the motivation matrix:

- i. Acquisition: The phase of acquisition is one of the most important phases and its aim is to attract users to the game environment. The user's attraction is gained through an engaging browsing process that takes place in the tutorial level, where the user is introduced to the basics of energy conservation.
- ii. Education: The task of training is active from the beginning of the tutorial to the end of the game. Training is conducted by providing trusted content sources and information to users. The tools we use in this section derive from the properly structured educational content, topics and tips that appear throughout the course of the implementation.



Figure 7 Smartege Motivation Matrix

- iii. **Attraction:** In this phase an emotional connection is formed between the game users, who have by now spent some time in the game, and the application. Actions and tools serving this goal are the entertaining and functional content and the personalized features of the game.
- iv. **Involvement:** This phase focuses on identifying and strengthening the leadership and collaborative nature of users. As the game progresses, users learn to trust their decisions and respond to the task of managing their building facilities more effectively and effortlessly.
- v. **Motivation:** This phase is very important because the user is induced to form a network around him and attract new users to the game through the dissemination of information. Tools to achieve this are to prompt the use of social networks, the competitions between users and the diffusion and communication with people outside the world of the game.
- vi. **Conversion:** In this phase we refer to the first objective of the game, which is to modify the electricity user's behavior. This is achieved with more specialized tools such as targeted content, targeted communication and targeted missions.
- vii. **Conservation:** In this phase we try to maintain and strengthen the energy behavior of users, so that they carry the actions they learned in the game into the real world to the maximum extent possible and be able to monitor and control real energy profiles.
- viii. **Excitement:** The last phase of the motivation matrix is based on the interest and passion of users for the game's environment and the ability to create emotional commitment that will make them come back again and again in the game. The tools to achieve this are the constant renewal of all type of content including quizzes, prompts to the user, as well as the game-user communication enabling the exploration of new ways and knowledge paths.

Conclusion

In this paper, we introduce a new methodology for the development of gamified educational applications for mobiles, tablets and PCs. It employs the persuasive technology for behavioral modification developing the application content in such a way as to increase the user's ability through education, increase the users' motivation to modify their behavior and trigger the users in the desired direction. The cognitive learning approach is used for the development of the educational content and game mechanics are used to trigger the user and increase user's motivation. *Smartege*, the pilot application presented here, targets the modification of users' behavior with respect to electricity use. In demand side management grids and deregulated electricity markets, the user must be trained to be an active participant rather than a passive consumer. *Smartege*, allows the users to shape their own path

towards learning how to understand, monitor, control and shape their energy profiles through the virtual management of a residential and an office building that must be transformed into net Zero Energy Buildings through optimum consumption management and small scale production using renewable energy sources. Furthermore, *Smartege* offers the possibility to manage an actual installation, such as the user's house, via appropriate metering and control hardware that communicates with the application's environment.

Acknowledgements

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TIDAL ENERGY: THE CASE OF EURIPUS' STRAITS

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Abstract

The tidal energy potential of low current tidal and marine currents is investigated in this work. Existing data on the current velocity and sea level at the Euripus' strait in Evia, Greece, is used to compute the energy yield based on contemporary turbine designs. Requirements, limitations and opportunities concerning the exploitation of low velocity tidal streams are discussed. The exploitation of tidal energy technology in conjunction with RES microgrids is proposed for coastal areas with abundance of sun and wind such as the Mediterranean islands.

Keywords: Tidal Turbines, Tidal streams, Tidal Energy, Energy assessment

Introduction

Tidal energy is being studied as a potential Renewable Energy Source (RES) over the last two decades, especially in the Northern European countries where pilot energy plants are harnessing the energy of the Atlantic Ocean tides. Tidal technology is not as mature, as wind or solar energy, but has the significant advantage of predictability, facilitating demand side energy management, the new paradigm in the smart grid and the emerging electric power markets (M.J. Khan, G. Bhuyan, M.T. Iqbal & J.E. Quaicoe, 2009; Greene, 2000). Currently, manufacturers are focused on the exploitation of the strong tides of the big oceans, deploying tidal farms from hundreds of kW reaching up to several MW, tied to the grid (Melton, 2012; Ray 2000; Hagerman and Polagye, 2006; Denny, 2009; Triton 2002). On the

other hand, little to no attention has been given to the weaker tides of smaller seas, eg the Mediterranean, or to the sea currents observed in straits.

The trend in electrical energy generation is distributed generation (Pepermans, 2005) along with demand side management and smart grid technologies (Buchholz, 2008, Strachan, 2002). Microgrids are an emerging technology for on location power generation and distribution, and minimized transmission costs. Microgrids (Kojima, 2009) are employing RES along with energy storage technologies with some backup generation facility.

Small island communities or communities along the coastline of the Mediterranean basin are often used as summer vacation destinations, leading to high power demand peaks in the summer months, often several times higher than those in the wintertime. As their connection to the main grid is not always possible or cost effective, they have to generate their own power using expensive and environmentally harmful diesel and, as of lately, supplement it with, wind and solar energy. 'Green islands' (ISET, 2008; Degner, 2004; Tselepis, 2003) whose energy supply will solely rely on Renewable Energy Systems (RES) have been studied and promoted over the last two decades in conjunction with EU's guidelines and goals for 2020 and 2050. However, sun and wind, which exist in abundance in such destinations, especially in the summer months, are highly unpredictable. Intermittency is a problem for wind and solar power. These sources of renewable energy require backup from traditional forms of power generation. The inherent predictability of tidal power is highly attractive for grid management, removing the need for back-up plants powered by fossil fuels. Tidal energy, when integrated in such a Renewable Energy Sources (RES) microgrid, can facilitate the optimum design and control of such a microgrid.

So far, tidal turbines have not been seen as part of a RES microgrid but rather as a plant in themselves tied to the main power grid. In this work, we use available data to explore the tidal energy potential of Euripos' Gulf in Evia, Greece, with respect to the state-of-the art in tidal energy generators. The potential and limitations of tidal turbines, optimized for low velocity currents, in conjunction with RES microgrids, consisting of photovoltaics (PV) and wind generators, often encountered in Southern Europe, is discussed.

Tides and Tidal Energy

Oceans and their currents are driven by the gravitational forces between our planet, the Sun and the Moon creating the periodic rise and fall of the sea's level, known as the tide. The Moon, being closer to our planet, contributes approximately twice as much to the tides observed on Earth.

Tides are classified according to their:

- a) Tidal range: spring/high tides and neap/low tides
- b) Periodicity: daily tides with tidal period of 24 hours and 50 minutes, semi-diurnal tides with tidal period of 12 hours and 25 minutes and mixed tides.

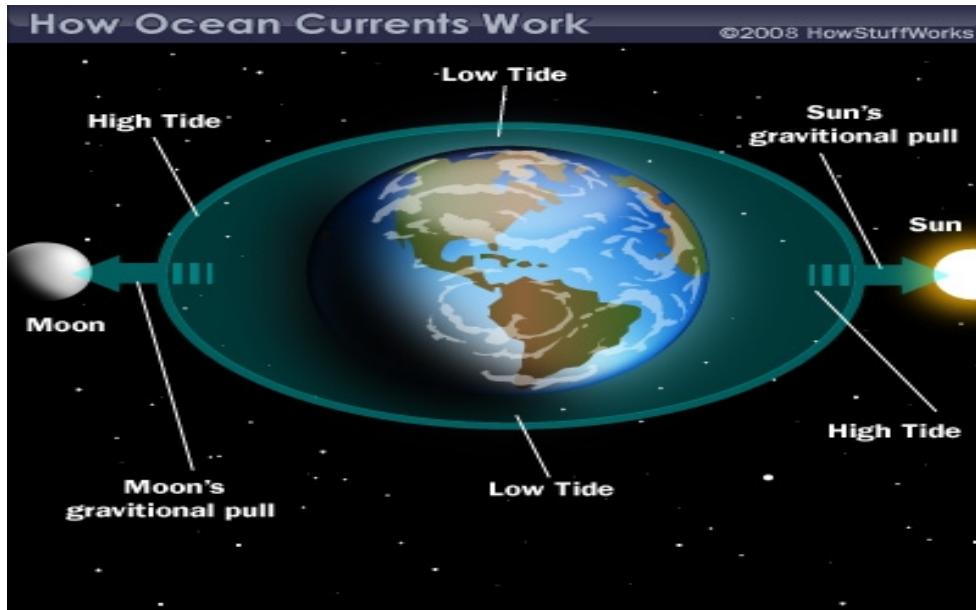


Figure 1: Contribution of Moon and Sun to the creation of the High and Low tides on Earth (Lemonis, 2004)

Tidal period is defined as the time between the appearance of high and low tide and tidal range is defined as the height difference between the highest and the lowest value of sea level (Lemonis, 2004). Tidal energy can be harnessed both in the potential and kinetic form. In the first case the difference in the water level between high and low tide is used to drive turbines in structures like dams, called tidal barrages (La Rance, France), similar to the hydroelectric barrages. In tidal stream systems instead, turbines are submerged to exploit the kinetic energy of tidal currents, with a working principle similar to that of wind generators (Figure 2).

These tidal generators can be deployed in arrays, in tidal farms, and are usually characterized by lower environmental impact and construction costs than tidal barrages. The average power density (APD) of such a turbine is estimated in a manner similar to that of the wind generators and is proportional to the cube of the flow velocity of the stream, U in m/s, and the sea water density, ρ which is approximately 1027 kg/m^3 , three orders of magnitude greater than air's (Horton):

$$APD = \frac{1}{2} \times \rho \times U^3 \quad (1)$$

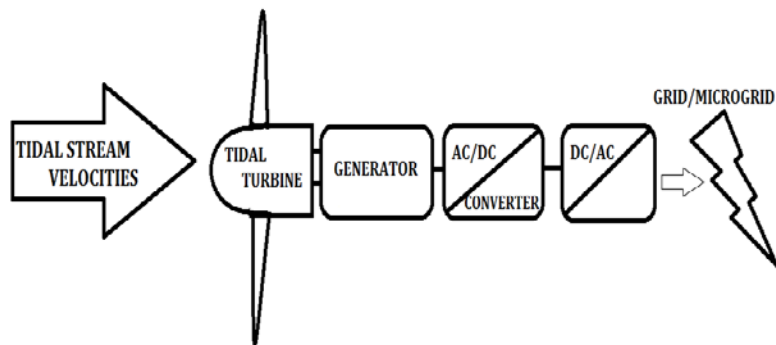


Figure 2: Tidal turbine block diagram.

APD varies with the cube of the velocity of the stream which means that the APD of a wind generator operating at 10m/s wind velocity corresponds to a tidal stream velocity of a mere 1m/s.

The tidal energy system is extremely site specific since its efficiency depends heavily on the stream velocity as well as the physical characteristics of the deployment location, bathymetry and morphology. Generally speaking, better conditions will be found in zones such as estuaries, straits or wherever the local morphology causes the water section to suddenly narrow down leading to bigger head or higher current speed. The useful channel section is though limited by the upper and lower depth bounds: turbines must be deployed below 5m for the small boat traffic and below 20m for all boat traffic. The lower limit is determined by the benthic layer of the channel which is typically 1/10 of the mean minimum channel depth (Hagerman and Polagye, 2006).

Because the tidal current velocity varies with time (Figs 3-5), the Root-Mean-Square (RMS) velocity, U_{rms} , as follows from the velocity distribution (Fig. 9), is used to compute APD in (1):

$$APD = \frac{1}{2} \rho \sum_{i=1}^{NB} (U_i^3 f(U_i)) = \frac{1}{2} \rho U_{rms}^3 \quad (2)$$

where U_i the center of every velocity interval, NB the number of velocity intervals, $f(U_i)$ the probability of the i-th velocity interval.

Tidal turbines are divided into two main categories, the horizontal axis (Figure 2) and vertical axis (Figure 3).

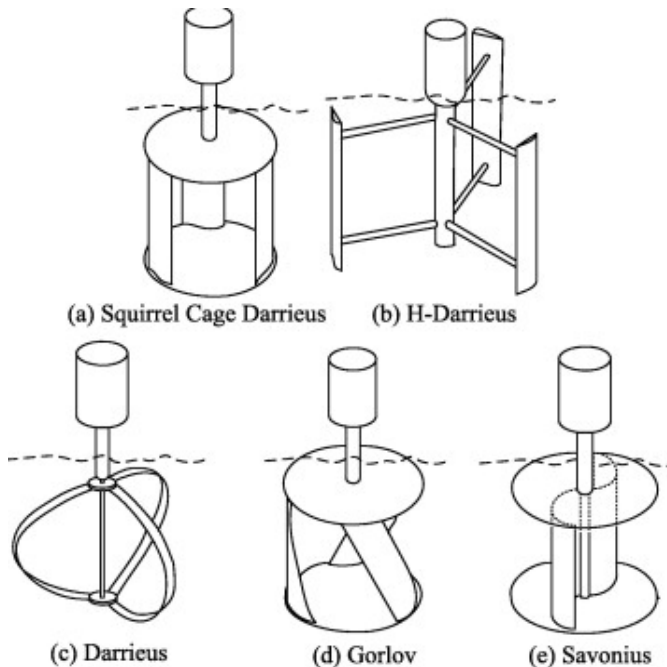


Figure 3: Vertical axis tidal turbines

Horizontal turbines typically consist of three or two wing blades that operate vertically with respect to the sea bed, spanning a circular cross sectional area. Horizontal axis turbines are usually installed in areas where the tidal effect is stronger. For lower stream velocities, their operation may be Venturi-enhanced. Vertical axis turbines don't have a specific number of blades and operate horizontally with respect to the seabed. Their cross sectional area is square and suffers from lower turbulence at the edge of the blades.

Ultimately, the power extracted, P , depends on the cross sectional area of the turbine's blades, A in m^2 , and the overall efficiency of the turbine given by the dimensionless performance coefficient C_p :

$$P = \frac{1}{2} \rho A U^3 C_p \quad (3)$$

C_p is the product of the performance coefficients of all subsystems, *i.e.* turbine, generator, power conditioning, and is typically lower than 45%.

Reports (Melton, 2012) indicate that with the existing technology less than 20% of the current's kinetic energy is harnessed.

Due to the high sea water density, the tidal generators may result in smaller constructions than the wind generators, for the same output power P , as long as the velocities are high enough to overcome the inertia of the given design. However for low stream velocities, the area swept by the blades, A , needs to be increased leading to significant up scaling in the geometric characteristics of the turbine. Furthermore, tidal generator designs must take

into account the harsh sea operating environment. Therefore, the optimal tidal turbine design is a technological object yet to be overcome.

Existing tidal plants are found mainly in Northern Europe, *e.g.* Northern Ireland, Scotland, Norway or the Netherlands. In Southern Europe and the Mediterranean Sea, tides are smaller because of the Gibraltar straits. However, the Mediterranean basin offers several sites where tidal currents are non-negligible as well as marine currents. Strong local currents are encountered in straits all over the Mediterranean Sea, with the most characteristic example being the Straits of Gibraltar, the Otranto, Messina and Sicily straits etc. Strong local sea currents can also be identified in island complexes, such as the Cyclades complex, Greece, the region south of the Cape of Kafireas, or the Mykonos-Tinos straits. One of the most characteristic tidal currents in Greece is the one observed in Euripus' Strait separating the island of Evia from mainland Greece. The tidal current spans the whole length of the channel from North to South but it is strongest at its narrower part, near the city of Chalkida, where the Old and New Bridge connecting Evia Island and mainland are located. The Old Bridge is at the narrowest part of the strait and it is where the phenomenon is significantly stronger.

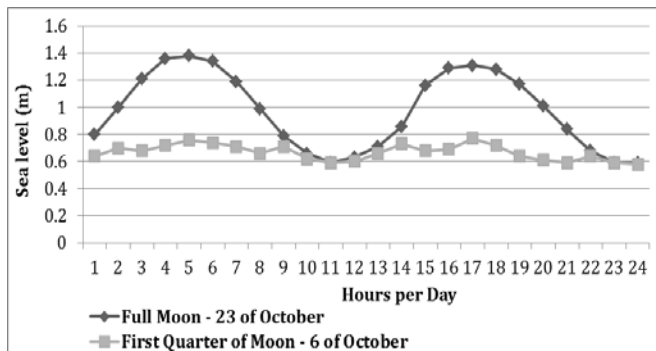


Figure 4: Sea level height at the North port of Chalkida, Greece, recorded during a full moon (high tide) and first quarter (low tide) day in October

The Euripus' strait tidal cycle is semi-diurnal, characterized by two peaks every 24 hours. Data on the Euripus' tidal current is rare. The Hellenic Navy Hydrographic Service (HNHS) has been systematically recording the sea level at the North and South end of the port of Chalkida where the Old Bridge is. Data on the months October – December 2010 has been kindly made available to us. The peak height which varies with the moon phase ranges from approximately 0.70m to 1.40m for a high tide (upper curve, Fig 4), and 0.60 to 0.75 for a low tide (lower curve, Fig.4), during a day.

A thorough profiling of the Euripus' current has been carried out by the Hellenic Centre for Maritime Research (HCMR). The data has been kindly made accessible to the authors for this work. The data consists of

velocity time series recorded along the channel at the New Bridge location for May and July 2010 and profiling of the current by magnitude and direction which was carried out at cross sections, along the depth and width of the channel in three different locations, namely the Old Bridge, New Bridge and North side of the port – Lighthouse on four different dates from May till September 2010. Based on these measurements, HCMR estimated APD to be 13.46 W/m^2 , 1105.87 W/m^2 and 13.46 W/m^2 at the New Bridge, Old Bridge and North Side respectively.

A comparison between the data from HNHS and HCMR was carried out to determine whether the energy potential could be inferred from sea level data, such as the HNHS time series, which are easier to obtain and usually more readily available for several locations in the Mediterranean Sea.

The sea level data (Figs 4 and 6) shows clearly the high tide coinciding with the full and new moon and low tide occurring at the quarter phases. The sea level variation at the North side is significantly stronger while at the South side it is small and quite unruly. This is in line with the weak but turbulent flow observed and the basin's morphology there. Fig. 5 shows the maximum and minimum values recorded during the month of November 2010. The maximum values typically range from 1.20m to 1.40m and the minimum values from 0.65 to 1.00m.

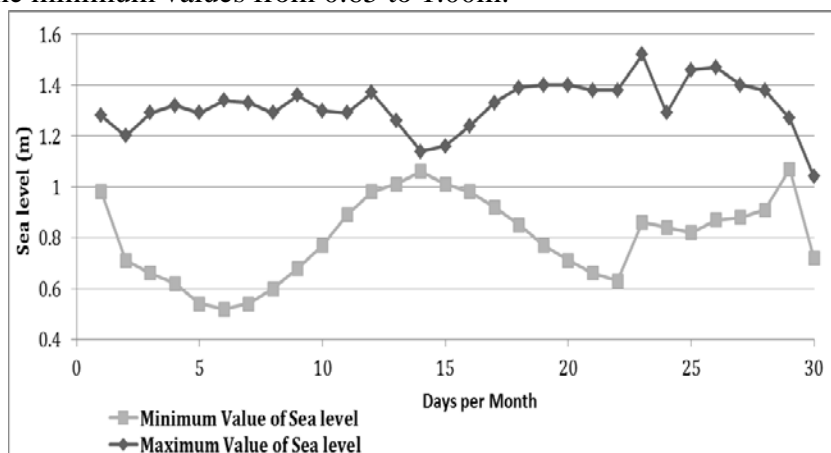


Figure 5: Maximum (top) and minimum (bottom) values of sea level for the month of November 2010 at the North side

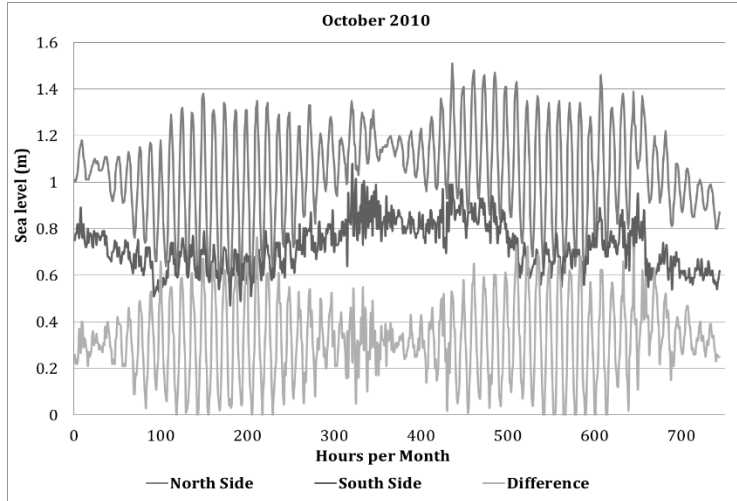


Figure 6: The sea level as recorded on an hourly basis at the North (top) and South side (middle) and their difference (bottom) for the month of October 2010

To assess the energy potential using sea level measurements, the Bernoulli’s equation for uniform non-viscous flow relating height difference, Δh , and velocity U is used:

$$U = \sqrt{2 * g * \Delta h} \tag{4}$$

where g is the gravitational acceleration. (4) does not take into account the channel and seabed profile so it yields a rough approximation of U which is typically overestimated.

After the velocity time series based on HNHS data is calculated using (4) the probability density of the velocity and the cumulative distribution for the months October – December 2010 (Fig. 7) are constructed. The distributions are hardly discernible from month to month which is a manifestation of the periodicity and the predictability of the tidal phenomenon.

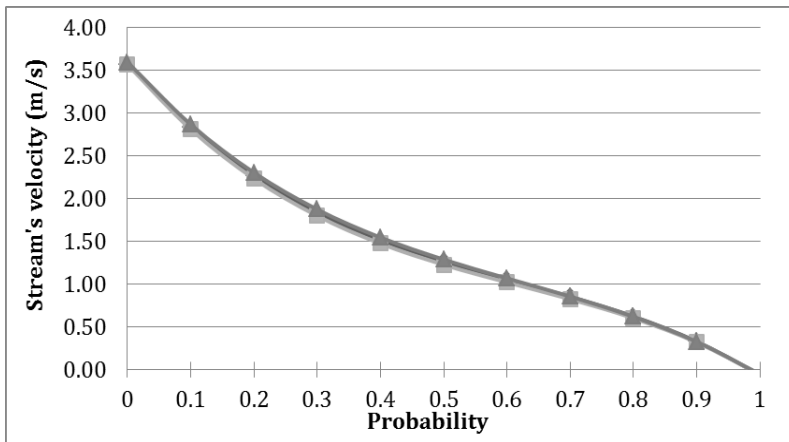


Figure 7: Calculated velocity distributions for October - December 2010

According to the calculations, the probability of velocities over 1m/s is higher than 50% and velocities over 2m/s, which is the minimum operating velocity for existing tidal turbine designs, have a probability of approximately 26%.

In order to compare our calculated velocity distributions based on the HNHS sea level measurements for the period October – December 2010 with the measured HCMR velocity distribution for the period May-June 2010, and test the hypothesis that sea level time series data can be used for the assessment of the tidal current energy potential, we need to calculate the velocity distribution for the months of May-June 2010 based on the sea level data.

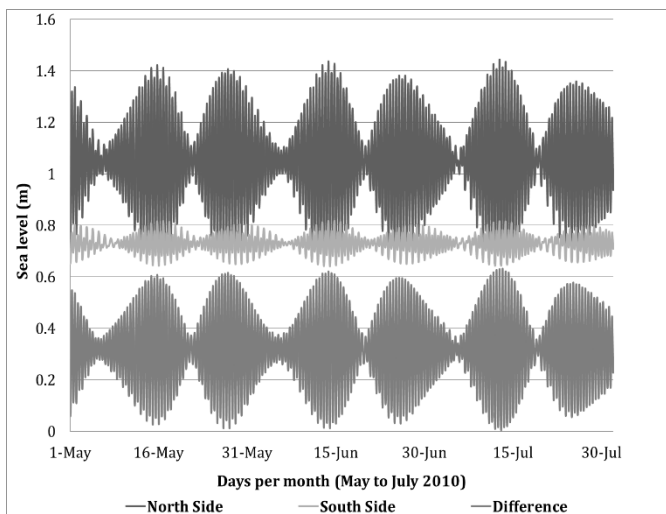


Figure 8: Estimated value of the sea level for the North (top), South (middle) side and their difference (bottom) for May - July 2010.

Harmonic Analysis Method of Least Squares (HAMELS) method (Boon, 2007) was used to construct sea level time series for the period of May-July 2010 and from that calculate the velocity distribution. HAMELS performs harmonic analysis on data, expressing tidal height differences as the summation of harmonic sinusoidal terms, which in our case are the tidal components. The major tidal constituents contributing to the astronomical tide are: M2 - Principal lunar semidiurnal constituent, S2 – Principal solar semidiurnal constituent, N2 - Larger Lunar elliptic semidiurnal constituent, K1 - Luni-solar declinational diurnal constituent, O1 - Lunar declinational diurnal constituent, M4 - First overtide of M2 constituent, M6 - Second overtide of M2 constituent, S4 - First overtide of S2 constituent and MS4 - A compound tide of M2 and S2. An estimate of these constituents can be obtained by HAMELS. Using this method, a set of water level or current observations is processed in order to determine the amplitude and phase of

the main tidal constituents of the place under consideration. The complete constituents set is used as a model and is made to “fit” the data according to the least squares criterion, i.e. picking the combination that causes the sum of the squared differences between observed and model-predicted water levels or currents to be as small as possible. The resulting constituents set can then be used to predict the tide at a different time period.

To compute the harmonic components, we use the time series of the maximum and minimum sea level values and their difference. Then, we use these harmonics to estimate the sea level at a different time period, such as May - July 2010 (Fig. 8).

Based on the comparison between sea level, estimated for the same time period, and measured velocity current (Fig. 9), the Euripus’ tidal current seems to be a hydraulic current, in the sense that the current is created by the difference in height of the tides at two locations joined by a waterway (<http://co-ops.nos.noaa.gov/faq4.html>).

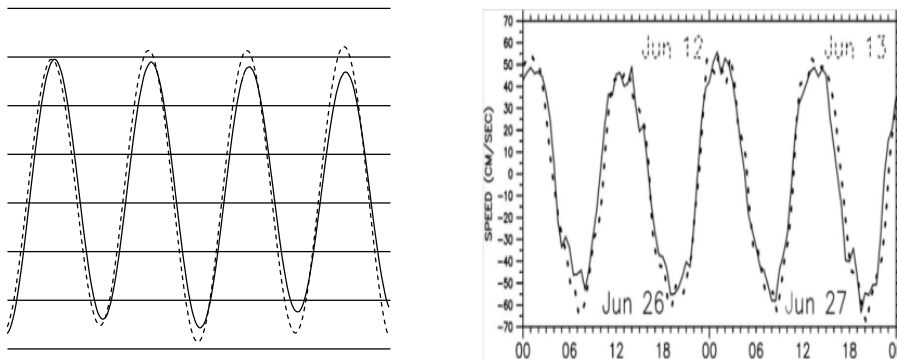


Figure 9: Estimated height differences and measured speed currents and between north and south ports of Evripos bay during June 12-13, 2010 (solid line) and June 26-27, 2010 (dashed line)

Next, we use (4) to compute the current velocity for May – July 2010, extract the velocity distribution for these months and compare it with the measured distribution by HCMR at the North side (Fig. 10). The calculated data are qualitatively comparable with the measured ones but they are shifted towards higher velocities due to the underlying assumptions in (4).

The estimated velocity distribution was used to compute the energy yield of a commercial turbine in Euripus’ channel. The Tocardo BV T2 model was chosen for the calculations because it can operate at velocities as low as 0.25m/s while the span of its blades is appropriate for the size of Euripus’ channel. The specifications of T2 are shown on Fig. 11 and summarized on Table I. Note that according to (3), the lower the stream velocity the higher the cross-sectional area needed and therefore the longer the blades. The turbine is bidirectional which means that it operates for both

stream directions and has an optimal operational range between 1.50 and 2.50m/s.

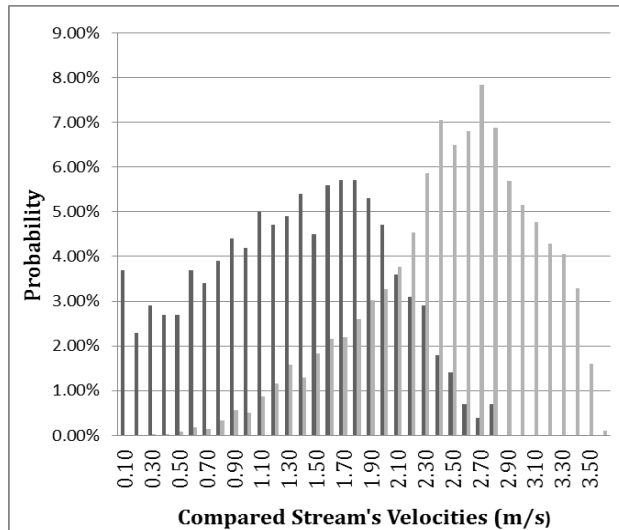


Figure 10: Comparison between recorded (left histogram) and calculated (right histogram) data of the current velocity

The results shown below (Fig. 12 -13) take into consideration the measured velocity distribution for the period May to July 2010 at the Old Bridge location and the data of T2. Fig. 12 shows the output power distribution using T2 at the Old Bridge based on the measured velocities $U_1 \dots k$. For velocities less than 0.25 m/s the T2 model cannot operate and the turbine's output is zero.

To calculate the energy yield at the Old Bridge using T2, we multiply the output power P as given by the T2 datasheets using the measured velocities with the number of operating hours, t :

$$E_{yield} = \sum_{i=1}^k P t \quad (5)$$

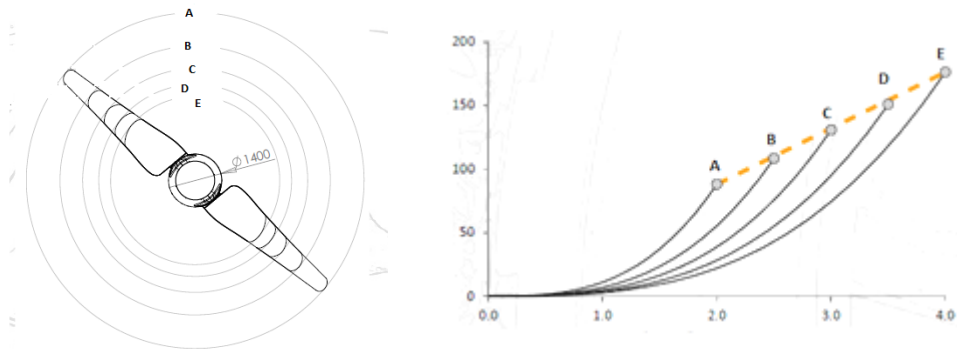
The expected energy yield exceeds an impressive 90000kWh per year for just one T2 turbine. However, the location at the Old Bridge is one of the narrowest areas of the Gulf, approximately 8 meters wide, which means that is unsafe to install even one T2 turbine which needs at least 7 meters for its optimal operation, even in the case of the smallest blade span (Fig.11) . Such an installation would also create problems to the boat traffic that goes on on a regular basis there. However, in the other locations, the yield is almost 60 times smaller, e.g. at the New Bridge the maximum calculated energy yield is 1475kWh per year because of the smaller velocity of this site. Taking into account that the average consumption of a Greek household, according to the Hellenic Statistical Agency, amounted to 3750kWh for 2012, deploying a T2

turbine at the New Bridge, where the current velocities are low would cover less than 50% of the household’s energy demand. However such a turbine could be combined with a RES microgrid, featuring solar panels or wind generators, to enhance the microgrid potential and stable operation given the predictability of the tidal energy. Nevertheless, for such an innovative approach to harnessing tidal energy, new generator low cost designs are needed which will be optimized for operation at lower current velocities.

Table I Tidal turbine T2 data

(<http://web.vims.edu/physical/research/TCTutorial/tideanalysis.htm>)

POWER OUTPUT	87-200 kW
NUMBER OF BLADES	2
DIAMETER OF BLADES	4.5-9.0 m
CROSS SECTIONAL AREA	15.8-63.7 m ²
ROTATIONAL SPEED	22-45 rpm
ROTATIONAL TYPE	Bidirectional



T200 Blade diameter (m)	A	B	C	D	E
	9,2	7,3	6,1	5,2	4,6

Figure 11: BV T2 specifications

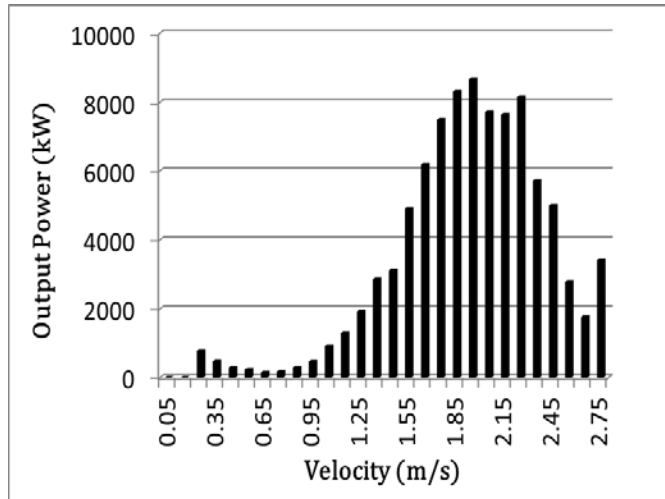


Figure 12: Estimated power production from T2 tidal turbine at the Old Bridge

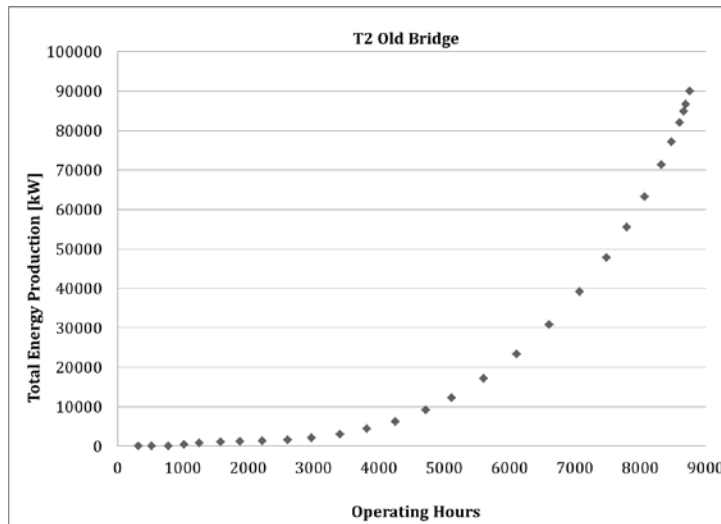


Figure 13: Yearly energy production from one T2 tidal turbine installed at the Old Bridge region

Conclusion

The Euripus’s channel tidal energy potential was explored based on existing current velocity and sea level data for three locations near Chalkida, Greece and a commercial tidal turbine design. A harmonic analysis method was used to extract current velocity information from sea level measurements, as the latter are more common in existing databases. It is possible to extract useful information from such an analysis based on existing sea level time series. However, alternative and more accurate methods must be used to convert sea level to stream velocity. The highest energy potential lies, as expected, at the Old Bridge location where

installation of a tidal turbine is not possible due to morphological issues and shipping use of the channel there. A small but not insignificant potential exists in other sites, such as the New Bridge. To tap this energy potential, new turbine designs, optimized for operation at velocities around 1 m/s, are desirable. Such a novel design should allow for integration in RES microgrid to exploit fully greatest advantage of the tidal energy, its predictability.

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ON A METHOD FOR FINDING THE NUMERICAL SOLUTION OF CAUCHY PROBLEM FOR 2D BURGERS EQUATION

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Abstract

In this paper a new method is proposed for finding the numerical solution of the Cauchy problem for 2D Burgers equation with initial function consisting of four piecewise constants in a class of discontinuous functions. For this goal, a special auxiliary problem which has some advantages over the main problem is introduced. Using these advantages of the auxiliary problem, the numerical solution of the main problem is obtained. Some computer experiments are carried out.

Keywords: Riemann-type problem, 2D-Burgers Equation, Numerical solution in a class of discontinuous functions, Numerical weak solution

Introduction:

As usually, let R^2 be an Euclidean space of points (x, y) . Let Q_T be a domain in $R_+^3 = R^2 \times R^+$ as $Q_T = \{(x, y, t) \mid a \leq x \leq b, c \leq y \leq d, 0 \leq t < T\}$. Here $a, b, c,$ and T are given constants.

In Q_T , we consider the Riemann-type initial value problem for a two-dimensional scalar equation which describes a certain conservation law as

$$\frac{\partial v(x, y, t)}{\partial t} + v(x, y, t) \frac{\partial v(x, y, t)}{\partial x} + v(x, y, t) \frac{\partial v(x, y, t)}{\partial y} = 0 \quad (1)$$

with the initial data

$$v(x, y, 0) = v_0(x, y). \quad (2)$$

Here $v_0(x, y)$ is piecewise constant on a finite numbers of wedges centered at the origin $x = 0, y = 0$. In particular, what is interesting is the

four-wedge problem with wedges corresponding to four quadrants $\left(\alpha_1 = 0, \alpha_2 = \frac{\pi}{2}, \alpha_3 = \pi, \alpha_4 = \frac{3\pi}{2}\right)$ of the spatial plane.

The existence and uniqueness of the solution for the single conservation law in several dimensions by the method of viscosity were studied in [4], [9], [12]. It should be noted that this method gives little information about the qualitative structure of the discontinuity set of solution. This problem for the one space dimension was investigated in [2], [5], [11] etc. where the structure of the solution was revealed in detail.

The solution of problem (1), (2) obtained by using the method of characteristics is

$$v(x, y, t) = v_0(\xi, \eta), \quad (3)$$

where $\xi = x - vt$ and $\eta = y - vt$ are the special coordinates moving with the speed of v , respectively.

First investigations of the two-dimensional Riemann-type initial value problem was initiated by Guckenheimer, [3]. Paper [7] is devoted to a construction of the solution of the 2D- Riemann-type initial value problem for scalar conservation law in the event of a three or more inflection point in state function $f(v) = g(v)$, by analyzing a study of the generalization of one- dimensional Riemann problem to allow for initial data having a finite number of jump discontinuities with constant data or rarefaction waves between jumps. In [6], it has been shown that the solution of the 2D- Riemann-type initial value problem can be classified and present in terms of two-dimensional nonlinear waves in analogy with the nonlinear rarefaction and shock waves of the one dimensional Riemann problem, i.e. explicit solutions are constructible from these waves.

Since the solutions for 2D-Riemann-type initial value problems have explicit structure, they also serve as a touchstone for numerical algorithms. In [1], the concept of the shock and rarefaction base points are included and using the characteristic analysis, the analytical solution for 2D-Riemann-type initial value problem for the Burgers equation is constructed. In addition, for the numerical solution the composite scheme developed by Liska-Wendroff in [8] is applied.

Auxiliary Problems

It is known that global continuous solutions for 2D-Riemann-type initial value problems will not yield appropriate smooth initial data. The weak solution of problem (1), (2), will be defined as follows.

Definition 1: *The function $v(x, y, t)$ satisfying initial condition (2) is called a weak solution of problem (1), (2) if the following integral relation*

$$\iint_{R^2} \int_{R_+^T} \left\{ v(x, y, t) \varphi_t(x, y, t) + \frac{v^2(x, y, t)}{2} \varphi_x + \frac{v^2(x, y, t)}{2} \varphi_y(x, y, t) \right\} dx dy dt + \iint_{R^2} v_0(x, y) \varphi(x, y, 0) dx dy = 0 \tag{4}$$

holds for every test function $\varphi(x, y, t)$ defined in R_+^3 and differentiable in the upper half plane and vanishes for $\sqrt{x^2 + y^2} + t$ sufficiently large.

Let Q_{xy} be a rectangular domain defined as

$$Q_{xy} = \{(\xi, \eta), a \leq \xi \leq x, c \leq \eta \leq y\}$$

such that $Q_{xy} \subset Q_T$ and $Q_{bd} \times [0, T) = Q_T$.

In order to find the weak solution of problem (1), (2) in the sense of (4) we will introduce the auxiliary problem as above. Integrating equation (1) on the region Q_{xy} , we get

$$\frac{\partial}{\partial t} \int_a^x \int_c^y v(\xi, \eta, t) d\xi d\eta + \frac{1}{2} \int_c^y v^2(x, \eta, t) d\eta + \frac{1}{2} \int_a^x v^2(\xi, y, t) d\xi = \varphi_1(a, y, t) + \varphi_2(x, b, t). \tag{5}$$

Here

$$\varphi_1(a, y, t) = \frac{1}{2} \int_c^y v^2(a, \eta, t) d\eta, \quad \varphi_2(x, b, t) = \frac{1}{2} \int_a^x v^2(\xi, b, t) d\xi.$$

It is clearly seen that $\varphi_1(a, y, t) + \varphi_2(x, b, t) \in \ker M$. Here

$$M\{\cdot\} = \frac{\partial^2 \{\cdot\}}{\partial x \partial y}.$$

We denote by $w(x, y, t)$ the following expression

$$w(x, y, t) = \int_a^x \int_c^y v(\xi, \eta, t) d\xi d\eta + \Psi(a, b, x, y, t), \tag{6}$$

where $\Psi(a, b, x, y, t) \in \ker M$. From (6) it follows that

$$v(x, y, t) = M\{w(x, y, t)\}. \tag{7}$$

Taking into consideration (6), (7), we get

$$\frac{\partial w(x, y, t)}{\partial t} + \frac{1}{2} \int_c^y v^2(x, \eta, t) d\eta + \frac{1}{2} \int_a^x v^2(\xi, y, t) d\xi = 0. \tag{8}$$

The initial condition for (8) is

$$w(x, y, 0) = w_0(x, y). \tag{9}$$

Here the function $v_0(x, y)$ is any differentiable solution of the equation

$$v_0(x, y) = M\{w_0(x, y)\}. \tag{10}$$

To find a solution of equation (8) with initial condition (9) we will call a first kind auxiliary problem.

The auxiliary problem (8), (9) has following advantages:

- (i) In this case the functions $v(x, y, t)$ and $\frac{1}{2}v^2(x, y, t)$ can be discontinuous too,
- (ii) the order of differentiability of the function $w(x, y, t)$ is greater than the order of differentiability of the function $v(x, y, t)$,
- (iii) the derivatives v_x, v_y and v_t in algorithm for obtaining of the solution of problem (8), (9) does not occur, as these derivatives does not exist.

The following theorem is valid.

Theorem 1: *If the function $w(x, y, t)$ is a solution of auxiliary problem (8), (9), then the function $v(x, y, t)$ expressed by $v(x, y, t) = Mw(x, y, t)$ is a weak solution of main problem (1), (2).*

To obtain a solution of equation (5) with initial condition (2) we will call second kind auxiliary problem.

Analysis of a Linear Problem

Before obtaining the solution of nonlinear problems, at first we investigate a simple linearized problem (1), (2) as

$$\frac{\partial v(x, y, t)}{\partial t} + A \frac{\partial v(x, y, t)}{\partial x} + B \frac{\partial v(x, y, t)}{\partial y} = 0, \tag{11}$$

where A and B are given constants. The exact solution of (11) with initial condition (2) is

$$v(x, y, t) = v_0(x - At, y - Bt). \tag{12}$$

In this paper we will study the first type auxiliary problem for (11), (12). In this case equation (8) can be rewritten in the following form

$$\frac{\partial w(x, y, t)}{\partial t} + A \int_c^y v(x, \eta, t) d\eta + B \int_a^x v(\xi, y, t) d\xi = 0. \tag{13}$$

For this case, relation (7) is valid too. Taking into consideration (7), we have

$$\frac{\partial w(x, y, t)}{\partial t} + A \frac{\partial w(x, y, t)}{\partial x} + B \frac{\partial w(x, y, t)}{\partial y} = 0. \tag{14}$$

The initial condition for (14) is

$$w(x, y, 0) = w_0(x, y). \tag{15}$$

Here $w_0(x, y)$ is any continuous differentiable function of equation (10).

The exact solution of problem (14), (15) is

$$w(x, y, t) = w_0(x - At, y - Bt). \tag{16}$$

It is seen that equation (14) coincides with equation (11), but the initial function $v_0(x, y)$ is more smooth than the initial function of the main problem.

Finite Difference Schemes in a Class of Discontinuous Functions

In this section, we intend to develop the numerical method for finding the solution of problem (1), (2), and investigate some of its properties. As it is stated above, in the nonlinear case, the solution of the main problem has discontinuous points, whose locations are unknown beforehand. These properties do not permit us to apply classical numerical methods to this problem directly. For this aim, we will use auxiliary problem (8), (2). By using the advantages of the suggested auxiliary problem, a new numerical algorithm will be proposed. In [10] the suggested numerical method was studied for two-dimensional nonlinear scalar equation, when $f(v) = g(v) = v^2/2$ and the Riemann data consist of the two segments piecewise constant.

The proposed method will be developed to find the numerical solution of the Cauchy problem for equation (1) in the following study.

The Finite Difference Scheme

In order to develop the numerical algorithm, we construct the following grids. Let

$$\omega_{hx} = \{x_i, x_i = a + ih_x, h_x = \frac{b-a}{n}, i = 0, 1, 2, \dots, n\}$$

and

$$\omega_{hy} = \{y_j, y_j = c + jh_y, h_y = \frac{d-c}{m}, j = 0, 1, 2, \dots, m\}$$

which are cover of the segments $[a, b]$ and $[c, d]$ respectively. Now we shall construct two new grids as

$$\omega_{h\xi} = \{\xi_\nu, \xi_\nu = a + \nu h_\xi, \nu = 0, 1, 2, \dots, np\} \text{ and}$$

$$\omega_{h\eta} = \{\eta_\mu, \eta_\mu = c + \mu h_\eta, \mu = 0, 1, 2, \dots, mq\}$$

which also cover the segments $[a, b]$ and $[c, d]$ respectively, where $h_\xi = \frac{hx}{p}$

and $h_\eta = \frac{hy}{q}$. Later we introduce the following notations $\omega_{xy} = \omega_{hx} \times \omega_{hy}$,

$\omega_{\xi\eta} = \omega_{h\xi} \times \Omega_{h\eta}$, $\omega_{xy}^T = \omega_{xy} \times \{t_k = k\tau; k = 0, 1, 2, \dots\}$ and $\omega_{\xi\eta}^T = \omega_{\xi\eta} \times \{t_k = k\tau; k = 0, 1, 2, \dots\}$. Since $\xi_{p\ell} = x_\ell$, $\eta_{q\lambda} = y_\lambda$ for any $0 \leq \ell \leq n$ and $0 \leq \lambda \leq m$ it clear that $\omega_{xy}^T \subseteq \omega_{\xi\eta}^T$. Here n , m , p , q are the given integer numbers which show nodal points on the segments $[a, b]$, $[c, d]$, $[a, x]$ and $[c, y]$ respectively.

In order to approximate equations (8) (or (13)) by finite difference, integrals leaving in (8) (or (13)) are approximated as follows:

$$\int_a^{x_i} v(\xi, y, t) d\xi = h_\xi \sum_{v=1}^{pi} V(\xi_v, y_j, t_k), \tag{17}$$

$$\int_c^y v(x, \eta, t) d\eta = h_\eta \sum_{\mu=1}^{qj} V(x_i, \eta_\mu, t_k), \tag{18}$$

$$(i = 1, 2, \dots, n), \quad (j = 1, 2, \dots, m).$$

Taking into consideration (17) and (18), equations (8) and (13) at any point (i, j, k) of the grid ω_{xy}^T are approximated by the following explicit scheme as

$$W_{i,k+1} = W_{i,k} - \frac{h_t h_\eta}{2} \sum_{\mu=1}^{qj} V^2(x_i, \eta_\mu, t_k) - \frac{h_t h_\xi}{2} \sum_{v=1}^{pi} V^2(\xi_v, y_j, t_k), \tag{19}$$

$$W_{i,k+1} = W_{i,k} - Ah_i h_\eta \sum_{\mu=1}^{qj} V(x_i, \eta_\mu, t_k) - Bh_i h_\xi \sum_{v=1}^{pi} V(\xi_v, y_j, t_k), \tag{20}$$

$$(i = 1, 2, \dots, n; \quad j = 1, 2, \dots, m; \quad k = 0, 1, 2, \dots).$$

Computer Experiments

Three type computer tests on basis of the proposed algorithms are carried out. Tests were made using the following data: $(x, y) \in (-2, 2) \times (-2, 2), T = 0.2, h_t = 0.001, \quad n = m = 500$ and $(v_1, v_2, v_3, v_4) = (1, 2, 3, 4)$.

At first we consider the initial value problem for (11) with piecewise constants connecting four wedges centered at the origin $x = 0, y = 0$, i.e

$$v_0(x, y) = \begin{cases} v_1, & x > 0, y > 0, \\ v_2, & x < 0, y > 0, \\ v_3, & x < 0, y < 0, \\ v_4, & x > 0, y < 0. \end{cases} \tag{21}$$

We will solve problem (14), (15) instead of (11), (2). In this case the function of $w_0(x, y)$ will be chosen as a continuous solution of (10)

$$w_0(x, y) = \begin{cases} v_1 xy, & x > 0, y > 0, \\ v_2 xy, & x < 0, y > 0, \\ v_3 xy, & x < 0, y < 0, \\ v_4 xy, & x > 0, y < 0. \end{cases} \tag{22}$$

Problem (14), (15) is approximated by following explicit finite difference schemes as

$$W_{i,j,k+1} = g_1 W_{i-1,j,k} + [1 - (g_1 + g_2)] W_{i,j,k} + g_1 W_{i,j-1,k}, \tag{23}$$

$$W_{i,j,0} = w_0(x_i, y_j). \tag{24}$$

Here $g_1 = \frac{h_t A}{h_x}$, $g_2 = \frac{h_t B}{h_y}$ and $W_{i,j,k+1}$ denote the approximated value of $w(x, y, t)$ at any point (x_i, y_j, t_k) of the grid $\omega_{xy}^T \subseteq \omega_{\xi\eta}^T$. It is no difficult to indicate that

$$V_{i,j,k+1} = \frac{1}{h_x} \left\{ \frac{W_{i-1,j,k} - W_{i-1,j,k}}{h_y} - \frac{W_{i-1,j,k} - W_{i-1,j,k}}{h_y} \right\}.$$

Second type calculation have been maked on basis of the following

$$V_{i,j,k+1} = V_{i,j,k} - \frac{h_t}{h_x h_y} \left[(h_x + h_y) V_{i,j,k}^2 + h_y V_{i-1,j,k}^2 + h_x V_{i,j-1,k}^2 \right],$$

$$(i = 1, 2, \dots, n), j = 1, 2, \dots, m, k = 0, 1, 2, \dots,$$

$$V_{i,j,0} = v_0(x_i, y_j), \quad (i = 0, 1, 2, \dots, n, j = 0, 1, 2, \dots, m)$$

difference schemes.

Finally, using difference schemes (19), (20) the numerical solution of the problems (1),(2) and (11),(2) on the same data are found. Obtained solutions show good coincidence with exact solutions of the investigated problem.

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A MODEL SUGGESTION FOR ACTIVITY BASED COSTING IN THE ERP SYSTEM

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Abstract

Activity Based Costing (ABC), has been developed as a result of the necessity that companies have been required to focus on the cost basis more closely to be able to survive and be successful in today's competition environment. Since overhead costs are traditionally exempted from the cost analysis, they have been treated as expenses for the period. As a result of the increase in these fixed costs, it has become more important to assign overhead costs to products via a logical model. We aim to illustrate a case for an activity center to explain our model. Our model has been used in many organizations in Turkey and its success has been proved for years. We classified costs in four categories as resource costs on the basis of the volume of activities, resource costs on the basis of activity level, resource costs independent from the volume of activities, and direct resource cost. This approach lets us manage costs of activities according to their characteristics.

Keywords: Activity Based Costing, Enterprise Resource Planning, Advanced Reporting, cost assignment.

Introduction

Companies have been trying to reduce their costs to gain more profit with different costing and budgeting techniques. Companies need faster, more qualified, more efficient and sustainable technologies in order to compete around the world. However technology is not only enough part for companies to compete with each other around the global world. Companies need to take decision to operate their business in a very short time and information should be very quick, true and accessible. Overhead costs are very important to identify real production cost such as rental, depreciation, maintenance, research and development, sales expenses. In addition companies have been trying to reduce their variable costs in order to more efficient and more profitable. We built a new model under Activity Based

Costing (ABC) method. We developed our model under ABC method to be able to reduce cost of the activities not only reach full commercial cost of products at different activity levels but also reduce in full commercial cost of products variable costs.

There is no any system as conventional costing systems production costs determination of variable and fixed production cost in the competitive periods. It determines via utilizing product variable and fixed costs database out of the system. Product variable costs do not reflect reality on a level with industrial cost which is limited with narrow scope direct raw material, labour costs, externally received benefit (Electricity, LNG) costs due to the insensitive determination. Product variable costs due to the determination results of lower than their actual level they determined their contribution margin higher than their actual level. Sales cause significant loss of profits and damages, in market prices on a level with full unit cost and below the level, higher contribution margins from the actual level determined by product based on contribution margin of the competition period. Due to the subjective measures is distributed to products and methods sales and marketing and administration costs do not reflect reality of full commercial cost. As a result of the cost distributions they may seem according to one type of measurement profitable, by another measurement harmful. Consequently using of traditional costing system sourced cost datas load important risks as providing failure of competitive advantage, losing of market and customer and losses. Providing of basic condition of sensitive and accurate costing in the competitive period. Using the activity based costing (ABC) system that can make sensitive and accurate costing to present a great importance in the competitive period.

1. The Basic Concepts of the Activity Based Costing (ABC)

a. Resource Concept

The resource concept to be defined as in the activity based costing system (ABC) consumed for products and operations assets such as material, machine, building, labour cost, externally received maintenance and repair services, electricity energy, compressed steam.

b. Activity Concept

Activity concept is formed from a lot lower activity declaratory business process. For instance it is formed from lower activities such as accounting activity is business process and book keeping and issuing of ledger records, issuing of dispatch note, submission of government declarations. Activities of activity based costing (ABC) is divided into three main groups such as activities for products and on a level with plant activities (Top management, factory management, human resources

management, IT, quality assurance, process development activities) and customer activities.

c. Product Intended Activities Concept

Product development activities (Product design engineering activities, research and development activities) extending the pre-production to sales in process, activities for products (Production, forwarding, material preparation, accounting, sales activities).

d. Cost Driver

When the number of activities increases, the number of cost driver is also increases. One of the main points of activity-based costing system to decompose the conventional costing system is the concept of cost drivers. While in ABC different cost drivers for each activity are used, in the conventional system it is used a single distribution key. This causes to produce erroneous report of the conventional cost system.

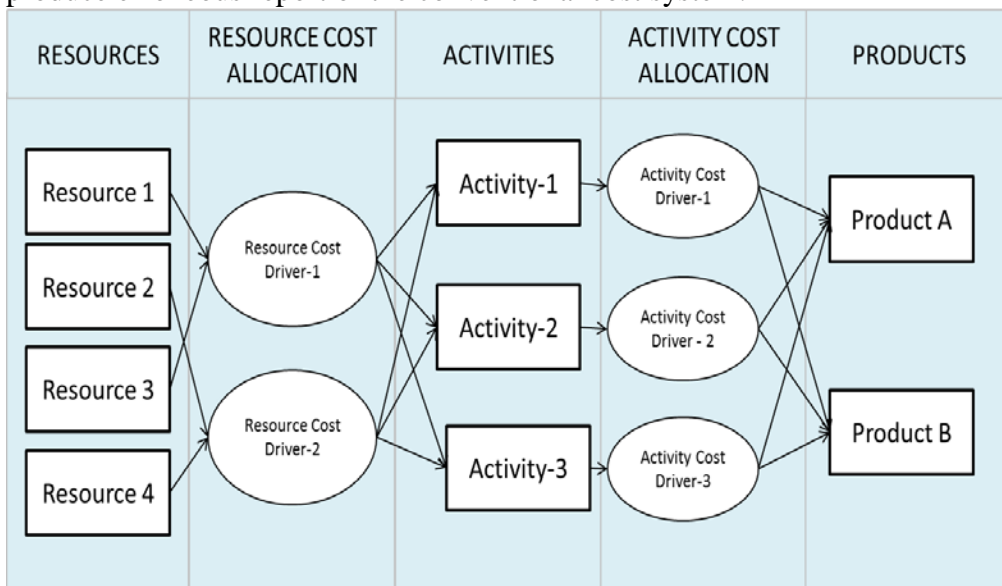


Figure 1. Cost Drivers in ABC (Pazarceviren, S. Y., & Şahin, N. K. (2013)

There are two different cost drivers in activity based costing system. One of them is used for carrying resource costs to activities and the other one is used for carrying activity costs to the products (Pazarceviren & Celayir, 2013).

e. Activity Unit / Unit Concept

It defines with machinery, bench, assembly line, work stations, product cells in the activity based costing (ABC) system.

f. Costing the Right Coverage

Source cost covers certainly consumption of resources in the cost carrier cost. Product variable and fixed costs, activity costs, source costs

which they produced inside within the true scope and determining of on a level with commercial cost.

g. Costing of Goal Accuracy

Resources which consumed for products, cost of activities of consumption type (product unit per party, as periodically) as admissible to determine of variable or fixed cost.

h. Sensitive Costing

Consumed source volume for product, consumed product operation, activity and activity unit, via using the method of unit basis engineering techniques, making sensitive and accurate measurements and determination of using different route machines(activity units).

i. Condition of Accurate Measurement for Costing

Determination of resource consumption volumes the consumption of resources on the basis of measurements and with engineering measurement methods if it is possible with measuring device.

j. Method Accuracy of Condition In Costing

On the basis of consumed resource costs for activities presence of activities, assigning of activity costs on the basis of consumed activity to product costs.

k. Measuring of Compliance Requirement In Costing

Determination of activity consumptions the relationship between the activities of the products as the basis of measurement that reflects the best. Budgeting on the basis of measurements that will be best express the activity capacity. Establishment of product activity relationships on the basis of lower activity if possible, made an activity costs on the basis of cost operating cost pool.

l. Estimation Accuracy Condition in Costing

Accurate estimating of product manufacturing volumes and activity capacities.

m. Consumptions Per Unit as Direct Products

Resources such as, material, labour, electricity, water, sales bonus, from production to sales, as all activities be analysed and be covered without exception for variable cost of goods. Basic principles of product variable costs on a level with commercial cost and sensitive determination:

- To determine a product (As products different quality level) how many it consumes, pinpointing as all activity units for its product as product variable costs according to different activity unit(Machine, bench, assembly station line) consumption.

Basic principles of accurate determination of product variable costs:

- To determine resources consumption volume, resources consumption measurement and engineering measurement method.

- A basis of determination of resources prices, future resource prices for future prices, current source prices for actual productions.

2. Basic Principles of Production Fixed Costs On a Level With Commercial Cost and Sensitive Determinations

- To cover consumed resources(The use of just for one production – machines, warehouses depreciations, product responsible salaries, sales persons salaries) costs as periodically just for one product as of all activities inside product direct fixed costs.
- Remain outside as periodically consumed direct fixed costs(Machine, bench depreciations) for activity units inside of the activity costs. Containing of activity unit direct fixed resource costs, on the basis of capacity consumption inside of the products fixed costs.
- To cover consumed resources costs(Quality control unit employee salaries established for customer, device depreciation) for activities carried out intended for customer, inside of the customers costs and just assignment of regarding the customers work orders scope manufactured products fixed costs.
- To cover as periodically consumed resource costs (Employee, device, area depreciation) for resource productions (water, electricity) at the corporation inside of the productions fixed costs.
- To base determination of activity costs of resource costs (Materials, employee, fixed assets, device depreciations, rental, insurance, consultation) as consumed periodically and to cover as a basis products activity consumption of activity costs inside of the fixed cost.
-

3. Basic Principles of Accurate Determination of Product Fixed Costs

To monitor products, activities, customers, manufactured resources of inside of the corporation, as periodically, direct consumed resources consumption volumes and costs in the accounting recording systems as resource type, consumed activity center and consumed cost carrier (Product, activity, customer operation, manufactured resource inside of the corporation) and this relationship layout determined via budgeting(Thus it is ensured resource costs related with cost carriers direct fixed cost). Apart from this method, it might determine resource costs, standard consumption volumes of resources a basis with their prices.

Activity consumption is determined activity capacity and products activity request analyze reflected measurements. Executed activities determine (Production planning, material preparation, paint chemical

cuisine, production and quality control) on a level with party as consumption measurement getting as a basis production parties, basis that labour and machine usage, per product unit activity consumption measurement (Machine, direct labour hours, meter, kg) in the per product unit manufacturing activities. Product development and design regarding the activities consumption measurements are product volume measurements. Corporate executed over activities are determined such as management activities, human resources activities, activities consumption measurement not on the basis of product activity relationship, these activities are determined intended for product activities relationship. Products activity consumptions are monitored, on the basis of these activity consumptions and per product unit consumptions are budgeted or direct products per product unit standard consumption volumes are found.

Activity capacities are budgeted on the basis of products budgeted production volumes and product per unit activity consumption volumes (budgeted or standard). Activity measurement per activity cost assignment ratios are found on the basis of budgeted activity costs and budgeted activity capacity. Activity costs products activity consumptions and on the basis of budgeted activity cost ratios with products activity consumptions are included product indirect fixed costs are included.

4. A Model Suggestion

Activity based Costing (ABC) has been the most popular costing method and provides the most accurate way for allocation of overheads. However, when overheads are treated the same way, there might be some inconsistency in the management of resources even though the costs assigned to products or services are exactly the right (Pazarceviren & Şahin, 2013).

We have developed a sub-approach for activity based costing classifying the overhead under four different categories:

1. Resource costs on the basis of the volume of activities,
2. Resource costs on the basis of activity level,
3. Resource costs independent from the volume of activities,
4. Direct resource cost,

We have been using ABC method for most of the companies that we consult with an ERP (Enterprise resource planning) program designed by Professor Selim Yuksel Pazarceviren¹ and we have seen the success of the method in practice.

¹ Professor at Istanbul Commerce University and Cost Management Consultant

Figure 1: (ABC) Activity Based Costing Operating System in the ERP (Enterprise Resource Planning)

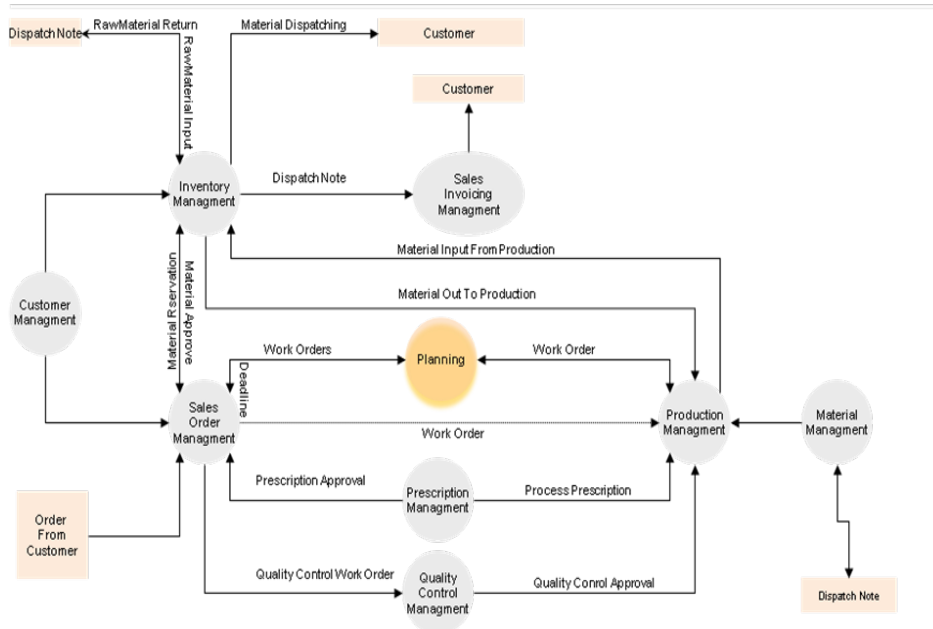


Figure 2: Activity Based Direct Costing(ABC) Cost Flow Chart

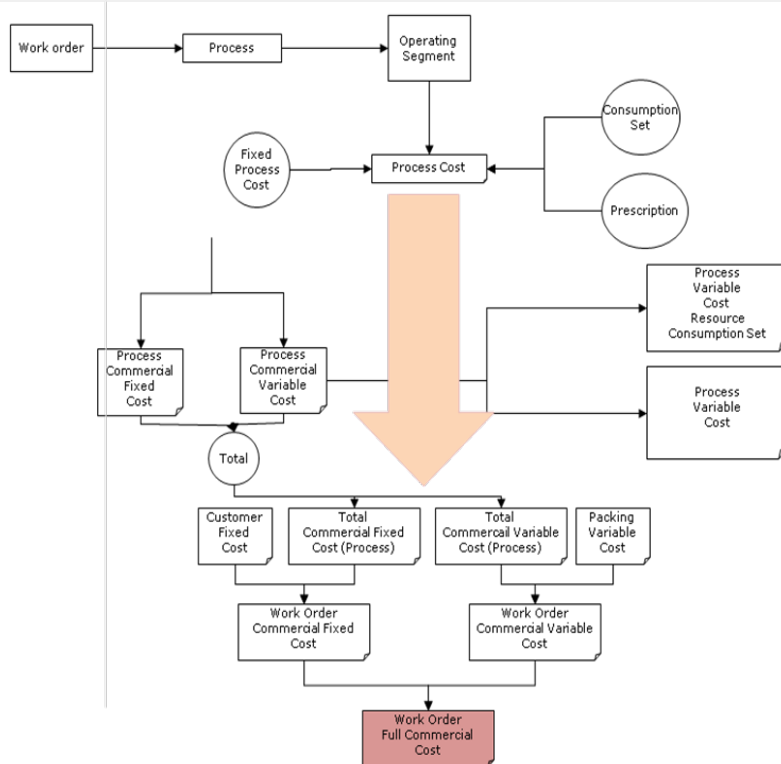


Figure 3: Activity Based Direct Costing(ABC) / Fixed Costing System

Budgeting of Direct Fixed Costs

Resources	Total Budgeted Costs	Process and Activities Direct Consumed Resource Costs Budget			
		Internal Resource Production	Preparation Processes	Main Processes	Activities (Shipment, Planning...)
0-Material Resource Cost					
...					
1-Labor Resource Cost					
...					
2-Employees Resource Cost					
...					
3-Service Cost					
...					
4-Miscellaneous Resource Cost					
...					
5-Tax / Duties					
...					
6-Depreciation					
...					
TOTAL					

Figure 4: Activity Based Costing(ABC) / Fixed Costing System

Finding of Value of Fixed Costs Budget Process

Activities	Total Budget Cost	Processes						
		Process 1	Process 2	Process 2	Process 1	Process 2
Merchandise								
Material Warehouse								
Prescription Process								
Lab 1								
Lab 2								
Production Planning								
.....								
Inspection								
Forwarding								
Sales								
Accounting								
.....								
Process Assignment Budget Activity Cost								
Process Direct Consumption Resource Cost								
Total Budget Process Fixed Cost								
Budget Process Volume								
Process Fixed Cost Per Kg								

Figure 5: Calculated Costs and Data Resources



5. Activity Based Costing ERP Based Tables

Table 1. Front Cost Simulation Report

Simulation Code	ABC 1	Material Code	X	Special Process	Simulation Date	01.06.2015	Cost Date	30.03.2015	
Customer Name	ABC	Material Name	Y	Route Code	120	Simulation Volume	10	Exchange Rate Date	30.03.2015
Order Code		Quality Code	1000	Material Type		Package		Daily Exchange Rate	1

Item Code	Item Name	Department Code	Department Name	Prescription Code	Version	Program Type	Duration	Fixed Cost	Variable Cost	Total Cost
1.200	Material Preparation	100	Machine 1		0	Type 1	120	\$2,000.00	\$500.00	\$2,200.00
	Prescription	Water	Electricity	Steam	Gas		Steam	Depreciation	Maintenance	Budget
	0	0	1.230	0	0		0	\$0.00	\$0.00	\$3,200.00
1.300	Process 1	200	Machine 2			Type 2	140	\$3,000.00	\$600.00	\$3,600.00
	Prescription	Water	Electricity	Steam	Gas		Steam	Depreciation	Maintenance	Budget
	0	0	1.320	0	0		0	\$0.00	\$0.00	\$1,444,500.00
Total								\$5,000.00	\$1,100.00	\$6,100.00

Unit Cost: \$610,00

Table 2. Work Order Based Actual Cost Report

Work Order Code	123	Material Code	X	Special Process	Work Order Date	23.02.2015	Cost Date	30.03.2015	
Customer Name	ABC	Material Name	Y	Route Code	22	Work Order Volume	12	Exchange Rate Date	30.03.2015
Order Code	AB1	Quality Code	200	Material Type		Package		Daily Exchange Rate	1

Item Code	Item Name	Department Code	Department Name	Prescription Code	Version	Program Type	Duration	Fixed Cost	Variable Cost	Total Cost
12	Material Preparation	N100	Machine 1		0	Type 1	60	\$1,550.00	\$0.00	\$1,550.00
	Prescription	Water	Electricity	Air			Steam	Depreciation	Maintenance	Budget
	0	0	0	0	0		0	\$0.00	\$0.00	\$1,650.00
13	Process 1	N200	Machine 2			Type 2	70	\$2,250.00	\$125.00	\$2,375.00
	Prescription	Water	Electricity	Air			Steam	Depreciation	Maintenance	Budget
	0	0	1.200	0	0		0,000	\$0.00	\$0.00	\$2,500.00
Total								\$3,800.00	\$125.00	\$3,925.00

Unit Cost: \$327,08

Table 3. Work Order Based Standard Cost Report

Work Order Code	201	Material Code	X	Special Process		Work Order Date	23.02.2015	Cost Date	30.03.2015
Customer Name	ABC	Material Name	Y	Route Code	30	Work Order Volume	20	Exchange Rate Date	30.03.2015
Order Code	AB 23	Quality Code	300	Material Type		Package		Daily Exchange Rate	1

Item Code	Item Name	Department Code	Department Name	Prescription Code	Version	Program Type	Duration	Fixed Cost	Variable Cost		Total Cost
102	Material Preparation	P200	Machine 1		0	Type 1	120	\$1.250,00	\$355,00	\$0,00	\$1.605,00
	Prescription 0	Water	Electricity	Air	0	Lpg	Steam	Depreciation	Meintenance	Budget	
		0	3.400	0	0	0	0	\$0,00	\$0,00	\$1.750,00	\$0,00
203	Process 1	M300	Machine 2			Type 2	105	\$1.450,00	\$265,00		\$1.715,00
	Prescription 0	Water	Electricity	Air		Lpg	Steam	Depreciation	Meintenance	Budget	
		0	2.500	0	0	0	0,000	\$0,00	\$0,00	\$1.610,00	
Total								\$2.700,00	\$620,00		\$3.320,00

Unit Cost:	\$166,00
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Table 4. Production Based Income Statement

Item		Total Sales Amount	Total Variable Cost	Total Contribution Margin	Total Fixed Cost	Profit	Total Sales Volume	Average Sales	Average Unit Cost	Average Variable Cost	Average Fixed Cost
1.100	Actual	\$15.000,00	\$10.000,00	\$5.000,00	\$3.000,00	\$2.000,00	50	\$300,00	\$260,00	\$200,00	\$60,00
Item A	Standard		\$10.850,00	\$5.500,00	\$3.350,00	\$2.150,00			\$284,00	\$217,00	\$67,00
2.200	Difference		-\$850,00	-\$500,00	-\$350,00	-\$150,00			-\$24,00	-\$17,00	-\$7,00
Item B	Actual	\$29.000,00	\$22.000,00	\$7.000,00	\$6.000,00	\$1.000,00	40	\$725,00	\$700,00	\$550,00	\$150,00
	Standard		\$23.000,00	\$8.000,00	\$4.500,00	\$3.500,00			\$687,50	\$575,00	\$112,50
	Difference		-\$1.000,00	-\$1.000,00	\$1.500,00	-\$2.500,00			\$12,50	-\$25,00	\$37,50
Total	Actual	\$44.000,00	\$32.000,00	\$12.000,00	\$9.000,00	\$3.000,00	90	\$1.025,00	\$960,00	\$750,00	\$210,00
	Standard		\$33.850,00	\$13.500,00	\$7.850,00	\$5.650,00	0	\$0,00	\$971,50	\$792,00	\$179,50
	Difference		-\$1.850,00	-\$1.500,00	\$1.150,00	\$2.650,00	0	\$0,00	-\$11,50	-\$42,00	\$30,50

Table 5. Customer Production Based Income Statement

Item Code:	150	Item Name:	Item C
Customer Name	Sales Amount	Sales Volume (Kg)	Fixed Cost
ABC	150.000	10.150	25.000
XYZ	255.000	24.000	32.000
Group Total	405.000	34.150	57.000
GHK	755.000	18.000	85.000
TXW	236.000	19.000	110.000
Outsource Total	77.748.076.414	37.000	195.000
			330.000
			525.000
			466.000

Table 6. Actual / Standard Duration and Cost Comparison Report								
Customer Name	ABC	Work Order Number	1100	Color Code	Exchange Rate Date	31.03.2015		
Order Code	AB 10	Work Order Date	01.01.2015	Item Type	Exchange Rate Code			
Order Date	31.03.2015	Volume	1150		Exchange Rate Amount	0		
Deadline Date	10.04.2015	Quality Code	4150					
				Actual		Standard		
Item Code	Item Name	Actual Duration	Standard Duration	Variable Cost	Fixed Cost	Variable Cost	Fixed Cost	Difference
11	Item A	110	87	0	0	0	0	23
35	Item B	0	0	0	0	0	0	0

6. Case Study

We aimed to illustrate use of our approach in a company case to show the entire process of activity based costing. We simplified the illustration as much as possible for both academicians and business professional to apply the model in their studies or working processes. We defined following steps in our models to illustrate the entire process:

1. Front Cost Simulation,
2. Work Order Based Actual Cost,
3. Work Order Based Standard Cost,
4. Production Based Income Statement,
5. Customer Production Based Income Statement,
6. Actual / Standard Duration and Cost Comparison.

Conclusion

Activity based costing (ABC) method ensures to companies to manage their cost with better style. It shows companies to define their resources with more details by the activity. Thus it gives companies better, more accurate and more flexible data to reach companies activity results. Resources are very important for companies activities especially “overhead” term is very important element in order to reach full commercial cost beyond the production cost. Thus activities are very important part inside of full commercial cost. In the past companies have focused on just production cost however they have omitted overheads due to the production cost logic. Full commercial cost ensure to companies to see big picture regarding all activities at companies. Thus it gives competition benefit between companies and it is a best solution.

We reach through ABC technique not only the manufacturing cost but also full commercial costs of products as well as the costs of activities in a more realistic way. By using our method, managers are able to reach more

efficient cost management system via reducing variable costs. Thus it will ensure companies more competitive environment.

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EDUCATION AS INTERDISCIPLINARY KNOWLEDGE: PRODUCTION, THEORY AND PRACTICE – IN SEARCH OF AN ESSAY

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Abstract

Throughout the text, we will be combining a dialogue of experiential construction and knowledge, linking methodology and object, a method that by its nature should be integrated by mobilising processes and procedures of various genres.

We will analyse some aspects of Education as an Interdisciplinary Area and Field of Knowledge in theoretical and theoretical and practical terms. We will highlight the concepts of multidisciplinary, interdisciplinary, and transdisciplinary, having in mind the cross-cutting dynamics of Curriculum and Knowledge. We will mention authors whose quite relevant studies potentiate an integrated curricular perspective that integrates Training, particularly the Multidimensional Training of Teachers. We will mention some legislation passed as part of the Portuguese Educational System, which helps understand the efforts to introduce interdisciplinary practices in the curriculum at the various levels of education in line with European and even global conceptions. We will highlight, among other possibilities, various areas of knowledge and specialties that substantially contribute – or could contribute – towards interdisciplinary reflection and work, particularly Philosophy of Education and Philosophy of Curriculum.

Keywords: Education, Interdisciplinarity, Complexity, Philosophy , Curriculum.

1. On the Theme and Object

We have defined for this paper the following theme: ‘Education as Interdisciplinary Knowledge: Production, Theory and Practice’. Throughout the text, we will be combining a dialogue of experiential construction and knowledge, linking methodology and object, a method that by its nature should be integrated by mobilising processes and procedures of various genres. We will use methodological approaches with historical-critical, analytical, reflective and comparative inclination, without following a linear

inductive or deductive logic that the complexity of the issue neither allows nor validates within the limits that we have to explore some of these strands of the utmost importance. There will certainly be a bibliographical research and document review but also aspects of the biographical method, since it is one that has accompanied us throughout life. It is, therefore, a challenge of epistemological configuration that we consider of vital importance to us.

2. Education as Interdisciplinary Field: Areas and Issues – Dynamics for Intertextualities

In theoretical and practical terms, that is, in the realm of Theory and Practice, Education is a field of great complexity that requires an interdisciplinary study and praxis. In this area of Knowledge and Human Action, various areas of disciplinary and interdisciplinary knowledge converge, with this area assuming an increasingly transdisciplinary nature. This transdisciplinary dimension leads us to unity, to a search for a connection of meaning, concepts and realities, to a search for a base of meaning and intersection that, in a phase that is mostly characterised by interface, is still at an interdisciplinary level. Therefore, to understand Education – particularly in what regards, for example, the training of educators and teachers – we must mobilise knowledge from various areas and specialties. Amongst others, we should mention Philosophy of Education, Philosophy of Curriculum, Education Policy, History of Education, Curriculum Development, specific Teaching Techniques, Professional and Educational Ethics, Citizenship and Civics, and Educational Administration.

One way or the other, the curriculum and curriculum designs always portray the conceptions and the balance of forces that determine them, based on an Education Policy which always reveals, explicitly or implicitly, a certain perspective and vision of Society and Man, that is, of what is regarded as important and worthy of being taught and learned. The curriculum organisation and structure always have underlying conceptions and are subordinated to an Education Policy. A more or less explicit political or ideological position can also concur for this vision of Education Policy, particularly prior to elections, but always with unforeseen elements, spelled out in the (future) government programme or in the political platform, listing priorities and certain political options, particularly in terms of education, vocational training and curriculum.

In certain situations, the government official in charge of Education – the element of subjectivity – can be, in some cases more than others, determinant in the measures adopted or to be adopted and also in the methodologies used by the government. There are ministers that you immediately know what they will do, especially if – among other things –

they have written and adopted public positions of rupture before being invited to the post. This happened with the current Minister of Education. Like them or not, have this or that position, the fact is his thoughts on nuclear issues of Education and Teacher Training had been known for a long time. If we undertake a hermeneutical analysis of his writings and public statements before being Minister, we see that they are in line with its action as Minister. One can agree or disagree, but there is coherence which in itself is positive. After these four years, Education will not be the same either by adhering to the measures or by opposing them. Perhaps, as time passes, we will see why there was a determined option for national examinations – of which we have never been big supporters – or understand his earlier criticism of the so-called ‘eduquês’ [parlance introduced by some recent educational trends] and ‘bolonhês’ “term used to refer to the focus on skills to the detriment of knowledge].

We must point out, however, that one cannot regard everything at the same level. In Education Sciences – which are of the utmost importance – there are various trends and currents, something which in itself is good. Perhaps, as time passes, we will see the relationship between meritocracy and democracy, that is, a situation in which all students have an actual chance (not just on paper) of reaching a level of literacy that helps them to defend themselves in a competitive and highly demanding Society. More than a curriculum differentiation – a concept that is valid and that we understand – we prefer to mention and defend Curriculum Diversity. We are all different, with different strengths and talents.

In 2006, Professor Nuno Crato edited a book called *Rómulo de Carvalho. Ser Professor. Antologia de Textos de Pedagogia e Didática*. [Rómulo de Carvalho. *Being a Teacher. Anthology of Texts on Pedagogy and Teaching*]. Nuno Crato says, ‘Rómulo de Carvalho was aware of the crucial role of teachers and of the need of them leading their students’. He continues, ‘Simply by his extensive experience and his keen observation of teaching, Rómulo de Carvalho knew that one cannot encourage independent thinking if it is not patiently cultivated through guided observation, study, reflection and exercise. It is not by pretending that students are authors of their own knowledge that we can develop this critical and independent spirit’ (Crato, 2006:14-15).

I have always advocated that students, as students, that is, as responsible and co-responsible participants in the learning process, are agents that (re)build knowledge and that can, should and do bring new insights. There is always continuity and discontinuity in the teaching and learning processes; it is necessary to reconcile the conceptions of John Dewey and Bachelard in problematologic consistency. For the latter, there is an ‘epistemological break’; for the former, there is not. And we see how

there can be differences in Humanities and in the so-called Exact Sciences. But to think is also to poetise. It is Rómulo de Carvalho himself that shows us that sensibility is a luminous source of knowledge and an ability that should be boosted in the field of education of the being and in the beauty and aesthetics of knowledge. Knowledge that does not move the heart does not activate the brain. We have to think and to get know with the whole body and the five senses. How much interdisciplinarity do we need to master, and how much Culture do we need to promote, combining knowledge that we thought would be in dysfunction and exclusive disjunction? How much do we need to learn, still and always, with Edgar Morin?

We are talking about Rómulo de Carvalho, a man of the Experimental Sciences – how much experimentalism can destroy humanity! He was a science teaching Man; he was a Teacher of Physics and Chemistry. How much power and strength of magnets, attraction and repulsion spring out of these fields and touch, attract or repel human beings? Rómulo de Carvalho, who adopted the pseudonym António Gedeão, wrote poems for eternity, our eternity; beautiful poems, full of light, life and love; unique poems that talk to everyone, to each one of us and to the sensitivity of those who have it in being and knowledge. Poems like these: ‘Pedra Filosofal’ [‘Philosopher’s Stone’], ‘Poema para Galileu’ [‘Poem for Galileo’], and ‘Lágrima de Preta’ [‘Black Girl’s Tear’]. When reading and interpreting these poems – to analyse them without the human soul is to mutilate them, will it be possible or permissible for reason to shut emotion and commotion? Poems that teach in ever new ways and from which interdisciplinary knowledge and expertise flow, these are Poems that, in every particle, every comma, every molecule, appear or emerge in perfect geometric synthesis. Here blood flows in the rigour of speech, and everything is looking for its perfect place in nature, culture, and human creativity, with order and disorder, as root elements that manifest themselves in Knowledge and in knowing as a generator verb. These poems feature everything in terms of beauty and perfection, and this is also valid for length, width and height, with *interdisciplinary anthropological education* equally revealing itself in concepts of simplicity, complexity and depth.

Multiple areas of interdisciplinary knowledge live in António Gedeão’s poems, within an aesthetic of successive touches and endless connections of meaning. There are also various faculties that enable and enhance knowledge itself, such as creative imagination but also solidary imagination, the imagination of brotherhood in a historic moment, when a grave injustice was committed against man and science. But Galileo endured, because the Truth moves and stands, safe before an unshakable conviction. It is appropriate to leave here some of António Gedeão’s poetic and scientific statements, inspired by Science, Humanity and the Values of Justice and also

by his deep conviction and defence of Democracy in and for Knowledge. Above all, there is the realisation that Science is axiological; Science is carried out by people and for people, even if it is also about the universe because the universe is seen by the Scientist, by mankind. There is, therefore, an evaluative and cultural look at Nature.

All poems by Rómulo de Carvalho, the Scientist – Doctor Honoris Causa – and the Teacher, have a density and content that are a clear expression of the experience, conceptualisation and pronouncement of interdisciplinarity in cultural and humanist syntheses that touch and move the scientist who experiments to verify the results. The poem ‘Lágrima de Preta’ [‘Black Girl’s Tear’] is also a shining example at a time when there are still so many forms of racism, including covert racism to which President Barack Obama drew our attention recently. It reads, ‘Encontrei uma preta/ que estava a chorar,/pedi-lhe uma lágrima/ para a analisar./ Recolhi a lágrima/ com todo o cuidado/ num tubo de ensaio/ bem esterilizado./ Olhei-a de um lado,/ do outro e de frente:/ tinha um ar de gota/ muito transparente./ Mande vir os ácidos,/ as bases e os sais,/ as drogas usadas/ em casos que tais./ Ensaiei a frio,/ experimentei ao lume,/ de todas as vezes/ deu-me o que é costume:/ Nem sinais de negro,/ nem vestígios de ódio./ Água (quase tudo)/ e cloreto de sódio.’ [‘I found a black girl / who was weeping, / I asked her for a tear / I could test. / I collected the tear / with great care / in a test tube / well sterilised. / I looked at it from one side / then from the other and from the front: / it was just a drop, / very transparent. / I asked for the acids, / bases and salts, / the substances used / in such cases. / I cold tested it, / then tried it with fire, / every time / the result was the same: / Neither blackness / nor traces of hatred. / Water (almost all of it) / and sodium chloride.’].

A Universal Poem, such as the Truth, Science and the timeless feelings of the Human Being. The poem features the word ‘traces’, and in rigour and truth, to research is precisely to look for traces, to prove and confirm, to make sure that it is the truth. Knowledge is construction but also discovery. In the construction of knowledge, with no positivism, it is of the utmost importance to use documents, but these also have to be subjected to a battery of tests, crossing information and comparing with other sources, for example, with reliable witnesses.

In a time of arid pragmatism without humanism, the ‘Pedra Filosofal’ [‘Philosopher’s Stone’] recovers the dream. The Child dreams and projects as, after all, a true scientist or philosopher does. We must recover the sense of a morning Philosophy, mentioned by Richard Rorty, or always awake in light of the motto of the University of the Azores – SICUT AURORA SCIENTIA LUCET – ‘assim como uma aurora a ciência brilha’ [‘as the dawn science shines’], as translated by Professor Machado Pires (Pires, 2015: 75 and 89). The author explains in his book *Memórias e Reflexões*

[*Memories and Reflections*] that it was a phrase that the distinguished Professor José Enes borrowed and proposed from the book *Ecclesiastes*. And we are certainly before bright and diverse sources of interdisciplinary knowledge in what regards education and culture.

In the great moments of educational and curriculum reform, there might be – and there has been in the Portuguese case – public consultations to gather opinions, to reach a consensus over certain measures and to approve certain documents, sometimes more successfully than others, in some cases adopted by the following governments, in other cases with ruptures introduced by subsequent governments. The area of Education is, academically speaking – and in practice, I would say – necessarily axiological. It should be, and it must be, axiological since it has to take into consideration human values as such. Furthermore, in political terms, bipartisan compromises might be often necessary, that is to say, the different political parties and political forces might need to reach agreements on what is essential or may be justifiably weighted and considered as essential, in order to create an environment of stable expectations among the various educational agents and stakeholders regarding, for example, what is to be included in the curriculum and syllabuses, the existence or lack of national examinations, and teacher training policies.

In the Portuguese case, there is an essential document that was adopted almost unanimously – the Basic Law on Education of 1986 – and that remains a reference to be reported not only by name but also by the date when it was approved, despite the two amendments that have taken place, one in 1997 and another in 2005. Its longevity is, therefore, rare. However, other general or more specific and targeted legislation has been passed, legitimising or having legitimised, in the Portuguese case, very different programmatic options even within the so-called Bologna process. And in this context, we can list or sketch some aspects that could lead us to Comparative Education, particularly within the European Union. But this is not the object of our paper.

On the other hand, in conjunction with what we have stated, today there is a connection between Education Sciences and the Education Policy or, if you wish, the scientification of Education and of the political decision-making process regarding education. However, both Science and Politics are not monolithic; there are also several paradigms and multiple methodologies that sometimes ideologically cross between the construction of educational knowledge and the different education policies. The objects, materials and scientific research subjects themselves are not neutral in their relationship with the methodological processes of research. One thing is aseptic research – if such a thing exists and is desirable – the other is field research, even if this field research is apparently only theoretical. Let us clarify. There may be

field research in education that, even unconsciously, leads to the scientification or manipulation of the subject in the field, and on the contrary, there may be theoretical research about education in which the subjects of education form the anthropological and human field of human action that is concrete and in the field. We could give many examples. It is the case, for example, of Paulo Freire, who has been revisited by many authors, equally Portuguese, including Professor António Sampaio da Nóvoa, who is, amongst others, a shining example of thinkers deeply involved in a clear and courageous action for the construction of educational knowledge for the benefit of individuals, communities and peoples. In this context, let us also mention the names of Professors José Ribeiro Dias and Manuel Ferreira Patrício. In their uniqueness, each has been the bearer of theoretical and practical knowledge of the utmost importance for the Educational Knowledge, the training of people and the transformation of communities. It is also curious that all mention several sources, including Poetry, which reveals the depth of their thought, their ability to engage in interdisciplinarity and the evidence that the scientificity of education should neither be confused nor reduced to any scientism and methodologism. The Education Sciences must talk about Education and Education must talk about People. Education is a living field, a field with a deeply human anthropological soul. It is no accident that António Nóvoa has long been interested in the autobiographical method in education and in the relationship between the person and the professional that intersect in the teacher. All this leads us also to the issues of educational axiology so dear to Manuel Ferreira Patrício, amongst other topics.

So what we have here is intertextuality, the intersection of perspectives on issues and problems related and important to education, as a Field to be cultivated and as an area that conjugates several areas of knowledge and multiple perspectives in interdisciplinary frameworks and dynamics.

Let us than talk about *interdisciplinarity*, which is a theme, a way of working, a methodology about which it is always important to get new insights, to cross new frontiers, and to take down some walls. Disciplinarity has a long history and a respected and respectable status; the same may happen with interdisciplinarity if it embraces – and it will only be credible this way – a path of diversity and unity that is much more enriching and enhancing, while promoting connections of fruitful conjugations. Interdisciplinarity implies cultivating culture, implies being cultivated not for exhibition but, on the contrary, as part of a genuine search for the much knowledge that is available to discover and build. Interdisciplinary Epistemology involves as much discovery as construction and (re)construction.

There is a huge gap between the discourse on interdisciplinarity and its practice that only Rigour and Competence allows to verify and scrutinise. Although using a different approach in what regards many issues of Education in Portugal, we consider that Professor Olga Pomba is one of the figures that has thematised interdisciplinarity in a greater and better way. All of her academic career and scientific production are unequivocal proof of the serious way how she approaches interdisciplinarity through a methodology that has summoned themes and authors to address different issues with all the necessary academic seriousness and competence. The cases of Professors Henrique Manuel Guimarães and Teresa Levy follow Olga Pomba's footsteps. In 2006, they published a book – *Interdisciplinaridade. Antologia [Interdisciplinarity. Anthology]*, edited by the three, with texts of great relevance from the following authors: Georges Gusdorf, Jean Piaget, John Dewey, Heinz Heckhausen, Trace Jordan, Sally A. Brown, Félix Guattari, Georges Vaideanu, Julio de Zan, Jürgen Mittelstrass, Martin Carrier, Gerhard Frey, and Ierre Delattre. One of the areas where Professor Olga Pombo, with a background in Philosophy, has developed her work is precisely Philosophy of Sciences, a field with much potential and many virtues.

Interdisciplinarity is, therefore, a serious construction – or is it something worthless and apparently without any interest? – that is important today for all areas of knowledge. Interdisciplinarity is a type of knowledge that is created and (re)constructed. In some sectors, Education has been lacking precisely a certain discourse on interdisciplinarity. It is undoubtedly preferable that someone teaches a subject or a specific type of knowledge, instead of that person being forced to engage in alleged interdisciplinarity that is useless without Culture. Culture is the lifeblood of interdisciplinarity. Actually, in a sense and to some extent, interdisciplinarity is an imperfect word for Culture. Becoming aware of that is already a key requirement for thematising and creating knowledge in an interdisciplinary way.

We consider that interdisciplinary work and interdisciplinarity provide, or may provide, very important contributions to the analysis and understanding of the Education System. Regarding the Education System, we will resort in this context to the statements we made in our book *A Filosofia como Centro do Currículo na Educação ao Longo da Vida [Philosophy as the Curriculum Centre of Lifelong Education]*,

When we talk about the education system, we clearly set us aside from a possible Hegelian perspective in which the Whole tends to dilute the particular subjects in favour of a State Logic. On the contrary, the design of the System that underlines Education values each and every one in a personalist and human perspective. The education system is neither an a priori

construction nor an absolute given. On the contrary, the education system is a living, dynamic, sometimes contradictory, but essentially plural reality. In a democratic society, the education system reflects various political, philosophical, cultural, social and economic perspectives, amongst other dimensions. It is this vitality that allows the subjects of education to always have an active and critical attitude towards the system. (Medeiros, 2005: 33).

So when we talk about the education system, we generally associate, perhaps exclusively, the concept to the school subsystem. We should clarify how we understand it and how the Education System is increasingly designed in a way that takes into consideration a broad conception of Education in a comprehensive and complex sense. For this reason, the education system comprises the school subsystem, the professional training subsystem, as well as a sense of education that occurs at all times and places, with everything and everyone and with humbleness, rigour and thoroughness. This complex and open conception of Education is full of potential and leads us to the concepts of Educational Society and Knowledge Society, which should be explored and promoted. It is this diversity and complexity that require us to get to know, to problematise and to create interdisciplinarity itself.

If accomplished, there may be, and it is essential that there is, *interdisciplinary knowledge*, which requires the command of diverse content, heuristic tools and methodologies – theoretical and practical – that enable the development of different areas of knowledge that are actually interdisciplinary and quite needed in multiple fields of human knowledge. These areas of knowledge might be useful and deployable in various professional sectors that require complementary knowledge and interdisciplinary teams in which each member has specific and transversal knowledge and in which the different fields of knowledge and specialties are respected, but without anyone judging themselves as owners of a particular area or specialty just because they hold a certain title or degree. However, holding academic degrees and titles in certain areas and/or specialties brings with it a natural demand and expectation for the (re)construction of knowledge and innovation in research, including innovative themes, content, issues, and methodologies. By its very nature, the University demands the universality of knowledge and the interconnection of the different areas of knowledge. This question requires rationality but also the intellection of connections and correlations of meanings and senses. In fact, the construction of disciplinary and interdisciplinary knowledge assumes and must assume, implicitly or explicitly, Philosophical Knowledge or Philosophy, while allowing and promoting the emergence of a General

Epistemology and other epistemologies that are often called regional. However, the practice of interconnecting knowledge should lead to what we have mentioned above, that is, to an Interdisciplinary Epistemology or even to an *Interdisciplinary and Transdisciplinary Epistemology* in a systematic and open search for knowledge. But this integral and integrated Epistemology also requires *Interdisciplinary Anthropological Education*. For us, this seems to be a fundamental point and a core element.

Education, Philosophy of Education and Philosophy lie at the heart of this paper and of its assumption of academic knowledge – and of life in general. It resorts to the contact with the source and with the spring where we also drink for inspiration and production, in order to renew and innovate, in theory and practice, Scientific Knowledge and all areas of human knowledge, including all knowledge from Nature to Culture. It is, therefore, necessary to cultivate the Search Method that Philosophy itself teaches us, as a process before it also being a product and an outcome. But the crucial element is the path. In this regard, José Ribeiro Dias's words are quite enlightening,

Philosophy triggers the process that has involved all of us over the millennia by conjugating the verbs to seek, to ask, to search, to question, to criticise, to consider, to think, from four-year olds who insist 'and why?', to students who begin the subject of Philosophy during secondary education, to experts who achieve the highest academic degree, being awarded a Ph.D. (Philosophiae Doctor), Doctor in Search of Wisdom, in the English tradition of medieval origin, regardless of the specific area: forestry, information technology, electromagnetism, social sciences or any other. And in terms of the formula received from another Anglo-Saxon tradition, we recognise that Philosophy unstoppably projects itself much further ahead, 'there are men who look at things that exist and ask *why?* I dream about things that have never existed and ask why not?' (Dias, 2005: 11)

It is curious that the Anglo-Saxon tradition, in this sense, conserves and preserves the true and full meaning of Philosophy, as it constitutes the basis and foundation of any area of knowledge if it is properly understood in its conceptual, analytical and formative work. Today the differences that separated – and still partly separate – the Anglo-Saxon philosophy and the European philosophy of Franco-German origin are more blurred. In the European continent, there has always been a very fruitful dialogue between French philosophy, or philosophy produced by French writers, and German philosophy. Such is the case of Descartes and Husserl, both mathematicians and philosophers, theorists of the Philosophy of Subjectivity. Husserl was and is considered to be the father of phenomenology but was quite inspired

by Descartes. On the other hand, we have the Anglo-Saxon tradition with philosophers like Locke and David Hume. I believe that Phenomenology, as Philosophy and as Method, is of the utmost importance not only for understanding the Human and Spiritual Sciences but also for Natural Sciences. Husserl, with the main goal of establishing and building '*Philosophy as a Science of Rigour*', opposed naturalism, historicism and psychologism. By valuing subjectivity in the construction of knowledge, he delivered a deep blow to the positivism defended by Augusto Conte. And today we know, for example with Heisenberg, that the observer's eyes change the object observed. From Heisenberg, we should always have in mind the '*uncertainty principle*'. Is there a greater principle commanding today the lives of humans, communities, peoples and areas of knowledge that are always living apart?

Phenomenology not only describes the phenomena, such as they present themselves and occur in consciousness, but also seeks their meaning and their logos. So today, everywhere and at all events, we must discover the meaning, the reasons and the foundations of what takes place and happens. Events, acts and facts are not innocent; we must uncover and scrutinise the intention that lies behind the phenomena. This is true for Education and for Human and Social Sciences, such as Politics and Political Science, Economy and Economics, Journalism and Communication Sciences, Art, amongst others.

3. Matters of Education and Interdisciplinarity – Revisiting Elements of Recent Curriculum History and Putting Them in Perspective

The recent history of education and curriculum reforms in Portugal present us with very important aspects to understand the issues of interdisciplinarity in theoretical and practical terms. One of the historical documents that must be analysed is Decree-Law No. 286/89, dated 29 August. In the introduction of this piece of legislation, we can read,

Law No. 46/86, dated 14 October, establishes the framework for the reform of the education system, with the definition of the curricula of primary and secondary education, defined under article 59 of the that law, being based on the educational objectives contained therein.

Taking into account all the proposals presented by the Commission for the Reform of the Education System and the contributions that resulted from the national debate, as well as the opinion submitted by the National Board of Education, by this law, the Government shall define the curricula of primary and secondary education.

The curriculum structure that is now approved seeks to meet the complex national and international demands that our education system faces: the construction of a project of society that, preserving our national identity, meets the challenge of modernisation that results from the integration of Portugal into the European Community.

We should remember that the *Curriculum Reform* was part of the context of a broad and deep *Education Reform*, which gave it meaning, and that the organisation and definition of the curricula aimed at a broader, nationwide Education aligned with the European and international horizon. We should emphasise the concern for the curriculum to meet the European challenges. Generally speaking, the Curriculum reforms equally sought to create interdisciplinary dynamics configured, at the time, in a ‘non-disciplinary curricular unit’ called ‘School Area’. In article 6 of the aforementioned Decree-Law, we read the following on ‘School Area’, ‘2. The non-disciplinary curricular unit aims to generate knowledge through activities and multidisciplinary projects, to promote the relationship between the school and the community, and to enhance the personal and social education of students’.

In the collective book *A Interdisciplinaridade: Reflexão e Experiência* [*Interdisciplinarity: Reflection and Experience*], the authors say in the ‘Introduction’, ‘From the perspective of interdisciplinary work, we analyse some aspects of the education reform that is currently being generalised. We would like to draw your attention, in particular, to the virtues and potential of a new curriculum unit of interdisciplinary nature – *School Area*’ (Pombo, Guimarães, Levy, 1993: 5).

I know from personal experience what School Area was from the beginning, since at the time I was a secondary education teacher at the Domingos Rebelo Secondary School in Ponta Delgada in school year 1990/91. It was, back then, one of the schools selected in the country for the experimental start of the Education Reform, which was followed by a progressive generalisation.

Although there were (some) good experiences, we cannot and should not generalise, and the truth is that School Area had many difficulties in terms of receptivity in schools and its implementation was never a fact, in the sense of it having been incorporated and promoted in the school subsystem. It is, therefore, a process that I know well, both in terms of my experience as a secondary education teacher and as a professor and researcher at the university. One of the courses/curriculum units that I taught at the University of the Azores, for several years, was precisely *Curriculum Development* for students of all degrees that qualified for teaching in basic education (2nd and 3rd cycles) and Secondary Education, namely Biology/Geology,

Portuguese/English, Portuguese/French, History/Philosophy, History/Social Sciences, Mathematics. During the course/curriculum unit Curriculum Development, students, future teachers, had contact and studied the syllabuses of the subjects in which they would undertake their internship. In addition to a test, they prepared and presented papers with an interdisciplinary configuration, developing in theory and in practice the intersection and dialogue between different areas of knowledge. Moreover, while it was in force, I always included School Area as a topic to be studied in Curriculum Development. I always stated and drew the attention of the students – future teachers – to the fact that, even if School Area disappeared from the basic and secondary education curriculum, the concepts of disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity would always be valid and have potential. In this sense, the interdisciplinary practices of School Area could possibly be transferred to other curricular situations and contexts of the teaching and learning process. And so it was. School Area was extinguished; it was even repealed after a disappearance that we could see in reality. I knew very well the difficulties and resistance to School Area in schools and with many teachers. School Area lasted but had its days numbered. And I think that, from the time it lasted, there are no effective tools left for the development of interdisciplinary work through this methodology that has, in fact, great potential. But you need to know and to know the meta-knowledge of the different areas of knowledge; you need foundations; you need Philosophy of Education and Philosophy of Curriculum in the Training of Educators and Teachers. I have said it and demonstrated it in production, in theory and in practice.

School Area represented, at the time, a reason, an impulse, and a source of external support in which researchers interested in an interdisciplinary approach could find greater motivation for their work.

One might read Teresa Levy's words in light of this, 'It is, however, in the creation of School Area that the current reform is undoubtedly not only innovative and courageous, but also more revealing of the impact that, through the emergence of a strong tendency to curriculum integration, the current state of the different areas of knowledge exerts on educational institutions' (Levy, 1993: 22). In her text from that collective book with author texts, Teresa Levy says, 'it is not a matter of choosing between disciplinarity and interdisciplinarity. Nothing forces us to choose between the analytic and synthetic moments of the dynamic cognitive processes. It is, rather, to see the possibilities and advantages of each of them and to seek a balance that will certainly have profound implications in the culture of today and how modernity is played out. This is an issue that is, at the same time, theoretical and practical and that should concern educators, scientists and philosophers' (Levy, 1993: 31).

Following the almost simultaneously work and publication of the Basic Law on Education (Law No. 46/86, dated 14 October) and of Decree-Law No. 286/89, dated 29 August, there have been several dynamics, adjustments, reorganisations and curriculum revisions in Portugal up until today. They have reflected and demonstrated the various conceptions, tensions and logical approaches to curricular organisation, sometimes with a greater inclination and emphasis – at least rhetorically – towards interdisciplinarity or disciplinarity. Today, with the current government, which reintroduced examinations as a strong element for evaluation and classification, there is a deepening of the disciplinary logic and a focus on the so-called ‘structuring’ subjects, such as Native Language and Mathematics. Therefore, Portuguese is reinforced as one of the ‘structuring subjects’ as is the case of History. But none of this is consistent in the long term without Philosophy and without having the clear perception that Portuguese without the human element – without the issues that matter to human life – can be particularly dry. We cannot separate semantics from syntax, as we cannot separate the flesh from the bone. True knowledge and the knowledge of truth is a living body that sees and feels with the five senses and with the many more that sensitivity, intelligence and other faculties develop. The structure and the textual and intertextual structures require content(s) and subject(s), as well as subjectivity and subjectivities that create and recreate knowledge and that carry with them the rights and duties. All of this requires Knowledge with an interdisciplinary inclination.

In 2001, Decree-Law No. 6/2001, dated 18 January, was published in Portugal providing the framework for the curriculum reorganisation of basic education. One can read the following in the introduction of this legal document, ‘This reorganisation is particularly important for the consecration in the curriculum of three new non-disciplinary curriculum units, as well as for the mandatory teaching of experimental sciences, the deepening of modern language learning, the development of artistic education and education for citizenship, and the strengthening of the core curriculum in the areas of native language and mathematics’. And in Article 3 of the same decree, one can read, ‘Integration, with a cross-section nature, of education for citizenship in all curricular areas’.

Citizenship and Civics are fundamental to the development of civic consciousness that is crucial for the participation in politics and in all matters that concern us, and for the common good. Furthermore, citizenship is only and truly exercised if each one of us holds good information, serious and honest information, and knowledge in multiple areas. For this reason, Schools and Universities should practice a Citizenship of and for Knowledge, comprehensive knowledge, which allows people to make informed choices and act with great astuteness.

In article 6 of Decree-Law No. 6/2001, dated 18 January, there is an explicit reference to ‘interdisciplinary training’. ‘1. Education for citizenship, as well as the appreciation of the Portuguese language and of the human dimension of work, constitutes interdisciplinary training in the context of basic education’.

In terms of the Training of Educators and Teachers, we have assumed this great task mobilising teachers and researchers from various departments and universities nationwide. The books *Educação, Cultura(s) e Cidadania* [*Education, Culture(s) and Citizenship*] and *A Educação como Projeto: Desafios de Cidadania* [*Education as Project: Citizenship Challenges*] are durable and lasting academic reference in terms of interdisciplinarity.

So, it is essential to develop the values, including the values of knowledge itself and of knowledge as a value. No one trains or is trained without values. Throughout all education and curriculum reforms, there has always been a reference to the importance of students acquiring attitudes, skills, knowledge, expertise and values. Since the Education Reform and even before, and since the publication of the Basic Law on Education, we have always considered to be crucially important to address all of those dimensions of learning and development.

When the Bologna Process started and laws were passed accordingly, the focus was often uncritically put on skills. In this context, it is extremely important to take into consideration two pieces of legislation that have completely changed the path of education and the training processes of educators and teachers. On the one hand, we have to consider Order No. 17169/2011, dated 12 December, exclusively signed by Minister Nuno Crato. At the end of the decree, in a brief text, the legislator says,

Accordingly, I determine the following:

The document National Curriculum of Basic Education – Essential Skills ceases to be a guiding document of Basic Education in Portugal.

I immediately informed my students and those who were, at the time, undertaking their internship. We carried out an analysis and interpretation of the document – that was very clear, by the way – drawing all consequences for the training of educators and teachers. It was a moment for hermeneutic reflection and consideration that can be contextualised by the Philosophy of Curriculum. Those who are truly trained are never left without support even when faced with new legislation.

In Decree-Law No. 115/2013, dated 7 August, one can be read the following in the introduction of the legislative document,

In the preamble of Decree-Law No. 74/2006, dated 24 March, it was often mentioned the need for a ‘transition from an

education system based on the transmission of knowledge to a system based on the development of skills.

But it is wrong to devalue knowledge or to artificially oppose it to the definition of 'skills', by which it was supposed to be replaced or in which it would always be encompassed.

...

Knowledge, however, is central and the Basic Law on Education is unequivocal in this regard, and nothing in the Bologna Process implies the opposite conclusion.

We should note here that the legislator felt the need to correct the perspective and perception through legislation. In fact, one way or the other, there was an eclipse of knowledge in favour of the word 'skill'. Only people with knowledge and expertise are truly skilful. There is, or there can be, serious misconceptions in University Pedagogy, which have or may have many serious and expensive consequences in the short, medium and long term. It is necessary to have a lot of university-level prudence and sapience, together with human depth, in order to contribute to make everyone greater and better from a perspective of citizenship, creating a more educated and cultivated society and more solidary Community.

It is this deep human sense that permeates the knowledge of the different areas, conferring unity to diversity and configuring interdisciplinary knowledge in a way that it may challenge, with meaning, each and every one. It is, therefore, important to note that, despite all the difficulties and obstacles, the interdisciplinary idea continues to make its way, permitting the meeting of knowledge, cultures, people, teachers, researchers and professionals from various areas. The mere presence of people from different areas affords a common goal that can be expressed by the prefix *inter*. This *inter* is not a sum but a common space where themes and issues are awoken, where concerns are shared. This idea was well expressed by Georges Gusdorf in all of his work. He states that,

...human sciences, originally few in number, have dispersed proportionally to the expansion of the epistemological space. Caught in the trap of their specialised technicalities, they have become more and more sciences and less and less human sciences, losing on the way the intention of humanity that initially guided them. Hence the need to rethink the degradation of the epistemological energy and to regroup what analysis has dissociated.

This is called *interdisciplinarity*. (Gusdorf, 2006: 18).

The author Georges Gusdorf developed what he called the 'theory of the sets of knowledge' and the 'theory of cultural sets' to develop intelligibility and cultural dynamics. At a time of crisis, of crisis of so many

crises, it is necessary for human beings to recover energy of significance and to be able to (re)build new rescue paths in economy of education and culture. We have to learn new things to enhance knowledge.

Another author who has long discussed and developed interdisciplinarity is Edgar Morin. He has two very significant books in this context: *La Tête Bien Faite. Repenser la réforme. Réformer la pensée* and *Les sept savoirs nécessaires à l'Éducation du Futur*. For the Education of the future, Edgar Morin challenges us to face 'the blindness of knowledge', to master 'the principles of relevant knowledge', 'to teach the human condition', 'to teach the terrestrial identity', 'to face the uncertainties', 'to teach thoughtfulness', and to develop the sense of an 'ethical approach to mankind'. These are all tasks and challenges of enormous complexity. And it is precisely to know how to deal with the complexity that we also have to develop and practice interdisciplinarity. Actually, Edgar Morin talks about the concept of 'inter-poly-disciplinarity'. The author equally criticises and demonstrates the shortcomings of 'hyperspecialisation'. He states,

There is an increasingly broader, deep and severe inadequacy between our separate and partitioned areas of knowledge compartmentalised by disciplines and, on the other hand, the realities or problems that are increasingly multidisciplinary, interrelated, global, and planetary.

In this situation, the following becomes invisible:

- Large complexes;
- Interactions and retroactions between the parts and the whole;
- Multidisciplinary entities;
- Essential problems.

And he synthesises accordingly, 'The essential problems are never fragmented and the global problems are increasingly essential' (Morin, 2002: 13). With great accuracy, Edgar Morin revisits a name leading to a culture of complexity and astuteness by stating, 'The first purpose of teaching formulated by Montaigne: it is better to have a well cultivated head than a well stuffed head' (Morin, 2002: 23).

Education is an interdisciplinary field that requires great astuteness and clarity, always trying to decipher what is essential and fundamental to the life of every person, every community and every people, and for humanity.

Education must, first and foremost, properly train each and every person, as individuals, as citizens and as (future) professionals. Will there be interdisciplinary Knowledge and Wisdom to carry out this urgent task?

Note: We translated all quotes to English from the original.

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