

# **INTELLECTUAL PROPERTY RIGHTS PROTECTION AND ECONOMIC DEVELOPMENT: THE CASE OF NIGERIA**

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# INTELLECTUAL PROPERTY RIGHTS PROTECTION AND ECONOMIC DEVELOPMENT: THE CASE OF NIGERIA

*Onyeka Uche Ofili*

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## **Abstract**

This research seeks to know whether tightening intellectual property rights protection in a typical developing country such as Nigeria can indeed promote innovation, attract foreign direct investment and invariably spur economic growth. Does the strength of a developing nation's IPRs regime determine the strength of its economic growth? Should a developing country such as Nigeria simply adopt strong IPRs protection regime and expect that its economy will respond with a strong growth? To examine these questions, the paper utilizes cross-country panel data of 81 countries on intellectual property rights protection, degree of innovation, extent of trade openness, number of education enrolment, gross domestic product, and foreign direct investment inflow spanning the period 1975 – 2010. Contrary to some views as seen in the literature review that increasing IPRs protection will bring about corresponding increase in economic development, the empirical evidence obtained from this research proves otherwise. It was seen that IPRs protection has negative and insignificant relationship with the rate of innovation in developing countries notwithstanding whether the developing country is within the low or high GDP band. It was also seen that IPRs protection is only significant in developing countries with low GDPCAP and not for developing countries with high GDPCAP with regards to the volume of FDI inflow.

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**Keywords:** Intellectual property rights; Innovation; Economic development

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# Table of Contents

<b>ABSTRACT.....</b>	<b>1</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>2</b>
<b>LIST OF TABLES.....</b>	<b>4</b>
<b>LIST OF FIGURES.....</b>	<b>5</b>
<b>CHAPTER ONE.....</b>	<b>7</b>
<b>INTRODUCTION.....</b>	<b>7</b>
Purpose and significance of study.....	8
The relationship between IPRs and Innovation; and IPRs and FDI.....	10
Research Objectives/Hypotheses Related to Research Problems.....	13
Method and Sample.....	13
Limitations, Delimitations, Assumptions of the Study.....	14
Operational Definitions of key Terms.....	15
Structure of the rest of the paper.....	15
<b>CHAPTER TWO.....</b>	<b>16</b>
<b>LITERATURE REVIEW.....</b>	<b>16</b>
<b>CHAPTER THREE.....</b>	<b>23</b>
<b>THEORETICAL BACKGROUND.....</b>	<b>23</b>
INTELLECTUAL PROPERTY.....	23
TRADE RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS.....	25
WHAT IS UTILITY PATENT AND WHY DO SOME COUNTRIES ADOPT IT?.....	28
PATENT SYSTEMS IN SELECTED COUNTRIES.....	31
NIGERIA INTELLECTUAL PROPERTY RIGHTS SYSTEM: ENFORCEMENT.....	43
Nigeria’s Corruption Perception Index.....	48
<b>CHAPTER FOUR.....</b>	<b>51</b>
<b>METHODOLOGY AND DATA DESCRIPTION.....</b>	<b>51</b>
Qualitative research.....	51
Quantitative research.....	53
Combining both methods.....	55
METHODOLOGIES AND DESCRIPTION OF SECONDARY DATA.....	55
DESCRIPTION OF HOW THE INDEX OF PATEN RIGHTS USED IN THIS RESEARCH WAS OBTAINED.....	55
DATA DESCRIPTION, METHODOLOGY AND MODEL SPECIFICATION.....	70
DATA DESCRIPTION AND METHODOLOGY.....	70
MODEL SPECIFICATION.....	75
METHODOLOGIES AND DESCRIPTION OF PRIMARY DATA.....	80
<b>CHAPTER FIVE.....</b>	<b>83</b>
<b>DATA ANALYSIS AND STATISTICAL RESULTS.....</b>	<b>83</b>
ANALYSIS OF SECONDARY DATA.....	83
USING SEEMINGLY UNRELATED REGRESSION.....	83
SCENARIO 1: USING THE FULL DATA SET.....	83
SCENARIO 2 USING DATA SET FOR GDPCAP ABOVE THE MEAN (1806.26).....	85
ANALYSIS OF PRIMARY DATA.....	90
Qualitative Analysis.....	93
DISCUSSION.....	103
<b>CHAPTER SIX.....</b>	<b>107</b>

<b>LESSON FROM THE BRICS COUNTRIES .....</b>	<b>107</b>
ADAPTING THE LESSONS LEANRT TO NIGERIA .....	112
IMPROVING DOMESTIC INNOVATION IN NIGERIA .....	114
Importance of a National Innovation System .....	127
Conceptualizing a National Innovation System for Nigeria.....	130
Redefining the proposed Nigerian National System of Innovation.....	131
<b>CHAPTER SEVEN.....</b>	<b>139</b>
<b>RECOMMENDATIONS AND CONCLUSION.....</b>	<b>139</b>
HOW NIGERIA CAN BENEFIT FROM IPRS PROTECTION .....	139
RECOMMENDATIONS FOR FUTURE RESEARCH.....	141
CONCLUSION.....	145
<b>REFERENCE .....</b>	<b>146</b>
<b>APPENDIX A: NIGERIA FDI VERSUS IN .....</b>	<b>164</b>
<b>APPENDIX B: NUMBER OF TECHNOLOGY AGREEMENTS</b>	
<b>REGISTERED PER INDUSTRIAL SECTOR (1999 – December 2010).....</b>	<b>165</b>
<b>APPENDIX C: SUMMARY STATISTICS.....</b>	<b>166</b>
<b>APPENDIX D: RESEARCH QUESTIONNAIRE .....</b>	<b>166</b>
<b>APPENDIX E: RESULTS OF REGRESSION USING FIXED EFFECT</b>	
<b>PANEL MODEL.....</b>	<b>166</b>

## List of tables

TABLE 1: THE NUMBER OF REGISTERED PATENTS IN NIGERIA .....	11
TABLE 2: ENFORCING CONTRACTS IN NIGERIA.....	45
TABLE 3: ENFORCING CONTRACTS IN NIGERIA - TIME (DAYS).....	46
TABLE 4: ENFORCING CONTRACTS IN NIGERIA - COST (US\$).....	47
TABLE 5: ENFORCING CONTRACTS IN NIGERIA - NO. OF PROCEDURES .....	48
TABLE 6: CORRUPTION PERCEPTION INDEX .....	50
TABLE 7: INDEX OF PATENT RIGHTS - CATEGORIES AND SCORING METHOD .....	61
TABLE 8: GP INDEX FOR 113 COUNTRIES MEAN (DEVELOPED AND DEVELOPING)	
AND 81 DEVELOPING COUNTRIES MEAN, ANGOLA AND UNITED STATES .....	62
TABLE 9: FRASER INDEX COMPARISON.....	65
TABLE 10: NEW DERIVED PATENT RIGHTS INDEX .....	67
TABLE 11: CORRELATION COEFFICIENT, USING THE OBSERVATIONS 1-733	
(MISSING VALUES WERE SKIPPED) .....	68
TABLE 12: NEW PATENT RIGHTS COMPARISON .....	69
TABLE 13: STATISTICAL SUMMARY OF TEH SECONDARY DATA .....	72
TABLE 14: CORRELATION BETWEEN THE VARIABLES.....	73
TABLE 15: SUR OUTPUT: DEPENDENT VARIABLE DIN .....	84
TABLE 16: SUR OUTPUT: DEPENDENT VARIABLES DFDI .....	84
TABLE 17: SUR OUTPUT: DEPENDENT VARIABLE DIN : USING DATA SET FOR	
GDPCAP ABOVE THE MEAN.....	85
TABLE 18: SUR OUTPUT: DEPENDENT VARIABLE DFDI: USING DATA SET FOR	
GDPCAP ABOVE THE MEAN.....	86
TABLE 19: SUR OUTPUT: DEPENDENT VARIABLE DIN: USING DATA SET FOR	

GDPCAP BELOW THE MEAN .....	87
TABLE 20: SUR OUTPUT: DEPENDENT VARIABLE DIN: COMPARING THE THREE SCENARIOS .....	87
TABLE 21: SUR OUTPUT: DEPENDENT VARIABLE DFDI: USING DATA SET FOR GDPCAP BELOW THE MEAN .....	88
TABLE 22: SUR OUTPUT: DEPENDENT VARIABLE DFDI: COMPARING THE THREE SCENARIOS .....	89
TABLE 23: PRESENTATION OF QUALITATIVE PRIMARY DATA.....	94
TABLE 24: NIGERIA YEARLY BUDGET ALLOCATION: FEDERAL MINISTRY OF SCIENCE & TECHNOLOGY .....	115
TABLE 25: PROFILE OF THE FEDERAL GOVERNMENT SPENDING ON EDUCATION IN NIGERIA (1977-2007) .....	119
TABLE 26: INDICATORS OF EDUCATIONAL DEVELOPMENT IN NIGERIA (1997-2005).....	120
TABLE 27: THE FIVE PARAMETERS OF THE NIGERIAN INNOVATION STRATEGY, ADAPTED FROM NIGERIA'S DRAFT FRAMEWORK FOR THE NIGERIAN NATIONAL SYSTEM OF INNOVATION .....	135

## List of figures

FIGURE 1: IP FILINGS AND ECONOMIC GROWTH FOR BRAZIL .....	32
FIGURE 2: IP FILINGS AND ECONOMIC GROWTH FOR RUSSIA .....	34
FIGURE 3: IP FILINGS AND ECONOMIC GROWTH FOR INDIA .....	35
FIGURE 4: IP FILINGS AND ECONOMIC GROWTH FOR CHINA.....	38
FIGURE 5: IP FILINGS AND ECONOMIC GROWTH FOR SOUTH AFRICA .....	40
FIGURE 6: IP FILINGS AND ECONOMIC GROWTH FOR NIGERIA .....	42
FIGURE 7: ENFORCING CONTRACTS IN NIGERIA.....	45
FIGURE 8: ENFORCING CONTRACTS IN NIGERIA - TIME (DAYS).....	46
FIGURE 9: ENFORCING CONTRACTS IN NIGERIA - COST (US\$) .....	47
FIGURE 10: ENFORCING CONTRACTS IN NIGERIA - NUMBER OF PROCEDURES .....	48
FIGURE 11: NIGERIA CORRUPTION PERCEPTION INDEX RANKING .....	49
FIGURE 12: NIGERIA CORRUPTION PERCEPTION INDEX - SCORE.....	49
FIGURE 13: NIGERIA GP INDEX COMPONENTS.....	60
FIGURE 14: GP INDEX COMPARISON.....	62
FIGURE 15: FRASER INDEX COMPARISON .....	65
FIGURE 16: NEW PATENT RIGHTS INDEX COMPARISON .....	69
FIGURE 17: DFDI VERSUS DIPRS .....	74
FIGURE 18: DINCAP VERSUS DIPRS .....	74
FIGURE 19: DFDI VERSUS DINCAP .....	75
FIGURE 20: HOW WOULD YOU DESCRIBE THE EXTENT OF INTELLECTUAL PROPERTY RIGHTS PROTECTION IN NIGERIA? .....	90
FIGURE 21: TO WHAT DEGREE WILL STRENGTHENING INTELLECTUAL PROPERTY RIGHTS PROTECTION INCREASE THE RATE OF INNOVATION IN NIGERIA? .....	90
FIGURE 22: TO WHAT DEGREE SHOULD NIGERIA STRENGTHEN ITS INTELLECTUAL PROPERTY RIGHTS PROTECTION IN ORDER TO PROMOTE INNOVATION?.....	91
FIGURE 23: TO WHAT DEGREE WILL TIGHTENING INTELLECTUAL PROPERTY	

RIGHTS PROTECTION INCREASE THE VOLUME OF FOREIGN DIRECT INVESTMENT INFLOW INTO NIGERIA?.....	91
FIGURE 24: ARE FOREIGN MULTINATIONALS MORE LIKELY TO INVEST IN NIGERIA IF ITS INTELLECTUAL PROPERTY REGIME IS STRENGTHENED? .....	92
FIGURE 25: WILL INCREASE IN THE RATE OF INNOVATION HAVE ANY EFFECT ON THE VOLUME OF FOREIGN DIRECT INVESTMENT INFLOW INTO NIGERIA? .....	92
FIGURE 26: WILL STRENGTHENING INTELLECTUAL PROPERTY RIGHTS PROTECTION IN NIGERIA INCREASE ECONOMIC GROWTH? .....	93
FIGURE 27: BRAZIL: MOVEMENT OF IPRs, EDU, IN, GDPCAP & FDI BETWEEN 1975-2010 .....	107
FIGURE 28: RUSSIA: MOVEMENT OF IPRs, EDU, IN, GDPCAP & FDI BETWEEN 1975-2010 .....	108
FIGURE 29: INDIA: MOVEMENT OF IPRs, EDU, IN, GDPCAP & FDI BETWEEN 1975-2010 .....	109
FIGURE 30: CHINA: MOVEMENT OF IPRs, EDU, IN, GDPCAP & FDI BETWEEN 1975-2010 .....	110
FIGURE 31: SOUTH AFRICA: MOVEMENT OF IPRs, EDU, IN, GDPCAP & FDI BETWEEN 1975-2010.....	112
FIGURE 32: NIGERIA YEARLY BUDGET ALLOCATION FOR FEDERAL MINISTRY OF SCIENCE & TECHNOLOGY .....	115
FIGURE 33: THE INNOVATION SYSTEM (ADAPTED FROM OECD).....	132
FIGURE 34: THE FIVE PARAMETERS OF THE NIGERIAN INNOVATION STRATEGY, ADAPTED FROM NIGERIA'S DRAFT FRAMEWORK FOR THE NIGERIAN NATIONAL SYSTEM OF INNOVATION.....	135
FIGURE 35: THE NIGERIA NATIONAL SYSTEM OF INNOVATION (INSTITUTION, KNOWLEDGE AND FINANCE).....	137
FIGURE 36: THE NIGERIA NATIONAL INNOVATION SYSTEM MAP ADAPTED FROM FEINSON (2003) .....	138



## Chapter one: Introduction

The 21<sup>st</sup> century is largely a knowledge driven era where the manipulation and effective application of information sets nations apart. Developed nations are in control of cutting edge technologies in areas such as pharmaceuticals, biotechnology, telecommunications, information technology including the Internet, and space technology. Developing nations are playing catch up, with different countries having different levels of success. Several of these developing nations are adopting different strategies and policies towards reaching their desired goals. The developed nations on the other hand, in order to maintain their superiority over less developed nations also pursue strategies and policies that will constantly keep them on top and relevant. Developed nations strive to continue to protect their technological achievements (innovations) and other intellectual assets by establishing strong Intellectual Property (IP) laws. And they only share these assets with other countries at a fee which can be in cash, in return for oil or other products or for other reasons but it is rarely for free.

As the issue pertaining to IPRs, its protection and enforcement continue to be a major factor in global trade its impact on the level of domestic innovation, foreign direct investment and consequently economic growth cannot be over emphasized. It is imperative that nations pay attention to this very important kind of ‘property’ as its control and management may end up defining the nation’s economic wellbeing. For developing nations, the issue is even more important as they are largely less technologically advantaged and need to put in place the right measures in order to catch-up with the more developed countries (Primo Braga et al., 2000). For developing countries to effectively take control and maximize IPRs in their jurisdictions they need to properly understand the possible impact IPRs protection and enforcement or lack of it can have on their economy. They need to know if they will be better off with having a tight IPRs protection and enforcement regime or if they are better off having a weak regime. It is after such understanding that they can define the right strategies and put together appropriate policies that will best suit their economic aspirations including encouraging innovation and attracting foreign direct investment.

Various countries at different levels of development have adopted various economic and even socio-political strategies to grow their economies. These strategies include manipulating IPRs protection or adapting it in such ways that are economically beneficial. The Japanese patent law for instance recognizes both the traditional and utility model systems, as inventors are encouraged to file narrow claims that are built incrementally on already existing fundamental technologies developed by domestic and foreign inventors (Sakakibara & Branstetter 2001). The Japanese system was designed this way with the intention to encourage domestic innovation, ensure technological catch-up and promote knowledge diffusion through incremental innovation. Japan utility model was established in 1905 and was originally an adaptation of the German utility model system of 1891 (Kardam, 2007). However, unlike the German system the Japanese system covered not only equipment for work and utility goods but also all commercial good. It adopted a longer protection term and also adopted substantive examination procedures as against the German non-examination system (Kardam (2007)). One of the reasons China began to develop its intellectual property system was for it to legitimize its trade system, integrate itself into the global trade market and attract investments from abroad (Yu, 2002). In the early stages of China’s economic reform in 1979, many argued that the adoption of a patent system will be detrimental to the development of the Chinese local industries considering the fact that the Chinese technology system at the time was weak (Zhang, 2010). Although Zhang (2010) believes that the establishment of a robust patent system is critical for effective technology borrowing. And furthermore Hayami & Godo (2005) argued that effective technology borrowing is a very

important step for any developing country to adopt if it is to catch-up with the more advanced countries. China has recorded positive economic growth for over two decades. And Zhang (2010) is of the view that the establishment of the patent system was largely responsible for this growth. The German patent system is very old dating back to 1877 when the first unified German Patent Act was adopted (Khan, 2010). The German patent system was established to foster technology diffusion, innovation and growth in selected industries with an overall aim of boosting economic growth (Khan, 2010). In Germany patent duration can be up to 20 years, see section 16 of the German Patent Law (as amended by the Law of July 31, 2009)<sup>1</sup>. The German patent system follows the first-to-file system<sup>2</sup>. This is unlike the US system, which follows the first to invent approach (however in March 16, 2013 the US switched to the first-to-file system upon the establishment of the America Invent Act). The utility model was introduced in Germany in 1891. It was originally conceived as “minor patent for minor inventions”. However, after the Reform Act in 1990, utility model has been likened to traditional patents but for a few substantial exceptions (Bardehle Pagenberg, 2010). The utility model in Germany like the patent protects technical inventions other than processes. However, unlike the patent the utility model does not go through formal examination.

### **Purpose and significance of study**

From the foregoing it is imperative that a developing country such as Nigeria defines and implements its IPRs policies in such ways that will bring maximum benefit to its economy. This research therefore aims to investigate the degree to which tightening intellectual property rights protection in Nigeria will promote domestic innovation, attract foreign direct investment and invariably cause significant growth in the economy. This research aspires to establish the real relationship between intellectual property rights protection (IPRs) and economic growth in developing countries using Nigeria as a case study. Even though some previous researches in this field argue that if at all anyone benefits from tight IPRs protection in developing countries it is not the developing countries (Primo Braga et al., 2000; Hossain & Lasker, 2010). Drahos & Braithwaite (2002) argue that the Trade Related Aspects of Intellectual Property Rights (TRIPS) was planned and executed by developed nations to cause developing nations to patronize goods and services produced from developed nations. In this scenario the economy of developing nations will always be dependent on that of developed nations and thus can never be better. This by extension could suggest that it is actually the developed countries that will benefit from strong intellectual property rights protection in developing countries. Could this therefore, imply that there is no need for further research on the impact of IPRs protection (and indeed its enforcement) on the economic development (or economic growth as both terms will be used interchangeably in this paper) of developing countries following the view expressed by Primo Braga et al., (2000) and others? The answer is in the negative as some other researchers have shown that protecting IPRs has benefits for developing countries as well. Saggi (2013) argue that with the absence of tight IPRs regime developed countries will be reluctant to develop technologies that will be used within the developing countries, as they will be uncertain as to the protection of their intellectual property rights in such jurisdictions. Yang & Maskus (2001) argue that with the absence of adequate intellectual property rights protection in the developing countries, firms in developed countries will build their technologies in such ways

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<sup>1</sup> Section 16(1): The duration of a patent shall be 20 years, beginning on the day following the filing of the application for the invention.

<sup>2</sup> Section 6: The right to a patent shall belong to the inventor or his successor in title. If two or more persons have jointly made an invention, the right to the patent shall belong to them jointly. If a number of persons have made an invention independently of each other, the right shall belong to that person who first files an application for the invention with the Patent Office.

that it will be difficult to imitate. This may possibly result to fewer investments in research and development, reduced efficiency in research outputs and general decline in the rate of innovation in developed countries. And lastly as globalization continues to deepen and cross border trade continue to increase; the issue of IPRs will remain a major concern in international trade such that countries will consider IPRs protection as a factor before engaging in trade (Schneider, 2005). It was on this basis that it became mandatory for member states of the World Trade Organization (WTO) to have reasonable IPRs protection regime. So if a developing country intends to be a member of the WTO it is required that the country signs The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). And invariably agree to comply with minimum guidelines as far as IPRs are concern as defined in the TRIPS agreement. The TRIPS agreement was actually established in 1995 as part of the outcomes of the Uruguay Round negotiations. The negotiation which was the 8<sup>th</sup> Round of the multilateral trade negotiations started in 1986 in Punta del Este and lasted until 1994 involving about 123 countries as contracting parties. It was conducted within the general framework of the General Agreement on Tariffs and Trade (GATT) ([www.wto.org](http://www.wto.org)). During the course of the negotiations those in support of strong intellectual property protection argued that weak and variable intellectual property rights regime have adverse effect on global economy (Drahos & Braithwaite, 2002; Matthews, 2002; and Sell, 2003). And for such reasons they advocate that nations should have strong level of IPRs protection regime in their jurisdictions in order to protect the global economy from collapse. The TRIPS agreement is specifically dedicated to IPRs protection and related matters. It is to date the most important and comprehensive multilateral agreement on intellectual property rights protection ([www.wipo.int](http://www.wipo.int)).

As will be explained in more detail in chapter three, Nigeria has a robust IPRs system in terms of laws and legislation. However, the country has not been able to effectively enforce the protection of patent, copyright and trademark. It therefore, requires to make substantial improvement in the area of IPRs enforcement. And largely the country has not been able to take full advantage of these laws as far as developing its economy is concern. Nigeria according to the World Bank has a population of around 168 million and accounts for about 47 percent of West Africa's population. It has about 200 ethnic groups and 500 indigenous languages. Its major export is oil and it is the largest exporter of oil in Africa and has the largest gas reserve in the continent. Over the past couple of years the country has pursued aggressive economic and even political reform. The country's economy between 2003 and 2010 grew by an average of 7.6 percent according to the World Bank. The country has complemented this growth by saving some of the excesses it makes from oil into a special Excess Crude Account (ECA). And the country has further taken more measures to improve transparency and management of its oil sector by implementing the Extractive Industry Transparency Initiative (EITI). However, shocks in the global oil prices tend to have very serious implications on the Nigerian economy, as oil is the main base of the economy. Oil accounts for about 90 percent of Nigeria's export and about 75 percent of its consolidated budgetary revenues ([www.worldbank.org](http://www.worldbank.org)). With an economy that is dominantly predicated on oil and with recent effect fluctuating global price of oil has had on the Nigerian economy the country needs to diversify and shift its economic base away from solely being dependent on oil. And even with some of the gains the country has recorded, poverty is still prevalent among its citizens; it is still largely a developing country and has over 50 million unemployed people ([worldbank.org](http://worldbank.org)). Nigeria however, can successfully diversify its economy by attracting FDI into other sectors that are non-oil and also by improving and encouraging domestic innovation. This paper believes effectively manipulating and adapting the country's IPRs strategies and policies can achieve this. It is in view of the foregoing that this paper will proceed to investigate the following research problems:

1. To what degree will tightening intellectual property rights protection increase the rate of innovation in Nigeria?
2. To what degree will tightening intellectual property rights protection increase the amount of foreign direct investment in Nigeria?

### **The relationship between IPRs and Innovation; and IPRs and FDI**

Economic growth as used in this paper refers to the increase of the real per capita income of a country over a period of time (Jhingan, 2002). A country is therefore deemed to record economic growth when there is obvious and measurable increase in the amount of goods and services produced in that country. It is in view of the above definition that innovation and Foreign Direct Investment (FDI) are seen as viable agents for economic growth.

### **Relationship between IPRs and Innovation**

Based on the assumption that a typical developing country say Nigeria and a typical developed country say US have different technology needs, if Nigeria does not have an effective IPRs protection framework then US based firms would not develop technologies needed by Nigerian consumers. Secondly the US based firms may resolve in the absence of robust IPRs system in Nigeria to make their technologies more difficult to imitate. This will cause a decline in the quality of research and innovation in the US. And even if the implementation of strong IPRs system does not directly affect Nigeria it will bring about increase in global welfare. The US and other advanced countries argue that for countries to join the World Trade Organization (WTO) they must sign the TRIPS agreement thereby implying that developing countries should accept to tighten their IPRs protection system. Nigeria is presently a member of the WTO and did sign the TRIPS agreement in 1995. Aside from the above considerations Nigeria may want to improve its IPRs protection and enforcement framework for other reasons especially for domestic economic reasons as weak IPRs system may be hampering the progress of certain domestic innovative activities. Activities that if allowed to flourish will greatly turn around the economic fortunes of the country. Nigeria therefore, needs to define and establish suitable IPRs regime that will balance the trade-off between the copying of highly advanced technologies from the US and the provision of the needed incentives for domestic innovation.

Taking a cue from the illustration used by Grossman & Helpman (1991) and later by Chen & Puttitanun (2005), we can assume that Nigeria has two sectors – an import sector and a local sector. Let the import sector be made up of a US firm and a local Nigerian firm. The US firm has the patent to produce more technologically advanced products than the domestic Nigerian firm. However, the domestic firm can copy the technology used by the US firm but this is dependent on the level of IPRs protection in Nigeria. As it stands today Nigeria has a very strong IPRs protection framework on paper but the level of enforcement of the various IP laws is still weak, thus giving domestic firms the freehand to copy US technologies. However, the requisite infrastructures such as power, transport system still pose some level of resistance to effective copying. The local sector consists of two domestic firms; one of the firms has the capacity including finance and manpower to develop patentable products while the other does not but can imitate the technology. If Nigeria puts together stricter policy and enforcement strategy to tighten its IPRs protection this will clamp down on imitation on both sectors and bring about a different result on the nation's overall welfare. For instance for the import sector strengthened IPRs system will cause less competition to the foreign firm and thereby bring about increase in price. It will further cause lower quality of goods from the local firm. In effect there will be a reduction in consumer surplus and local social surplus will also decrease. In the local sector strong IPRs protection will be an incentive for the

innovating local firm to commit more investment into research and development thus developing high quality technology, getting more return on its investment and also creating better local social surplus.

In summary based on the foregoing tighter IPRs protection is expected to have varying effect on Nigeria depending on their level of production and innovation capabilities. For a developing country with no or very limited production and innovation strength and whose IPRs system has insignificant effect on global R&D, tightening IPRs protection will improve welfare as long as it brings about access to products and services that will otherwise be inaccessible by the country. On the other hand if the country has high production capacity (implying it has a high capacity to imitate) but a low innovative capacity (implying its R&D capacity is weak) tightening the degree of IPRs protection will most likely displace local producers, bring about increase in prices and invariably transfer rent from local producers and consumers to foreign IPRs owners. This in the overall results in a negative welfare impact. Nigeria falls squarely into this later scenario as it has high capacity to imitate foreign technologies even though this ability is heavily threatened by lack of basic infrastructure such as power supply and declining education system. Nigeria lacks innovative capacity as its R&D capability over the years has greatly diminished. The number of registered patents in Nigeria over the years exemplifies this as reported by WIPO, see table 1 below. As can be seen non-residents mostly own the yearly total number of registered patents, howbeit inconsistent. This goes to show strong weakness in the Nigerian innovative system.

Table 1: The Number of Registered Patents in Nigeria

Applicant Type	Resident	Non -resident	Total
1991-2010	0	0	0
1990	12	246	258
1989			
1988			
1987			
1986			
1985	10	431	441
1984			
1983			
1982			
1981			
1980			
1979			
1978	6	506	512
1977			
1976	8	428	436
1975	6	401	407
1974			
1973			
1972			
1971	4	387	391
1970		165	165
1969			
1968		138	138
1967			
1966		173	173
1965			
1964		127	127

Source: WIPO website

## **Relationship between IPRs and FDI**

The influence and importance of FDI in global business is on the rise. Companies use it as a strategy to expand their businesses into new markets thereby taking advantage of new opportunities, cheaper production facilities, cheaper labor, access to new technologies and even access to cheaper financing. Countries on the other hand strive to make their markets attractive destination for FDI as it helps to create new jobs, improve their GDPs and generally provide economic growth (The World Bank, 2011). One of the major reasons why countries strive to encourage and attract FDI is to fill the domestic demand for more capital such that will help spur economic growth. However, multinational corporations and other institutional investors will only want to invest in countries where they can obtain maximum returns on their investments with very minimal risks. FDI brings about technology transfer to the local company. This technology transfer can be taken advantage of by the country in which the domestic company is located to improve its economy. However, the attraction of FDI and subsequent benefits to a nation is not automatic across countries, sectors and local communities (OECD, 2002). The amount of FDI inflow and its subsequent benefit are influenced by national policies and business environment framework of the country. There must be clearly transparent, extensive and far reaching enabling policy framework for investments to thrive and there must also exist human and institutional capacities to implement and sustain these investments.

As globalization deepens, as the movement of high technology goods increase in the world (the figure was actually reported to have doubled from 12 percent to 24 percent between 1980 and 1994) and as FDI growth increases the relevance of IPRs are expected to rise (Fink & Maskus, 2004). To understand the impact of IPRs (whether weak or strong protection) on the decision for firms to invest in foreign countries one may need to first understand the economic considerations firms make before going abroad. To determine this we will adopt the framework developed by Dunning (2001) commonly known as “ownership-location-internalization theory” (OLI). The first economic factor is the ownership advantage transnational corporations (TNCs) have over local firms in terms of intangible assets especially as it concerns new and improved technologies; reputation for quality; people skills developed over the years; tested and trusted business strategy among others. In as much as TNCs have ownership advantage over local firms it is not enough grounds for TNCs to venture into foreign markets. For firms to decide whether to go abroad or not two other conditions must be met. The foreign country must offer location advantage. So for instance if foreign firms are to invest in Nigeria, it must offer superior location advantage compared to other competing countries. The business environment in Nigeria must be conducive in terms of reasonable transportation costs and tariffs, good input prices, good distribution network, sound local regulatory environment and effective judicial system. And then secondly it must be more profitable for the firms to internalize production especially when compared to licensing or outright sell of their intellectual property to local firms. The OLI framework is therefore a very important tool when it comes to assessing the impact of IPRs protection on a firm’s decision to invest in a foreign market. The IPRs protection policy is therefore a critical factor when it comes to firm’s decision to invest abroad. Dunning (2001) is of the view that registering your intellectual assets in a foreign country gives the foreign firm location advantage. This is so especially as IPRs are territorial in nature. So the nature of IPRs protection will determine whether the foreign firm will localize its IPRs or keep it in the home country or in an entirely different country for that matter. The amount of ownership (in terms of control and the level of exposure) a foreign firm has in a joint venture with a local firm will somewhat determine the firm’s interest on the level of protection of IPRs in that local market. If the foreign firms perceive that they are likely to lose their IP assets by going into the joint venture they will rather not (Branstetter, Fisman, Foley, & Saggi, 2007).

However, IPRs will be of less concern to a foreign firm that has very minimal investment in a joint venture. This is because since the firm has very minimal control it may not most likely transfer its advanced technologies to any foreign affiliate. So in a nutshell the level of importance attached to the relationship between FDI and IPRs from the perspective of a foreign firm is a function of the extent to which it can maintain control over its IP assets in the presence of lack of adequate protection. It should be however, mentioned that the relevance and full potential of FDI towards economic growth is a function of the host country's ability to properly utilize the benefits of FDI. Education level of a country (absorptive capacity) determines its ability to take advantage of FDI (Xu, 2000). Another condition is for the country to have robust financial system (Alfano, Chanda, Kalemli-Ozcan & Soyek, 2004; Durham, 2004; Hermes & Lensink, 2003). At this juncture one may want to ask, what is the exact relationship between FDI and IPRs protection in a typical developing country as Nigeria? To what extent does strong or weak IPRs regime affect FDI flow?

### **Research Objectives/Hypotheses Related to Research Problems**

Following the foregoing the objectives of this research can be summarized and outlined as follows:

1. To what degree will tightening intellectual property rights protection increase the rate of innovation in Nigeria?
  - a. To what degree should Nigeria strengthen its intellectual property rights protection in order to promote innovation?
  - b. Will intellectual property rights protection increase or hurt innovations in Nigeria?
2. To what degree will tightening intellectual property rights protection regime increase the amount of foreign direct investment in Nigeria?
  - a. Are foreign multinationals more likely to invest in Nigeria if its intellectual property regime is strengthened?
  - b. Will increase in the rate of innovation have any effect on the amount of foreign direct investment inflow into Nigeria?

While arguing that effectively implementing the right IPRs policies will enhance innovation and bring about increased inflow of FDI, which invariably lead to economic development. It is also possible that having a robust system of innovation can force improvement in the IPRs regime of a country, a strategy that could held attract more FDI and in the overall help boost the economy. To achieve such level of innovation the country may need to pay more attention to policies that will help improve research and development among universities, corporations and research institutes. Special grants can be given that will also help drive firm level innovations. All these can in turn create the right competitive environment that will in turn create the need for innovations (intellectual assets) to be protected.

### **Method and Sample**

The research will adopt a mixed method approach, using both quantitative and qualitative methods. Quantitative approach will be used to analyze the relationship between innovation, foreign direct investment and intellectual property protection using a total of 81 developing countries (these countries will further be separated and analyzed based on Gross Domestic Product). This analysis will be carried out using a superior and updated IPRs index compared to previous similar studies (the patent index that will be used in this research will be an adaptation of the new index proposed by Hu & Png which is a combination of GP index and the Fraser index). The paper will then go ahead to extract Nigeria and compare and contrast its behavior to that of the rest of developing countries. The data for this analysis will

be largely obtained from organizations such as the World Bank, UNESCO, UNICEF, The United States Patent and Trademark Office (USPTO), and the Economic Freedom of the World Report (various issues), the World Intellectual Property Office, Central Bank of Nigeria, National Office for Technology Acquisition and Promotion and Nigeria Bureau of Statistics. It is worthy of note that there are very limited economic freedom measurements indices notably the studies carried out by Fraser institute, the Heritage/Wall Street Journal ([www.heritage.org](http://www.heritage.org)), Freedom House ([www.freedomhouse.org](http://www.freedomhouse.org)); and Scully and Slottje (1991). Among these the Fraser index and the Heritage index have been the most consistent and both show a lot of similarities as reported by Caudill, Zanella & Mizon (2000) and de Haan & Sturm (2000), including the fact that both are derived through subjective measures. Even though both indices are based on subjective measures and therefore prone to bias, the heritage index uses more subjective variables than the Fraser index (Breggren, 2003). This paper will use the Fraser index despite the above mentioned limitation, because it is more consistent with the period of this study, is less subjective than the Heritage index and has been more widely used in academic researches (Berggren, 2003; and Doucouliagos & Ulubasoglu, 2006).

Next, this research will seek to get primary information from respondents in Nigeria. This portion of the research will adopt a triangulation approach (multi-method approach) by combining both quantitative and qualitative methods. The methods will be combined in such a way that they would yield better results than if the methods were applied independently. This will be achieved through the equal adoption and application of the two models. The two models will act as check and balance to each other. The findings from qualitative approach will be used to validate the findings from quantitative findings and vice versa. A survey will be conducted by sending emails to respondents and using other web-based survey tools. The respondents will be asked to share their views on the relationship between IPRs protection and innovation; IPRs protection and foreign direct investment; and how these relationships influence economic growth if at all in Nigeria. The obtained results will be analyzed using statistical tools including basic Microsoft Excel charts and graphs. Finally, qualitative method will be used to support the quantitative survey conducted within Nigeria. The qualitative research will include in-depth individual interviews and focus group interviews. It will seek to discuss with a selected number of policy makers or people working in selected public institutions with affiliation to IPRs protection such as Nigeria Copyrights Commission, National Office for Technology Acquisition and Promotion (NOTAP), Federal Ministry of Trade and Investments, National Information Technology Development Agency (NITDA) and the Federal Ministry of Science and Technology. The aim of discussing with the staff from such offices is to have first hand information on what has been done or being done by the government as regards using IPRs protection and innovation as tools for national economic development.

### **Limitations, Delimitations, Assumptions of the Study**

The extent of innovation in the various developing countries is measured using the number of patents filed by the residents of those countries in the United States Patent and Trademark Office (USPTO). It would have been better and more accurate to use the actual number of patent applications filed domestically as this will give a better reflection of the degree of domestic innovation. However, due to lack of availability of data in some jurisdictions, including Nigeria, on the number of patent applications filed, the number of patents application filed in the US was used instead.

The patent index as used in this research (a combination of Ginarte & Park and Fraser (EWF) indexes) may not give a true representation of the degree of robustness of intellectual property regime (including other IPRS types) in a given jurisdiction including enforcement.



The patent index as used in this research focuses more on patent protection and largely ignores the other classes of IPRs. This may be biased as some countries may pay more attention, including protection and enforcement, to other intellectual property types other than patents. However, due largely to lack of availability of data in most developing countries this research could not begin to measure the level of IPRs protection for each intellectual property type country by country. This dissertation assumes that most developing countries share certain common characteristics including the degree of IPRs protection. Therefore, their patent rights protection can be used as a yardstick to measure the extent of the behavior of other intellectual property types. It is assumed that the economic growth of these countries will behave the same way with regards to IPRs protection, innovation and foreign direct investment. Furthermore, because Nigeria does not exist in isolation this study compares its behavior to those of other developing countries. And lastly the subject of IPRs protection is still not very popular and deeply rooted in Nigeria as yet, so it is a challenge getting reasonable number of unbiased responses to questionnaires. So this limits the number of people that will be asked to respond to the questionnaires and also the number of people that will be interviewed.

### **Operational Definitions of key Terms**

In this study **Intellectual Property** refers to the creations of the mind; these include inventions, literary and artistic works, and symbols, names, images, and designs used in commerce (WIPO, IP Handbook). It is divided into two broad categories industrial property and copyright. Industrial property includes the following: inventions (patents), trademarks, industrial designs, and geographical indications of source. Copyright include the following: literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. Furthermore the following rights are protected by copyright performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programs (WIPO, IP Handbook).

In this study **Innovation** refers to developing and transforming novel ideas into forms that bring about unique improvement to existing products or processes or create entirely new products or processes. Such products and processes must possess tangible economic benefit and furthermore must satisfy specific societal or customer needs (Kalanje, 2006).

In this study **Foreign Direct Investment (FDI)** refers to when a company situated in country A invests in a company situated in country B or sets up a wholly owned subsidiary in country B. Usually the company making investment obtains a controlling share of the company it invests in (Ball et al. 2002, p.69; Hill 2003, p.204). It is different to portfolio investment in that it could mean the investing company to invest in infrastructure such as building, machinery and general office equipment (Wu, Li, & Selover, 2012).

### **Structure of the rest of the paper**

The rest of the paper is organized as follows; chapter two is a review of past literatures in the field of intellectual property, innovation, FDI inflow and economic development. Chapter three is on data description, the methodology used for the research and the model specification for the research. In chapter four the data obtained during the course of the research is analyzed and the resulting statistical results are presented. Chapter five is on recommendations and conclusion. It suggests possible ways in which a typical developing nation such as Nigeria can transform its economy using technological innovation as a launch pad.

## Chapter two: Literature review

Many previous literatures argue that the protection of intellectual property rights (IPRs) in developing countries can be viewed from a developed countries-less developed countries perspective, where developing countries are the losers as far as strengthening IPRs regime is concern. This is largely because globally tightening IPRs systems will make developed countries' innovators more powerful at the expense of their counterparts in less developed countries, and this power will give the firms situated in developed countries the freehand to arbitrarily increase prices in the south in other to maximize profit (Cannady, 2004; Saint-Paul, 2008; Qiu & Lai, 2004; Borota, 2009; Primo Braga et al., 2000; and Hossain, & Lasker, 2010). Grossman & Edwin (2004) and Borota (2012) also support the argument that when the IPRs system is tightened in developing countries, developed countries benefit more. Grossman & Edwin's argument is predicated on the assumption that innovation takes place in developed countries while imitation takes place in developing countries. They considered a global economy with ongoing innovation in two countries; one a developed country and the other a developing country. The countries are assumed to have different market sizes, varying innovative capacity, and differ in their absolute and comparative advantage in manufacturing. The findings by Borota (2012) reveal that under free trade the quality lag of the developing country is positive even in the absence of IPRs protection. This is largely attributed to the comparative advantage the developing country has in lower quality goods production and trade. However, it was discovered that stronger IPRs protection lowers the welfare of the developing country and negatively impacts economic growth. The results also showed that stronger IPRs protection would increase welfare in the developed up to a certain point.

Falvey, Foster & Greenaway (2006) examined the impact of IPRs protection on economic growth using a panel data of 80 developed and developing countries over the periods 1975-1994. They argue that IPRs system has varying effect on economic growth depending on country specific characteristics. They suggest that IPRs protection is positively and significantly related to economic growth for low-income and high-income countries but not for middle-income countries. They suggest that IPRs protection promotes innovation in high-income countries, and encourages technology or FDI inflow into low-income countries but that low-income countries suffer losses as a result of reduction in the gains they would have enjoyed from imitation. Falvey, Foster & Greenaway (2006) in their research concluded that the relationship between IPRs protection and economic growth is ambiguous. This is so as IPRs protection on one hand could encourage growth by promoting innovation (increase in innovation could lead to increase in economic growth see Rosenberg, 2004) and research, while on the other hand it could lead to monopolistic tendencies and drastically reduce the role of imitation and technology diffusion. And these are important economic growth agents in developing economies especially the ones that embark on little or no innovation at all. They therefore, suggest that IPRs protection will have different effect on different countries, with developed countries benefiting more from strong IPRs protection than developing countries. Horri & Iwaisako (2007) support the argument by Falvey, Foster & Greenaway. They argue that IPRs give patent owners monopoly for extended period of time. And this ends up creating a huge problem in the society as important sectors of the economy may be taken over by monopolies. And such companies may begin to lower the quality of their products and probably increase the price of their products in such ways that may adversely affect the overall interest of the public. Fink and Maskus (2005) further suggest that IPRs protection even when they are intended to encourage invention end up inhibiting it. Boldrin & Levine (2002) argue that having a strong IPRs system creates "intellectual monopoly" as

the owners of intellectual property not only have the right to own and dispose of ideas but the right to also regulate their use. They compared the purchase of a product such as potato to the purchase of intellectual property products such as CDs, books or software programs. They argue that while when one buys a potato he can eat it, give it out, plant it or make a sculpture out of it, the same cannot be done to the CDs, books or software program. While the buyer of the potato can do whatever he pleases with the potato, as the potato is entirely his property but he cannot do whatever he likes with the CD, books or software as the owners still have right over how they can be used. Current intellectual property laws permit the producers of this computer software, CDs and books to have exclusive right over how these products are used. They agree with the aspect of IPRs that grants IPRs owners the privilege to own and sell ideas but disagree with the second aspect, which grants IPRs owners the right to control the use of those ideas after sale. David (2004), Krinsky (2003), Lessig, (2002) and Murray & Stern (2005) suggest that strengthening IPRs may stifle the diffusion of knowledge thereby inhibiting innovation. This they attributed to lack of adequate disclosure in patent applications, plethora of dormant patents and inhibition of copying. Schneider (2005) in the research using a panel data set of 47 developed and developing countries from 1970 to 1990 observed that IPRs protection affect the rate of innovation but the impact is more significant in more developed countries. In fact Pollock (2008) argues that significant amount of innovation can still take place in the absence of intellectual property protection and that welfare may actually be higher than when intellectual property protection is present. Also Adams (2011) is of the view that strong IPRs protection has adverse impact on growth in developing countries especially Sub-Sahara African countries. Adams (2011) used a single equation to analyze the relationship between economic development and IPRs protection in 34 Sub-Saharan Africa countries using a panel data of four different time periods. In the equation Real GDP per capita was used as the dependent variable and IPRs and other variables are the independent variables. Three different estimation techniques were used. The reason was to obtain a more error free result that is both accurate and precise. For instance according to Adams the fixed effect model was used to control for any bias that may arise as a result of omitted variables and unobserved country heterogeneity. The results obtained indicate that strengthening IPRs has negative effect on economic growth, domestic investment is positively correlated with economic growth and finally human capital is an important factor in determining economic growth.

There are however, arguments that are in favor of the notion that strong IPRs protection will bring about tangible economic growth in developing countries. Saggi (2013) argue that developing countries and developed countries have varying technological needs. And that for the developed countries to keep investing and producing new technologies required by the developing countries, the developing countries must have reasonable protection of IPRs. Firms situated in developed countries in the absence of tight IPRs regime in the developing countries may decide to cut down their investment in research and development, make their products more difficult to imitate and at the end churn out less efficient technologies (Yang & Maskus, 2001). These actions will reduce the volume of technology transfer to developing countries, a move that will invariably affect effective technology utilization, adoption and diffusion. This will further have adverse effect on the economic wellbeing of developing countries. Chen & Puttitanun (2005) are of the view that aside from the pressure from developed countries, developing countries may want to strengthen their IPRs systems to boost local economic growth. This argument is predicated on the assumption that some domestic innovation will only come about as a result of strong IPRs systems. They therefore, argue that it is imperative that a country establishes IPRs system that balances the ability of a nation to imitate technologies from advanced countries and at the same time provide necessary incentives for local innovation (Chen & Puttitanun, 2005).

Branstetter & Saggi (2009) recognize intellectual property rights as critical to the support and investment in research and development, which leads to innovation and invariably economic growth. By granting investors temporary exclusive rights on their inventions they are able to price their products above marginal cost and are therefore able to recoup their original investment cost after a period. Giving inventors exclusive rights to their inventions give them the needed incentives to invest in research and development thereby contributing to technological innovation and transfer, and diffusion of knowledge in such ways that are beneficial to social and economic welfare (Leger, 2006; Kanwar & Evenson, 2003; and Kanwar, 2006)).

Branstetter, Fisman, & Foley (2006) and Park (2008) suggest that strengthening IPRs will bring about increased inflow of foreign direct investment and technology transfer into developing countries, which in turn will spur domestic innovation. Some literatures (such as Lerner (2002) suggests that developing countries provide weak IPRs because they have few innovations to protect and would rather prefer to benefit from imitations. Whereas developed countries provide strong IPRs protection because they have more innovations to protect. Falvey & Foster (2009) asserts that IPRs protection tends to be of more significance in open economies than in closed economies. Lerner (2002) and Hall (2007) suggest that there is a possibility that tight IPRs protection is peculiar to more technologically advanced countries and that this explains why Maskus (2000a) and later Chen & Puttitanun (2005) obtained U-shaped relationship between IPR protection strength and GDP per capita (the proxy for economic growth).

Kanwar & Evenson (2003) working with data obtained for 32 countries between the periods 1981 and 1990 discovered that strengthening IPRs protection has significant positive impact on research and development investment. They then went ahead to infer that having strong IPRs would promote innovation and technological advancement, which will in turn have a positive bearing on economic growth. However, when they analyzed the data obtained from 307 Japanese firms during the period 1980 to 1994, they found out that the expansion of the Japanese patent scope have very limited or no impact on the research and development effort by Japanese firms. And the results also revealed that the expansion had very little or no effect on innovative output. Kanwar (2006) argue that having a strong IPRs system is capable of bringing about greater innovation in developing countries, which in turn will bring about greater economic development. This position was reached from the findings obtained after considering the relationship between research and development investment and index of patent rights. Kanwar (2006) also noted that innovations that are suitable in a developed country might not be suitable in a developing country.

Sattar & Mahmood (2011) in their study considered the impact of IPRs on economic growth using a panel data comprising of 38 countries (11 high income countries, 16 middle income countries and 11 low income countries) analyzed over the period 1975-2005. The Ginarte and Park index (see detailed explanation of the index below) was used as measure of the degree of IPRs protection and per capita GDP was used a measure of economic growth. Sattas & Mahmood (2011) suggest that economic growth (represented by GDP per capita) depends on the following variables; the initial level of per capita GDP, inflation, intellectual property rights, population growth rate, trade openness and rate of investment. The empirical result obtained reveals that IPRs protection has a significant impact on economic growth. The impact was however found to be more significant in high-income countries relative to middle and low-income countries. And it was further discovered that the impact of IPRs protection was even more significant in upper middle-income countries when compared to lower middle-income countries and low-income countries. The uniqueness of this study is that it measures the impact of IPRs protection on economic growth for different income levels.

Studies by Kanwar & Evenson (2003) and Park (2003) suggest that strong economic growth could give rise to strong patent protection. And some other studies as mentioned above suggest that countries strengthen their IPRs protection in order to encourage economic development. This reverse causation hypothesis, that is economic growth giving rise to strong patent protection, is further emphasized by empirical studies such as Maskus (2000a), Primo Braga et al., (2000) and Chen & Puttitanun (2005) which revealed a U-shaped relationship between patent regime and GDP per capita (economic growth). Chen & Puttitanun (2005) suggest that there is an empirical U-shaped curve relationship between IPRs and per capita GDP in developing countries. This view was earlier established by Maskus (2000a) and Primo Braga et al. (2000) but Chen & Puttitanun (2005) went further to establish a theoretical explanation for such a relationship. In fact Maskus (2000a) is of the view that the notion that wealthier countries are more prone to tighten their IPRs regime is well established but the contention is whether tightening IPRs protection really promotes growth. He eventually concludes that there is indeed a U-shape relationship between patent strength and economic growth. He argues that as income level increases patent protection (IPRs protection strength) is lowered. It reaches a certain optimal point after which patents protection begin to rise again as it is tightened intentionally through government policies. Optimal IPRs regime is one that takes into consideration the level of economic development and technological ability of a country. It balances the trade-off between encouraging local imitation of advanced technologies from developed countries and providing the necessary incentives for domestic innovation (Chen & Puttitanun, 2005). The empirical model used by Chen & Puttitanun (2005) is a system of two simultaneous equations; the first equation represents IPRs protection while the other represents domestic innovation. Two different models were used to analyze equation one, model 1 is without time dummies and model 2 is with time dummies. Equation two was analyzed using four models; model 1 has no time dummies, model 2 has time dummies. To obtain models 3 and 4 an interactive term between IPRs and GDPCAP were added to both models 1 and 2 respectively. The result of equation 1 shows that there is indeed a U-shaped relationship between economic development and IPRs. This they suggest implies that countries tend to lower their IPRs initially as the economy (proxied by GDPCAP) begins to grow and then tighten it after the level of GDPCAP reaches a certain optimal level; which was estimated to be US\$854.86 in 1995 prices when estimated without time dummies. The import of this optimal GDPCAP figure since it was found to be below the GDPCAP of many developing countries is that for many developing countries increase in GDP per capita causes corresponding increase in IPRs. When the equation was analyzed with time dummies present it revealed that the time dummies are not individually significant and the effects of other variables used in the equation maintain similar effects on IPRs except that the dummy variable (WTO) became insignificant. The output of equation two analysis showed that both IPRs and economic development have positive and significant impact on the rate of innovation under model 1 but economic development is insignificant in model 2. The impact of IPRs and economic development remain the same in models 3 and 4 except for IPRs, which was positive but insignificant in model 4. The outcome of the research result can be summarized as follows; innovation in developing countries increase with increase in IPRs protection and the IPRs protection is affected by the level of development, it first decreases and then increases. This is the reason for the U-shape relationship between IPRs and economic development.

It is worthy of note at this juncture that even empirical studies give conflicting results as to the impact of IPRs protection on economic growth. For instance Kanwar & Evenson (2003), among others in their literature concluded that strengthening IPRs have significant positive effect on innovation and growth, whereas Sakakibra & Branstetter (2001) concluded otherwise. The general assertion is that increment in new technological innovation gives rise

to increment in TFP, which in turn bring about increase in GDP per capita. The question then, is how can individuals and organizations be encouraged to make the investments that will give rise to innovation and invariably economic growth? To get these individuals and organizations to make the investment in the first place there must be adequate incentive and reward system in place. Jackson (2013) asserts that a robust reward system is capable of promoting innovation. One can generally infer that IPRs system can bring about the necessary incentives for entrepreneurs to want to invest in technological innovations that result in increment in TFP which in turn results in growth in the economy. Having a reward system that is predicated on a robust IPRs framework will cause entrepreneurs to develop new products or processes in such ways that they become more useful to the community. With such reward system entrepreneurs will be willing to invest the necessary resources (money and time) to achieve their objectives. But such a reward system should not be at the expense of the rest of the public. In other words the IPRs regime should seek to reward the inventor and at the same time benefit the wider public. All these should be done in a way that will create a positive impact on the overall economic development of the country. So for a country that is at the early stages of its development, it will be better off putting in place strategies and policies that encourage technology adoption, such that will enhance imitation of advanced technologies. This should include having a robust education system that will produce the right human capital, establish policies that will ensure seamless linkage between universities, research institutions and industries and also establish policies that will promote firm-level innovation. It is very important to state that for a country to properly learn and imitate technologies from advanced countries it must build the relevant human capacities to develop, absorb and utilize such technologies. The country should have workforce that has the ability to effectively learn from and adapt existing technologies to forms that are beneficial to its local needs. These kinds of skills can be acquired through the right education and by encouraging local companies to engage in focused research and development programs. There should be strong linkages between research institutes, universities and industries. Such ties will ensure that research institutes embark on research projects that are commercially, economically and socially relevant. To strengthen this sort of ties there should be well-defined framework on how the accrued benefits will be shared between the research institutes and the enterprises in a manner that is mutually beneficial. And lastly financial institutions should be encouraged to invest in research and development (Maskus, 2000a). However, as the country climbs up the technology advancement ladder it can then gradually refine and modify the above strategies and policies to encourage more advanced innovation. At this time the country can then begin to further tighten its IPRs protection. Acemoglu, Aghion & Zilibotti (2006) corroborate this view.

As is seen above there have been several researches with respect to the impact of IPRs protection on economic growth in both developed and developing countries. Recent among these efforts especially for developing countries are the works by Adams (2011) and Chen & Puttitanun (2005). Adams (2011) focused more on the impact of IPRs on economic growth in 34 Sub-Saharan African countries. The degree of IPRs protection was proxied using the Ginarte and park index. The panel data consists only of four separate time periods: 1985-1989; 1990-1994; 1995-1999; and 2000-2003. Adams used three different estimation techniques; ordinary least square, seemingly unrelated regressions, and fixed effects regression model. The work by Chen & Puttitanun (2005) considered the impact of IPRs protection on innovation and also on economic development using a panel data of 64 developing countries. The level of IPRs protection for each country was determined using Ginarte and Park index as was also the case in Adams (2011). The panel data was collected over six separate time periods; 1975, 1980, 1985, 1990, 1995 and 2000. The empirical model used was two simultaneous equations, the first representing IPRs protection and the other

represents domestic innovation. The equation was analyzed using the ordinary least square model. On the other hand this paper is an extension and improvement on previous researches on the impact of IPRs protection on economic development especially the work done by Adams (2011) and Chen & Puttitanun (2005). This research covers a broader range of developing countries other than Sub-Sahara Africa countries and more than the 64 developing countries used by Chen & Puttitanun (2005). It actually used a panel data of 81 developing countries. It also collected and analyzed data over eight separate time periods; 1975, 1980, 1985, 1990, 1995, 2000, 2005 and 2010. Most importantly unlike the previous researches it used a better IPRs index, one that did not only take into consideration IPRs laws as is the case with the Ginarte and Park index but also the degree of enforcement of IPRs laws. This was achieved by combing the Ginarte and Park index and the Fraser index (Hu & Png, 2010). The Index of Patent Rights put together by Ginarte & Park (1997) and later updated by Park (2005) is made up of five key components. These include: the extent of coverage of patent protection; membership in international patent agreements; provisions of loss protection; enforcement mechanisms and duration of protection. Each country within a specified period of time can obtain a score ranging between 0 to 1 per category. The unweighted sum obtained by a country for each of the categories constitutes the country's index of patents rights for that particular time period. It therefore, implies that each country within a specified period of time will have a patents right index of not less than 0 and not more than 5. The original index as conducted by Ginarte & Park (1997) was for 110 countries and was between the period 1960-1990, and was conducted every five years. It was then later updated by Park (2005) to 122 countries. The updated version by Park also included more countries such as China and the East European countries. These countries were excluded from the original Index largely because laws protecting industrial property were absent or based on different systems such as inventor certificates (Park, 2008). The patent of index rights (GP Index) has huge limitations as far as the actual measurement of a country's level of IPRs enforcement is concern. It only takes into cognisance a country's level of IPRs enforcement as it exists on paper without taking into consideration whether the existing legal system and enforcement framework provide for the effective enforcement of IPRs and proper punishment for offenders. The GP index sometime gives a wrong impression about the actual position of a country's IPRs regime especially as it concern enforcement. Take for example, the 1990 GP index rating of Nigeria (3.05) which is significantly ahead of countries like Hong Kong with a rating of 2.57 and Singapore also with a rating of 2.57. This clearly shows that the GP index does not take into consideration the enforcement of patent rights in these countries (Hu and Png, 2010) as the level of enforcement of laws in Nigeria is still very weak (Onyeozili, 2005). To take care of these limitations Hu and Png proposed that a new patent index be used, one that is a product of the GP index and the economic freedom of the world (EFW) index (also referred to as Fraser Patent Index in this paper). The Fraser index is made up of seven major categories. These are judicial independence, impartial courts, protection of property rights, military interference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts and regulatory restrictions on the sale of real property. In as much as this argument put forward by Hu and Png may be true, it is worthy of note that there will be no enforcement without first having in place the right laws; laws that have the right content, scope, coverage and other provisions. It is on the foundation of a robust legal system that enforcement can thrive. Another uniqueness of this research is that it does not just stop in measuring the impact of IPRs on developing countries or on sub-Saharan Africa countries but narrows it down to a particular country in this case Nigeria. It brings out subtle details that can only be seen when a specific country is analyzed as different countries have unique social, political and economic characteristics. This paper is therefore more extensive as it carries out primary research on the actual impact of IPRs on innovation and FDI in Nigeria.

As already mentioned above many developing countries and indeed Nigeria (see [www.wipo.int](http://www.wipo.int)) have the necessary intellectual property protection laws and have signed the Trade Related Aspect of Intellectual Property Rights (TRIPS) agreement. However, most developing countries including Nigeria have not performed very well in enforcing the protection of IPRs as is reported in various issues of the Economic Freedom of the World Annual Report (see [www.freetheworld.com](http://www.freetheworld.com)). This research therefore intends to understand whether enforcing strict IPRs regime will help spur innovation, attract more foreign direct investment and generally increase overall economic growth in developing countries especially Nigeria. At the end of the research we should be able to ascertain with reasonable confidence whether IPRs protection is important in raising the level of innovation, attracting foreign direct investment and invariably improving the economic growth of a typical developing country using Nigeria as a case study. And following the outcome of the research, strategy and policy measures will be recommended on how best Nigeria can indeed take advantage of intellectual property protection.



## Chapter three: Theoretical background

This section of the paper will provide a brief background on the subject of intellectual property. It will start by giving a brief introduction of the concept of intellectual property rights (IPRs) protection and The Trade Related Aspects of Intellectual Property Rights (TRIPS) will also be highlighted. And it will consider the reasons why some countries adopt the utility model patent approach. This section will also consider the patent system in some selected jurisdictions including Brazil, Russian Federation, India, China and South Africa. The section will further take a cursory look at the intellectual property regime in Nigeria with special emphasis on the level of enforcement, issues such as the enforcement of contracts in Nigeria, and the country's corruption perception index will be considered.

### Intellectual property

The term intellectual property (IP) refers to the creations of the mind; these include inventions, literary and artistic works, and symbols, names, images, and designs used in commerce (WIPO, IP Handbook). It is divided into two broad categories industrial property and copyright. Industrial property includes the following: inventions (patents), trademarks, industrial designs, and geographical indications of source. Copyright include the following: literary and artistic works such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs and sculptures, and architectural designs. Furthermore the following rights are protected by copyright performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programs (WIPO, IP Handbook). There are various international treaties and conventions on intellectual property. Some of the very popular ones include the Paris Convention for the Protection of Industrial Property, the Berne Convention for the Protection of Literary and Artistic Works, the Madrid Agreement Concerning the International Registration of Marks and the Protocol Relating to the Madrid Agreement and the Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPS") and WIPO-WTO Cooperation among others. The TRIPS agreement will be considered in more detail in the next section.

The expression copyright is the exclusive right the original creator of a copyrightable work gets usually for a limited time period. During this period the copyright holder has the right to prevent a distorted production of the work, to make copies, to be credited for the work, determine who may perform the work, and determine who may financially benefit from the work and other related rights (Rubin, 2011). The right to make copies can be exercised by other parties who have duly obtained license and authorization from the original owner to do so. As mentioned earlier the right of the copyright holder does not exist indefinitely, the law provides for a specified period of time that the right can be enjoyed. The duration of the copyright usually begins from the moment when the work has been created or when it has been fully expressed in a tangible and recognizable form. The right continues for some time even after the death of the owner. The duration of copyright usually vary from one country to another but in countries party to the Berne Convention and indeed many other countries the duration is quite similar. The Berne Convention provides that the duration should be the life of the author plus at least 50 years after his death. This is the minimum allowed for countries that are party to the convention but these countries are allowed to extend the duration. For example the European Union, the United States of America and many other countries have extended the term of copyright to 70 years after the death of the author (WIPO; US Copyright Office, 2012).

The term trademark refers to any word, phrase, symbol or design, or any combination of words, phrases, symbols or designs that identifies and distinguishes the source of the goods

of one party from those of other parties. Similarly service mark (which in some jurisdictions is also referred to as trademark) refers to any word, phrase, symbol or design, or any combination of words, phrases, symbols or designs, that identifies and distinguishes the services of one party from those of other parties (USPTO; International Trademark Association, 2012). So basically a trademark gives the owner of the mark the exclusive right to use the mark to identify goods or services and the owner in return for payment can give his mark to a third party. The duration of a trademark right varies but it can be renewed indefinitely beyond the initial period on payment of additional fees (Ramello, 2006). Trademark can be registered in a single country as most countries in the world today register and protect trademarks. However, trademarks can also be registered internationally such that the registration applies to other countries thereby avoiding registering separately in each country. WIPO administers an international system of trademark registration. This system of international registration is possible due to two major treaties, the **Madrid Agreement Concerning the International Registration of Marks** and the **Madrid Protocol (WIPO)**.

According to WIPO a patent can be described as an exclusive right granted to an applicant (this can be an individual or an organization) who has made a formal application for an invention to be recognized and protected. This invention can be a product or process but must be new and novel in the sense that it must provide a new way of doing something or offer a new technical solution to a problem ([www.wipo.int](http://www.wipo.int)). Patent application can be made nationally, regionally or internationally. A patent application filed at the national patent office may only be granted and enforced within that jurisdiction in accordance with the subsisting laws in that country. The same patent can be filed separately in various other countries. The applicant may choose not to apply separately in each individual country. To avoid this, the application must be made regionally or internationally. For regional patent application, the application must be made at a regional office for instance the African Regional Intellectual Property Organization (ARIPO). The patent when granted will be effective in all the countries in that region that are members of ARIPO. Likewise international applications may be filed with the patent offices of member States of the Patent Cooperation Treaty (PCT) or the International Bureau of the World Intellectual Property Organization (WIPO) or a regional Office by any resident or national of a PCT Contracting State (MacQueen, Waelde & Laurie, 2007). The typical duration of a patent is 20 years from the date of filing of the patent application. However, for various countries after the initial period the term of protection can be extended (WIPO). This paper will go further to examine the patent systems (as the patent system will be used as a proxy for other intellectual property rights) in Japan, China, Germany and Nigeria including looking at the utility model system in these countries. The utility patent model is basically an inexpensive, fast and less stringent alternative to the traditional patent system. They usually have shorter term of between 6 to 15 years and are mainly “incremental inventions” (Mott, 2007; and Suthersanen, 2001). That is they are usually improvement on already existing patents. They may be also referred to as "petty patent", "innovation patent", "minor patent", and "small patent". The utility model system aside from having the attributes mentioned above does not require substantive examination (for novelty, non-obviousness and industrial applicability) and requires lower standards of inventiveness (Kim et al., 2012). And it often takes less time to obtain a utility patent grant. In as much as utility model has several advantages it also has some disadvantages. Utility model protection is not as strong as the traditional patent system. And the fact that there may be very weak differences between the protected invention and the state of the art coupled with the weak or no substantive examination enforcing utility models may be more difficult than traditional patents (Kim et al., 2012).

### **Trade related aspects of intellectual property rights**

International IPRs is governed by several conventions notably the Paris Convention for patents and trademarks and the Bern Convention for copyrights. Both conventions are administered by WIPO. The TRIPS agreement came into effect in 1995 and it is so far the most comprehensive multinational agreement on intellectual property including copyrights and related rights; trademarks including service marks; geographical indications including appellations of origin; industrial designs; patents including the protection of new varieties of plants, the layout designs of integrated circuits; and undisclosed information including trade secrets and test data. The TRIPS agreement is contained in annex 1C of the World Trade Organization (WTO) charter. The TRIPS agreement became imperative following the continuous and growing involvement of intellectual property in global trade. This necessitated setting up a global standard for the protection of IP right. It was on this basis that the TRIPS agreement was consummated (Adewole, 2010). It actually came into effect as a fall out of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994. It is administered by the WTO and defines minimum standards for various forms of IP regulations; see TRIPS Article 1(3). Prior to 1994, the GATT was the major agreement that defined the way nations behave to one another as far as international trade is concern. The GATT was replaced by WTO. The WTO basically defines and sets the rules for free and fair international trade. Even though the TRIPS agreement came into effect in 1995 developing countries were given a grace period of 5 years between when the TRIPS agreement was established and when to fully implement it, see article 65 of the TRIPS Agreement. The agreement became compulsory for all developing countries from January 1, 2001<sup>3</sup>.

The TRIPS agreement requires members to put in place and enforce strong and non-discriminatory minimum standards of IPRs protection. In signing the TRIPS agreement developing countries basically accept a very broad range of responsibility in almost all aspects of IPRs protection including: copyrights and “related rights”; industrial designs; trademarks; geographical indications; patents; plant varieties protection; integrated circuits and undisclosed information (Islam, 2009). The TRIPS agreement is considered the most important as well as the most controversial agreement as far as IP protection and economic development is concern (Rai, 2009). There is doubt as to the impact and how far the agreement can go in actualizing article 7 of the agreement which says “the protection and enforcement of IP rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare and to a balance of rights and obligations”. Maskus (2000c) is of the opinion that when fully implemented developing countries have a lot to benefit from the TRIPS agreement including increased FDI, increase in the in trade volume of more technologically advanced products, increase in the volume of technology transfer through licensing and stimulation of domestic innovation.

The TRIPS agreement was developed to curtail piracy, counterfeiting and infringement of IPRs. The agreement was intended to remove any barriers to trade as a result of piracy, counterfeiting and infringement. So in essence the objective of the agreement was to remove distortions and obstacles that hinder international trade while taking into consideration the need to promote competence and substantial protection of IPRs (Jatkar, 2009). The agreement further aims to ensure that measures and procedures adopted by

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<sup>3</sup> Article 65 (1) and (2): Subject to the provisions of paragraphs 2, 3 and 4, no Member shall be obliged to apply the provisions of this Agreement before the expiry of a general period of one year following the date of entry into force of the WTO Agreement. A developing country Member is entitled to delay for a further period of four years the date of application, as defined in paragraph 1, of the provisions of this Agreement other than Articles 3, 4 and 5

countries to protect IPRs do not in turn become obstacles to legitimate trade. In the overall it aims to build seamless linkage between WTO and WIPO. So generally as involvement of IP in global trade increased to a level that requires special attention the TRIPS agreement became more necessary. Furthermore, existing conventions such as Paris and Bern conventions lacked the required provisions to ensure enforcement against counterfeiting and piracy (Olsson, 2004). The three main features of the TRIPS agreement include: standards, enforcement and dispute settlements. The TRIPS agreement is a minimum standard agreement, giving room for member states to provide more extensive protection in selected areas of their choice but they are however not allowed to go below the set minimum standard. The TRIPS agreement for each area of IP defines the rights to be conferred to the owner of the IP, the permissible exceptions to the rights and the minimum duration of protection that can be granted to the IP owner. The TRIPS agreement recognizes the other main conventions of WIPO mainly the Paris convention for the protection of Industrial Property and the Bern Convention for the protection of Literary and Artistic works. It indeed complies with the recent versions of these conventions. Furthermore, the TRIPS agreement provides additional protection and enforcement procedures where the existing conventions are either silent or where the provisions are seen to be inadequate (WTO, 2011). The agreement goes further to provide for procedures member states should comply with locally as regards the enforcement of IPRs. The TRIPS agreement spells out defined general principles applicable to IPR enforcement. This is apart from the basic administrative, civil and criminal procedures available for enforcement of rights of the IPRs owner. It spelt out the procedures and remedies that must be available such that IPR owners could have a basis to efficiently enforce their rights. And finally the agreement is structured to settle dispute between contracting members of the TRIPS agreement using the WTO's dispute settlement procedures.

Some have argued that the TRIPS agreement was designed to favor the developed countries (Archibugi & Phillipetti, 2010; and Drahos & Mayne, 2002). Drahos & Mayne (2002) are of the view that the agreement was “pushed through by a handful of rich countries under the influence of a heavy corporate lobby without the informed participation of many developing countries”. Developed countries often demand that developing countries fully implement the TRIPS agreement before accepting to enter into bilateral agreement with them. And the lack of signing of the TRIPS agreement or lack of its implementation often lead to trade disputes even with the presence of a bilateral agreement. Take the trade dispute between the United States and Argentina in 1997 and the one between United States and South Africa in 1999 on pharmaceutical patents (Correa, 2005). Sometimes the implementation of the TRIPS is not quite favorable to developing countries as it causes increase in the cost of protected products such as pharmaceuticals. The increase in the price of goods is not the only cost developing countries have to bear in implementing the TRIPS agreement (Carsten, 2006). They have to contend with the cost of setting in place the right domestic legal framework that will help in the effective enforcement of the agreement. The domestic laws have to align with the various areas of the TRIPS agreement including civil and criminal procedures in courts, administrative procedures and the intervention of relevant law enforcement authorities (Carsten, 2006). To obtain the requisite legislative approvals and put in place these procedures and ensure responsible enforcement authorities are fully equipped in terms of training and other resources will cost a lot of money. Developing countries are already overwhelmed with other developmental challenges and may therefore find additional financial obligations required to properly implement TRIPS rather burdensome. In fact in 2001 developing countries worried that the TRIPS agreement was more favorable to the developed economies initiated a round of talks that resulted in the Doha Declaration (referred to as the Declaration on the TRIPS agreement and public health). The Doha Declaration removed the overly narrow interpretation of the TRIPS agreement by developed countries

especially as it concerns public health<sup>4</sup>. The Doha Declaration made it clear that TRIPS should be interpreted in light of the objective “to provide access to medicines for all”<sup>5</sup>. The Doha Declaration re-enforced the objectives and principles set forth in articles 7 and 8 of the TRIPS agreement (Yu, 2009; and Schott, 2002). In essence the main reason for the Doha Declaration is to grant WTO members, especially developing countries the right to duly utilize the TRIPS flexibilities thereby lowering the adverse effect of the high price of patented drugs and giving more access to patented pharmaceutical products (Correa & Matthews, 2011).

After the Doha Declaration the general expectation was that there would be an increase in the number of compulsory licenses claimed by WTO member nations especially among developing countries. A compulsory license according to the World Health Organization (2000) is simply “an authorization that is granted by the government [of a given country] without the permission of the patent holder.” And the Declaration has also acted as a framework upon which national and regional policy decisions can be based upon. Take for example the decision reached by the European Parliament on the 12<sup>th</sup> of July 2007 on the TRIPS agreement and access to medicines where it cited the Doha Declaration. The Parliament encouraged all developing countries to use all means available to them under the TRIPS agreement such as compulsory licenses and the mechanism provided by article 30 of the TRIPS agreement<sup>6</sup>. However, skeptics doubted that the Declaration would have the desired impact in increasing the number of compulsory licenses recorded by nations. This doubt was based on the expected political pressure against compulsory licenses, the lack of production capacity (including health system incapacity) and the legislative challenges of issuing a compulsory license in most developing countries (Beall & Kuhn 2012). Despite the pessimism by some concerning the Doha Declaration’s likely impact, Beall & Kuhn (2012) observed that there was increase in the number of compulsory licenses recorded in developing countries between 2003 and 2005, although there has been a decline after 2006. It is worth mentioning that the volume of compulsory licenses, especially as it concerns HIV/AIDS drugs, recorded after the Doha declaration may not be entirely inspired by the declaration. It is possible that the recorded increase may be caused by increased philanthropic activity, public-private partnerships, bilateral aid and increased global campaign on

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<sup>4</sup> See paragraph 4 of the Doha declaration: We agree that the TRIPS Agreement does not and should not prevent members from taking measures to protect public health. Accordingly, while reiterating our commitment to the TRIPS Agreement, we affirm that the Agreement can and should be interpreted and implemented in a manner supportive of WTO members’ right to protect public health and, in particular, to promote access to medicines for all. In this connection, we reaffirm the right of WTO members to use, to the full, the provisions in the TRIPS Agreement, which provide flexibility for this purpose.

<sup>5</sup> See paragraph 5 of the Doha declaration which recognizes the flexibilities to include:

In applying the customary rules of interpretation of public international law, each provision of the TRIPS Agreement shall be read in the light of the object and purpose of the Agreement as expressed, in particular, in its objectives and principles.

Each member has the right to grant compulsory licenses and the freedom to determine the grounds upon which such licenses are granted.

Each member has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, it being understood that public health crises, including those relating to HIV/AIDS, tuberculosis, malaria and other epidemics, can represent a national emergency or other circumstances of extreme urgency.

The effect of the provisions in the TRIPS Agreement that are relevant to the exhaustion of intellectual property rights is to leave each member free to establish its own regime for such exhaustion without challenge, subject to the MFN and national treatment provisions of Articles 3 and 4

<sup>6</sup> Article 30 of the TRIPS agreement “Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.”

HIV/AIDS treatment (Beall & Kuhn, 2012). The poor number of compulsory licenses recorded, especially before 2003 and after 2006, can be largely attributed to the fact that many developing countries have failed to trigger the TRIPS flexibilities. According to Beall & Kuhn, (2012) there are quite a few reasons why many developing countries have not fully triggered the TRIPS flexibilities to increase access to medicines. One of the reasons identified is that many developing countries modified their IPRs laws too early (including their patent laws) before the expiration of the transitional period for the general application of the TRIPS agreement, which was 1 January 200 and they failed to realize the impact IPRs protection has on access to medicine. And most of these countries have been quite reluctant to modify their existing IPRs regime to include the necessary flexibilities. Another factor that has inhibited the implementation of the TRIPS flexibilities among developing countries is that a significant number of them have entered into Free Trade Agreements and other forms of bilateral agreements that prevents them from using compulsory licenses, permit parallel importation or indeed use any other TRIPS flexibilities (Musungu, Villanueva & Blasetti, 2004). And lastly quite a good number of developing countries lack the technical know-how to fully understand and implement the TRIPS flexibilities.

### **What is utility patent and why do some countries adopt it?**

In the quest by many developing countries to promote and encourage innovation, which invariably spurs economic growth, they adopt the use of petty patents or utility models. Utility model is an inexpensive alternative to the traditional patent system. Utility model system offers low cost no examination protection regime for technical inventions, which would ordinarily fall short of the regular patentability criteria (Suthersanen & Dutfield, 2005). Among all countries that practice the utility model, certain features and attributes as regards utility models are common. Utility models in all the countries confer exclusivity rights to the owner. Novelty is a general criterion for the grant of utility model right although the standard of novelty may vary from one country to another. And lastly it is required that utility models get registered even though substantive examination of the application is not practiced (Suthersanen & Dutfield, 2005).

The desirability of utility model varies from one industry to another. While some industries will welcome with open hands affordable, fast protection system others may be skeptical that such system will rather destroy “creative imitation”. One may argue that some inventions are better off left in the public domain and open to imitation. To understand the real advantage of utility model and economic relevance in a country it will be recommended that it be compared against the behavior of the firms in an innovative environment. Hansen & Birkinshaw (2007) recognize the importance of firms been able to efficiently convert ideas into viable products and services. In some jurisdictions the issue of having or not having a utility patent system has been subjected to serious debate. For instance in Singapore opponents of utility model argued that there was little or no need both from a legal and economic perspective to establish a utility model system. Industry wise, it was believed that a large domain is necessary to spur innovations. However, the proponents argued that the cost of getting an IP protection is too high and that it also takes too long and that the present IP system as structured is rather too complex. The opponents suggested that these concerns can be taken care of not necessarily by establishing a new IP system but by reviewing the existing system and restructuring it such that takes into consideration the expressed concerns (Suthersanen & Dutfield, 2005). At the long-run both parties agreed that if the industry feels it is better having a utility model system in place, then such a system should have the following features: The renewal tenure should not exceed 20 years; first period of registration should not attract any examination; the renewal fees should be different for SMEs and large enterprises; applications for second time renewal should be subjected to examinations;

novelty should be universal; utility model right holders should have the choice of filing for standard patent applications; and government should take coordinated actions to promote and instill a culture of utility model.

Innovation is a process that begins with an invention and the eventual transformation of the invention into a new and commercializable product, process or service (Popadiuk & Choo, 2006). For firms to commercialize their inventions effectively in an innovative market environment they have to take certain factors into consideration. They need to properly understand what the market demand is. It may therefore, be more strategic to concentrate more on design and market driven commercialization as against technology-enabled commercialization. Design and market driven commercialization are more tailored to suite the desires and aspirations of the market. It can be argued that countries introduce utility model primarily because of design and market driven commercialization, as most inventions are mainly incremental in nature. And furthermore, they are susceptible to imitation when released in the open market (Suthersanen & Dutfield, 2005). It is generally believed that utility model is very important for the growth of small and medium scale enterprises. This is based on the argument that SMEs have prevalent presence in industries that witness plethora of incremental inventions. Such industries are also known to be plagued with unfair copying (Suthersanen & Dutfield, 2005). It is therefore, believed that utility model will help sanitize such industries and provide the required legal environment for SMEs to thrive, in terms of having the confidence to embark on incremental innovation knowing that their inventions will be adequately protected.

A nation should consider its present patent regime and see the impact such regime has on SMEs. It should then analyze the situation and figure out the impact having a utility model system will have on SMEs. The assessment should aim to determine the volume of incremental and fresh innovations that come from SMEs. The patent system should be such that is in consonance with the needs of SMEs in terms of the type of innovations been churned out by SMEs. It may be possible that having a utility model will promote innovation among SMEs, which will invariably bring about growth in the economy. One may assert that industries within which SMEs thrive are quite susceptible to high level of copying. It therefore implies that providing a robust utility model framework will not only promote innovation among SMEs, but also create a positive impact on the economy. Furthermore, the regular patent regime may be too expensive for SMEs. The utility model system will provide them a more cost effective solution for the protection of their inventions, even though the inventions are only incremental.

In as much as the utility model system may seem very good, it is not without some challenges that should not just be over looked. Since the utility model regime entails the lowering of the standards when compared to traditional patent standards it could lead to a huge number of legal uncertainties and invariably lots of litigations. Furthermore, bigger firms may decide to rather apply for utility model instead of filing for standard patents as a means of side stepping the more stringent conditions present in the standard patent system. These bigger firms may end up abusing the system and making it more difficult for SMEs to compete. One of the major snags with utility model is the fact that rights are granted without proper examination, which invariably could lead to legal uncertainty and plethora of litigations. This is largely because it will be more difficult for third parties when carrying out infringement searches to determine the rights that exist in a given technological field. This may not only bring out so many infringement cases but will act as barrier to other competitors. The danger of having the utility model system further extends to undermining the rights and privileges of existing IPRs owners. The argument for the award of utility model rights is predicated on the assumption that cumulative innovations are very prone to unfair copying and abuse by third parties. However, granting utility model right may very well

undermine the real essence for the award of traditional patent rights. Traditionally the reality is that all inventions and creative works are in the public domain except works that fulfill certain criteria such as novelty, inventive step, originality or distinctiveness. So by allowing utility model system, it implies granting right to inventions that fail to satisfy standard requirements. The import of this is that many inventions that are sub-standard may be granted rights. This may end up having adverse effect on existing IPRs. The system may further kill copying drastically, which in turn may not be the best for economic growth. Copying and free riding is sometimes perceived to be healthy for competition and invariably economic growth (Gimenez, 2011).

Generally speaking having a reasonable intellectual property regime is necessary to protect innovative ideas and give creators of such ideas incentives to keep creating. However, any idea that does not meet the full requirements including such traditional standards, as novelty, inventive step and originality are not granted any protection. Ideas that do not meet these traditional standards fall within public domain and can therefore be freely copied and shared. But in a situation where these ideas that do not meet these standard criteria are granted protection they will not only deny the public free access to these ideas but the integrity of already existing IPRs including the benefits accruable to the owners are jeopardized. Copying and free sharing of ideas is known to be beneficial to economic growth and promotion of healthy competition among businesses (Gimenez, 2011). However, utility model protection can be justified on the grounds that intellectual property protection is not meant to only grant protection for inventive ideas but also to allow reasonable products, services and methods to be developed that are essential to the public. Such inventions require capital investments and for such inventions to keep coming the organization or individual who invested in the research and development of such products, services or new methods should be given the necessary cover to recoup their investments. They need to know that even though these inventions will eventually get imitated that there will be reasonable time between when the idea is conceptualized (and commercialized) and when it will become freely available in the public domain. With these protection and understanding organizations and individuals will feel more comfortable to invest in industrial research development and innovation.

Policy makers are therefore, faced with the option of not encouraging sub-patentable regimes and simply leaving them unprotected, instead of lowering the inventive step threshold. They may alternatively decide to put in place a legal system that can give some level of protection to such inventions such as statue-based tort (Suthernanen & Dutfield, 2005). Under such conditions anyone who feels he has suffered loss can sue the infringer for trespass. In summary, the utility model system can bring about possible increase in litigation; firms may be tempted to redirect funds that could have been put to other use to gain utility model protection. The system may lead to an overall increase in royalty and licensing fees to foreign companies. Due to potential increase and monopoly in the volume of patent and utility model protection certain industrial areas may suffer adversely as competitors may be shut out. On the other hand utility model system can be advantageous to a country that is a net importer of intellectual property goods as utility model protection may encourage local businesses to be more creative and produce more goods which in turn will reduce the overall import. The utility model system will provide a platform for the protection of certain intellectual property goods, which do not meet the standard intellectual property goods protection under the standard system. This action will further discourage firms from freely imitating other people's ideas and will cause them to rather invest in research and development and thereby bringing an increase in the volume of intellectual property goods produced in the society. The utility model system will also help to generate revenue for the government through registration. It is recommended that in implementing or adopting a



utility model system that a nation should not adopt a one-size-fit all approach for all industries. Two critical questions should be answered in determining the appropriate utility model solution for an industry. These include: ascertaining if copying is a problem in the industry and secondly if it is better for the inventions in that industry to be left in the public domain and be open for free imitation.

### **Patent systems in selected countries**

This section looks at the patent system in selected countries including Brazil, Russian Federation, India, China and South Africa (BRICS). The BRICS countries have maintained successful and sustained growth over the past 20 years. They are among the fastest growing economies in the world and they are the largest economies outside the OECD countries with annual GDPs of more than 1 trillion USD (Kanwar, 2013). These countries hold a huge percentage of the global foreign exchange reserves, and China has even surpassed Japan as the largest creditor country (The Economist, 2010). So arguably these countries are countries Nigeria should emulate. But has IPRs management got anything to do with the fast growth rate in these countries? Was the growth recorded by these countries a function of the level of technological innovation and IPRs protection? Did innovation and FDI increase after the post TRIPS period? The WIPO statistics on IP filings and economic growth has shown mixed relationship between IP filings (especially) patents and economic growth in the various BRICS countries. IP filings include patents, trademarks and industrial filings domestically and abroad (including regional filings). Gross Domestic Product using constant 2005 United States dollars represents economic growth.

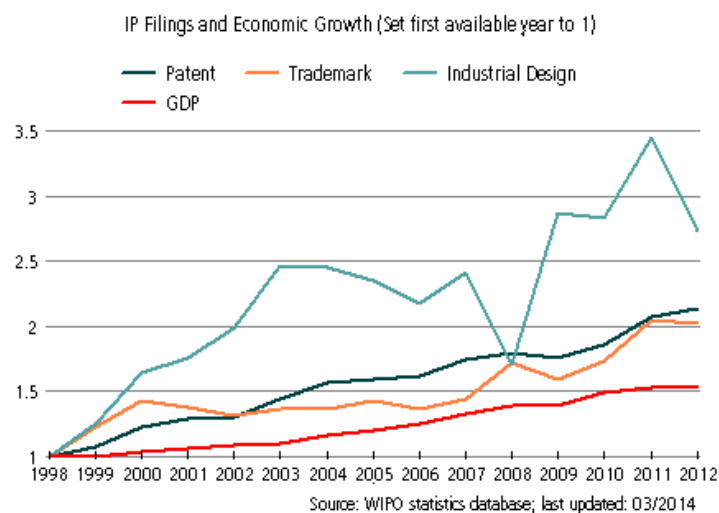
### **Brazil**

For over 15 years now Brazil has recorded tremendous economic growth and has attracted more foreign and domestic investors than it was able to achieve prior to this period. This is attributable in a broader sense to its more stable political system, better financial system and more tolerable legal system. All these have helped to build a more reliable and trustworthy relationship between Government and the business community (Advocacia Pietro Ariboni, 2010). Brazil has been a member of the WTO since January 1, 1995 making it a signatory to the TRIPS agreement. It is also signatory to other conventions such as the Paris and Berne Conventions. All these treaties have been duly ratified by the Brazilian National Congress and have become part of the Brazilian legislation and therefore are duly enforceable within that jurisdiction. After becoming signatory to the TRIPS agreement the country has since updated its IP laws. The Brazilian Patent and Trademark Office (BPTO) is responsible for the registration of trademarks and patents. The country has still not perfected its IP recognition and registration process as it takes up to five years to register a trademark and sometimes up to as much as eight years to get a final decision on patent application (Advocacia Pietro Ariboni, 2010). Furthermore, the huge backlog of lawsuits in Brazilian courts makes prosecuting IPRs offenders very slow and more difficult. However, in recent years the BPTO and the National Council of Justice have made serious efforts in reducing this backlog and generally making the legal system more efficient and attractive to both domestic and foreign companies (The Economist, 2012). The economist (2012) further reports that more judges are beginning to understand the subject of IPRs protection laws and the country has even taken a step further by establishing a IPRs appeal court in Rio de Janeiro. And there is strong convergence between the present handling of patent application in Brazil and what is obtained in developed countries. Brazil's proposed patent strategy is that " it [Brazil] should use its inherent creative ability to adapt and tropicalize its patent system to promote public policies for innovation in the country. So did India, when reviewing

its patent act in 2005. And so did China, in 2008.” (Center For Strategic Studies And Debates, 2013).

Patents in Brazil are protected for a period of 20 years from the date of filing of the application. Utility models are protected for 15 years from the date of filing of the application. Owners of patents granted in Brazil are authorized by law to prevent any third party from unduly exploiting the protected invention within Brazil irrespective of the patent type. Brazil does not recognize any patent that is not formally filed within its jurisdiction. If the owner of a patent filed and granted abroad decides to extend the protection of such patent to Brazil, he/she must file an application with the BPTO. However, the applicant may benefit from the priority term as stipulated in the Paris Convention of which Brazil is signatory, as long as the application is filed within 12 months following the date of the first application abroad. In a situation where the application is filed in Brazil after such priority period, the subsisting filing date will become the date of the actual filing with the BPTO (Advocacia Pietro Ariboni, 2010).

Figure 1: IP Filings and Economic Growth for Brazil



According to the data obtained from WIPO website Brazil reported a strong relationship between the number of patents filed and economic growth with a strong correlation of 0.9688, see figure 1 above. This does not however, necessarily imply that the increased (or growing) number of patent filing is directly responsible for the economic growth of Brazil as there may be other factors causing it to record such as impressive economic growth. There is also a possibility that the economic growth in Brazil may be responsible for the rise in the number of patent applications. For example the economist (2012) reported that there is a decrease in the volume of imitation (especially for software and music piracy) in Brazil as the income rises. Thus suggesting that economic growth may spur more interest in creativity and innovation.

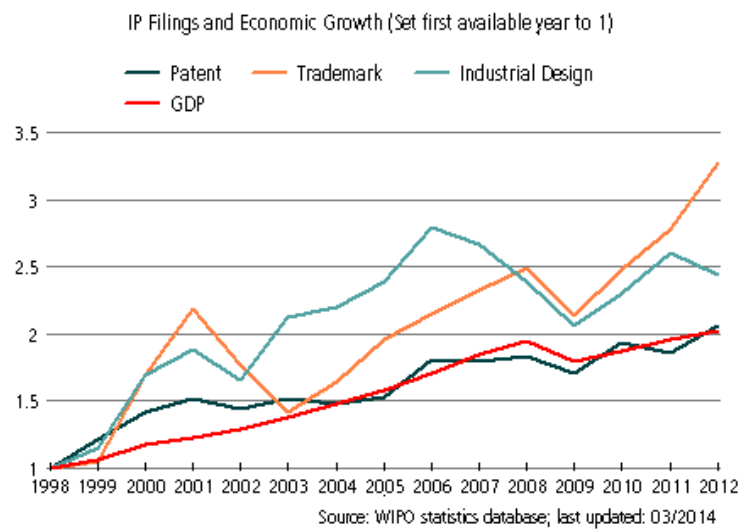
The report as stated by WIPO makes it difficult to ascertain and compare the level of innovation in the various countries using a common yardstick. The levels of protection of IPRs vary from one country to another. And furthermore the thoroughness of the various patent offices vary, while some countries may easily grant patent rights others may be more stringent in awarding patent rights. For that reason this research chose to the United States as a standard mainly for the purpose fair comparison and secondly because the US has quite a robust patent regime. This paper therefore, will use the number of patents filed by individuals and companies resident in Brazil but filed for patent in the US as a measure of the level of innovation in Brazil. And this will be measured against the GDP of Brazil for the period 1975-2010.

## Russian Federation

Russia has recorded reasonable economic growth in recent years, growing at an annual rate of between 6-7 percent. This has considerably raised the standard of living in Russia and narrowed the income gap between it and other emerging economies (Beck, Kamps & Mileva, 2007). However, the income gap between the poor and the very rich in Russia is very wide, and arguably has one of the highest wealth inequalities in the world (Weiss, 2013). The growth and relative stability including rating upgrade in Russia has contributed to attracting FDI and generally helped boost investors confidence. This growth in Russia's economy is largely attributable to the fact that among other factors Russia is the second largest producer of oil and it also has large natural gas reserves (Beck, Kamps & Mileva, 2007).

From early 2000 there has been significant improvement in the Russian IPRs system compared to the Soviet days. One of the most notable steps taken by Russia in this regard was the adoption of the part IV of the Civil Code, signed on December 19, 2006 and became effective January 1, 2008. The new legislation replaced the then Russia Intellectual Property Rights regime. Furthermore changes in criminal procedures code also provided the platform for the police to get more involved in combating IPRs infringement (Eugster, 2010). The Russian Patent Office is responsible for patent registration. Patents are granted for inventions, utility models and industrial designs. Inventions are innovations that possess substantive technical novelty whereas utility models are inventions that are merely technical improvements on perhaps existing technologies. And lastly design patents are inventions that are more or less in the field of artistic designs ([www.wipo.int](http://www.wipo.int)). The duration of an inventive patent protection in Russia is 20 years from the date of filing; 10 years for utility model (may be extended by up to 3 years) from the date of filing; and up to a total of 25 years for design patents (although the initial term is 15 years). It is interesting to note that if an invention is created in Russia (whether by a citizen or non-citizen) using facilities situated in Russia the inventor must first file his/her patent application in Russia before filing abroad. The reason for this is to check whether the invention in anyway contains state secrets, failure to comply with this rule is regarded as an offence. This however, does not apply to patent applications in Russia by individuals or firms from foreign countries where it is obvious that the inventor's R&D facilities are situated outside Russia. While Russia has long been a member of some IPRs related conventions including Berne for the protection of Literary and Artistic works 1886 and Patent Cooperation Treaty 1970, it only recently became a member of WTO. It joined the WTO in August 2012, which implies that Russia is only under obligation to implement IP rules and regulations contained in TRIPS after joining WTO (Zubarev, Martinenko & Morton, 2013). After its accession to WTO agreement Russia started putting in place measures that will help improve the protection of IPRs within its jurisdiction including setting up special courts to handle IPRs infringement cases. It has also moved to put in place measures against counterfeiting, piracy and circumvention of technologies (Office of the US trade representative, 2012).

Figure 2: IP Filings and Economic Growth for Russia



The data provided on the WIPO website suggests a very strong positive correlation between economic growth represented by GDP and the number of total patents filed domestically and abroad, see figure 2 above. As mentioned above for Brazil, consistent rise in economic growth may not necessarily be only as a result of the rising level of innovation in Russia. Other factors including innovation may be responsible. Russia between 1998-2000 recorded strong recovery following the post-Soviet recession. The quick recovery was possible due to more robust monetary policy and fiscal policies. Russia also strengthened its institutions bringing them at par with what is obtained in more advanced countries. The cost of capital in Russia fell, thanks to improved ratings from Moody, Fitch and S&P. And also the increase recorded in the level of innovation may be as a result of increase in GDP. In essence it could be that economic growth may be driving innovation.

## India

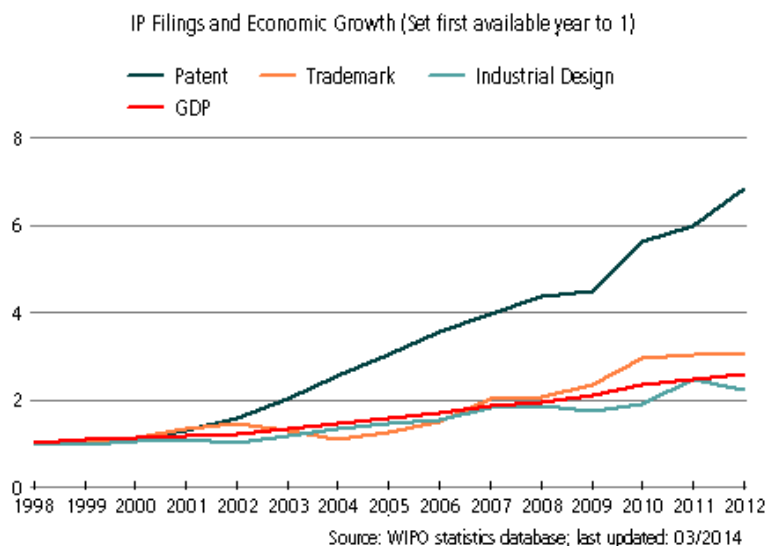
India is among one of the fastest and largest economies in the world, growing at an annual average of about 8 percent during the 11<sup>th</sup> Five Year Plan (2007-2012) (The Economic Times, 2014). According to the report India was not able to meet its target plan of 9 percent growth rate due to both internal and external factors including global economic crisis; slow down in growth in its agricultural sector due mainly to draught; fluctuations in international prices; and rise in inflation. Even though India has recorded strong growth in recent years it is still largely one of the poorest countries owing essentially to its very large population. India has recorded some tremendous results in the area of high technology even at that a good percentage of its citizens still use traditional methods in important areas such as farming (and most Indian farmers are still small scale farmers). This is particularly of interest considering the fact that agriculture is the largest industry in India. India's growth has come mainly from the service and manufacturing sectors. However, the growth achieved in India is unlike that of China, while China achieved strong growth mainly from export that is not the case for India. Most of the growth seen by India is majorly from high consumer demand within the country and from medical tourism (people across the world come to India for affordable medical assistance). The rising domestic consumption in India is as a result of the rising disposable income of the middle class population. This has helped to protect it against external shocks including fluctuation in oil prices ([www.wipo.int](http://www.wipo.int)). And another factor that has contributed to India's economic success apart from those earlier mentioned is the fact that the country has been able to improve its savings and investment ratios from previous years taking it to about 30 percent of its GDP. All these factors helped and will continue to help

ensure that India meets and maintains its medium term economic growth target of 8-9 percent (Verma, & Muralidhar Rao, 2007).

India has also joined the list of countries that have adopted IPRs protection at least on paper as a means of boosting economic growth and also to be in good bilateral relationship with more advanced countries. India has a robust IPRs framework; it signed the TRIPS agreement as early as January 1995. It is also a member of the Paris Convention and the Berne Convention. India's 1970 Patent Act was designed and expected to provide a reasonable balance between adequately protecting and ensuring that the patentee is well compensated. The Act also ensures that India benefits in terms of technological development and that in all public interest is well protected. To ensure that the patentees do not abuse the power they have, compulsory licensing and registration of only process patents for food, medicine etcetera are given as conditions before a patent is granted. And furthermore, products that are considered vital to the country's economic wellbeing are not patentable such as agricultural and horticultural products, atomic energy inventions, and all living things. The Act was amended in 2002 to meet with certain obligations as contained in the TRIPS agreement especially as it concerns the term of patents. The amendment allows for a term of 20 years for patents and the reversal of burden of proof. The Act was further amended by way of the Patents (Amendment) Ordinance 2004 and came into force on 1st January 2005. This new amendment provides for granting product patent in all fields of technology including chemicals, food, drugs and agrochemicals (Verma & Muralidhar Rao, 2007).

In India the Office of the Controller General of Patents, Designs and Trademarks (CGPDTM) is responsible for the registration of trademarks and the processing and granting of patents. The term of patents is 20 years from the date of filing of the patent. Once a patent is granted the owner must continue to pay the yearly maintenance fees if not the patent will cease to remain in force and the invention will go into the public domain.

Figure 3: IP Filings and Economic Growth for India



From the statistical data provided by WIPO there seems to be a steady rise in the total number of patents filed domestically and abroad, see figure 3 above. Likewise during the same period that is from 1998-2012, there was also a steady growth in the economy. As stated in the other BRICS countries there is no certainty whether it is economic growth that is driving innovation or vice versa; or if there are other factors responsible for both economic growth and increase in the rate of innovation. However, during this period as a result of growth in the economy there was noticeable improvement in income among Indians especially the middle class. It is possible that more people are beginning to have increased

appetite for more original and genuine products, thereby encouraging individuals and companies alike to invest more in creating innovative products.

## **China**

One of the reasons China began to develop its intellectual property system was for it to legitimize its trade system, integrate itself into the global trade market and attract investments from abroad (Yu, 2002). China's initial slow pace in developing its intellectual property system can be attributed to its Confucian beliefs and lack of formally established legal systems especially during the Imperial period (Yu, 2002). China's first substantive national patent law was established in 1912, although it was very weak and offered very minimal protection to both domestic and foreign patent holders. Over the years China kept amending its intellectual property system to conform to global standards. After China opened its doors to the world in 1979 as far as business is concerned it has come to realize the importance of intellectual property rights. It joined the World Intellectual Property Organization (WIPO) in 1980 and in 1985 it became a member of the Paris convention for the protection of Industrial Property Rights. In 1994 it became a member of Patent Cooperation Treaty (PCT) and in 2001 it ratified the agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). China in 1984 put in place its own domestic patent law for granting patents for inventions, utility models and designs. Zhang (2010) discovered that the recent surge in patenting in China is as a result of the revision of the Chinese Patent Law in 2000, increase in foreign direct investment in China and increase in the China research and development expenditure.

In the early stages of China's economic reform in 1979 many argued that the adoption of a patent system will be detrimental to the development of the Chinese local industries considering the fact that the Chinese technology system at the time was weak (Zhang, 2010). Zhang (2010) however, also believes that the establishment of a robust patent system is critical for effective technology borrowing. And furthermore Hayami & Godo (2005) argued that effective technology borrowing is a very important step for any developing country to adopt if it is to catch-up with the more advanced countries. China has recorded positive economic growth for over two decades. And Zhang (2010) is of the view that the establishment of the patent system was largely responsible for this growth. This is evidenced in the number of both domestic and foreign patent applications filed after the implementation of the Chinese patent law in 1985. If one assumes that the increase in the number of patent applications is directly proportional to increase in research efforts and productivity growth as was the case for the US domestic patenting dynamics prior to the late 1980s; one can then infer that the increase in the number of patent applications filed in China means an increase in research and development and invariably productivity growth.

The Chinese patent law recognizes three types of patents namely inventions, utility model and design patents. Invention under the Chinese patent law refers to any new technical solution pertaining to a product, process or improvement thereof. Utility model under the Chinese patent law is defined as any new technical solution that has to do with shape, structure or the combination of shape and structure of a product such that makes the product fit for practical use. And lastly design under the Chinese patent law is defined as any new design of the shape, the pattern or their combination in such a manner that creates an aesthetic feeling and the new design industrially applicable. The Chinese patent law was enacted to ensure adequate protection for patentees, ensuring they reap the benefits of the effort they put in creating the invention and also to serve as a means of encouraging individuals and organizations to invest in creating inventions. In essence the law aims to promote innovation in the society and invariably encourage science and technology growth, which it believes will lead to economic growth.

Before an invention or utility model is considered fit to receive patent grant it must possess novelty, inventiveness and must be practically applicable. By novelty it means that the invention is not part of a prior art, in the sense that nobody has previously filed an application to the patent office for an invention that is identical. By inventiveness it means that the invention or utility model has prominent substantive features and represents substantial progress. And lastly by practical applicability it means that the invention or utility model can be used and has the ability to produce effective results. By prior art as used in the Chinese patent law refers to any technology known to the public before the date of filing in China or abroad. The law also provides that before a design is granted patent right it must not be a prior design. And an individual or any organization should have filed an application for such design before the date of the application with the patent office. The law had shortcomings, one of which was that it provided little protection for pharmaceuticals and chemical inventions. To cater for this limitation the law was amended in 1992 to include protection for pharmaceuticals and chemical inventions and also to provide protection for microbiological products and processes. The amendment also increased the duration of patent rights from 17 years to 20 years from date of filing. The duration for patent rights for utility models and for designs were put at 10 years<sup>7</sup>. The extent of protection for both inventive patents and utility models depends on the terms of the claims<sup>8</sup>. The law was further amended in 2000 (although this amendment took effect only in July, 2001) to simplify patent application procedures; improve administrative and judicial enforcement procedures. The amendment also provided patent owners better substantive rights, such as rights of “offer for sale”. In 2007 China reviewed its intellectual property system for the third time with the aim of creating a better efficiency in the creation, utilization, protection and administration of intellectual property rights by the year 2020 including preventing further abuse of IPRs (Guo Jia Zhi Hui Chan Quan Zhan Lue Gang Yao, 2008). To discourage people from infringing IPRs the third amendment increased the monetary damage against patent infringers (Wu, 2011). The amendment also made provision for additional administrative and judicial tools to enhance the enforcement of patent rights. And furthermore the amendment prohibits two key aspects of patent laws violations namely the act of “passing-off” of patents and patent infringement, see Rule 84 of the Third Revision of China’s Patent Law (Patent Law of the People’s Republic of China (2008)) (Wu, 2011)<sup>9</sup>.

The Chinese patent law practices the first-to-file principle. This implies that when two or more applicants file for a patent right for similar inventions, the applicant whose application was filed first is granted the patent right. In a situation where the applications were made on the same day, the law permits the applicants to work out among themselves who should receive the patent grant. In a situation where they cannot reach a resolution among themselves they can approach the patent office or a relevant court. None of the parties will be granted the patent right until the dispute is resolved (Fang, 2005). The law also gives priority to applications filed in a foreign country that is a member of the Paris convention within 12 months (6 months for design patents) before filing in China (Stembridge, 2010).

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<sup>7</sup>Article 42: The duration of patent right for inventions shall be twenty years, and the duration of the patent right for utility models and patent right for designs shall be ten years, counted from the date of filing.

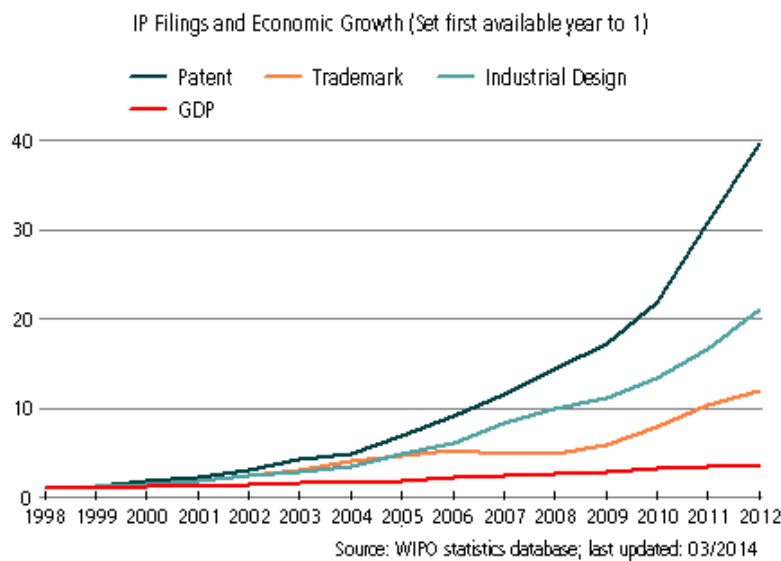
<sup>8</sup>Article 59 (Original Article 56): The scope of protection for an invention patent or a utility model patent shall be determined on the basis of the patent claim which may be explained by use of the specification and appended drawings.

<sup>9</sup>Rule 84: Any of the following constitute acts of patent passing-off referred to in Article 63 of the Patent Law: (1) indicating the patent notice on a non-patented product or the package thereof..... (2) selling the products specified in the paragraph one of this Rule (3) indicating in the product instructions or other materials, a non-patented technology or design as a patented technology or design,..... (4) Counterfeiting or transforming any patent certificate, patent document or patent application document of another person; (5) other acts that mislead the public into perceiving the non-patented technology or design patent as a patented technology

Since 2000 the number of inventive patent applications in China has grown at an average of over 24 percent per annum. Many domestic Chinese firms and individuals opt for the more affordable and less rigorous Chinese utility model. The number of utility model applications has grown at an average of over 17 percent per annum since 2001. Only a small fraction of these applications are from foreign organizations. Inventive patents provide 20-year protection from the date of filing. Furthermore inventive patents are subjected to substantive examination, while utility patents are not. However, utility model patents only provide 10 years protection from the date of filing the application. It is worthy of note that what is referred to as inventive patents in China is what is known as utility patents in countries such as Germany, Japan, Australia (although in Australia it is referred to as petty patents) and so on.

In 2009 it was reported by Thomson Innovation that 280,000 Chinese inventive patents and 200,000 Chinese utility model patents were published. In the same year only 85,477 applications were made by foreign companies for inventive patents and only 1,190 applications for utility model patents. Utility model patents in China provide the same degree of protection as inventive patents except for the fact that they offer lesser protection duration. Furthermore utility model patents cannot be obtained for all types of inventions. Some of the exceptions include physical products, methods and chemical compounds. Utility models in China are easier and cheaper to obtain as they are only subjected to preliminary examination and not the full substantive examination received by inventive patents. Utility model patent protection is particularly of huge advantage to products with relatively short life cycle; these include products such as computer software and hardware, electronics and so on (Stembridge, 2010). In October 2009 the Chinese patent law was further amended. One major aspect of this review was the provision to take care of double patenting. The amendment provides that an invention is entitled to only one patent. So in a situation where an applicant applies for both utility model and inventive patents, the applicant must give up the utility model patent for the inventive patent to be granted. So it is a good strategy for individuals and businesses alike to apply for both utility model and inventive patents for a particular invention. They will be granted utility model patent faster as the application does not have to go through substantive examination. They can then hold on to the utility model patent until the invention patent is granted.

Figure 4: IP Filings and Economic Growth for China



According to the statistical report provided by WIPO China recorded a huge rise in the number of patents filed locally and abroad (including regional offices) between 1998 and



2012, see figure 4 above. The rate of increase in the number of patents filings during this period is more than the rate of increase in GDP. In essence the rate of increase in the rate of innovation in China during the period does not correspond proportionately to the rate of economic growth experienced by China within the same period, looking at the slope of the two curves. The argument that economic growth may spur innovation could still hold but the evidence is not very strong in this case implying that some other factors including improvement in the patent system may have contributed to the spike in in the rate of innovation. Other factors may include reforms in the education system and sound government policies including the encouragement of interaction between universities (research institutes) and industries (Chang & Shih, 2004).

### **South Africa**

South Africa suffered many years of apartheid but in 1994 the country transitioned into a more stable and all-inclusive political country through a multi-racial democratic election (Mattes, 2002). This election was won by the Africa National Congress (ANC), which has maintained leadership of the country since that first election till today. According to the World Bank, consistency, financial prudence and favorable global environment enabled South Africa to achieve steady growth in its GDP for a decade until the global financial crisis of 2008-2009. Efficient financial management has helped the country to reduce its debt to GDP ratio from 50 percent in 1994/95 to 40 percent in 2013. South Africa has achieved good success in its revenue collection drive with more than 100 percent increase in the number of taxpayers between 1996-2007. The country's economy suffered a slow down between 2011 and 2012 from 3.5 percent to 2.5 percent. This was largely caused by external factors and the persistent labor strife. Most of the country's major sub-sectors suffered a decline in growth during the period with the exception of the agriculture and construction sectors. The rate of unemployment still remains high; it was 21.9 percent in 2008 but has since risen to 24.9 percent.

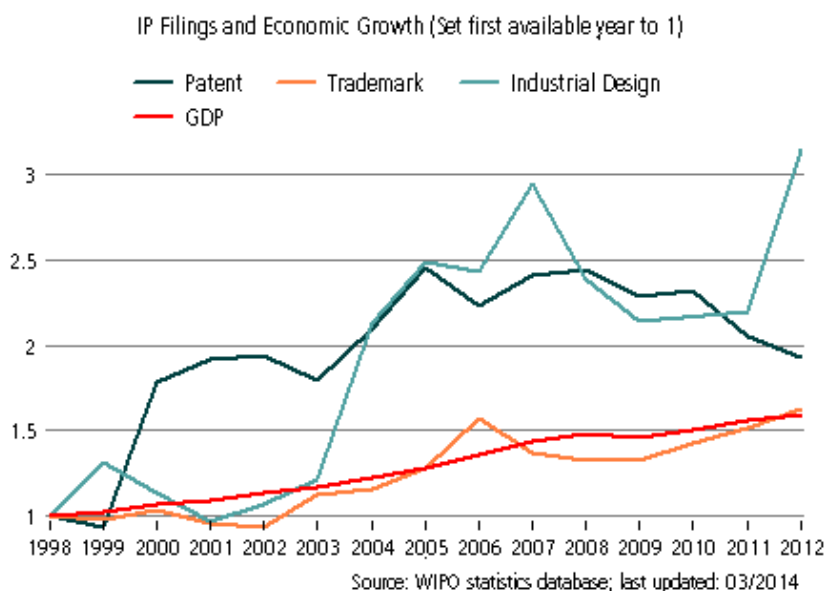
South Africa has a relatively advanced IPRs system with strong legislative provisions. The South African IPRs system was established and contained in the Patents, Design, Trade Marks and Copyrights Act No. 9 of 1916 (Pechacek, 2012). The first legislation dealt with all the major categories of IPRs but subsequently the country resolved to establishing separate statutes for each of the major categories of IPRs. The South African Patent Act was established in 1978 and generally provides that for an invention to be protected it must be new, inventive and is capable of use or applicable in trade or industry or agriculture (Pechcek, 2012).

Initially the South Africa Patent Act was modeled around British laws but it has been recently reviewed and modeled after the European Patent Convention, such that when it joined WTO on January 1, 1995 it only needed to make few adjustments to its patent laws (Wolson, 2005). South Africa is a member of many conventions and treaties related to IPRs protection namely Paris Convention for the protection of industrial property, The Patent Cooperation Treaty (PCT), The Budapest Treaty on the International Recognition of Deposit of Micro-organisms for the purpose of patent procedures and on January 1, 1995 it ratified the TRIPS agreement. It was also signatory to the Berne Convention for the protection of literary and artistic works, WIPO Copyright Treaty (WCT) and the WIPO Performance and Phonograms (WPP). So South Africa especially when compared to other developing countries has quite a robust patent system (Lesser, 2001). For instance 2010 Ginarte and Park index shows that South Africa has better patent protection index compared to other BRICS countries except for China. In South Africa IPRs is administered by The Companies and Intellectual Property Registration Office (CIPRO). It is responsible for the registration of patents, designs and trademarks.

In South Africa, full patent applications can only be filed by patent attorneys, as individuals are allowed to only file for provisional patent applications. Provisional patent applications cost 60 rands (about US\$ 8) while full patent applications cost 590 rands (about US\$ 79). Patent owners are expected to pay annual renewal fee of 130 rand (around US\$ 17). In South Africa patents do not go through formal examinations, implying that CIPRO does not exactly verify the novelty and the inventive merit of the patent applications (Pechacek, 2012). It however, offers surface search services. It does not fully follow the WIPO's International Patent Classification systems (IPC). It only does searches to the level of sub-classes but does not get to the level of the sub-groups and groups (Teljeur, 2003). It however, has hardcopy register that patent attorneys can view but the process is very long and tedious, it may even take as long as one year to obtain a file to undertake a patent search (WIPO, 2009).

In as much as patent registration is cheap and easy to process in South Africa it has some fundamental limitations. The fact that the patent system does not support full search and examination before a patent grant implies that there is no real guarantee on the validity of the patent. Furthermore, a patent granted in South Africa may not qualify for protection in other jurisdictions, which is a huge minus for its firms looking to commercialize their inventions abroad. So to test and proof the validity of patents firms have to count on the courts. This is an exercise that does not suit small firms as the South African legal system is quite expensive. Due to the fact that there is no substantive examination and the cost of registration is low, companies take advantage and file large number of patents applications locally. These companies may file for patents that they are not ready to commercialize immediately thereby blocking other companies and in the end hindering innovation. Also the system allows for the granting of patents with very broad scope since there is no proper examination process. This also has the potential to dissuade firms from engaging in innovation. Other factors that discourage innovation in South Africa include the fact that there is no electronic database where searches can be made and the manual method take very long will definitely discourage innovation (WIPO, 2009).

Figure 5: IP Filings and Economic Growth for South Africa



According to the WIPO statistical report on South Africa, the country has maintained a somewhat unstable record in terms of the total number of patent filings domestically and abroad, see figure 5 above. As is seen from the graph above the figure declined between 1998 and 1999, rose sharply afterwards in 2000 and ever since it has been going up and down and

then recorded steady decline between 2009 and 2012. However, the GDP of the country has grown steadily from 1998 till 2012 irrespective of the fluctuations in the number of patents applications filed. One can therefore, infer that the country's economic growth may not be necessarily attributed to IPRs protection. The country may have achieved the steady growth in its economy due to other factors as earlier mentioned including prudent financial discipline.

## Nigeria

The patent system in Nigeria is quite relatively old. Patent law was first established in Nigeria in the early nineteen century through the Patents Ordinance No. 17 of 1900 and the Patents Proclamation Ordinance No. 27 of 1900. The status initially only applied to the colony of Lagos and the Southern protectorate of Nigeria. It was later extended to the Northern protectorate through the enactment of the Patents proclamation Ordinance No. 12 of 1902. After the amalgamation of Northern and Southern Nigeria in 1914 it became necessary to have a single unified patent system. Both the Patent Ordinances and Patent Proclamations were repealed and a new patent system, the Patent Ordinance of 1916, was enacted and eventually renamed and re-established as the Registration of United Kingdom Patents Ordinance of 1925. One of the prominent features of the 1925 ordinance was the extension of the validity of patents granted in the United Kingdom to Nigeria as long as the patent owner makes an application to register the patent in Nigeria within three years of the grant of the patent in the United Kingdom. The 1925 Ordinance remained in force until 1970 when it was repealed and replaced by the Patents and Designs Decree No. 60 (and later renamed as the Patents and Designs Act).

The duration of a patent in Nigeria is 20 years from the date of filing the patent application. The Patent Act however states that the patent right shall cease to be of effect in the event that the annual fees are not paid as at when due<sup>10</sup>. An invention under the Nigeria Law is patentable if it is new, results from inventive activity and is capable of industrial application<sup>11</sup>. Furthermore an invention can also be deemed to be patentable if it constitutes as improvement upon patented invention, is new and results from inventive activity and is capable of industrial application<sup>12</sup>. So obviously the Nigeria Patent and Design Act recognizes and grants patent rights for unique improvements on earlier patented inventions. This in a way can be referred to as petty patent or utility model. The Nigerian legal system does not however, have a separate Act for utility model neither does the Patent and Design Act expressly describe or make provisions for utility models. Not everything can be patented in Nigeria. Inventions that will contravene public order and morality are not patentable<sup>13</sup>.

In Nigeria patent is granted without guaranty, section 4(4) of the Patent and Design Act provides that patents are granted at the risk of the patentee without guarantee of their

<sup>10</sup>Section 7 (1) Subject to this Act, a patent shall expire at the end of the twentieth year from the date of the filing of the relevant patent application.

Section 7 (2) A patent shall lapse if the prescribed annual fees are not duly paid in respect of it: Provided that- (a) a period of grace of six months shall be allowed for the payment of the fees; and (b) if the fees and any prescribed surcharge are paid within that period, the patent shall continue as if the fees had been duly paid.

<sup>11</sup> Section 1 (1) Subject to this section, an invention is patentable- (a) if it is new, results from inventive activity and is capable of industrial application

<sup>12</sup> Section 1 (1) Subject to this section, an invention is patentable- (b) if it constitutes an improvement upon a patented invention and also is new, results from inventive activity and is capable of industrial application

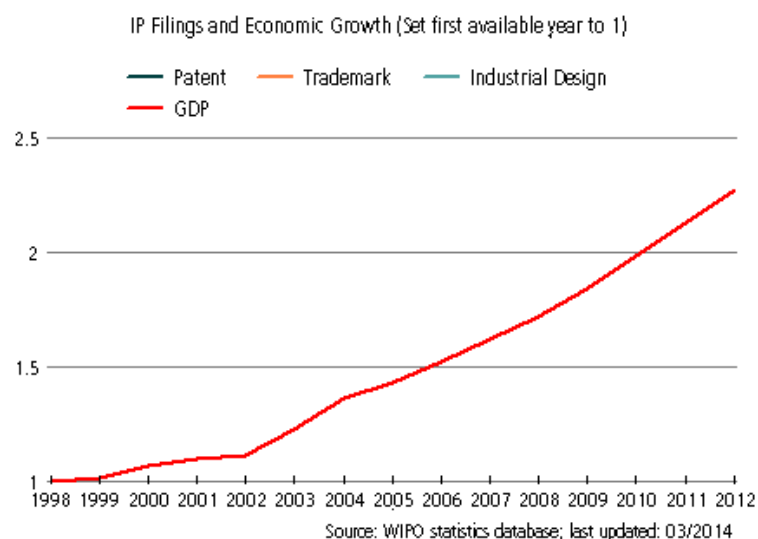
<sup>13</sup> Section 1(4) Patents cannot be validly obtained in respect of- (a) plant or animal varieties, or essentially biological processes for the production of plants or animals (other than microbiological processes and their products); or (b) inventions the publication or exploitation of which would be contrary to public order or morality (it being understood for the purposes of this paragraph that the exploitation of an invention is not contrary to public order or morality merely because its exploitation is prohibited by law).

Section 1(5) Principles and discoveries of a scientific nature are not inventions for the purposes of this Act.

validity<sup>14</sup>. This is unlike what is obtained in some other jurisdictions where a patent application is thoroughly examined before a grant is issued. In Nigeria the registrar grants a patent without thoroughly examining the patent application as in without examining the actual invention. The only major examination carried out is to ascertain that the documentation for the application was properly filed<sup>15</sup>. So the fact that one receives a patent grant in Nigeria does not imply that the patent is valid. As the patent is open to challenge in court where the patentee has the onus to prove the validity of the patent.

Allan and Ogunkeye legal practitioners (2009) are of the view that the adoption of the deposit system (a system where no rigorous examination is conducted on patent application and where patents are granted without guaranty of validity) in Nigeria has some advantages. One of which is that the burden of establishing the patentability of the invention is shifted from the registrar to the party opposing the patent. This they argue saves the government (that is the patent office) from spending its scarce resources on conducting thorough examination including the funds that will otherwise be paid experts to examine patent applications. Furthermore the process of patent grant is faster as the time that patent applicants would have spent waiting for patent applications to go through the full examination process have been eliminated. This should however, not be the case as most other jurisdictions especially developed economies carry out detailed examination. Some of the reasons and benefits of thorough examination is to ensure that quality patents are granted and that such patents are subject to less litigation. Nigeria unlike the US, Japan and the European patent office should actually conduct more detailed examination as only few patents are filed in Nigeria (see patent application and patent grant document at [www.wipo.int](http://www.wipo.int)). According to Gallini (2002), Bessen & Meurer (2008) the quality of examination in the US patent office is less than the quality in the European patent office because US patent office processes much more patent applications than the European patent office (Van Pottelsberger de la Potteri, 2011). So if it were that the volume of patent application in Nigeria is very high one may begin to justify the reason for the lack of proper examination but not when the volume of patent application is very low.

Figure 6: IP Filings and Economic Growth for Nigeria



<sup>14</sup> Section 4 (4) Patents are granted at the risk of the patentee and without guarantee of their validity.

<sup>15</sup>Section 4 (1) The Registrar shall examine every patent application as to its conformity with section 3(1), (3) and (4) of this Act, and- (a) if section 3(1) of this Act has not been complied with, the Registrar shall reject the application;

According to the WIPO website there was not enough data on the number of patents filed by Nigerian citizens domestically and abroad, see figure 6 above. The lack of availability of the total number of patent applications filed by Nigerians (and indeed some other developing countries) necessitated the use (by this research) of the number of patent applications filed by citizens of developing countries in the United States as measure of the degree of innovation in those countries. More detailed analysis of the impact of IPRs protection in Nigeria on variables such as innovation, FDI and economic growth will be analyzed latter in this research.

### **Nigeria intellectual property rights system: Enforcement**

Nigeria arguably has a very comprehensive IPRs regime in terms of the requisite laws and legislation. It is a member of the World Intellectual Property Organization (WIPO); it has signed the TRIPS agreement and signed the Universal Copyright Convention and indeed other relevant conventionssuch as the Berne Convention, Paris Convention and so on. The Nigeria Trademarks Act (1965) establishes the framework for exclusive rights to use registered marks. The Nigeria Copyright Decree (1988) sets out the relevant law for copyright protection. And in 1999 the Copyright Decree was amended to make it compliant with most aspects of the trade-related aspects of international property rights (TRIPS) copyright protection. Copyright has been the most popular among the other IPRs in terms of activities in Nigeria. This is due mainly to the vibrant Nigeria entertainment industry. The Nigeria movie and music industries have continued to grow. The movie industry popularly referred to as Nollywood is the biggest of such industries in Africa and third biggest globally only next to Hollywood and Bollywood (Nwokocha, 2012). However, according to a United Nations Report in May, 2009 the Nigeria movie industry has surpassed Hollywood to become the world's second largest film producer (United Nations, 2009). The Nigeria Copyright Commission was established with the purpose of regulating music, artistic and literary creations<sup>16</sup>. The Nigeria Trademarks Acts<sup>17</sup> makes provisions for the definition of a trademark and its registration and applicability<sup>18</sup>. Applications for trademark registration are received, processed and administered by the Registrar of Trademarks (RTM) at the Trademark Registry under the Federal Ministry of Trade and Commerce, Abuja. The Nigeria Trademarks Acts provides an initial term of seven (7) years for registered trademarks, which can be renewed for term period of fourteen (14) years indefinitely. The law requires that application for renewal be made not less than three (3) months from the due date<sup>19</sup>. Presently the provisions of the Nigeria Trademark Act only allows for the registration of trademarks in relation to goods. It is not directly possible to register trademarks in relation to services. A draft legislation to amend this is currently in progress and is yet to be enacted into law. However, to work around the registration for service marks in Nigeria it can be achieved by registering the service mark in international Class 16 as such registration is recognized in Nigeria and therefore enforceable. The Nigeria Patent and Design Act (PDA) was first established in December 1970 with the objective of creating robust provisions for the registration and proprietorship of patents and designs in Nigeria<sup>20</sup>. Just as is the case for many other countries especially countries such as Nigeria that are signatories to the TRIPS agreement and WIPO, there is a minimum requirement to be fulfilled before a patent

<sup>16</sup> The Nigeria Copyright Commission was established via the Nigeria Copyright Act CAP N97, Laws of the Federal Republic of Nigeria, 2004

<sup>17</sup> See CAP 436 Laws of the Federal Republic of Nigeria and the subsidiary legislation that is contained within the ACT – the TradeMarks Regulation

<sup>18</sup> Sections 9 through 16 of the Act contains provisions concerning the registrability and validity of registration

<sup>19</sup> See section 23 of the Act: duration and renewal of registration.

<sup>20</sup> Chapter P2 of the Patent and Design Act, CAP P2 LFN 2004

application can be granted. In Nigeria for an invention to be patentable it must fulfill the following: it must be new, and result from inventive activity and must be capable of industrial application (see section 3.1.2 above for more details on the Nigeria patent system). And in a situation where the invention is an improvement on an already patented invention it must still be new enough, result from an inventive activity and must be industrially applicable. The grant of patents in Nigeria is regulated by The Registry of Trademarks, Patents and Designs office. This office is also responsible for the registration of trademarks and industrial designs. Only recently the Nigeria Office for Technology Acquisition and Promotion (NOTAP) was mandated to assist The Registry of Trademarks, Patents and Designs office in the registration of inventions carried out by government funded research institutes and also inventions from private entities. NOTAP's responsibilities in this regard are basically to connect the inventors with other relevant patent offices in other jurisdictions, assist inventors where necessary to draft patent applications and finally assist in the actual filing at the Registry<sup>21</sup>.

So as is seen from the foregoing Nigeria on paper has a robust IPRs system in terms of laws and legislation. However, in practice patent, copyright and trademark protection in Nigeria remain very weak in terms of enforcement and requires substantial improvement. The remaining portion of this section of the paper will take a brief look at the enforcement of IPRs in Nigeria. Nigeria law is a combination of English common law, domestic customary law and Islamic Sharia's law (especially in a few northern states). The court system is somewhat complex with different courts and court system in the various regions across the country. The 1999 Constitution makes provisions for the establishment and constitution of the following courts: The Supreme Court of Nigeria; The Court of Appeal; The Federal High Court; The High Court; The Sharia Court of Appeal; The Customary Court of Appeal. Aside from the above-mentioned courts created by the Constitution there are also the Magistrate Courts, District Courts, Area Courts and Customary Courts established in various states by state laws. These courts are of limited jurisdiction as specified in their enabling laws and appeals from them lie to the High Court, Sharia Court of Appeal or Customary Court of Appeal as the case may be (Babalakin & Co., 2012).

The judicial system in Nigeria can be considered to be slow, underfunded and largely subject to external interference from influential members of the society (Adebayo, 2009). The entire judicial system is heavily marred by corruption. All these make the judicial system ineffective such that it takes several days to enforce a contract, see table 2 and figure 7 below. According to the World Bank and the International Finance Corporation Doing Business Report the number of procedures required to enforce a contract in Nigeria was 23 in 2004 and by 2012 it has increased to 40<sup>22</sup>. The number of days it takes to get a contract enforced decreased from 730 days in 2004 to 457 days in 2012. However, during the same period the amount of money required to enforce contracts went from 18 percent to 32 percent. Enforcement is the process of making effective the judgment or order of a court according to the laws of that country, in this case Nigeria<sup>23</sup>. It is the last stage of the judicial process after the legal right; claim or interest has ended in a judgment or order, which remains to be executed (Adebayo, 2009).

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<sup>21</sup> According to the NOTAP's website "The National Office [NOTAP] has been mandated [by the Federal Government of Nigeria] to assist in the patenting of all inventions and innovations carried out by government funded Research Institutes and others in the Private sector." See [www.notap.gov.ng](http://www.notap.gov.ng) for more details

<sup>22</sup> [www.doingbusiness.org](http://www.doingbusiness.org)

<sup>23</sup> Some of the assumptions made in the Doing Business survey include: The value of the claim equals 200% of the economy's income per capita; The dispute concerns a lawful transaction between 2 businesses (Seller and Buyer), located in the economy's largest business city. Seller sells goods worth 200% of the economy's income per capita to Buyer. After Seller delivers the goods to Buyer, Buyer refuses to pay for the goods on the grounds that the delivered goods were not of adequate quality.

One of the main reasons why there was dramatic improvement in the number of days it takes to enforce commercial contracts in Nigeria could be attributed to the fact that Nigeria established commercial division within its courts in the past 10 years. According to the recent edition of the Doing Business report, Sub-Sahara Africa countries that introduced commercial courts or sections since 2003 (these are namely Burkina Faso, Cameroon, the Democratic Republic of Congo, Côte d'Ivoire, Ghana, Mauritania, Mozambique, Nigeria, Rwanda and Togo) saw reductions in the number of days it takes to enforce contracts by as much as 2.5 months. Furthermore, the court used for the survey is the Lagos Magistrate Court, which arguably may be more efficient than other similar courts elsewhere in Nigeria see the website of the Lagos State Judiciary- [www.lagosjudiciary.gov.ng](http://www.lagosjudiciary.gov.ng). In essence the improvement recorded in the enforcement of contracts in Nigeria according to the Doing Business report may not be an exact reflection of what goes on in other courts in Nigeria.

Figure 7: Enforcing Contracts in Nigeria



Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

Table 2: Enforcing Contracts in Nigeria

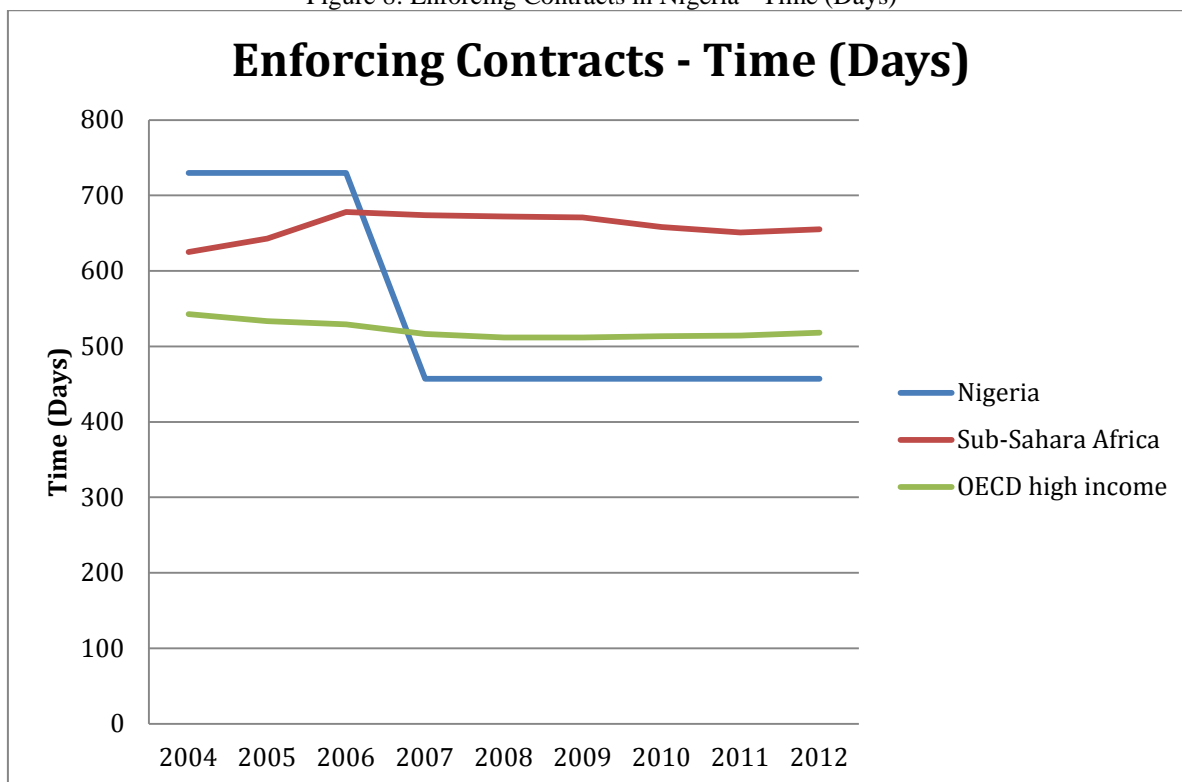
	Number of procedures	Time (Days)	Cost (US\$)	Ranking
2004	23	730	18	
2005	23	730	37.2	
2006	23	730	37.2	
2007	23	457	27	66
2008	39	457	32	93
2009	39	457	32	90
2010	39	457	32	94
2011	40	457	32	97
2012	40	457	32	97

Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

The time required to complete procedures is expressed in calendar days and it includes the time to file and serve the case, the time for trial and obtaining judgment and the time it will take to actually enforce the judgment. So basically the time starts counting from when the plaintiff actually files the lawsuit in court until when he actually receives payment. It includes both the days that actual court proceedings take place and waiting period in between court proceedings until when judgment is passed and actual payment made.

The number of days it takes for a contract to be enforced in Nigeria was 730 days between 2004 and 2006. This figure however decreased to 457 days from 2007 until 2012, which is an obvious improvement. Between 2004 to 2006 the number of days it takes to enforce a contract in Nigeria was higher than Sub-Sahara Africa (which was 625 days in 2004, 643 days in 2005 and 678 days in 2006) and OECD high-income countries (which was 543 days in 2004, 533 days in 2005 and 529 days in 2006). This however, changed from 2007 till date as the number of days required to enforce a contract in Nigeria became better than Sub-Sahara Africa and high income OECD countries, see figure 8 and table 3 below.

Figure 8: Enforcing Contracts in Nigeria - Time (Days)



Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

Table 3: Enforcing Contracts in Nigeria - Time (Days)

Enforcing Contracts-Time (Days)			
	Nigeria	Sub-Sahara Africa	OECD high income
2004	730	625	543
2005	730	643	534
2006	730	678	530
2007	457	674	517
2008	457	672	512
2009	457	671	512
2010	457	658	514
2011	457	651	515
2012	457	655	518

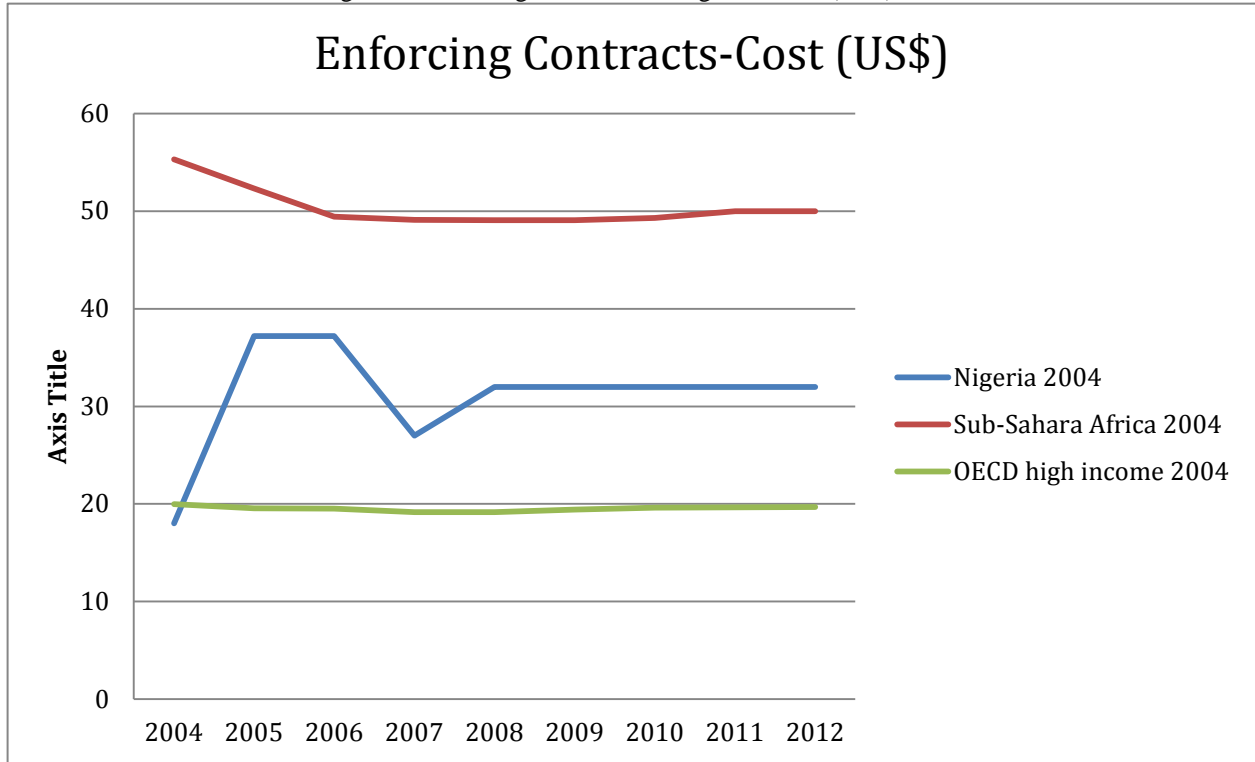
Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

The cost required to complete the entire procedure is measured as a percentage of the claim and is assumed to be 200 percent of Nigeria's income per capita. This cost is a sum of



the following costs: court costs including expert fees; enforcement costs; and average attorney fees. This does not include the amount of money that may be spent bribing court officials and others. The cost of enforcing a contract in Nigeria was consistently lower than the average for the rest of Sub-Sahara Africa. The same was not the case for high-income OECD countries. The cost for enforcing contracts in Nigeria was consistently higher than the high income OECD countries except for 2004 when it was lower than both the high-income OECD countries and Sub-Sahara Africa, see table 4 and figure 9 below.

Figure 9: Enforcing Contracts in Nigeria - Cost (US\$)



Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

Table 4: Enforcing Contracts in Nigeria - Cost (US\$)

Enforcing Contracts-Cost (US\$)			
	Nigeria	Sub-Sahara Africa	OECD high income
	2004	2004	2004
2004	18	55.31	19.98
2005	37.2	52.31	19.57
2006	37.2	49.42	19.52
2007	27	49.11	19.18
2008	32	49.07	19.18
2009	32	49.07	19.44
2010	32	49.29	19.63
2011	32	50	19.64
2012	32	50	19.7

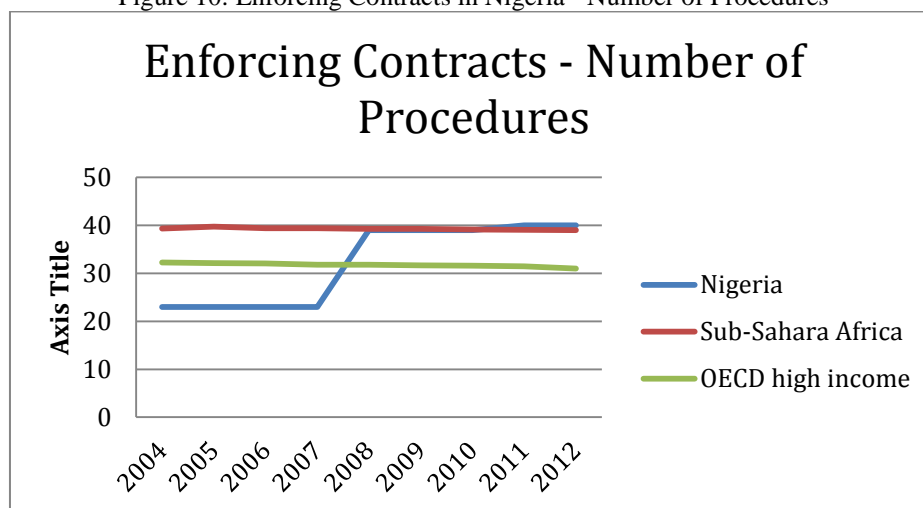
Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

Procedure in this instance refers to any interaction expressly required by law or a matter of common practice between the disputing parties or between them and the court. This simply measures the physical number of steps that will be involved from when the case is

filed and served. It also includes the steps for trial and judgment and the steps necessary to enforce the ensuing judgment.

As can be seen from table 5 and figure 10 below, the number of procedures required for the enforcement of contracts in Nigeria was lower than those for Sub-Sahara Africa and high income OECD countries between 2004 and 2007. And from 2008 to 2012 remained around the same number of procedures with Sub-Sahara Africa but became higher than high-income OECD countries.

Figure 10: Enforcing Contracts in Nigeria - Number of Procedures



Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

Table 5: Enforcing Contracts in Nigeria - No. of Procedures

Enforcing Contracts - Number of Procedures			
	Nigeria	Sub-Sahara Africa	OECD high income
2004	23	39.33	32.28
2005	23	39.76	32.13
2006	23	39.42	32.07
2007	23	39.41	31.77
2008	39	39.28	31.77
2009	39	39.26	31.65
2010	39	39.15	31.58
2011	40	39.11	31.48
2012	40	39	31

Source: Adapted from Doing Business Report 2012 (<http://www.doingbusiness.org/reports>)

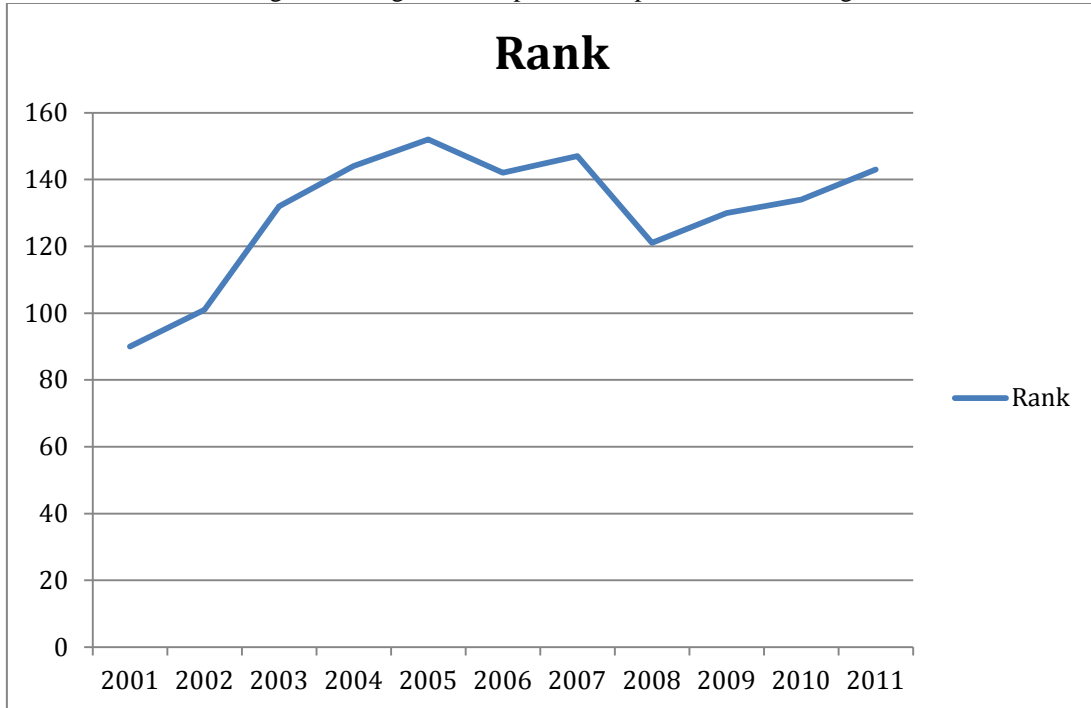
### Nigeria's Corruption Perception Index

The corruption perception index was established in 1995 by Transparency International<sup>24</sup>. It ranks countries based on the perceived level of corruption within the country. The ranking is based on a scale of zero to 10 where zero represents very high level of corruption and 10 indicate very low level of corruption. In 2001 the number of countries included in the ranking where only 91 but as at 2011 there were 182 countries. According to the results recorded so far by the index developed countries usually rank higher than developing countries, this is can be attributed to higher level of transparency and tighter regulation in developed countries.

<sup>24</sup> <http://cpi.transparency.org/cpi2012/>

The methodology used for measuring corruption perception index varies from one year to another thereby making it difficult to carry out accurate yearly comparison. This has posed a major problem for analysis and proper understanding of the actual effects of specific government agencies.

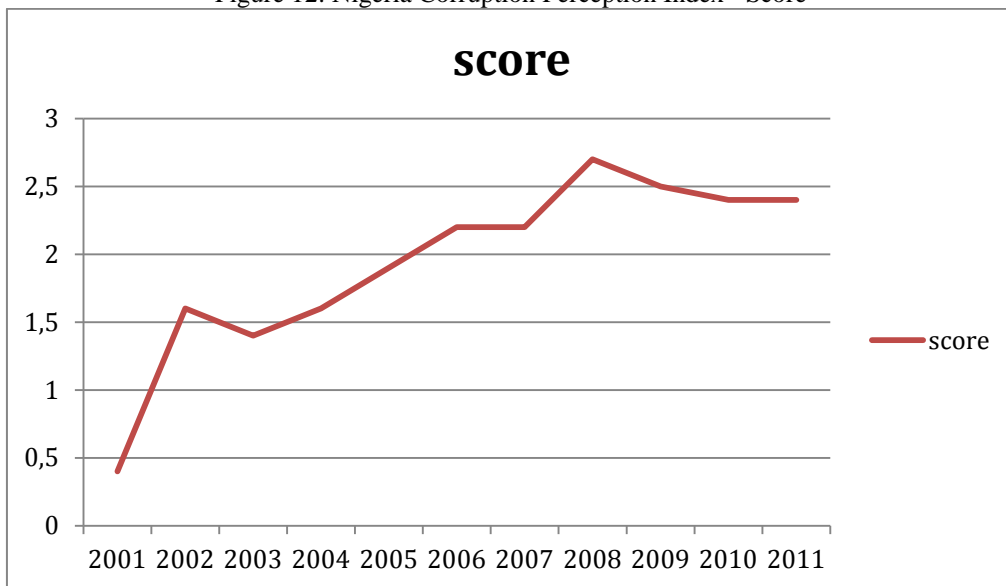
Figure 11: Nigeria Corruption Perception Index Ranking



Source: Adapted from Corruption Perception Index: Transparency International 2012

Nigeria's ranking over the years has remained unsteady mostly rising showing a continuous increase in the level of corruption in the country, see figure 11 above. Although the country's CPI scores has risen especially when compared to what it was in 2001, see figure 12 and table 6 below. However, this still remains very poor compared to the level of global improvement.

Figure 12: Nigeria Corruption Perception Index - Score



Source: Adapted from Corruption Perception Index: Transparency International 2012

**Table 6: Corruption Perception Index**

Corruption Perception Index for Nigeria					
	Rank	Score	Regional Rank	Number of Countries	
2001	90	0.4		91	
2002	101	1.6		102	
2003	132	1.4		133	
2004	144	1.6		145	
2005	152	1.9		158	
2006	142	2.2	35	163	
2007	147	2.2	37	179	Africa
2008	121	2.7	22	180	SSA
2009	130	2.5	27	180	SSA
2010	134	2.4		178	
2011	143	2.4	30	182	

Source: Adapted from Corruption Perception Index: Transparency International 2012

Looking at the analysis of the level of enforcement of laws in Nigeria it is obvious that more work still needs to be done to get the country to an acceptable level. This poor level of enforcement of laws in Nigeria by extension impacts on IPRs and IPRs related issues. The various authorities charged with the responsibility of upholding and enforcing IPRs are poorly financed and lack proper understanding of IPRs. The Nigeria police force for example does not fully understand the value of IP and as such is ill prepared to give adequate protection for IPRs. This lack of proper understanding by the relevant agencies leaves IP owners with little motivation to seek protection of their IPRs (Business Monitor International Ltd, 2010).

Even though overall there was improvement in recent years in the number of days it takes to enforce a contract there is not much improvement in the cost involved in enforcing a contract and in fact the number of procedures involved increased. It was earlier noted that the cost involved in contract enforcement as used by the Doing Business report does not take into consideration the amount plaintiffs spend as a result of corruption (money spent on bribes). As the number of procedures increase the plaintiffs are exposed to more hurdles and each of these hurdles may attract bribery implying that the plaintiffs may have to part with more money. So in essence the actual financial burden on the plaintiffs may be much higher in Nigeria with increase in the number of procedures involved in enforcing a contract. It is also possible that the lack of very obvious improvement in the level of corruption in Nigeria as shown in the corruption perception index above could be responsible for the increase in the number of procedures involved in commercial contract enforcement.

## Chapter four: Methodology and data description

Individuals and organizations embark on research to understand how and why things happen especially as it concerns their specific individual or collective interests. The individual in addition to seeking to understand how often specific things happen may want to know the reasons behind the happenings. He may want to know people's feelings, motives, understanding and concealed interpretations (Cooper & Schindler, 2008). Research therefore, helps to understand in detail why an event occurs and not merely knowing the frequency of occurrence. The main reasons behind carrying out research is to contribute to the body of knowledge by building upon what other researchers have achieved or throwing more light on new areas of study. It could be to understand the past and bring to the fore historical perspective, uncover unknown areas, identify the relationship between the past and the present, answer pending questions, and so on. No need repeating a research except there is a clear reason to do so. Such as if the initial work or works are inconclusive or there is a clear intention to improve upon earlier works. Understanding what others have done will help the researcher to develop a good approach including designing the questionnaire or planning the interview. The researcher should not waste his time trying to unravel an issue that has already been previously unraveled by another research work. A researcher should only work on areas that has not been researched upon or work towards improving existing findings. It is therefore, important for the researcher to carry out an in-depth literature review to ascertain and understand other works done in that area. The researcher needs to read through all or a reasonable number of works especially recent publications. Understanding recent research findings in the area he wants to research on helps to define one's research approach and how to fashion our questions and/or interviews. To carry out the actual research, the researcher may use qualitative, quantitative or even a combination of both research methods.

### Qualitative research

Qualitative research was traditionally used in social sciences to enquire into why a given social issue is the way it is. However, today its use has extended to other academic disciplines, market research, organizational research, health research and so on (Denzin, & Lincoln (Eds.) 2005). Mostly qualitative study is embarked upon when there is no theory or when existing theory fails to properly explain a given phenomenon, as is the case in this research.

One of the major keys to understanding qualitative research is realizing that individuals attribute different meaning and interpretation to particular issues depending on their perception of that given issue. In essence meaning is socially constructed by individuals based on their interaction within the world they live in (Merriam, 2002). This further implies that there is no necessarily generally agreed and fixed reality; rather there are multiple construction and interpretation of reality based on individual perception. And these individual perceptions are not all together fixed as they may even change with time. There remain some degrees of debate on the exact definition of qualitative research (Ritchie & Lewis, 2003). Some authors may even choose to define qualitative research in terms of what it is not. For instance Strauss & Corbin (1998) refer to qualitative research as any research with output or findings that are not obtained through statistical procedures or other forms of quantification. However, the generally accepted consensus is that qualitative research is "a naturalistic, interpretative approach concerned with understanding the meanings which people attach to actions, decisions, beliefs, values and the like within their social world, and understanding the mental mapping process that respondents use to make sense of and interpret the world around them" (UK Office of National Statistics, 2014). Bryman (1988) noted that one of the main reasons behind qualitative research is to ascertain how people being studied (this could be

through in-depth interviews, group discussions, observations and so on) understand and interpret their social reality. The interest of qualitative researchers is basically to understand what individual interpretations are at a given point in time and in a given context. It is particularly important that qualitative researchers learn how individuals experience and interact/relate with their social world bearing in mind that this interaction influence their view, perception and interpretation.

After the researcher has properly understood and defined the research question and the purpose for the research, the next step of a qualitative research process will be to select a sample from which data will be collected. Since the intention of a qualitative research is to understand a given phenomenon from the perspective of the research participants it only makes sense to select a sample that has good knowledge of the subject. This is referred to as purposive or purposeful sampling. The sample has to be the right size and has to have the right representation. Choosing the right sample is a very key step in any research projects, as it may be practically impossible to study an entire population especially if the population is large. The sample size needs to be of manageable size, a size that the researcher can effectively handle. In essence the size should not be too large neither should it be too small. Take for example a researcher who wants to find out what journalists think about the recently passed Freedom of Information Bill in Nigeria (Mugaga, 2011). The researcher may want to interview a selected number of journalist across the country and perhaps a few other journalists from outside Nigeria. There are only a given number of interviews the researcher can conduct within a reasonable time frame bearing in mind that the research cannot last forever or it will lose its purpose. And the availability of resources for the project is not infinite. So since the researcher cannot afford to interview too many journalists he has to carefully select the right number of journalist and ensure there is proper representation. Furthermore to make his research more credible the researcher in his findings should clearly spell out the number of journalists interviewed and the geographic spread and other criteria used in the selection. The optimal sample size is one that allows for the right inference to be obtained about the population. With a large sample size the chances of having sampling error is minimized. This is because the sampling error is inversely proportional to the square root of the sample size (Marshall, 1996). The sample size (that is a subset of the population) selection is informed by the characteristics of the population and the aim of the research (Family Health International, 2010). If the sample size is too small the researcher may not be able to get the right information upon which to make the necessary inference, as the data may not be enough to achieve informational redundancy or theoretical saturation (Sandelowski, 2007). On the other hand if it is too large the researcher will not be able to get the desired detailed information which is the reason in carrying out a qualitative research in the first place. So a reasonably appropriate sample selection strategy as already mentioned above is to adopt the purposeful sampling approach (Patton, 2005) as against probability sampling as is the case for quantitative sampling (see below for further details). One of the most commonly used purposeful sampling approaches is maximum variation sampling. This strategy tends to include a wide range of extremes in its sample selection strategy. The logic is when participants with very diverse views and backgrounds are selected for a qualitative study; their aggregate responses can be assumed to be close to the views of majority of the population (List, 2004).

Researchers using qualitative approach basically explore relationship or behavioral patterns using textual data rather than numerical data. Qualitative analysis data collection methods include focus groups, individual in-depth interviews, ethnography, case studies, action research, ground theory and observations. Qualitative research data can be captured in the form of field notes, audio recording, video recordings and transcripts. For analysis the qualitative researcher carries out content analysis of the written texts, audio and video

recordings of the participants, debriefing of observers (where the observer is not the person carrying out the analysis), study of artifacts, behavioral observations and trace evidence of the physical environment (Cooper and Schindler, 2008). Like other scientific research methods it seeks answers to questions using systematically laid out procedures. The aim of the research is usually to bring about clarity to specific areas of concern. The use of the findings produced usually goes beyond the immediate boundaries of the study that produced the findings (Family Health International, 2010). By using qualitative research the researcher is able to properly understand the attitude, behavior, value system, life style, culture, concerns, aspirations and emotion of the population he is studying. The researcher from observing from a distance or interviewing the population is able to find out other details such as body language that ordinarily will not be captured by say response to a questionnaire in the absence of the researcher (Ereaut, 2007). The findings made by the researcher from studying a subset of the entire population can then be used as a guide to have a relatively fair idea of what the views of the entire population might be.

Furthermore, the data collection techniques as used in qualitative research is such that entail close contact and interaction between the researcher and the research participants thereby allowing room for other pertinent issues that may pertain to the subject of study to be explored. The data collected for qualitative research is usually very detailed, extensive and informative (Ritchie & Lewis, 2003). It is worth mentioning that in qualitative research, the researcher is the primary instrument for data collection and data analysis. Even though human instruments have shortcomings and biases capable of negatively impacting the outcome of a qualitative study, this should be taken into consideration and monitored in such ways that will reduce or even eliminate the potential biases it may cause.

### **Quantitative research**

Quantitative research method is the examination of a given phenomena through investigation and analysis of specific quantitative attributes with the aim of understanding the relationship between the attributes and the phenomena (Hunter & Leahey, 2008). Quantitative research therefore, entails the collection of numerical data. This data is collected from a sample population that is large enough to represent the entire population. The collected data is subsequently subjected to analysis using one or more statistical tools (Picciano, 2007). The analyzed data is then expressed in a numerical format. This could take the form of a chart, graph, histogram, and tables, showing relationship between key variables that would have been defined by the researcher before commencing the research.

Like is the case for choosing the right sample size in a qualitative research, the sample size selected in a quantitative research must be statistically significant. It must be large enough to represent the entire population. In as much as too small a sample size will lead to waste of resources as the outcome of the project will not adequately represent the interest of the larger population a sample size that is too large will equally lead to waste of resources (Lenth, 2001). Take a case where a researcher wants to send out questionnaires to find out what causes job satisfaction among employees in the various geopolitical zones of a particular country say Nigeria. And the researcher further seeks to understand if motivational factors are influenced by the size of the organization. In such a situation it will be very wrong for the researcher to send out questionnaires to only employees working in small organizations within one geopolitical zone. If the questionnaires are sent out to only employees working in small organizations the outcome of the research will most likely be misleading with no contribution to knowledge. This is particularly so as the researcher has failed to take into consideration the various types of organizations in the country in terms of size. It also failed to recognize the possibility of variation in the responses from the residents based on the part of the country they reside in. It is possible that different employees may

perceive motivation or job satisfaction differently depending on the size of the organization they work for and the region of the country they reside in. The researcher may also want to know if the responses obtained from the respondents will vary by gender, number of years employed, tribe and educational level. All these should influence the sample size and the distribution of the questionnaires. Quantitative research sample size varies from case to case. The sample size depends on the research question and what the researcher wants to achieve and the size of the population (Chuang, Chen, & Yang, 2005). In quantitative research just like qualitative research having the right sample size that is a true representation of a population is very important to the success of the research. The information obtained from the sample should be such that can be generalized to the whole population taking into consideration limits of random error (Bartlett, Kotrlik & Higgins, 2001). The researcher should not fail to take into consideration sampling error when determining the appropriate sample size and he should not disregard response and non-response bias. Research carried out using entire population census may end up returning low response rate. It would be better if such research were carried out using the right sample size with better data collection technique. This will most likely result to a more valid, reliable and generalizable outcome. Furthermore, it will bring about savings in other areas such as the amount of money, effort and time that would be spent say in distribution and supervision of questionnaires.

As mentioned earlier, ideally it is important to use a sample size that will yield a sampling error that is as small as possible. And typically the sample size is inversely proportional to the sampling error that is the larger the sample size the smaller the sampling error. So in order to minimize sampling errors it is important to select larger sample size. However, there are other factors that may necessitate the selection of smaller sample size. Some of these factors include the cost of sampling, the time it takes to administer and collect large samples, potential increase in non-sampling errors (such as nonresponse biases, non-truthful responses, voluntary biases, and measurement error) (Albright, Winston, & Zappe, 2003).

The calculation for an appropriate sample size is determined by the degree of sampling error the researcher is willing to permit. To estimate the population mean ( $\mu$ ) using the sample mean ( $\bar{X}$ ), it is ideal to use the standard error of the sample mean, which can be expressed as follows:

$$SE(\bar{X}) = \sigma / \sqrt{n} \text{-----} 1$$

Where  $SE(\bar{X})$  is the standard error of the mean,  $\sigma$  is the standard deviation of the population and  $n$  is the sample size. The standard error measures the variation of the estimate from different samples. From central limit theorem, it is known that if  $n$  (sample size) is reasonably large there is about 95% chance that the sampling error will not be more than twice the standard error of the means (that is not more than  $2SE(\bar{X})$ ). In that case lets say the sampling error is represented by  $B$ , it implies:

$$B = 2SE(\bar{X}) \text{-----} 2$$

After carrying out some mathematical arrangements and algebra equation (1) and (2) can be combined to obtain an expression for the sample size:

$$n = 4\sigma^2 / B^2$$

Note that  $n$  as used in this case is the sample size that will achieve a maximum probable absolute error. That is the largest sampling error the researchers is willing to accept. Typically the sample size,  $n$ , is chosen with the intention that there is only a 5% chance of obtaining a sampling error larger than the acceptable maximum (Albright, Winston, & Zappe, 2003; and Brown, 2007)<sup>25</sup>.

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<sup>25</sup> Note that the sample size formula as used above is with the assumption that sample size will be small compared to the population size. Otherwise other formulas that take special consideration of the population size



### **Combining both methods**

Integrating qualitative and quantitative research methods is an option that should not be left out in research projects. Newman, Ridenour, Newman & DeMarco (2003) argue that combining qualitative and quantitative research methods yield more comprehensive research result than when the methods are used separately. Onwuegbuzie & Leech (2004) recognize that the mixed method technique ensures that research outcomes are more flexible and complete. Onwuegbuzie (2003) argues that mixed method help to achieve a smooth blend of empirical accuracy and descriptive exactness. So in essence the mixed method helps the researcher to more properly understand and explain quantitative portion of the research using qualitative data and vice versa. So with the use of qualitative data, researchers can better explain an outcome emanating from a quantitative research, likewise quantitative data can be used to complement some shortcomings of qualitative data such as the issue of generalization (Onwuegbuzie & Johnson, 2004). And furthermore, with mixed method researchers can achieve convergence and corroboration of findings from the two methods, a phenomenon that is often referred to as triangulation. The mixed method therefore, is the combining of the strengths of both the quantitative and qualitative research methods in such a way that they complement each other while making up for the weaknesses of the individual methods (Johnson & Turner, 2003; Onwuegbuzie & Teddlie, 2003).

### **Methodologies and description of secondary data**

This section will provide a description of the secondary data used in this research. It will however, start by describing how the patent index used in this research was derived. It will then provide description for the secondary data used in the research; the methodology adopted and lastly gives details of the model specification.

### **Description of how the index of paten rights used in this research was obtained**

With increasing global awareness and attention on issues of IPRs, more focus is been placed on the impact of IPRs protection on economic growth. The actual or rather fair measurement of IPRs protection in specific countries has been a challenge. Should countries be assessed purely on established IPRs laws or should the level of enforcement of these laws be taken into consideration as well? Previous measurement strategy seem to focus mainly on established laws with little attention on the level of enfocement of these laws. However, it is very critical that the enforcement of these laws be taken into full consideration. The importance of enforcement as a major criteria for IPRs assessment is furthre highlighted in the TRIPS agreement. The agreement requires that nations should comply with the minimum standard for IPRs protection as set out in the agreement by the year 2006. In reality the main factor distinhushing one nation from another as far as IPRs protection is concern is not just in establishing intellectual property laws but rather in the level of enforcement of these laws. The level of enforcement of IP laws has been a major factor that infleunces trade between a developed nation and a developing nation. Most developed nations are more comfortable dealing with nations that enforce their IP laws. In consideration of the foregoing this paper aims to adopt a measurement approach that takes into consideration not just the establishment of robust laws but also on the degree of enforcement of these laws.

The patent index represents and measures the patent readiness of a country, this is usually in terms of the intellectual property laws put in place in the country and the framework for the enforcement of these laws. Some of the indexes used in previous resaerch for this meaurement include the Ginarte and Park Index, the Economic Freedom of the World

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should be adopted, see Levy and Lemeshow (1999)

Index (The Fraser index), the Lee and Mansfield, Sherwood<sup>26</sup> index, the Rapp and Rozek index<sup>27</sup> and Seyoum index<sup>28</sup>. The patent law is used as a proxy for other intellectual property laws. Ostergard (2000) argues that this may not be a true reflection of the economic impact of the extent of IPRs as for instance copyrighted software production and entertainment products may have significant impact on the economic position of a country. And he further argues that some countries may pay more attention to other areas of IPRs other than patent. In as much as this may be true, nations do not exist in isolation. They are supposed to trade with other nations and comply with global IPR treaties and agreements such as the TRIPS agreement. They are not required to comply with only some sections of the TRIPS agreement but all areas including the minimum requirements set out for the different classes of IP.

So the impact of a nation's patent system, as patent system will be mainly used in this research, on the economic development of that nation is a fair representation of the overall IPR system impact on the economy. Another reason why this paper uses the patent is due to availability of data. It is not very easy to get adequate data on all classes of IPR as in some cases the data does not simply exist. Even though it was also difficult to get data on patents it was a much easier. This research used the number of patent application filed at the US patent and trademark office by developing country residents as a measure of the degree of innovation by the developing countries. The reason for this was especially due to the fact that it was easier to get this data for most developing countries including Nigeria than it is to get research and development expenditure for these countries. Generally speaking data on patent is much easier to obtain not only for Nigeria but other developing countries than it is to obtain data for say trademark applications. For example there is no record in the World Intellectual Property Organisation website for trademark applications in Nigeria from 1991 to 2010 ([www.wipo.org](http://www.wipo.org)). This paper however, recognises that using only patent may have some limitation. This therefore, leaves room for future research to be carried out using other forms of IPR or a combination of all.

This paper will use a new index derived from combining the Ginarte and Park index and the Fraser index as proposed by Hu and Png (2010). The Index of Patent Rights put together by Ginarte & Park (1997) and later updated by Park (2005) is made up of five key components. These include: the extent of coverage of patent protection; membership in international patent agreements; provisions of loss protection; enforcement mechanisms and duration of protection. Each country within a specified period of time can obtain a score ranging between 0 to 1 per category. The unweighted sum obtained by a country for each of

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<sup>26</sup> Sherwood (1997b) measure of IPR protection in addition to personal knowledge and experience also included professional interviews. The protection scores theoretically range from 0-103 and were developed for eighteen countries. The components considered and the corresponding points assigned include: Enforceability (25); Administration (10); Substantive Law: Copyright (12); Patents (17); Trademarks (9); Trade Secrets (15); Life Forms (6); Treaties (6); Public Commitment (3). The conditions for rating countries were derived from the US Chamber of Commerce Guidelines, but the relative weights assigned to each category were mainly obtained from the author's experience (Sherwood, 1997b; Ostergard, 2000)

<sup>27</sup> Rapp & Rozek (1990) in their work used patent laws as a proxy for IPR protection. The research analyzed the patent laws of 159 countries on a scale of zero to five, where zero represents countries with no patent laws and five represents countries whose laws are consistent with the minimum standards established by the US Chamber of Commerce Intellectual Property Task Force. Countries with no intellectual property protection laws score zero; inadequate protection laws or no law prohibiting piracy gets a score of 1; seriously flawed laws attracts a score of 2; flaws in laws, some enforcement laws gets a score of 3; generally good laws gets a score of 4 and lastly protection and enforcement laws fully consistent with minimum standards proposed by the U.S. Chamber of Commerce gets a full score of five

<sup>28</sup> Seyoum (1996) like Rapp & Rozek and Sherwood indexes also used the US Chamber of Commerce's minimum standards for his criteria. He used the result of the survey sent out to IPR practitioners to construct a 0-3 scale IPR protection component. Furthermore, he established four variables (namely: patents; copyright; trademarks and trade secrets) after validating the response from the survey

the categories constitutes the country's index of patents rights for that particular time period. It therefore, implies that each country within a specified period of time will have a patents right index of not less than 0 and not more than 5, see table 7 below for a listing of the various categories and the values assigned for each of the criteria (also see figure 13 on how the Nigeria GP index components behaved over the years). The original index as conducted by Ginarte & Park (1997) was for 110 countries and was between the period 1960-1990, and was conducted every five years. It was then later updated by Park (2005) to 122 countries. The updated version by Park also included more countries such as China and the East European countries. These countries were excluded from the original Index largely because laws protecting industrial property were absent or based on different systems such as inventor certificates (Park, 2008).

Many countries recorded high scores for the membership and duration categories especially for the 2000 and the 2005 index reports. The reason for the high scores under these criteria is because many more countries have become signatory to international treaties on IPRs.

### **Ginarte and Park Index**

The Ginarte and Park index is derived using five categories namely; coverage (a determination of subject matters that can be patented); duration, that is the lifespan of the protection; enforcement (the strategies and policies put in place to enforce patent rights); membership in international intellectual property agreements; and restriction placed on the use of patent rights (Park, 2008).

### **Coverage**

Patent rights are granted to inventions that are novel, these are inventions that possess new features that are not in direct conflict with existing inventions (prior art). These inventions must be of practical industrial use and inventions must demonstrate **inventive steps which cannot be ordinarily** deduced by a person with average knowledge of the technical field (WIPO, 2012).

However, the laws governing what is "patentable" vary slightly from one country to another. Some countries may choose as a matter of national welfare or economic strategy to leave out some inventions from their patentable portfolio. Under this category a country is judged by the patentability of the following eight areas; pharmaceuticals, chemicals, food, plant and animal varieties, surgical products, micro-organisms, utility patents and software (the patentability of software was later added by Park (2005)). The score a nation obtains for this category is dependent on the fraction of the eight elements that are patentable by law in that country.<sup>29</sup> A country whose laws make provision for the patenting of one of the elements will receive a score of 1/8 if the it is for two of the elements it will receive a score of 2/8 and so on. If it provides for all the eight elements it will receive a score of 1.

### **Membership in international agreements**

When countries sign up to international patent treaties they do not only show that they are willing to provide fair patent protection to their nationals but also to foreigners. The five main international agreements that countries are expected to sign up to under this category include<sup>30</sup>: the Paris Convention of 1883 (and subsequent revisions); the Patent Cooperation

<sup>29</sup> It is worthy of note that some in addition to other reasons countries prohibit the patenting of certain inventions for various reasons including public welfare, health or merely on moral grounds.

<sup>30</sup> The original Index of Patents Rights considered only three international agreements; the Paris Convention of 1883 (and subsequent reviews) the Patent Cooperation Treaty (PCT) of 1970, and the International Convention for the Protection of New Varieties of Patents (UPOV) of 1961. Park (2008) in the updated Index of Patents

Treaty (PCT) of 1970, the International Convention for the Protection of New Varieties of Patents (UPOV) of 1961, Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (Budapest Treaty) and The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). Countries that are signatories to only one of the five agreements get a score of 1/5 while countries that have signed the entire five agreements obtain a score of 1 in this category.

The Paris Convention for the Protection of Industrial Property is one of the earliest intellectual property treaties. It was signed in Paris, France, on March 20, 1883. Its main object is to ensure that persons who are either nationals or domiciled in country that is party to the Convention enjoy full privileges and rights in other countries that are signatories to the Convention equal to what the nationals of those country enjoy as far as intellectual property protection is concern. PCT is an international patent law treaty that came into effect on June 19, 1970 in Washington. Its main object is to provide a unified administrative procedure for filing patent applications among its contracting states. With the PCT a patent application filed in a member state can be effective in any of the member country's patent offices. UPOV convention was adopted on December 2, 1961 by a Diplomatic Conference held in Paris. The main object of the convention is to grant plant breeders right. This right is similar to patent rights. Its aim is to give plant breeders the necessary encouragement to develop new varieties of plants. The Budapest Treaty was signed in Budapest on April 28, 1977 and entered into force on August 9, 1980, and was later amended on September 26, 1980. The treaty enables the applicant to deposit the biological material in only one recognized authority without the applicant having to deposit the biological material in all countries where he seeks to obtain patent, and this deposit will be recognized in all countries that are signatory to the Budapest Treaty. The Treaty also exempts applicants from fulfilling the supposed legal requirement of sufficiency of disclosure as required for any patent application. Inventions involving microorganisms are impossible to completely describe in a manner that is understandable to a third party. That is why such inventions are rather required to be deposited in a universally recognized institution. The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) is an international agreement administered by the World Trade Organization (WTO). It was established at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994. Its main objective is to setup minimum standards for the regulation of various forms of intellectual property for World Trade Organization (WTO) members. TRIPS makes regulation provisions for copyright rights, including the rights of performers, producers of sound recordings and broadcasting organizations; geographical indications, including appellations of origin; industrial designs; integrated circuit layout-designs; patents; monopolies for the developers of new plant varieties; trademarks; trade dress; and undisclosed or confidential information. TRIPS also specifies enforcement procedures, remedies, and dispute resolution procedures.

### **Restrictions on Patent Rights (RIG):Loss of protection.**

The possibility of patent owners losing their rights is a situation that must be mitigated. This category measures protection against this risk under three sub-categories namely: 'working' requirements, compulsory licensing and revocation of patents. A country within which all three sub-categories are protected receives a value of 1 for this category and if only one of the sub-categories is protected it receives a value of 1/3.

Working requirements in this instance refers to the exploitation of inventions. A situation where a country as a matter of policy requires that patent owners must actually

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Rights added the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (Budapest Treaty) and The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS)

develop, manufacture or construct as the case may be, products based on the patent. And in a case where the patent is granted to a foreigner the foreigner is asked to import the goods. This may pose a serious burden on the patent owner as he may not be financially buoyant enough to fulfill such expectation. The desired scenario is for authorities not to impose such expectation on patent owners. So a country that does not make mandatory working requirements during the term of a patent will receive a score of 1/3 for this sub-category and if it does it will receive a value of zero. It is further desirable that countries don't impose compulsory licensing on patentees, that is requiring that patentees to license their patents to third parties. This move reduces the revenues accruable to the patentee; this is particularly bad when it is imposed during the early periods of the patents life span. It is therefore desirable that a country does not impose compulsory license on patentees especially during the first few years of the patent. A country that does not impose compulsory licensing within 3 to 4 years of the date of patent grant or application (this time frame is recommended by the Paris Convention, see World Intellectual Property Organization, 1988) will receive 1/3 value, and if it does impose compulsory licensing within 4 years it will receive a value of zero. And lastly countries that do not revoke patents for non-working will obtain a value of 1/3.

As regards restrictions some developed and developing countries alike still insist on compulsory licenses. Government use this as a strategy to guide the direction they want to head as far as technological advancement is concern. In Nigeria for instance the National Office for Technology Promotion and Acquisition (NOTAP) ensures that Nigerian companies go into technology transfer agreements with their foreign partners. It is compulsory for Nigerian companies to register technology transfer agreements entered with their foreign partners before they are allowed to make any monetary transfers to the foreign company. The technology transfer agreements are designed to ensure eventual domestication of the technology within a specified period. NOTAP has registered substantial amount of technologies since its inception, in fact it registered a total of 1237 between 1999 to 2009 see appendix B.

### **Enforcement**

Intellectual property laws are of no use if they are not enforced. The right owner feels more comfortable not only with robust intellectual property laws but more with the enforcement of such laws. The true strength of a nation's legal system should be measured by the degree to which its existing laws are enforced. If enforcement is non-existent it would not matter whether the nation has strong or weak laws (Sherwood, 1997). The measurement of IPR must therefore consist of both statute component and enforcement component. This category is assessed using three conditions namely: availability of preliminary injunctions; contributory infringement pleadings and burden-of-proof reversals<sup>31</sup>.

Preliminary injunctions are pre-trial orders that prevents a party from going ahead with an alleged infringement. In this case the patentee goes to court and gets a temporary ruling by the court restraining the other party from going ahead with a course of conduct prior to the final determination of the merits of the legal case. Apple for instance won a preliminary injunction against Samsung Galaxy tablet sales in the United States (Fiegerman, 2012). Apple had initially accused Samsung of copying the designs of its iPad and iPhone products. This move meant that Samsung will have to stop the production or sale of its Galaxy tablets in the United States until the final determination of the case, so in essence Apple obtained a

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<sup>31</sup>Article 34(1)(a) of the TRIPS agreement expects that countries signatory to the TRIPS agreement should put the burden of proof on the alleged patent infringer. It states that "... Therefore, Members shall provide, in at least one of the following circumstances, that any identical product when produced without the consent of the patent owner shall, in the absence of proof to the contrary, be deemed to have been obtained by the patented process:(a) if the product obtained by the patented process is new."

preliminary injunction of this matter against Samsung. Contributory infringement are actions which may not by themselves be an infringement but which can provide basis for others to carry out actions that will result to an infringement. An importer of a given raw material necessary for the production of a patented invention may not be doing any wrong. However, another party may use that raw material to produce infringing goods. It is therefore, imperative that a country's legal system recognises and makes necessary provisions to protect IPRs owners from infringers by reversing the burden of proof. Burden-of-proof reversals are procedures that shift the burden of proof from the patentee to alleged infringers. This gives huge advantage to the patentees as they do not have to bother with proofing that an alleged infringement actually took place rather the infringer is the one posed with the responsibility of proving that he did not actually infringe. In the real sense it is quite a difficult task for a patentee to prove that an infringement actually took place as there may be many processes to producing the same product. So it is better for the patentee that the burden of proof be passed to the alleged infringer to prove otherwise.

A country that provides grounds for preliminary injunction will obtain 1/3 value and where it does not exist it will score 0. And if it also provides the remaining two conditions under this category it will receive the full value of 1.

### Duration of protection

The length of patent term is critical to the benefits that the patentee can receive from his innovation. The longer the term the more time he has to benefit from his patent and the shorter the less time he has to reap the benefit of his labour. This category takes into consideration the length of time awarded to patents bearing in mind that patent terms can either start from the date of the patent application or the date of the patent grant. The Ginarte and Park index recognises 20 years as standard for patent terms based on the date of application. So countries that provide 20 years or more of protection will receive the maximum value of 1. And those that provide shorter terms than 20 years from the date of application will receive a fraction of the 20 years that they provide. So in essence if a country provides 18 years of protection it will receive a value of 0.9 (18/20) for this category. A similar approach is applicable to situations where the patent terms is established from the date of grant. For this scenario the index recognises 17 years of protection as the minimum a country should allow for patent protection. So a country will obtain a value of 1 when it allows a patent term of 17 years protection or more. And where it is less the country will obtain a fraction of the 17 years that they provide.

Figure 13: Nigeria GP Index Components

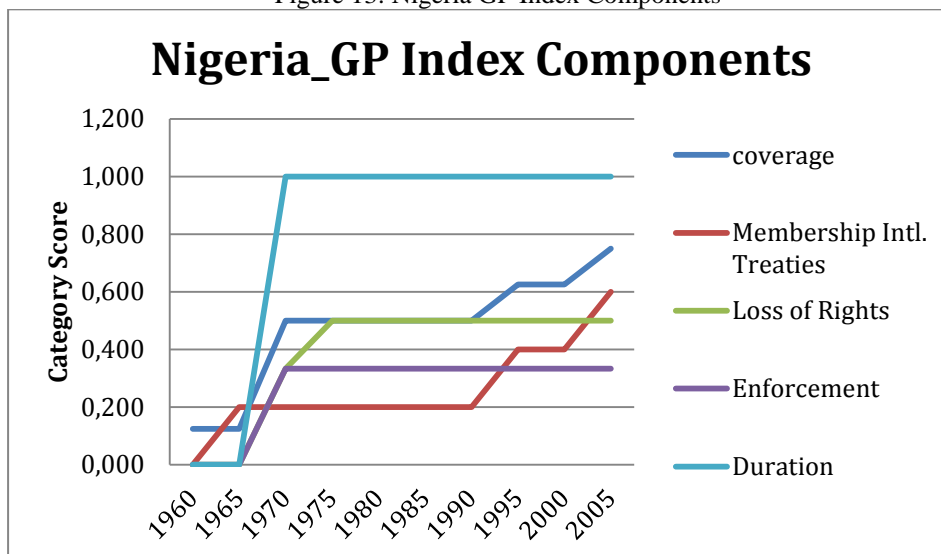


Table 7: Index of Patent Rights - Categories and Scoring Method

Coverage (COV)	Available	Not Available
Patentability of pharmaceuticals	1/8	0
Patentability of chemicals	1/8	0
Patentability of food	1/8	0
Patentability of plant and animal varieties	1/8	0
Patentability of surgical products	1/8	0
Patentability of micro-organisms	1/8	0
Patentability of utility models	1/8	0
Patentability of software*	1/8	
Duration of Protection (DUR)	Full	Partial or No Protection
Full duration in this instance is 20 years from the date of application (or 17 years from the date of grant, for grant-based patent systems) and $f$ equals the duration of protection as a <i>fraction</i> of the full duration	1	$0 < f < 1$
Enforcement (ENF)	Available	No Available
Preliminary Injunctions	1/3	0
Contributory Infringement	1/3	0
Burden-of-Proof Reversal	1/3	0
Membership in International Treaties (MEM)	Available	Not Available
Paris Convention and Revisions	1/5	0
Patent Cooperation Treaty	1/5	0
Protection of New Varieties (UPOV)	1/5	0
Budapest treaty (microorganism deposits)*	1/5	
Trade-related intellectual property rights (TRIPS)*	1/5	
Restrictions on Patent Rights (RIG)	Does Not Exist	Exists
“Working” Requirements	1/3	0
Compulsory Licensing	1/3	0
Revocation of Patents	1/3	0

Source: Park (2008). International Patent Protection

Notes: Each category has specific number of relevant legal criteria assigned to that category except for the duration category. Each category has a maximum score of 1, so the total Index of Patent Rights obtainable is 5 and the least score obtainable is 0. All criteria within a category have equal weights. \* The patentability of software criteria under the coverage category was added in 2007 by Park (2007). Likewise Trade-related intellectual property rights (TRIPS) and Budapest treaty (microorganism deposits) were added by Park in 2007.

Ginarte and Park (1997) did not fail to recognize some of the limitations of their index. They recognized that there may be gaps between real and statutory protection, as there may be problems of actual execution of these laws in some countries. They noted that countries like Brazil, India, Korea and Mexico have slow enforcement procedure attributable to lengthy court procedures or slow response from the police. They further recognized that high level of corruption in some countries may actually work against the effective enforcement of these laws. In countries like Nigeria, Peru and Philippines even though the laws provide for adequate enforcement actions, these has not been properly implemented. And in some other countries such as Japan the gap between actual and statutory protection is

not necessarily peculiar to only patent related issues but also to non-patent related matters. This is largely due to the strategy the nation has adopted to promote its own internal economy. For example US firms realized that the Japanese Patent Office does not provide adequate protection to emerging technologies except Japanese industries are ready for such technologies and that there are no existing Japanese competitors.

**Ginarte and Park Index over different time periods: Nigeria.** As can be seen from figure 3B and table 3B below the GP Index for Nigeria was consistently above the average GP index for 81 developing countries between 1970 and 2000. It remained steady at 2.37 between 1970 and 1990 and then rose to 2.69 in 1995 and 2000. It further rose to 2.89 in 2005 and 2010. It was also above the average global index until 1995. After 1995 the average global GP index was consistently above the Nigerian index. Among the 122 countries studied the United States consistently had the highest GP index and Angola consistently had the lowest GP index. For instance Nigeria had an index of 2.89 in 2005 compared to United States, which had the highest index of 4.88 in the same period, and Angola, which had 1.20 within the same period as well. As is seen from figure 14 and table 8 below there was a steady increase in both the GP index for developing countries as well as the global index for the periods under review. On the other hand the global standard deviation to the mean increased between 1970 to 1990 and then decreased thereafter. This simply implies that the wide gap between countries as far as patent system is concern increased between 1970 and 1990 and then started decreasing afterwards.

Figure 14: GP Index Comparison

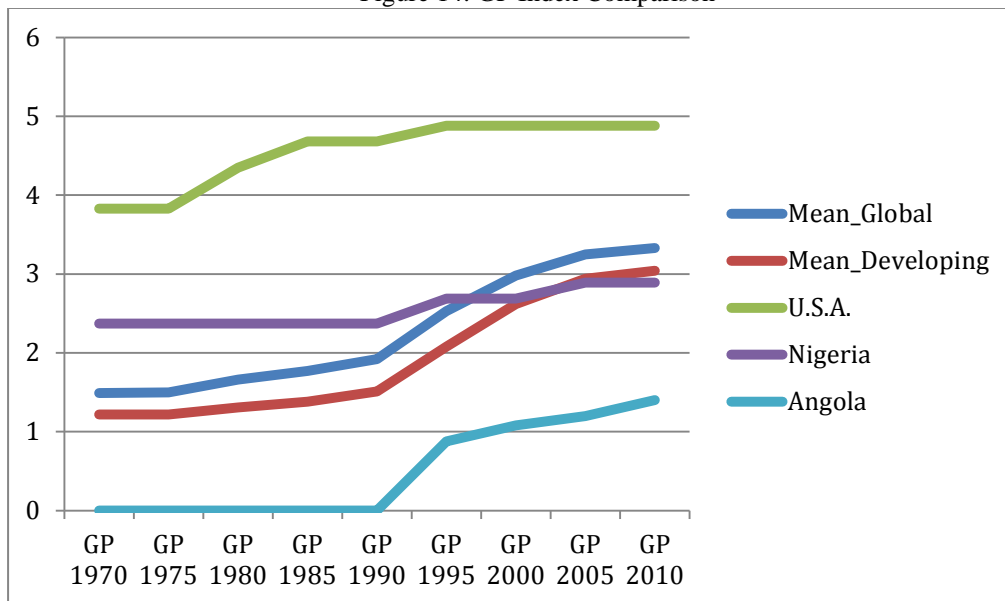


Table 8: GP Index for 113 Countries Mean (Developed and Developing) and 81 Developing Countries Mean, Angola and United States

	GP 1970	GP 1975	GP 1980	GP 1985	GP 1990	GP 1995	GP 2000	GP 2005	GP 2010
Mean_Global	1.49	1.5	1.66	1.77	1.92	2.53	2.98	3.25	3.33
Mean_Developing	1.22	1.22	1.31	1.38	1.51	2.08	2.62	2.94	3.04
U.S.A.	3.83	3.83	4.35	4.68	4.68	4.88	4.88	4.88	4.88
Nigeria	2.37	2.37	2.37	2.37	2.37	2.69	2.69	2.89	2.89
Angola	0	0	0	0	0	0.88	1.08	1.2	1.4

The distribution of patent strength around the world was negatively skewed between 1970 and 1975 and then became positively skewed thereafter until the late 1990s, see appendix C below. It then became negatively skewed again from 2000 and 2005. This



basically implies that after the late 70s more countries began to have patent index scores that are above the mean. However, this situation reversed from early 2000 to late 2000. Skewness in this case is calculated by subtracting the median from the mean and dividing the result by the standard deviation. This increase in patent index between 1980 and 1995 is attributable to the fact that many nations adopted stronger patent regimes especially after the establishment of TRIPS. Furthermore, there was a broader adoption of patent systems by various nations including Indonesia, Angola, Ethiopia, Mozambique, and Papua New Guinea. However, the reason for the negative skewness in the early and late 2000 could be due to the fact that as more countries improved on their patent systems others could not cope with the pace and then lagged behind.

The patent of index rights (GP Index) has huge limitations as far as the actual measurement of a country's level of IPRs enforcement is concern. It only takes into cognisance a country's level of IPR enforcement as it exists on paper without taking into consideration whether the existing legal system and enforcement framework provide for the effective enforcement of IPRs and proper punishment for offenders. The GP index sometime gives a wrong impression about the actual position of a country's IPRs regime especially as it concern enforcement. Take for example, the 1990 GP index rating of Nigeria (3.05) which is significantly ahead of countries like Hong Kong with a rating of 2.57 and Singapore also with a rating of 2.57 (this rating was however only recently revised in 2013 by Walter Park to 2.37, see <http://www.american.edu/cas/faculty/wgp.cfm>). Even with this recent revision it still shows that the GP index does not take into consideration the enforcement of patent rights in these countries (Hu and Png, 2010) as the level of enforcement of laws in Nigeria is still very weak (Onyeozili, 2005).

### **Fraser Index**

The legal structure of property rights defines the patent protection strength under the economic freedom of the world (EFW) index (also referred to as Fraser Patent Index in this paper). It is made up of seven major categories. These are judicial independence, impartial courts, protection of property rights, military interference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts and regulatory restrictions on the sale of real property.

The judiciary independence category measures the degree of independence of the judiciary from undue interference. For this category respondents are expected to provide answer to the question "is the judiciary in your country independent from political influence of members of government, citizens or firms?" This question was originally derived from the Global Competitiveness Report (GCR). If the answer to the question is No – heavily influenced, the country scores 1 out of 7 and if the answer is Yes – entirely independent, it scores 7. This variable as well as other variables from the GCR was converted from the original scale of 1-7 to 10 using the following formula:  $EFW_i = ((GCR_i - 1) / 6) \times 10$ . So if a country scored a total of 7 under the GCR in this component, its score when converted to EFW will be  $((7-1) / 6) \times 10 = 10$  and if the score was 1 under the GCR rating, its EFW rating will be  $((1-1)/6) \times 10 = 0$ .

The impartial courts component is from the GCR question "the legal framework in your country for private businesses to settle disputes and challenge the legality of government actions and/or regulations is inefficient and subject to manipulation (=1) or is efficient and follows a clear, neutral process (=7)". For those countries omitted in the primary data source since 1995 the "rule of law" ratings from the World Bank's Governance Indicators Project was used to fill the gap.

The protection of property rights component is from the GCR and respondents are expected to provide answers to the following question "property rights, including over

financial assets, are poorly defined and not protected by law (=1) or are clearly defined and well protected by law (=7)". This component replaces previous GCR question on intellectual property right protection.

The military interference in the rule of law and political process component measures the degree of military interference in the rule of law and politics. This could be internal or external military interference. It could be a complete takeover of the entire government. Nigeria for instance is one country that has suffered serious military interference in its political system. This many have argued have brought strong level of corruption in the political system and has generally drawn the country back as far as economic development is concern. Nigeria has had eight military regimes beginning from 1966. The fourth and fifth military regimes were interrupted by a return to civil rule with the second republic between October 1979 and December 1983. The last military regime left power only on May 29, 1999, when the present fourth republic was ushered in (TOTAL, 2013). This component is based on the International Country Risk Guide, Political Risk Component G., Military in Politics. And for those countries omitted in the primary data source since 1995, the "political stability and absence of violence" ratings from the World Bank's Governance Indicators Project is used.

The integrity of the legal system component is also derived from the International Country Risk Guide, Political Risk Component I., for law and order. It comprise of two sub-components, the law sub-components and the order sub-component. The 'law' sub-component appraises the strength and impartiality of the legal system while the 'order' sub-component appraises the popular observance of the law.

The legal enforcement of contracts component measures the ease of doing business in a particular country. It is obtained from the World Bank's *Doing Business* estimates for the time and money required to retrieve a clear-cut-debt. The debt in this instance is assumed to be 200% of the country's per capita income and it is further assumed that the plaintiff has complied with the terms of the contract and that he has obtained favorable judgment. This component has two sub-components namely the time cost and the monetary cost. The time cost is measured in the number of calendar days required from the moment the lawsuit is filed until payment is made. The maximum permissible number of days is 725 (1.5 standards deviation above average) and the minimum is 62 days. Any country whose value exceeds 725 or equal 725 days receives a rating of 0 and a country with ratings below 62 days or equal to 62 days receives a rating of 10. The monetary cost sub-component is measured as a percentage of the debt. Countries also receive a rating of between 0 and 10 like is the case with the time cost. The maximum permissible percentage of monetary cost is 82.3 percent (1.5 standards deviation above average) and 0 percent minimum. Countries with values above 82.3 percent or equal 82.3 percent receive rating of 0 and countries with values below or equal 0 percent will receive ratings of 10. Then if the country obtains a rating between 725 days and 62 days (for time cost) or between 0 percent and 82.3 percent (for the monetary cost) it gets a rating that is calculated using  $[(V_{\max} - V_i)/(V_{\max} - V_{\min})] \times 10$ . Where  $V_{\max} = 725\text{days or } 82.3\%$ ,  $V_{\min} = 62\text{days or } 0\%$  and  $V_i$  is the time cost or monetary cost value. For each of these sub-components the country will receive ratings between 0 and 10. To arrive at the final rating of this component the average of the two sub-components is taken.

The component on the regulatory restrictions on the sale of real property is based also on the World Bank's *Doing Business* data. It has two broad sub-components, time cost and monetary cost. The time cost is measured in the number of calendar days required to transfer ownership of a property. The maximum allowable number of days for the transfer to be effected is 265 days (1.5 standard deviations above average) and the expected least number of days is 0 days. Countries with values that are equal to 265 days or above receive ratings of zero and countries with values of zero receive ratings of 10. The monetary cost of transferring ownership is measured as a percentage of the value of the property. The maximum

permissible percentage of monetary cost is 15 percent (1.5 standards deviation above average) and 0 percent minimum. Countries with values higher than or equal to 15 percent obtain ratings equal to 0 and countries with values equal to 0 percent receive ratings equal 10. Values between 0 and 265 days (for time cost) or 0 to 15 percent (for monetary cost) will receive ratings calculated using the following formula:  $[(V_{max} - V_i)/(V_{max} - V_{min})] \times 10$ . Where  $V_{max} = 265\text{days}$  or  $15\%$ ,  $V_{min} = 0\text{days}$  or  $0\%$  and  $V_i$  is the time cost or monetary cost value. For each of these sub-components the country will receive ratings between 0 and 10. To arrive at the final rating of this component the average of the two sub-components is taken.

**Fraser Index over different time periods: Nigeria.** The mean for the Developing countries Fraser Index increased consistently over the period under review. The same is the case with Nigeria; see figure 15 and table 9 below.

Figure 15: Fraser Index Comparison

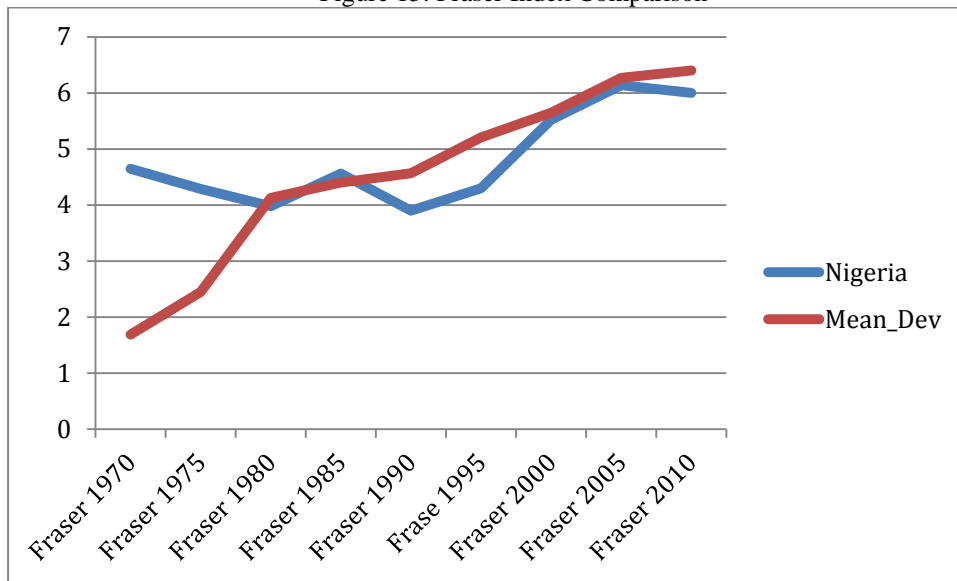


Table 9: Fraser Index Comparison

	Fraser 1970	Fraser 1975	Fraser 1980	Fraser 1985	Fraser 1990	Fraser 1995	Fraser 2000	Fraser 2005	Fraser 2010
Nigeria	4.65	4.29	3.98	4.56	3.9	4.3	5.52	6.14	6
Mean_Development	1.69	2.45	4.13	4.4	4.57	5.21	5.65	6.27	6.4

The Nigeria Fraser index was higher than the developing countries average in 1970, 1975, and 1985.

**Combining Ginarte and Park Index of Patent Rights and the Fraser Index**

This paper will suggest that future indexes should not take into consideration only the length of protection and other theoretical considerations but should ensure to fully understand the actual degree of enforcement of intellectual property laws and the scope of protection as well. Many countries differ in the coverage, enforcement and restriction categories. Hu and Png (2010) noted that the GP index may be misleading for example as is seen between the patent index of Nigeria and Hong kong. They argued that Nigeria has a weaker IPRs enforcement system compared to Hong Kong. And they further supported their argument by suggesting that enforcement is a critical part of any meaningful IPRs system. To take care of these limitations Hu and Png proposed that a new patent index be used, one that is a product of the GP index and the Fraser Index.

In as much as this argument put forward by Hu and Png is true, it is worthy of note that there will be no enforcement without first having in place the right laws. Laws that have

the right content, scope, coverage and other provisions. It is on the foundation of a robust legal system that enforcement can thrive. The GP index may not be entirely complete but while arguing that there remains room for improvement the GP index still remains a good measure of IPRs protection in the various countries of the world, see the short empirical comparison of the GP index and the Fraser Index below.

Comparing the GP Index of Patent Rights and the Fraser index (EFW Index) reveals a moderately strong correlation between them, see table 4E below. This indicates that there is a relatively strong relationship between statutory levels of patent protection and what actually takes place (that is what is implemented) in the various countries. The Index of Patent Rights is largely criticized for not taking into consideration actual experiences, as is the case with EFW. It should be noted that even when actual experiences are measured using surveys and questionnaires the results may be prone to certain levels of errors. However, in as much as the GP Index of Patent Rights did not take into cognizance actual experiences the results as seen below is highly correlated with the EFW which takes into cognizance actual experience. The EFW rating is largely based on the opinion of individuals and firms as regards the legal regime including intellectual property right protection in each country whereas the Index of Patent Rights is based on patent laws in the various countries.

To minimize the inherent shortcomings of the GP Index this paper will adopt the new index of effective patent rights proposed by Hu and Png (2010). This new index is obtained from multiplying the GP index and the Fraser index: New Patent rights index = GP x Fraser. Hu and Png (2010) also proposed alternative way of calculating the new patent index. This is derived by summing the GP index and the Fraser index. Specifically because the GP index ranges from 0 to 5 while the Fraser index is from 0 to 10. The alternative new patent index is therefore obtained by first multiplying the GP index by 2 so that it has an equal weight with the Fraser index and then adding it to the Fraser index. The resultant sum is then multiplied by 0.5. The alternative new patent index is derived from the expression below:

New Patent Index = 0.5 [GPx2 + Fraser]

This paper however, went further to make slight adjustments to the work done by Hu and Png (2010). The paper generally computed the new patent index by multiplying the GP index by the Fraser index. However, for countries without records of any of the two indexes, the missing index is replaced by the available index. So if a country has the GP index but lacks the Fraser index, the patent index for that is calculated as 2GP x GP. And if the country lacks the GP index but has the Fraser index its patent index is computed as Fraser x 1/2Fraser.

This new index as proposed by Hu and Png was predicated on the argument that inventors will be more interested in the enforcement of patent laws than the mere establishment of those laws. As a full bouquet of all the necessary patent laws without an effective enforcement mechanism is as good as having no patent laws at all (Mookherjee & Png, 1992). They went ahead to argue that patent laws and enforcement mechanism should co-exist and complement one another. Hence the construction of a new index that takes into consideration a country's patent laws as it exists on paper and the level of enforcement of those laws in that particular country. The new derived patent index (represented as GP\_F) for the various countries over the various time periods is as shown in table 10 below.

Table 10: New Derived Patent Rights Index

Country	GP_F19 70	GP_F19 75	GP_F19 80	GP_F19 85	GP_F19 90	GP_F19 95	GP_F20 00	GP_F20 05	GP_F20 10
Algeria	13.26	13.26	11.56	10.92	9.97	11.66	13.82	16.12	15.26
Angola	0.00	0.00	0.00	0.00	0.00	1.53	2.31	4.16	7.42
Argentina	8.75	5.22	6.70	6.04	7.16	15.60	25.58	21.07	20.28
Banglad.	2.76	4.60	4.88	5.28	6.08	9.28	9.89	10.10	9.92
Benin	4.96	4.96	8.76	8.21	9.56	8.17	11.03	16.10	16.88
Bolivia	2.96	2.96	5.28	4.38	6.87	14.80	20.20	19.01	18.24
Botswana	4.55	4.55	9.67	10.10	10.32	12.00	22.37	23.22	23.45
Brazil	6.81	5.12	5.65	4.62	5.47	6.65	20.04	21.41	22.26
Bulgaria	0.00	0.00	0.00	18.97	7.68	13.50	19.76	27.09	28.29
Burk. Faso	4.96	4.96	4.96	5.78	5.78	7.80	8.82	15.91	16.32
Burundi	0.00	7.35	8.26	8.93	9.01	9.10	9.48	9.58	10.51
Cameroon	4.96	4.96	11.50	11.12	10.77	11.55	12.99	17.09	17.35
Cent. Afr.	4.96	4.96	9.16	8.93	9.63	9.20	10.69	13.03	14.39
Chad	4.21	4.21	6.30	8.09	9.35	9.30	11.49	14.86	14.94
Chile	7.91	7.31	10.54	11.78	15.06	29.19	32.58	35.22	37.40
China	0	0	7.96	6.76	6.47	11.01	17.72	25.64	26.51
Colombia	4.85	4.72	4.61	4.95	4.97	13.78	17.52	19.90	22.26
Congo	4.96	4.96	9.58	8.91	9.41	9.96	10.01	13.42	13.88
Cost. Rica	2.160	7.056	6.131	6.415	8.021	10.918	21.138	21.369	22.569
Dom. Rep.	9.02	9.02	12.57	11.72	10.15	14.15	13.82	15.87	8.65
Ecuador	5.26	6.48	6.89	5.82	6.48	12.80	20.25	20.64	21.80
Egypt	3.97	6.13	6.83	7.58	6.96	10.00	12.27	18.80	18.80
El Salv.	5.84	5.84	7.88	7.84	8.22	22.76	23.60	25.12	26.68
Ethiopia	0	0	0	0	0	0	8	11.4325	12.1125
Fiji	9.67	11.76	12.58	13.28	12.95	13.37	14.92	15.83	17.00
Gabon	4.96	4.96	9.03	10.75	10.41	11.36	12.79	16.42	17.06
Ghana	3.83	5.81	5.10	5.45	7.87	15.17	18.46	21.64	22.78
Guatemala	5.01	5.39	4.79	3.89	5.07	7.47	8.13	22.24	25.56
Guyana	1.28	1.28	1.28	3.06	1.71	5.60	8.82	10.23	10.28
Haiti	13.26	13.26	14.52	13.72	13.00	13.62	18.97	19.23	18.56
Honduras	3.13	3.13	7.25	7.21	7.29	12.14	17.52	19.66	21.72
Hungary	21.72	0.00	0.00	10.58	11.86	10.75	23.75	25.38	32.24
India	5.36	4.69	5.57	5.23	5.21	7.07	14.21	24.73	23.30
Indonesia	0.96	1.04	1.04	1.22	1.29	10.00	14.90	17.62	19.09
Iran	11.83	11.43	7.67	7.77	9.10	8.59	10.99	12.00	14.91
Ivory Cst.	4.96	4.96	9.49	9.88	8.79	9.96	14.32	17.18	16.48
Jamaica	14.13	14.13	11.40	14.04	15.18	18.75	22.11	25.12	23.51
Jordan	0.28	0.66	3.12	3.33	3.29	5.75	19.55	23.10	25.41
Kenya	7.52	6.94	8.16	8.74	11.35	14.31	19.26	22.81	22.20
Lithuania	0.00	0.00	0.00	0.00	2.00	13.37	21.04	28.79	29.45
Madagas.	5.50	1.81	5.06	5.31	5.37	8.70	12.97	12.86	13.97
Malawi	2.53	6.09	6.49	6.85	7.10	8.23	9.94	11.07	15.38
Malaysia	10.42	10.02	10.98	13.39	14.86	20.17	20.36	24.00	25.78
Mali	0.00	0.00	0.76	9.19	9.46	9.95	13.08	16.54	16.88
Mauritan.	4.96	4.96	5.78	7.22	7.22	7.80	11.84	19.96	18.91
Mauritius	4.70	8.63	9.27	11.28	10.95	14.46	14.29	18.92	20.53
Mexico	5.25	4.42	4.37	4.89	6.29	17.20	20.55	23.92	25.13
Morocco	8.19	8.36	7.23	8.44	8.32	10.92	17.70	20.84	23.08
Mozamb	0.00	0.00	0.00	0.00	0.00	0.08	2.24	13.99	16.89

Nepal	6.37	6.37	10.41	9.60	9.59	9.44	10.26	11.97	13.55
Nicaragua	0.69	0.69	2.43	1.35	1.81	4.43	12.39	18.69	21.95
Niger	4.96	9.04	8.84	8.60	8.64	7.90	11.38	14.88	15.49
Nigeria	11.01	10.15	9.42	10.79	9.23	11.57	14.86	17.75	17.35
Pakistan	5.13	4.04	4.91	6.02	6.06	7.88	10.18	12.06	14.07
Panama	3.59	9.68	8.21	9.01	9.09	11.16	24.82	25.39	24.12
P.N.Guina	0.00	0.00	0.00	19.66	19.85	19.41	15.30	17.82	19.09
Paraguay	2.53	2.53	7.47	6.67	6.99	10.66	15.02	18.51	19.37
Peru	2.90	2.35	2.36	1.71	2.34	16.14	21.39	21.87	26.03
Philipp.	13.08	11.68	11.68	12.03	13.61	18.24	25.71	27.53	27.57
Poland	0.00	0.00	0.00	7.92	4.76	17.25	23.21	26.31	28.40
Romania	0.00	0.00	0.00	15.57	6.96	12.76	18.42	27.56	29.20
Russia	0.00	0.00	0.00	0.00	0.00	15.29	19.37	23.45	23.89
Rwanda	0.00	6.12	8.76	7.28	9.69	6.99	11.49	11.81	18.63
Senegal	4.96	4.96	8.96	9.98	9.98	9.26	12.39	15.66	16.60
S. Leone	11.28	12.99	12.71	9.50	9.60	10.98	15.80	16.42	19.53
S. Africa	19.01	16.81	17.49	16.50	16.52	20.64	26.10	25.80	25.96
Sri. Lanka	6.60	6.60	12.81	14.00	14.00	18.04	18.94	19.00	20.96
Syria	7.421	7.774	7.653	6.365	7.149	8.568	9.165	11.925	12.607
Tanzania	8.18	6.88	9.20	7.88	9.50	12.81	15.72	15.98	20.46
Thailand	4.72	4.49	7.36	7.37	8.24	15.92	15.43	17.04	21.61
Togo	4.96	4.96	7.38	9.38	9.40	10.49	12.26	16.52	15.77
Trin. & Tob.	6.00	8.04	9.01	8.75	9.82	16.25	26.03	26.48	25.88
Tunisia	7.06	7.02	7.28	6.86	8.00	9.57	13.97	21.09	22.10
Turkey	4.87	4.80	4.52	5.82	5.83	14.97	23.05	25.17	26.74
Uganda	5.84	5.84	6.13	5.76	5.59	14.79	20.37	20.96	22.63
Ukraine	0.00	0.00	0.00	0.00	3.56	12.64	17.27	20.62	22.86
Uruguay	4.75	4.75	10.18	9.94	10.39	12.77	19.91	22.58	23.54
Venezuela	6.44	5.63	6.09	5.74	5.19	11.40	17.67	14.87	11.10
Vietnam	1.53	1.53	1.53	1.53	2.53	14.05	14.05	17.70	22.26
Zambia	3.78	6.44	7.12	5.49	4.74	7.06	11.27	13.11	16.08
Zimbabwe	2.76	2.76	8.02	9.54	9.83	12.27	11.74	8.65	11.51

Table 11: Correlation Coefficient, Using the Observations 1-733 (Missing Values were Skipped)  
5% critical value (two-tailed) = 0.0745 for n = 692

Fraser	GP	GP_F	
1.0000	0.4973	0.6900	Fraser
	1.0000	0.9210	GP
		1.0000	GP_F

When the new patent right index (GP\_F) was plotted against the GP Index, the two indexes were highly correlated (0.921), see table 11 above. Also when the new patent right of index (GP\_F) was plotted against the Fraser Index, the two indexes were moderately correlated (0.6900). It can be seen that the correlation between GP\_F and the GP index and GP\_F and the Fraser index is much stronger than the correlation between the GP index and Fraser index (0.4973).

### New Patent Index over different time periods: Nigeria

The figure 16 and table 12 below show that for the new patents right index (a combination of the Ginarte and Park Patents right index and the Fraser index) Nigeria was

consistently below the global mean. But it was consistently above the mean of developing countries between 1970 to early 1995. However, from 2000 the mean of developing countries became higher than the Nigeria new patents right index. The United States has the highest Index as far as the new patent right index is concern and has values that are consistently higher than both the global and Nigeria indexes. Papua New Guinea recorded the least index between the periods under consideration that is from 1970 to 2010.

Figure 16: New Patent Rights Index Comparison

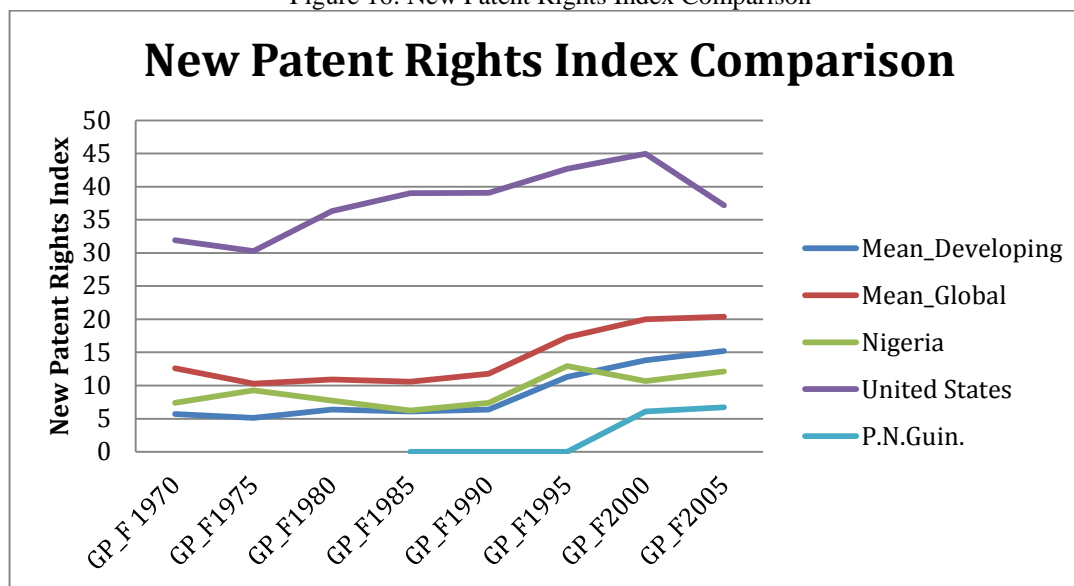


Table 12: New Patent Rights Comparison

	GP_F 1970	GP_F19 75	GP_F19 80	GP_F19 85	GP_F19 90	GP_F19 95	GP_F20 00	GP_F20 05
Mean Developing	5.7	5.1	6.4	6.1	6.4	11.3	13.8	15.2
Mean Global	12.6	10.3	10.9	10.6	11.8	17.3	20	20.4
Nigeria	7.41	9.26	7.75	6.23	7.4	12.94	10.69	12.11
United States	31.93	30.26	36.31	39.02	39.06	42.71	44.98	37.18
P.N.Guin.				0	0	0	6.1	6.73

The relationship between Nigeria’s Fraser Index to that of the rest of the developing countries is almost opposite that of the relationship between Nigeria’s GP index to that of the rest of the developing countries. While in GP index Nigeria was consistently outperforming the rest of the developing countries the opposite is the case for the Fraser index except in 1975 (in 1975 the Nigeria’s Fraser index was higher than that for the rest of the developing countries). This goes to show that the level of enforcement of IPRs in Nigeria is not very good compared to the rest of the developing countries and therefore needs serious improvement. Another lesson learnt from the above analysis is that using the GP index alone will not give the true reflection of IPRs enforcement in developing countries, which will in turn negatively affect the result that will be obtained by this research if the GP index was to be used. Combining both indexes will therefore, yield a much better reflection of the IPRs activities in developing countries including the robustness of existing laws and how effectively these laws are implemented.

### **Data description, methodology and model specification**

The empirical analysis as carried out in this research is based on a panel of data set of 81 developing countries for the period 1975 to 2010. This empirical analysis is an improvement on previous IPRs and economic growth literatures by Chen & Puttitanum (2005), Falvey et al. (2006) and Adams (2010). The first section of this chapter describes the data and how the data were obtained and the second section is on the model specification. The second section specifically goes into detail of how the new patent index used in the empirically analysis was obtained. This new patent index is different from the patent index (or indeed IPRs proxies) used in previous IPRs and economic growth literatures. It is an adaption of the patent index derived from combining the Ginarte and Park index and the Fraser index as originally proposed by Hu & Png (2010).

### **Data description and methodology**

This section of the paper describes the various variables and how the data for each variable was obtained. It also presents the statistical summary of the data used in this research and the graphical relationships between some of the key variables used in this research.

The variable IPRs, which represents the level of intellectual property rights protection (is a combination of the Ginarte and Park (GP) index and the Fraser index) is derived by multiplying the GP and Fraser indices obtained for each country in every time period, see above for detailed description of the IPRs index and how the new index was obtained.

To measure the level of economic growth, the per capita Gross Domestic Product (denoted by GDPCAP) is used. The GDP is the sum of the gross values added by all resident producers in the economy plus any products taxes and minus any subsidies not captured in the value of the products. It should also be noted that the GDP calculation did not take into consideration deductions for depreciation of fabricated assets or for depletion and degradation of internal resources. Data on GDPCAP was obtained from the website of the United Nation's data division ([www.data.un.org](http://www.data.un.org)). GDPCAP as measured in this research is based on current US dollar prices and is obtained by dividing the annual GDP by mid-year population of each country.

The variable for education, EDU, measures the gross enrolment ratio into tertiary institutions. It is measured using the percentage of the total enrolment with respect to the total school age population at the tertiary label. It takes into consideration total enrolment in tertiary education including first and second stages of tertiary education (that is the international standard classification of education (ISCED) stages 5 and 6 respectively) irrespective of age. The gross enrolment ratio is therefore obtained by expressing the total enrolment in tertiary education (ISCED 5 and 6) as a percentage of the total population of students that have completed secondary education within the last five years. The data for education was obtained from the World Bank website ([www.worldbank.org](http://www.worldbank.org)) and from the UNESCO website ([www.unesco.org](http://www.unesco.org)).

The variable TRADE is used to denote the degree of trade openness within a particular country. It is the total volume of imports and exports of goods and services measured as a percentage of GDP. According to the World Bank, the volume of imported goods and services represent the value of all goods and other market services received from the rest of the world. This include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services such as communication, construction, financial, information, business, personal, and government services and exclude compensation of employees and investment income and transfer payments. In like manner,



the volume of exported goods and services represent the value of all goods and other market services provided to the rest of the world<sup>32</sup>.

The variable POP is the estimate of the total population for each country. Although this variable was not directly used in the regression, it was used to standardize some variables (FDI, EDU, TRADE, and IN) to correct for any population bias. This correction is necessary as some countries have large population size that can influence the size of some of the variables and consequently the result of the regression. The total population for each country was obtained from the World Bank website<sup>33</sup>.

The level of innovation in any country can be measured through its research and development expenditure (which is a measure of the input on innovation) or through the number of patent applications/grants (which is a measure of inventive outputs) (Chen & Puttitanun, 2005). For this research the number of patents filed by residents of developing countries in the US patent and trademark office was used as proxy for the level of innovation in those countries and is represented as IN. The decision to use patents filed in US by developing country residents was largely influenced by the fact that it is a more straightforward measure and the data is more readily available compared to the data on research and development expenditure for developing countries<sup>34</sup>. The data for this variable was obtained from the United States Patent and Trademark Office. Data from 1980 to 2005 consists of utility patents (that is “patents for invention”), design patents, plant patents, reissue patents, statutory invention registrations, defensive applications granted by the US Patent and Trademark Office. Whereas the data for 1970 and 1975 consists only patents for invention granted during the period. This is due to the fact that only patents for invention data were available prior to 1977<sup>35</sup>.

The data on Foreign Direct Investment, denoted as FDI, was obtained from the World Bank website ([www.worldbank.org](http://www.worldbank.org)). It is the net inflows of investment into a country (in this case the developing countries in the data set) other than the host country of the investor with the intention to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise. It is the aggregate sum of the equity capital, reinvestment of earnings, other long term capital, and short-term capital as shown in the balance of payments. The FDI data as measured here are in current US dollars.

A dummy variable for World Trade Organization membership represented as WTO was included. Prior to 1995 nations that were interested in multi-lateral trading signed the General Agreement on Tariffs and Trade (GATT) and were referred to as the “GATT contracting parties”. However from January 1, 1995 the GATT as an organization was replaced by the World Trade Organization (WTO). And countries including those that had earlier signed the GATT were expected to sign the WTO agreement or more like become member states of the WTO. The WTO is saddled with the responsibility of basically

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<sup>32</sup> The measurement of export follows the same convention as imports.

<sup>33</sup> It was recorded that the World Bank consulted certain organizations to obtain the resulting population figures. Some of these organizations include: United Nations Population Division; United Nations Statistical Division; Census reports and other statistical publications from national statistical offices.

<sup>34</sup> Note that the degree of research and development was not used as a measure of the level of innovation due to lack of availability of data. For instance as a measure of the level of innovation per country one could use the percentage of expenditure on R&D per GDP as a measure but many developing countries (especially Sub-Saharan Africa Countries) lack the data for this including Nigeria. Nigeria for example, as reported by the World Bank and UNESCO, only has record for 2007 for R&D expenditure (percentage of GDP). Furthermore the US patent office was used because it has data for patent application filed and granted from the 1960s till date. This is unlike the data obtainable from say European Patent Office that dates only from 2004. The data obtained from the US Patent Office is more consistent with the period of under review in this research.

<sup>35</sup> 1980 to 2005 data can be found at: [www.uspto.gov/web/offices/ac/ido/oeip/taf/cst\\_allh.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_allh.htm).  
1970 to 1975 data can be found at: [www.uspto.gov/web/offices/ac/ido/oeip/taf/cst\\_utlh.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_utlh.htm)

overseeing and providing fundamental guidelines and rules of trade between nations at a global level. Members of the WTO have some key responsibilities, which includes avoiding the erection of trade barriers such that restricts other members from freely transacting with that nation. In this research countries that signed up for membership of the WTO within one year of the establishment of the WTO get a score of 1 and countries that sign after the one-year period of establishing WTO get a score of 0.

Tables 13 and 14 below provide a statistical summary of the data used for this analysis. Table 13 shows the statistical summary of the data set while table 14 shows the correlations between the various variables. Since one of the major interests in this research is to ascertain the relationship between IPRs and key variables such as innovation and economic growth and vice versa, it is imperative that we plot a simple graph showing the relationship between IPRs and some key variables before we go into the empirical analysis proper. The scatter plots will give us a preliminary view of the relationship between the variables. This will include a revelation of the strength of the relationship, whether it is linear, curved, and positive or negative and so on. The results of the scatter plots will also help determine the most appropriate regression model to use. Figures 17-19 present these graphs. Figure 18 shows that IPRs protection is negatively correlated with innovation. Figure 17 shows that IPRs is positively correlated with FDI inflow. In figure 19 we see that there is no obvious relationship between innovation and FDI inflow.

Table 13: Statistical Summary of the Secondary Data

Variable	Mean	Std Dev	Minimum	Maximum	N	Median	Upper Quartile	Lower 95% CL for Mean	Upper 95% CL for Mean
<b>IPRS</b>	11.7969 995	7.22928 28	0	37.4	64 8	10.4002 162	16.5167 5	11.2393 401	12.3546 588
<b>GDPCAP</b>	1806.26	2267.57	0	15572.69	64 8	952.435 8788	2304.22	1631.34	1981.18
<b>EDU</b>	13.0727 252	15.3018 69	0	79.46975	64 8	6.51872 5	18.6306 9	11.8923 55	14.2530 954
<b>TRADE</b>	63.3597 196	38.1752 714	0	220.4067 89	64 8	57.3553 371	81.0849 311	60.4149 189	66.3045 203
<b>POP</b>	5160981 3.94	1644722 51	576634	1337825 000	64 8	1120301 2.5	3331400 2	3892259 5.74	6429703 2.14
<b>EF</b>	4.88467 59	2.18224 26	0	8	64 8	5.49	6.29	4.71634	5.05301 18
<b>IN</b>	17.3734 568	142.053 4415	0	3303	64 8	0	3	6.41560 22	28.3313 113
<b>INCAP</b>	3.60E- 07	1.09E- 06	0	0.000010 142	64 8	0	1.89E- 07	2.76E- 07	4.44E- 07
<b>FDI</b>	1648498 212	9694116 403	- 37597531 717	1.85081 E+11	64 8	8269606 2.77	5708459 81	9007041 68	2396292 256
<b>FDICAP</b>	39.1522 257	180.875 5103	-3759.74	882.0328 459	64 8	8.10745 23	37.7799 31	25.1996 772	53.1047 743
<b>DIPRS</b>	1.88781 81	3.28048 19	-11.29205	19.65645	64 8	0.91367 5	3.11762 5	1.63476 51	2.14087 1
<b>DGDPCA P</b>	471.780 3126	1053.72	-2963.39	8102.05	64 8	165.279 6985	604.649 1756	390.497 1229	553.063 5023
<b>DGDPCA PSQ</b>	4019271 .03	1479550 8.98	- 36851216 .06	1540735 94	64 8	180353. 9	1940238 .32	2877960 .87	5160581 .19
<b>DEDU</b>	2.41659 25	4.80213 89	-17.08318	36.4559	64 8	0.76693	3.22217	2.04616 05	2.78702 45
<b>DTRADE</b>	4.22912 58	23.8177 784	- 203.8293	186.9406 61	64 8	2.73327 28	12.7625 034	2.39184 72	6.06640 45

			9						
<b>DPOP</b>	4097564 .11	1201022 5.62	-3153000	9808000 0	64 8	1080987 .5	2715970 .5	3171107 .82	5024020 .41
<b>DEFREE</b>	0.58875	1.61793 49	-6.39	7.22	64 8	0.145	0.64	0.46394 42	0.71355 58
<b>DIN</b>	8.73919 75	113.575 6693	-42	2738	64 8	0	1	- 0.02191 13	17.5003 064
<b>DINCAP</b>	5.44E- 08	6.53E- 07	-4.18E-06	7.19E-06	64 8	0	1.45E- 08	3.98E- 09	1.05E- 07
<b>DFDI</b>	8.87085 01	192.668 5198	-4515.78	551.1586 388	64 8	1.59823 71	14.8459 634	- 5.99139 89	23.7330 991

Table 14: Correlation Between the Variables

Correlation  
Analysis

The CORR Procedure

<b>9 Variables:</b>	<b>DIPRS</b>
	<b>DGDPCAP</b>
	<b>DGDPCAPSQ</b>
	<b>DEDU</b>
	<b>DTRADE</b>
	<b>DPOP</b>
	<b>DEFREE</b>
	<b>DINCAP</b>
	<b>DFDI</b>

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
<b>DIPRS</b>	648	1.88782	3.28048	1223	-11.29205	19.65645
<b>DGDPCAP</b>	648	471.78031	1054	305714	-2963	8102
<b>DGDPCAPSQ</b>	648	4019271	14795509	2604487628	-36851216	154073594
<b>DEDU</b>	648	2.41659	4.80214	1566	-17.08318	36.4559
<b>DTRADE</b>	648	4.22913	23.81778	2740	-203.82939	186.94066
<b>DPOP</b>	648	4097564	12010226	2655221545	-3153000	98080000
<b>DEFREE</b>	648	0.58875	1.61793	381.51	-6.39	7.22
<b>DINCAP</b>	648	5.44E-08	6.53E-07	0.0000352	-4.18E-06	7.19E-06
<b>DFDI</b>	648	8.87085	192.66852	5748	-4516	551.15864

Pearson Correlation Coefficients, N = 648

Prob >  r  under H0: Rho=0								
	<b>DIPRS</b>	<b>DGDPCA P</b>	<b>DGDPCAPS Q</b>	<b>DEDU</b>	<b>DTRAD E</b>	<b>DPOP</b>	<b>DEFRE E</b>	<b>DINCA P</b>
<b>DIPRS</b>	1	0.0549	0.00682	0.08805	0.042	0.01951	0.47948	- 0.03071
		0.1627	0.8624	0.025	0.2857	0.6201	<.0001	0.4351
<b>DGDPCAP</b>	0.0549	1	0.89275	0.34924	-0.11864	- 0.04913	-0.00011	0.15496
	0.1627		<.0001	<.0001	0.0025	0.2117	0.9977	<.0001
<b>DGDPCAPS Q</b>	0.00682	0.89275	1	0.33398	-0.13224	- 0.05058	-0.03841	0.23383

	0.8624	<.0001		<.0001	0.0007	0.1984	0.3289	<.0001
<b>DEDU</b>	0.08805	0.34924	0.33398	1	-0.01275	-0.03327	-0.05724	0.11441
	0.025	<.0001	<.0001		0.746	0.3979	0.1455	0.0035
<b>DTRADE</b>	0.042	-0.11864	-0.13224	-0.01275	1	0.00615	0.05729	-0.09413
	0.2857	0.0025	0.0007	0.746		0.8757	0.1452	0.0165
<b>DPOP</b>	0.01951	-0.04913	-0.05058	-0.03327	0.00615	1	-0.0434	0.01112
	0.6201	0.2117	0.1984	0.3979	0.8757		0.2699	0.7775
<b>DEFREE</b>	0.47948	-0.00011	-0.03841	-0.05724	0.05729	-0.0434	1	0.00086
	<.0001	0.9977	0.3289	0.1455	0.1452	0.2699		0.9826
<b>DINCAP</b>	-0.03071	0.15496	0.23383	0.11441	-0.09413	0.01112	0.00086	1
	0.4351	<.0001	<.0001	0.0035	0.0165	0.7775	0.9826	
<b>DFDI</b>	0.11619	0.0784	0.00391	0.09564	-0.0606	-0.00221	0.03529	-0.32575
	0.0031	0.046	0.9208	0.0149	0.1233	0.9553	0.3698	<.0001

Figure 17: DFDI Versus DIPRS

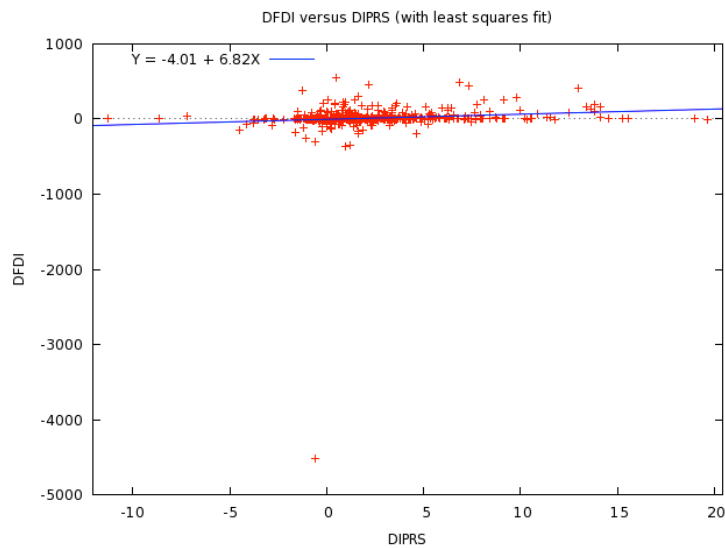


Figure 18: DINCAP Versus DIPRS

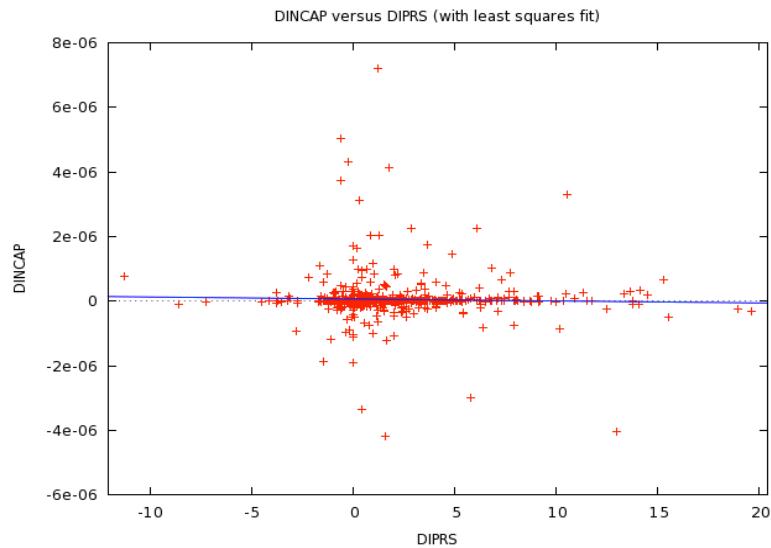
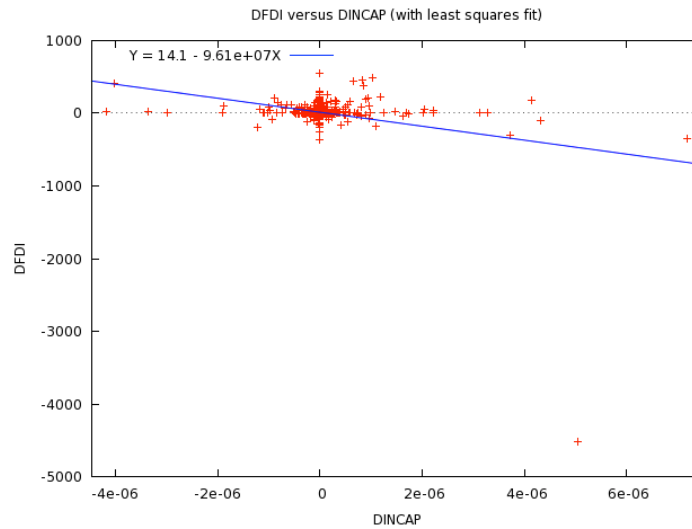


Figure 19: DFDI Versus DINCAP



**Model specification**

The empirical model in this research is a system of two simultaneous equations. The first is a measure of the level of domestic innovation denoted by IN, and the second is the degree of inflow of foreign direct investment denoted as FDI. The simultaneous equation is expressed as follows:

$$IN = f(IPRs; EDU; TRADE; WTO; FDI; GDPCAP) \dots\dots\dots (1)$$

$$FDI = f(IPRs; EDU; TRADE; WTO; IN; GDPCAP) \dots\dots\dots (2)$$

Economic related variables such as GDPCAP, trade volume, and FDI have been found to possess non-stationary properties over time (Iordanova, 2009). This implies that statistical parameters such as the mean and variance of such data will keep changing over time. If these sorts of data are used in their raw forms they will pose some problems analyzing statistically. It is therefore, imperative that such data be transformed such that the ensuing key statistical parameters yield constant results; this is referred to as stationarizing. To ensure that the means of the various variables are constant over time the first difference of the variables are taken except for WTO that is a dummy variable. Taking the first difference will help avoid any issues that may arise due to the continuous changing of the mean and standard deviation of the variables over time. The first difference of a time series is the series of changes from one period to the next (that is the change between period t-1 and period t). For instance if Z(t) denotes the value of the time series for the variable Z at period t, then the first difference of Z at period t is equal to Z(t)-Z(t-1). Generally speaking, the first difference of Z can be represented as DIFF(Z), however for the purpose of this research the first difference will simply be represented as DZ. One notable advantage of the first difference approach is that it helps to eliminate unobserved heterogeneity (Meghir & Pistaferri, 2004). In as much as taking the first difference will help take care of the problem of missing variables it can also remove any time-invariant variables from the model (Wooldridge, 2002). The above equations 1-2 can be re-expressed taking into cognizance the transformation using first difference as:

$$DIN = f(DIPRs; DEDU; DTRADE; WTO; DFDI, DGDPCAP). \dots\dots\dots (3)$$

$$DFDI = f(DIPRs; DEDU; DTRADE; WTO; DIN; DGDPCAP). \dots\dots\dots (4)$$

**Equation 1 has IN on the left hand side and IPRs, EDU, TRADE, WTO, FDI AND GDPCAP on the right hand side**

Equation 1 has IN (or DIN if we refer to equation 3: note that hereafter, the various variables and their differenced forms will be used interchangeably.

Innovation is arguably one of the most important steps to be taken by any nation that hopes to achieve long-term economic growth. Tellis, Prabhu & Chardy (2009) noted that radical innovation is an important component of the growth, success and wealth of firms and nations. Nations and firms especially in emerging markets such as China, Taiwan and India have come to realize the importance of innovation in their long-term development (Atuahene-Gima, 2005; Im et al., 2003; and *The Economist*, 2004). These nations have understood the strategic importance of innovation and have therefore put in place policies that will continue to help them promote innovation. For example they have ensured that the right drivers of innovation (such as R&D spending, scientific/research workforce and patent applications and grants) are aggressively promoted (Archibugi & Coco, 2005; Furman, Porter & Stern, 2002). In addition, they have ensured that the outputs of innovation, such as commercialization and financial rewards to innovators (Godin, 2002) are established. This section will therefore consider the impact the various variables on the right hand side of equation 1 have on innovation.

Ordinarily it should be expected that IPRs should have a significant and positive effect on the level of innovation. More specifically, we expect to observe that higher protection for intellectual property will encourage individuals and firms to develop new commercializable inventions. Branstetter & Saggi (2009) argued that increasing IPRs protection in developing countries brings about increase in the rate of innovation. However, some other schools of thought argue otherwise suggesting that it all depends on the level of development of the country in question (Horii & Iwaisako, 2007; and Falvey et al., 2006). The latter group argues that in a country where the level of development is still poor tightening IPRs protection may be counterproductive to the overall growth of the country. They went further to assert that tightening of IPRs protection is only effective as a driver of growth when a country has attained significant level of development. Pollock (2008) revealed that a significant amount of innovation can still take place without the presence of intellectual property protection and that the overall welfare under such scenario may indeed be higher than with IPRs protection. Park (2008) argued that stronger IPRs protection have an insignificant effect on research and development and a negative effect on patenting. So the expected impact of IPRs protection on innovation still remains a subject of global debate depending on the level of economic development of the country or group of countries in question. For developing countries therefore, it is expected that increase in the level of IPRs protection will negatively impact the level of innovation. This will be particularly so as most developing countries are still technologically disadvantaged and quite a number of them thrive more on imitation.

It is expected that education should have both a positive and significant effect on innovation, as a more educated society will be better positioned to understand and take advantage of innovative ideas. Larocque (2008) suggest that education especially higher education spurs economic growth by causing workers to be more productive and this invariably causes workers to be more creative and innovative. This view is supported by Dowrick (2002), Frantzen (2000) and Dowrick & Rogers (2002) who suggest that the more educated the workforce the more they are able to understand and implement technological advances. Arguably, the more technologically advanced a workforce is, the more they can innovate and produce new technologically advanced products that can benefit the society. From the foregoing, we can assert that education is expected to have a positive and significant effect on innovation<sup>36</sup>.

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<sup>36</sup> The more educated the people are the more they will understand matters pertaining to IPRs protection and hence the more they will be willing to innovate knowing that their IPRs will be adequately protected and that they will in turn have the opportunity to reap from their labor. Education should therefore encourage innovative activities and in essence promote the creation of patentable products

The impact of trade openness (TRADE) on innovation can either be positive or negative. Opening your borders widely to all sorts of goods can help provide the much-needed platforms for local firms to learn from and imitate, which in the long run may spur domestic innovation. On the other hand the rapid influx of new technologies could suffocate local firms and leave them with no room to compete other than to leave the market. So the impact of trade openness on local businesses as far as innovation is concern may be positive or negative.

Membership of WTO means that the country is expected to adopt TRIPS and therefore increase their IPRs protection standards. Ordinarily when there is tight IPRs protection people will be more encouraged to innovate as they have more confidence that their IPRs will be adequately protected. But following the argument earlier laid down concerning the relationship between IPRs and innovation especially as it concerns developing countries it will therefore be expected that the relationship between innovation and WTO may not be that straight forward. And will have a lot to do with the economic standing of the country.

Cheung & Lin (2004) observed in their research that FDI inflow is positively correlated with the number of domestic patent application in the host country. They concluded that the host country could benefit from FDI through certain ways. Local firms can porch some workers that have acquired certain skills from foreign firms. And these workers will in turn provide their know-how to the local firms. Secondly, the presence of FDI, specifically foreign technologies, can inspire local innovators to develop new and advanced products and services. And furthermore, by way of technology transfer through training and other means local suppliers can acquire new technologies. All these knowledge spillover methods mentioned above will help improve the innovation capability of local firms. However, it is worthy of note that the ability of the host country to absorb new technologies is important in order for FDI to have any real impact on the rate and quality of innovation (Toulaboe, Terry & Johansen, 2009). This paper therefore, expects a positive and but not necessarily a significant correlation between FDI and innovation.

Arocena & Sutz (2000) and Cassiolato et al, (2003) observed that there is significant difference in the nature of innovation that takes place in developing countries compared to developed countries. One may therefore, argue that the economic status of a country has substantial influence on the rate and quality of innovation that takes place in that country. Szogs, Cummings, & Chaminade, (2009) in fact suggested that poor socio-economic infrastructure; weak institutional framework and low level of interactions between key institutions are prevalent in developing countries. They argued that this is as a result of the state of the economy and that these subsequently have adverse effect on the quality and quantity of innovation that takes place in developing countries. This research therefore, expects that the economic standing of a country will have a positive and significant influence on innovative activities in the country. It is also worthy of mention that previous researches have pointed out a reverse relationship between innovation and economic growth. Some authors argue that economic growth is spurred by the amount of innovation that takes place within a country. The OECD report (2007) is of the view that a nation's capability to encourage innovative activities and also successfully bring these innovations to the market will determine how well the nation will fair economically and be competitive globally. It further asserts that the importance of innovation as a major economic driving force has become more obvious to policy markers. Schaaper (2009) and Zhang et al. (2009) noted that for economic growth to be sustained policy makers need to intensify the role of innovation within the system. Such move will help transform the economy into one that is knowledge based and less dependent upon external markets. This view is corroborated by Musai et al. (2011) who suggest that increase in entrepreneurial activities and increase in innovation will

cause a corresponding increase in gross domestic production. Akinwale et al., (2012) asserted that increasing spending on research and development and invariable innovation can increase economic growth in developing countries (Nigeria was used as case study) but only as far as other factors are taken into consideration. They suggest that for innovation to be effective there must be strong education system, and vibrant linkage between the academia and industries. Kanwar (2006) is also of the opinion that increase in innovation would lead to economic growth in developing countries. However, the works by some other authors suggest that the relationship between innovation and growth may not be that straight forward for developing countries. For instance Horii and Iwaisako (2007) suggested that strengthening IPRs protection in a technologically weak economy (a move that would ordinarily have increased innovation in a technology advanced economy) could lower growth. This is particularly so, as the rate of imitation would be lowered by the tightening of IPRs protection.

**Equation 2 has FDI on the left hand side and IPRs, EDU, TRADE, WTO, IN and GDPCAP on the right hand side.**

Currently, the inflow of FDI is seen as a critical means of achieving quicker and greater economic growth especially in developing economies (Loungani & Razin, 2001; UNCTAD, 2004; and OECD, 2008). This equation assesses the various variables that have possible impact on the inflow of FDI into developing countries. It is noteworthy that FDI has critical benefits to any economy and also has some noticeable side effects on host countries (Chakraborty & Basu, 2002; OECD, 2002; Wei, 2005; and Rajan, 2005). Some of the obvious positives of FDI to the host country include; gains from technology spillovers which in turn cause an increase in knowledge acquisition by the locals, exposure to international trade; creates competition in the local market; causes growth amongst local businesses and in aggregate improves the economy. However, in the midst of all these positives there exists some costs which the host country has to contend with. Some of these costs include: balance of trade payments as a result of repatriation of profit by the foreign company; local companies may suffer as a result of high influx of FDI and this will hinder their growth especially when the foreign firms are not interested in working with local firms; some technologies brought in by the foreign firms may negatively impact on the environment; the host country may not effectively benefit from the technologies brought in by the foreign firms and in some extreme cases FDI can lead to host country losing its sovereignty. Let us put all of these into perspective using Nigeria as an example. Telecommunication companies such as MTN, Etisalat, and Airtel have made huge investments in Nigeria, created a lot of jobs, developed some infrastructure, and delivered cutting-edge telecommunications services. However, due to the fact that these companies are not 'indigenous' companies, they end-up sending large amount of their profit abroad, thereby grossly impacting on Nigeria's trade balance. Likewise this applies to large multinational oil companies such as Shell, Agip, Chevron, Total and Mobil, who also have made huge investments in Nigeria. On the overall, these companies have helped a great deal to develop Nigeria by bringing-in much needed developmental funds, creating jobs, introducing new technologies, and helping in human capital development. However, some of their activities have negative effect on Nigeria's environment (through oil spill and gas flaring) and economy (negative trade balances). FDI inflow into developing countries appears to have significant effect, both in terms of costs and benefits. Since most developing countries are heavily reliant on FDI for economic growth, policy makers in these countries should therefore evaluate the merits of FDIs using rational cost-benefit analysis. For example countries can encourage FDI into critical areas of their economy such infrastructure, education, and healthcare, while at the same time discouraging or closely monitoring investment in area mostly extractive by nature, such as mining, and oil production.



It is expected that foreign investors will be more confident to invest in countries with strong IPRs protection, as they know that the intellectual component of their investment will receive more protection. It is therefore expected that IPRs will have both significant and positive effect on FDI. Haley (2000) argued that multinational corporations are more comfortable to invest in environments where they are sure that their IPRs will receive adequate protection. Others corroborate this view such as Adams (2010) and Yu (2007). Although some other researchers such as Abbott (2005) and Chow (2007) argue that countries can still receive substantial FDI with weak IPRs structure. In as much as there are arguments for and against it can generally be asserted that stronger IPRs should positively and significantly influence FDI.

Education should have positive and significant effect on FDI. Companies will feel more confident investing in economies with adequately educated work force that can be employed to work in their firms. Firms will not ordinarily want to invest in societies where it will be difficult to find the requisite manpower to fill certain positions (Business Monitor International Report, 2012). Although some may argue that the firms will not mind going to hire individuals with the right skill set and know-how from foreign countries. In as much as this may be true, cost is a factor most employers take into consideration when hiring. The argument in support of a positive relationship between education and FDI may however, not be as straightforward as it looks. Zhang and Markusen (1999) suggested that there exists an inverse U-shaped relationship between human capital and FDI implying that countries with both low income and low human capital will find it very difficult to attract FDI. This view was partly corroborated by Akin & Vlad (2011) who argued that both rich countries with high human capital and poor countries with low human capital demonstrate inverse correlation between FDI and human capital. They went further to assert that the same is not the case for middle-income and upper middle-income countries. These countries show a positive relationship between human capital and FDI. If the argument by Zhang and Markusen (1999) and Akin & Vlad (2011) is adopted one can say that for developing countries with low income and low wage the relationship between education and FDI will be an inverse correlation and for developing countries with middle income the relationship will be positive. However, this paper is of the view that developing countries should generally show a positive and significant relationship between education and FDI.

The degree of trade openness should be positively correlated with FDI because such openness contributes to attracting investors in the first place. However it may not be significant as it may not be a key factor in persuading investors to come in to a local market. Adams (2010) asserts that the degree of trade openness is critical to the amount of FDI a nation can attract. Other researchers corroborate this view some of which include Martens (2008), Gosh (2007) and Liagovas & Skandalis (2012). So one can say based on the foregoing that it should be expected that the trade openness will not only be positively correlated with FDI but also a significant factor.

Membership in WTO as mentioned earlier implies that the country has adopted the TRIPS agreement, which in turn means better respect for IPRs protection. As pointed out by Maskus (2000c) strengthening of IPRs is often a pre-requisite for developing countries to be allowed entrance into WTO. This like IPRs protection should be positively correlated with FDI and should be a significant factor in FDI decisions. Adams (2010) noted that the impact of IPRs on FDI for instance after the TRIPS agreement is signed by a nation is much higher than its pre-TRIPS era. One can then deduce that membership of the WTO will impact positively on FDI inflow for a given country.

Innovation is expected to be positively correlated with FDI but may not necessarily be a strong factor to influence FDI decisions into foreign markets especially in developing countries. Firms will like to make FDI available to countries that show tangible innovative

abilities as these innovative ideas will complement the technologies been brought in by the foreign firms. The foreign firms can leverage these technologies to improve the scope and quality of their services in the local market. In essence one can argue that where there is innovation the profit that is derivable from FDI by foreign firms will actually increase. So one can expect that innovation will encourage FDI inflow at least to some extent.

GDP will most probably be positively correlated with FDI but may not necessarily be a major factor in FDI decision. Some investors may prefer to invest in economies that show strong growth potential while some may rather want to take advantage of the opportunities present in weak economies. Ghose (2004) is of the view that FDI flows from developed countries to developing countries; it did not however state the actual impact changes in GDPCAP will have on FDI inflow into developing countries. On the contrary Mottaleb (2004) asserts that FDI flows to countries with higher GDPCAP and higher GDP growth rate. This paper will align with the views of Mottaleb (2004) that FDI flows more to countries with higher GDP and less to countries with low growth of which most developing countries fall into unfortunately. This basically implies that GDPCAP will be positively related to FDI but may not necessarily be significant.

### **Methodologies and description of primary data**

This section of the paper will describe the sample selection criteria and the method used for the data gathering. It will also describe the interview procedures for the qualitative aspect.

### **Method**

This portion of this research entails the collation of primary quantitative and qualitative data with the aim of further exploring and understanding the earlier secondary quantitative analysis carried out. The primary quantitative data will be obtained by sending out electronic questionnaires to respondents (see appendix D for a list of the questions used in the gathering of the primary quantitative data). The data will be subsequently analyzed using basic statistical tools found in Microsoft excel. The primary qualitative data will be used to bring deeper insight and understanding to the primary quantitative data (King & Dennis, 2006). The aim of using this mixed method approach to analyze the primary data is to get a deeper grasp of how IPRs protection, influences innovation and FDI inflow in Nigeria. The questions used for the interview are basically built around the defined objectives of this research. Interviews were conducted so that one can obtain clearer understanding of the feedback obtained during the primary quantitative process.

### **Sample**

The samples for both the quantitative and qualitative data for the primary research will be carefully selected to ensure they adequately represent the entire population. It is critical that the samples are purposefully selected. Even though the sample size for qualitative research is usually small, it is important that the size is carefully selected if the researcher has plans of deriving the right feedback from the respondents (Onwuegbuzie & Leech, 2005). The quality of the sample selected is very critical for any meaningful research project. The same applies to quantitative research. It is important to get feedback from respondents who really understand the subject matter. This research will ensure that the right people are selected for both the qualitative and quantitative primary research.

### **Procedure**

For the quantitative primary research a preliminary informal assessment was first conducted on the degree of awareness and understanding of the subject matter, that is the

relationship between IPRs and FDI; and IPRs and innovation. This initial informal assessment helped to shape how the questionnaire was eventually designed and how it was administered. Based on the feedback obtained from the initial informal assessment it was observed that quite a good number of Nigerians lack proper understanding of the subject of intellectual property and its protection. The questionnaire was therefore, kept as simple as possible so that at least fairly reasonable responses can be obtained from the respondents. The questionnaire was designed with the help of an online survey design website, precisely [www.surveymonkey.com](http://www.surveymonkey.com). The questionnaire was distributed electronically via emails, Skype, yahoo messenger, twitter and indeed via other social and electronic media. Respondents return their responses electronically and these responses were collated by [www.surveymonkey.com](http://www.surveymonkey.com).

For the qualitative research few competent individuals were selected and in-depth discussions held with them. The individuals selected include scientists, engineers, senior public sector employees and businessmen. The individuals interviewed were basically people involved one way or the other in decision-making and policy formulation in their organizations. The list include past governor of one of the states in Nigeria, a former minister of the Federal Republic of Nigeria, a former Permanent Secretary of the Federal Ministry of Science and Technology, a serving and two former Director Generals of Government Agencies within the Ministry of Science and Technology of Nigeria, a professor with research interest in economics and innovation systems in Nigeria, a scientist with research interest in IPRs and innovation in Nigeria, a senior executive in a telecommunication company, a director in a government agency, two chief executive in information technology companies, an IPRs lawyer and business owner, a medical doctor and former commissioner of health in one of the states in Nigeria, an information technology expert, a senior bank executive, and a business analyst.

### **Interviews**

The interviews were conducted in a semi-structured manner using the following methods; face-to-face interviews, telephone interviews and electronic (email) interviews. It is worthy of mention that electronic interviewing as a method of qualitative research is growing in popularity (Curasi, 2001; Meho, 2006). Each of the respondents used any one or a combination of the above-mentioned methods depending on convenience and availability. The interviewees were first informed via emails and text messages (only two of the participants were informed face-to-face) about the intention to engage them in a formal in-depth interview. The emails and text messages contained brief explanation of the research objectives. A total of 20 people were contacted but only 17 gave a positive response in terms of being available for in-depth interview. After getting positive feedback from the 17 respondents, 15 of them were further followed up with a telephone call to enquire as to their preferred interview option. The 2 participants that were initially informed through face-to-face chose to be interviewed via email and then also face-to-face. Out of the 15 that were followed up with telephone calls; 9 chose email interviews' 2 chose telephone interviews and 4 opted for face-to-face interviews.

Irrespective of the method(s) selected by the respondents, the interview was structured in such a way that it gets the most out of the respondents. A guide was developed for the interviews. The guide helped to ensure that there is consistency in the questions asked and that the questions are delivered in manners that help generate the right data from the respondents. The interview guide helped to make the entire interview process more methodical and comprehensive (Patton, 2002). The questions used for the interview are in line with main objectives of this research. And furthermore, preliminary focused group (this was an interactive session with friends and colleagues in the academia, oil and gas

professionals, information technology experts and business owners) discussions on the subject also helped to sharpen and shape the way the questions were presented during the interview process.

The interviews were conducted over several weeks all in the year 2013. This was basically due to availability of the respondents. It took some time to get a suitable interview dates for the respondents that chose face-to-face interviews. It was much easier to interview those that chose the telephone interview option all though it required calling them more than once. It was particularly very important carrying out follow-up phone calls to the respondents as this helped to clarify their initial responses (Kazmer & Xie, 2008; Meho, 2006). And lastly for the email respondents, the responses did not come immediately. It took several days before most of the email responses started coming in and for a few of them it took several weeks. For most of the email respondents a second follow-up and in some cases a third follow-up email was sent to them. The follow-up emails were mainly further questions with the aim of further getting insights into their views. Although the questions spelt out in the objectives of this research were used as a guide in each of the interview methods, this guide mainly served as a platform for more in-depth interview. The phone interviews lasted between 20-45 minutes while the face-to-face interviews lasted between 60-120 minutes. Most of the respondents in all the interview methods used, expressed eagerness to go deeper and be more comprehensive during the interview sessions. Although this was more pronounced in the face-to-face interviews and the telephone interviews. Even though 5 of the email respondents were quite eager to express their views on the subject. This was evidenced by the length of their responses and the number of follow-up emails that they responded to.

## Chapter five: Data analysis and statistical results

The analysis is in two parts. The first part is the analysis of the secondary data. The secondary data is obtained from various sources including the World Bank, United Nations, and United Nations Organization for Education, Science and Culture (UNESCO), Economic Freedom index; Ginarte and Park Index, among others. And the second part analyses the primary data obtained from questionnaire feedbacks and interview results.

The secondary data is analyzed using seemingly unrelated regression (SUR) under which there are three scenarios. In scenario 1 the entire data set was analyzed using seemingly unrelated regression, in scenario 2 only the data set above the mean Gross Domestic Product per capita (GDPCAP) was considered and for scenario 3 only the data set for GDPCAP below the mean was considered. The mean GDPCAP is as obtained and shown in table 4G above which is 1806.26. As an additional measure the fixed effect panel data regression model was used to analyze the same sets of data under the same scenarios. The fixed effects regression model is basically an extension of the multiple classical linear regression model. The fixed effect method is particularly useful when it is expected that the averages of the dependent variables in a given data set, as is likely in this instance, will vary for each cross-section unit or each time period (Borenstein, Hedges, Higgins, & Rothstein 2009). The data set was separated into three groups (the complete data set, data set with GDPCAP above average and data set with GDPCAP below average) for ease of analysis. This is particularly useful in understanding how different countries depending on economic status respond to changes in Intellectual Property Rights (IPRs) protection, and how the rate of innovation (represented by IN) and Foreign Direct Investment (FDI) inflow are also affected. And these three different scenarios, representing three different income levels, will be compared against one another in terms of how IPRs protection affects the rate of innovation and FDI inflow into different countries.

### Analysis of secondary data

#### Using seemingly unrelated regression

##### Scenario 1: using the full data set

The results for equation 1 are reported in table 15, and the results for equation 2 are reported in table 16. All variables are presented as first difference of the original variables except for WTO (which is a dummy variable representing date a country became a member of the World Trade Organization). All first differenced variables are represented with a 'D' in front of the original variable. Thus GDPCAP will become DGDPCAP, FDI becomes DFDI, IN becomes DIN, IPRs becomes DIPRs, EDU (a variable that measures the gross enrolment ratio into tertiary institutions) becomes DEDU and lastly TRADE (a variable that denotes the degree of trade openness within a particular country) becomes DTRADE<sup>37</sup>. All the estimation done in this research executed using Gretl statistical software. The equations were re-structured to suit the command structure of Gretl.

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<sup>37</sup> Initially EFREE (representing economic freedom) was used as a variable in the simultaneous equation but the resultant output reported collinearity. This was basically due to the fact that EFREE was already a major component in determining the new IPRs index. So to avoid this, the simultaneous equation was carried out dropping the EFREE variable.

Table 15: SUR Output: Dependent Variable DIN

Equation 1: SUR, using observations 1-648				
Dependent variable: DINCAP				
	Coefficient	std. error	t-ratio	p-value
-----				
DIPRs	2.58531e-09	7.41225e-09	0.3488	0.7274
DEDU	1.50457e-08	5.21238e-09	2.887	0.0040 ***
DTRADE	-3.18159e-09	9.88057e-10	-3.220	0.0013 ***
WTO	3.11143e-08	4.30221e-08	0.7232	0.4698
DGDPCAP	8.60485e-11	2.40820e-11	3.573	0.0004 ***
DFDI	-2.10870e-09	1.16947e-10	-18.03	4.09e-59 ***
Mean dependent var	5.44e-08	S.D. dependent var	6.53e-07	
Sum squared resid	2.52e-10	S.E. of regression	6.24e-07	

From the result represented in table 15 above it can be seen that the level of education (p-value 0.0040), degree of trade openness (p-value 0.0013, howbeit with a negative coefficient), economic standing (p-value 0.0004) and FDI (p-value 4.09e-59, howbeit with a negative coefficient) were all found to be significant with respect to innovation. And these variables as can be seen from the table above are strongly significant as they all have very small p-values. The result however, revealed that the degree of IPRs protection, degree of economic freedom and membership of WTO have no influence on the level of innovation in developing countries.

Table 16: SUR Output: Dependent Variables DFDI

Equation system, Seemingly Unrelated Regressions				
Equation 2: SUR, using observations 1-648				
Dependent variable: DFDI				
	Coefficient	std. error	t-ratio	p-value
-----				
DIPRs	4.70164	2.18944	2.147	0.0321 **
DEDU	4.54722	1.54598	2.941	0.0034 ***
DTRADE	-0.909890	0.293360	-3.102	0.0020 ***
WTO	-6.94472	12.7671	-0.5440	0.5867
DGDPCAP	0.0208447	0.00717489	2.905	0.0038 ***
DIN	-1.85619e+08	1.02943e+07	-18.03	4.09e-59 ***
Mean dependent var	8.870850	S.D. dependent var	192.6685	
Sum squared resid	22223378	S.E. of regression	185.1900	
Cross-equation VCV for residuals				
(Correlations above the diagonal)				
3.8961e-13	(0.801)			
9.2586e-05	34295.			
Log determinant = -19.1568				
Breusch-Pagan test for diagonal covariance matrix:				
Chi-square(1) = 415.725 [0.0000]				

The results as seen in table 16 for equation 2 reveal that the following variables: IPRs protection (p-value 0.0321), level of education (p-value 0.0034), trade openness (p-value 0.002, howbeit with a negative coefficient), economic standing (p-value 0.004), and the rate of innovation (p-value 4.09e-59 and a negative coefficient) have significant influence on the amount of FDI inflow into developing countries. Among all the variables that are significant only the degree of IPRs protection was found to be weakly significant, significant only at the 10 percent significant level. Degree of economic freedom and membership of WTO were found to have no significance on the amount of FDI inflow into developing countries.

When fixed effect model was used to analyze equation 1 using the same data as above all the variables were found to be significant at least at the 10 percent significant level (see appendix E for full results of the regression using the fixed effect panel model) except for DIPRs. Trade openness and the amount of FDI inflow were seen to be strongly significant with p-values less than 1 percent. The level of education and membership of WTO were both weakly significant at the 10 percent significance level.

When equation 2 with the same data set as above was analyzed using fixed effect panel model the following variables were found to be significant: the level of IPRs protection, level of education, trade openness, economic status and the level of innovation. The degree of IPRs protection, the level of education, and the level of innovation were found to be strongly significant. Membership of WTO has no significance at all.

**Scenario 2 using data set for gdpicap above the mean (1806.26)**

The outputs for the SUR analysis using data set for GDPCAP above the mean (that is GDPCAP above 1806.26) are reported in tables; 17, and 18 below.

Table 17: SUR Output: Dependent Variable DIN : Using Data Set for GDPCAP Above the Mean

Equation system, Seemingly Unrelated Regressions					
Equation 1: SUR, using observations 1-220					
Dependent variable: DIN					
	Coefficient	std. error	t-ratio	p-value	
-----					
DIPRs	-3.20041e-10	1.52192e-08	-0.02103	0.9832	
DEDU	2.05668e-08	1.05674e-08	1.946	0.0529	*
DTRADE	-5.60025e-09	2.12278e-09	-2.638	0.0089	***
WTO	8.75867e-08	1.15360e-07	0.7592	0.4485	
DGDPCAP	5.84893e-11	4.25716e-11	1.374	0.1709	
DFDI	-2.10972e-09	1.85312e-10	-11.38	8.70e-24	***
Mean dependent var	1.54e-07	S.D. dependent var	1.05e-06		
Sum squared resid	2.15e-10	S.E. of regression	9.90e-07		

When the data is separated into developing countries with above average GDP and below average GDP, the ensuring results are found to be different. Some variables that were previously found to be significant became insignificant.

When the above average data is analyzed only the level of education (p-value 0.0529), trade openness (p-value 0.0089, howbeit with a negative coefficient) and FDI (p-value 8.70e-24 and a negative coefficient) were found to be significant as far as the rate of innovation is concern. However, unlike when the full data was analyzed education was found to be weakly significant. And furthermore, the economic standing of the country was found to be of no

relevance to the degree of innovation. Also the extent of IPRs protection, level of economic freedom, membership of WTO still remained insignificant with respect to innovation.

Table 18: SUR Output: Dependent Variable DFDI: Using Data Set for GDPCAP Above the Mean

Equation 2: SUR, using observations 1-220						
Dependent variable: DFDI						
	Coefficient	std. error	t-ratio	p-value		
-----						
DIPRs	5.71797	4.76774	1.199	0.2317		
DEDU	7.16229	3.31627	2.160	0.0319	**	
DTRADE	-1.70681	0.668779	-2.552	0.0114	**	
WTO	-11.3998	36.3493	-0.3136	0.7541		
DGDPCAP	0.0164969	0.0134097	1.230	0.2200		
DIN	-2.08856e+08	1.83453e+07	-11.38	8.70e-24	***	
Mean dependent var	18.92840	S.D. dependent var	328.7277			
Sum squared resid	21329529	S.E. of regression	311.3718			
Cross-equation VCV for residuals (Correlations above the diagonal)						
	9.7935e-13	(0.833)				
	0.00025682	96952.				
log determinant = -17.3562						
Breusch-Pagan test for diagonal covariance matrix: Chi-square(1) = 152.824 [0.0000]						

When the second equation was analyzed only the level of education (p-value 0.0319), trade openness (p-value 0.0114 and a negative coefficient) and the level of innovation (p-value 8.70e-24 and negative coefficient) were found to have any significant influence on FDI inflow. Economic standing of the country and the level of IPRs protection did not have any significant effect on the amount of FDI inflow. Also the membership of WTO still remains insignificant.

When the fixed effect panel model was used to analyze equation 1 for the above average data only the degree of trade openness, membership of WTO and level of FDI inflow were found to have significant influence on the rate of innovation. While FDI and trade openness were found to be strongly significant, membership of WTO was recorded to be moderately significant. The other remaining variables were all insignificant.

When equation 2 was analyzed using the same method and data as above it was discovered that the level of IPRs protection, education, trade openness and level of innovation were seen to have significant influence on FDI inflow. Innovation had very strong influence; level of education was moderately significant while trade openness and degree of IPRs protection were only marginally significant. The remaining variables were reported to have no influence on FDI inflow.

### Scenario 3 Using Data Set for GDPCAP below the Mean (1806.26)

The outputs for the SUR analysis using data set for GDPCAP below the mean (that is GDPCAP below 1806.26) are reported in tables; 19 and 20 below.



Table 19: SUR Output: Dependent Variable DIN: Using Data Set for GDPCAP Below the Mean  
Equation system, Seemingly Unrelated Regressions

Equation 1: SUR, using observations 1-428					
Dependent variable: DIN					
	Coefficient	std. error	t-ratio	p-value	
DIPRs	2.08129e-10	5.43913e-09	0.03827	0.9695	
DEDU	3.01766e-09	3.96184e-09	0.7617	0.4467	
DTRADE	-2.94687e-10	6.69088e-10	-0.4404	0.6599	
WTO	-7.20426e-09	2.48353e-08	-0.2901	0.7719	
DGDPCAP	1.33129e-10	4.73900e-11	2.809	0.0052	***
DFDI	-3.73384e-10	5.01105e-10	-0.7451	0.4566	
Mean dependent var	3.19e-09	S.D. dependent var	2.76e-07		
Sum squared resid	3.19e-11	S.E. of regression	2.73e-07		

When the data was separated into developing countries with GDP below 1806.26 the results obtained when equations 1 and 2 were analyzed were significantly different from previous results. For equation 1 only the economic standing of the country was found to be significant with respect to rate of innovation. These variables were found to be significant only at the 5 percent significance level. The remaining variables were found to be of no significance at all as far as the amount of innovation that goes on within a developing country is concern.

Table 20: SUR Output: Dependent Variable DIN: Comparing the Three Scenarios

Dependent Variable DIN									
	GDPCAP Below Average			GDPCAP Above Average			Full Data Set		
	Coeff.	P-Value		Coeff.	P-Value		Coeff.	P-Value	
DIPRs	-2.08E-10	0.9695		-3.2E-10	0.9932		-2.58E-09	0.7274	
DEDU	3.02E-09	0.4467		2.06E-08	0.0529	*	1.505E-08	0.0040	***
DTRADE	-2.95E-10	0.6599		-5.60E-09	0.0089	***	-3.18E-09	0.0013	***
WTO	-7.20E-09	0.7719		8.76E-08	0.4485		3.11E-08	0.4698	
DGDPCAP	1.33E-10	0.0052	***	5.85E-11	0.1709		8.60E-11	0.0004	***
DFDI	1.33E-10	0.4566		-2.11E-09	8.70E-24	***	-2.11E-09	4.09E-59	***

It is worthy of note that within the period of this study (1975-2010) and among the selected developing countries used Nigeria's GDPCAP was always below the average mark. Its highest GDPCAP was recorded in 2010 as 1431.60. This study chooses to further breakdown the data into countries with GDPCAP above and below the average mark of 1806.26. This will help to analyze and understand how the various variables will affect countries with low GDPCAP especially Nigeria.

From the table 20 above it can be seen that the degree of IPRs protection has no impact on the rate of innovation in developing countries irrespective of the economic standing of developing countries. The level of education tends to have more impact on the degree of innovation as the economic standing of the country improves. This is obvious, as the level of education has no significance when the GDPCAP is below average but becomes significant, howbeit marginal, when the GDPCAP is above average. Trade openness is of

more significance to innovation in developing countries with high GDPCAP as is seen from the table 20 above. Membership of WTO like level of IPRs protection appears to be of no effect irrespective of the economic status of a developing country. Economic growth is seen to be only significant with respect to innovation in countries with low GDPCAP. Although when the full data set was analyzed it was seen to be very significant. FDI inflow is significant in countries with GDPCAP above average.

Table 21: SUR Output: Dependent Variable DFDI: Using Data Set for GDPCAP Below the Mean

Equation 2: SUR, using observations 1-428				
Dependent variable: DFDI				
	Coefficient	std. error	t-ratio	p-value
DIPRs	2.24825	0.513102	4.382	1.49e-05 ***
DEDU	0.0669587	0.382282	0.1752	0.8610
DTRADE	0.000114434	0.0645342	0.001773	0.9986
WTO	-1.21361	2.39437	-0.5069	0.6125
DGDPCAP	0.0140130	0.00456169	3.072	0.0023 ***
DIN	-3.47195e+06	4.65957e+06	-0.7451	0.4566
Mean dependent var	3.701083	S.D. dependent var	27.29571	
Sum squared resid	296677.9	S.E. of regression	26.32817	
Cross-equation VCV for residuals (Correlations above the diagonal)				
	7.4546e-14	(0.054)		
	3.8802e-07	693.17		
Log determinant = -23.689				
Breusch-Pagan test for diagonal covariance matrix: Chi-square (1) = 1.24706 [0.2641]				

When equation 2 was analyzed the rate of protection of IPRs and the economic standing of a country were both found to be the only significant variables with regards to FDI inflow, see table 21 above. And they are both significant at 1 percent significant levels. The other variables were found to be of no consequence to FDI inflow.

When equation 1 of the below average data was analyzed using the fixed effect panel model only economic status was found to be significant at the 10 percent level of significance. All other variables were found to be insignificant. When equation 2 of the same data as above was analyzed using the fixed effect panel model only degree of IPRs protection and economic status were found to be significant while the other variables returned insignificant.

Comparing the above result with the result obtained when the full data and the above mean GDPCAP data sets were analyzed shows some level of difference, see table 22 below.

Table 22: SUR Output: Dependent Variable DFDI: Comparing the Three Scenarios

Dependent Variable DFDI									
	GDPCAP Below Average			GDPCAP Above Average			Full Data Set		
	Coeff.	p-value		Coeff.	p-value		Coeff.	p-value	
DIPRs	2.248	1.49e-05	***	5.72	0.2317		4.70164	0.0321	**
DEDU	0.0670	0.8610		7.16229	0.0032	**	4.54722	0.0034	***
DTRADE	0.000114	0.9986		-1.71	0.0114	**	-0.91	0.002	***
WTO	-1.21	0.6125		11.40	0.7541		-6.94	0.5867	
DGDPCAP	0.014	0.0023	***	0.0165	0.2200		0.0021	0.0038	***
DIN	-3.47e-06	0.4566		-2.09E+08	8.7E-24	***	-1.9E+08	4.09E-59	***

As can be seen from table 22 above the level of IPRs protection seems to have more significance with respect to FDI inflow in countries with GDPCAP below average than in countries with GDPCAP above average. The level of education is shown according to the table to be of more effect with respect to FDI in countries with GDPAP above average. Trade openness is appears to have more effect on FDI, howbeit with negative coefficient, in countries with GDPCAP above average. Membership of WTO has no effect whatsoever on the rate of FDI inflow irrespective of the GDPCAP of the developing country. Economic status of developing countries tends to have more influence on FDI inflow for countries with GDPCAP below average than for countries with GDPCAP above average. The level of innovation has more significant effect on FDI inflow, howbeit with negative coefficient, in countries with higher GDPCAP.

In summary the empirical analysis carried out using the secondary data provides answer to the question “To what degree will tightening intellectual property rights protection increase the rate of innovation in Nigeria”. The answer from this empirical analysis is that strengthening IPRs protection will not increase the rate of innovation in Nigeria. In fact even though IPRs was not significant with respect to innovation, the results reveal that IPRs had negative coefficient except for countries with GDPCAP above average. So for Nigeria if at all IPRs has any influence on innovation such influence will be negative. From the foregoing it also implies that the answer to the question “To what degree should Nigeria strengthen its intellectual property rights protection in order to promote innovation?” is provided. And lastly the analysis also provides answer to the question “Will intellectual property rights protection increase or hurt innovations in Nigeria?” Tightening IPRs protection at the moment will not promote innovation in Nigeria it will rather hurt it.

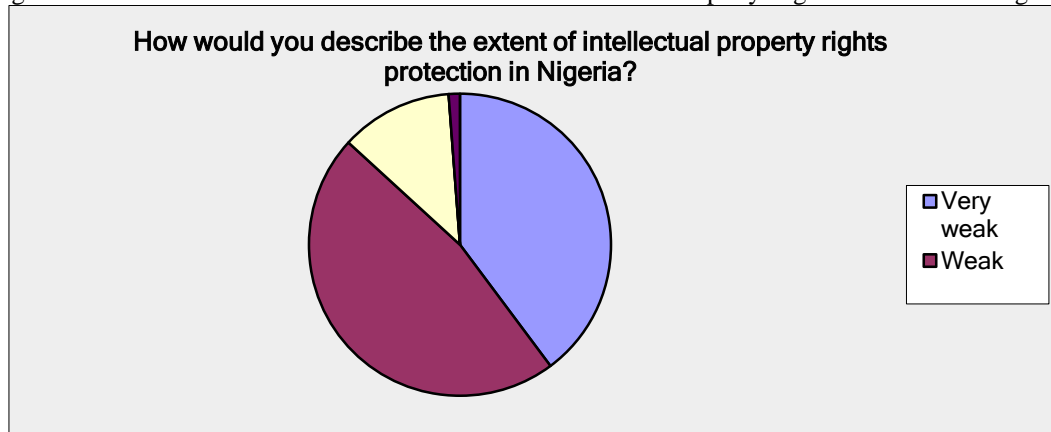
And secondly it also provides answer to the question “To what degree will tightening intellectual property rights protection regime increase the amount of foreign direct investment in Nigeria?” It shows that IPRs protection only has strong effect as far as attracting FDI inflow is concern only in developing countries with small GDPCAP, which in this case includes Nigeria. It further provides answer to the question “Are foreign multinationals more likely to invest in Nigeria if its intellectual property regime is strengthened?” Since FDI inflow will increase in Nigeria with tightening of IPRs protection regime it also implies that foreign multinationals will most likely invest more in Nigeria with strengthened IPRs protection regime. And lastly, from the results seen above we can deduce that increase in the rate of innovation will not have any significant effect on the amount of FDI inflow into Nigeria.

## Analysis of primary data

### Quantitative analysis

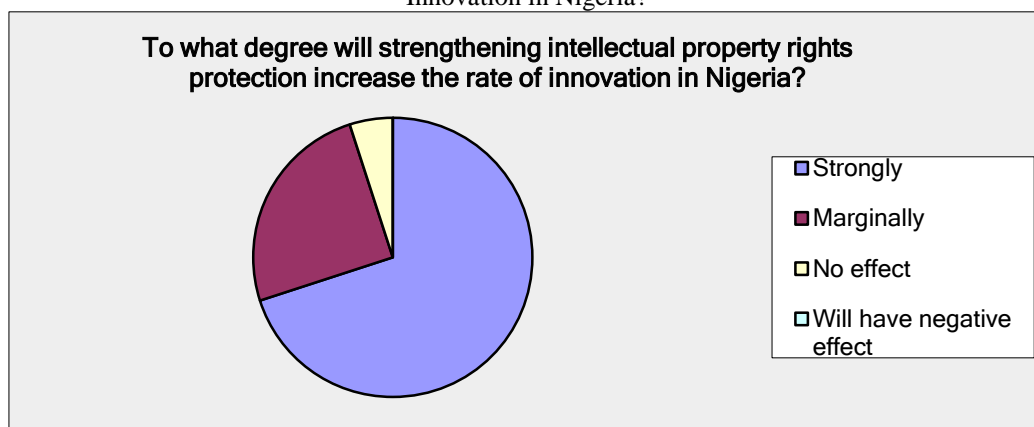
There were a total of 83 responses to the questionnaire sent. The respondents include individuals from public sector organizations, private organizations and non-governmental organizations. These include individuals working in advertising and marketing, finance and financial services, government, information technology and so on. Most of the respondents claimed to have somewhat average understanding of the subject of intellectual property (this is understandable as intellectual property is not yet a very popular subject in the Nigeria education and business environment). Only about 38 percent of the respondents claimed to have good or very good knowledge of the subject. About 86 percent of the respondents believe that intellectual property protection in Nigeria is either weak or very weak, see figure 20 below.

Figure 20: How Would You Describe the Extent of Intellectual Property Rights Protection in Nigeria?



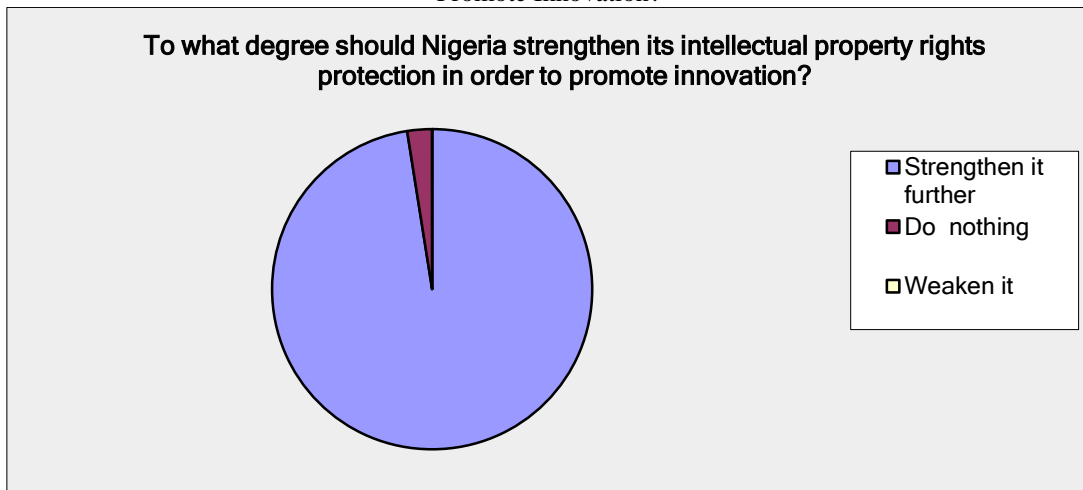
Responses obtained show that 95 percent of the respondents believe that strengthening IPRs protection will either marginally or strongly increase the rate of innovation in Nigeria, see figure 21 below. Actually 70 percent of the respondents are of the view that strengthening IPRs protection will definitely increase the amount of innovation that takes place in Nigeria.

Figure 21: To What Degree Will Strengthening Intellectual Property Rights Protection Increase the Rate of Innovation in Nigeria?



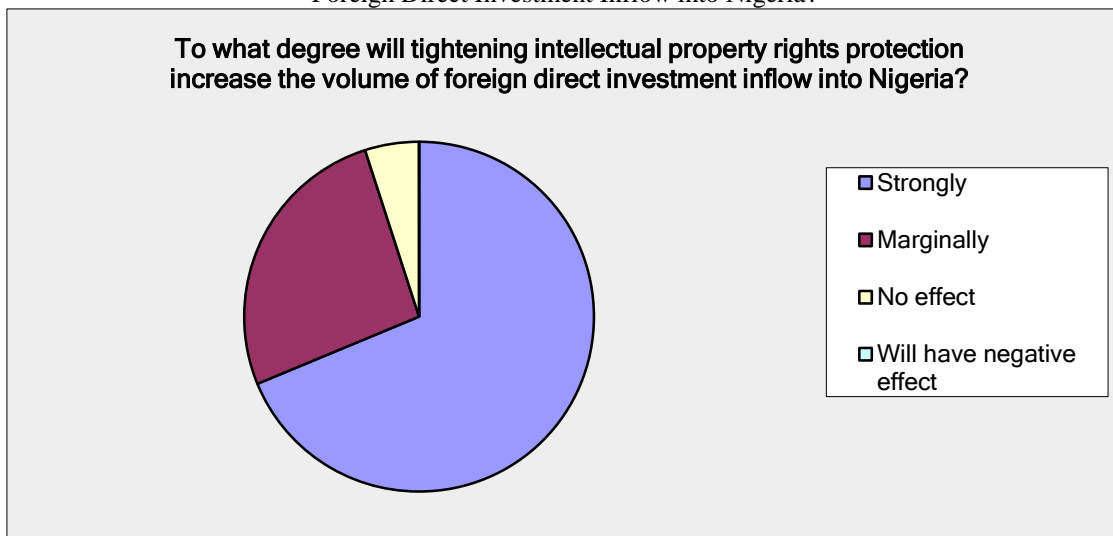
And furthermore 97.5 percent suggests that Nigeria should indeed strengthen its current IPRs regime further if it has any intentions of promoting real innovation, see figure 22 below.

Figure 22: To What Degree Should Nigeria Strengthen its Intellectual Property Rights Protection in Order to Promote Innovation?



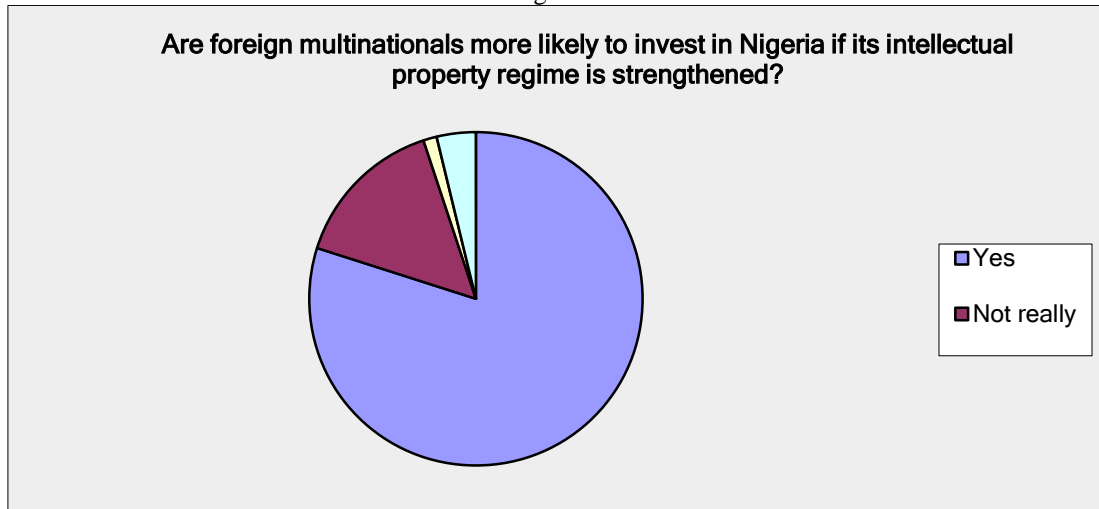
About 95 percent of the respondents believe that strengthening IPRs protection will either marginally or strongly increase the rate of inflow of FDI into Nigeria, see figure 23 below. Actually about 69 percent of the respondents are of the view that strengthening IPRs protection will definitely increase the amount of FDI inflow into Nigeria.

Figure 23: To What Degree Will Tightening Intellectual Property Rights Protection Increase the Volume of Foreign Direct Investment Inflow into Nigeria?



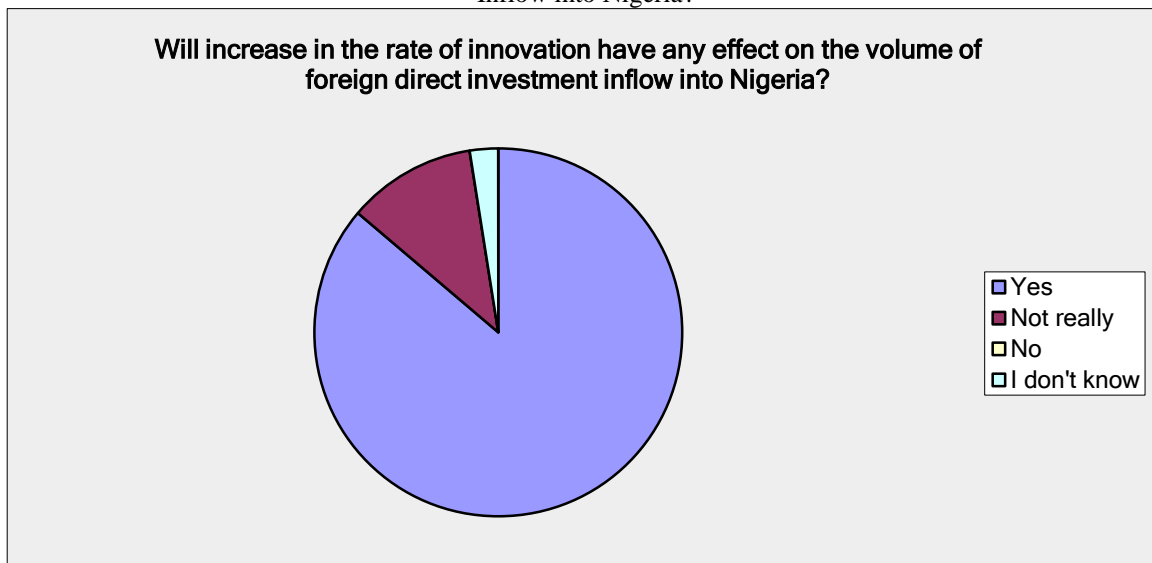
And most of the respondents, 80 percent, believe that multinationals will most likely invest more in Nigeria if its intellectual property regime is strengthened, see figure 24 below. Only 1.3 percent thinks otherwise, while 15 percent say not really and 3.8 percent claim not to know what the effect will be.

Figure 24: Are Foreign Multinationals More Likely To Invest in Nigeria if its Intellectual Property Regime is strengthened?



And furthermore, most of the respondents are of the view that increase in the rate of innovation will also cause a corresponding increase in the volume of FDI that flows into Nigeria, see figure 25 below. In fact 86.3 percent hold this view while only 11.3 percent believe that it may not really be the case. And 2.5 percent simply said they have no idea of what the outcome of increased innovation will have on the volume of FDI inflow into Nigeria.

Figure 25: Will Increase in the Rate of Innovation Have Any Effect on the Volume of Foreign Direct Investment Inflow into Nigeria?



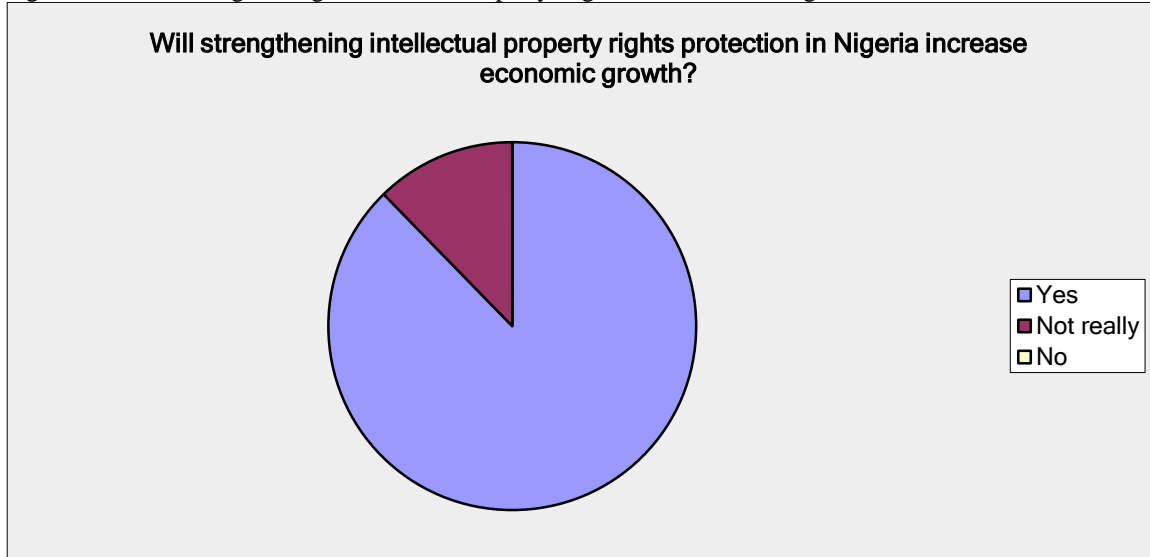
Most of the respondents believe that there is a direct relationship between the rate of innovation and the economic growth of Nigeria, actually 98.6 percent of the respondents believe that increase in the rate of innovation will bring about marginal or strong corresponding increase in the rate of economic growth of Nigeria. In fact 93.1 percent believe it will cause strong increase in economic growth. Only 1.4 percent thinks that increase in the rate of innovation will have no effect on the rate of economic growth of Nigeria.

Similar to the reaction of respondents on the impact of innovation on the economic growth of Nigeria, most of the respondents think that increase in FDI inflow in Nigeria will consequently increase economic growth. About 89 percent of the respondents think that increase in the rate of FDI will affect the economic growth of Nigeria positively. Only 9.5

percent of them think that it may not really be the case while 1.4 percent thinks that it will simply not have any positive effect on the economic growth of Nigeria.

In the overall most of the respondents is of the view that strengthening IPRs protection in Nigeria will in turn cause a corresponding increase in the economic wellbeing of Nigeria, indeed 87.7 percent of the respondent holds this view. However, 12.3 percent of the respondents think that increasing IPRs protection may not really increase the economic growth of Nigeria, see figure 26 below.

Figure 26: Will Strengthening Intellectual Property Rights Protection in Nigeria Increase Economic Growth?



From the foregoing it can be seen that the general perception is that strengthening IPRs protection in Nigeria is viable means of promoting innovation in Nigeria. And the respondents do not think that this will in any way hurt innovation but rather it will increase the rate at which new ideas are developed and commercialized. And furthermore, the respondents largely agree that tightening IPRs protection will encourage foreign multinationals to invest more in Nigeria and invariable increase the volume of FDI inflow into Nigeria. The views as expressed by the respondents, especially as it concerns the relationship between IPRs protection and the rate of innovation, is somewhat in contrast to the evidence seen when the secondary data was analyzed as shown above. The possible reasons for this difference will be further highlighted under the discussion section below.

Qualitative Analysis

Table 23: Presentation of Qualitative Primary Data

	Designation of Respondent	Summary of Remark	Method of Interview
Respondent 1	Former Minister of the Federal Republic of Nigeria	<p>The respondent is of the view that there is no need tightening IPRs at the moment. The country should first attain comfortable level of domesticating certain technologies such as IT, biotech, space technology before tightening IPRs protection. The respondent further asserts that tightening IPRs protection at this stage of the country's technological development will hurt the country economically. But as the country gains competence in specific areas it can then begin to increase its level of IPRs protection in those areas. In overall IPRs protection should not be globally applied to all industries but rather each industry should be dealt with individually in terms of IPRs protection and general regulation.</p> <p>The respondent believes that FDI will be attracted with or without IPRs protection as long as the country is politically stable, secure and have the right policies.</p> <p>The respondent in summary suggests that skills acquisition and manpower development should be a key focus for the government and indeed private organizations if they have any intentions of promoting innovation. Polices should be put in place by government that will help in ensuring adequate technology transfer by foreign organizations doing business in Nigeria.</p>	Face-to-face
Respondent 2	Former Nigeria State Governor	<p>Respondent argues that there are no real innovations going on in Nigeria and suggests that there is no need to strengthen IPRs for now. The respondent further suggests that the country should simply adopt the Chinese model and imitate until such a time when it is technologically matured. Respondent continues that the movie and music industry where Nigeria is quite active doesn't need any IP protection legislation to thrive. The argument is predicated on the fact that music and movie producers sell their rights to distributors. These distributors then have the permission to copy and sell the products, as they so desire.</p> <p>Respondent believes that even though strengthening IPRs will encourage FDI inflow there are other factors that can equally or better attract FDI inflow such as improved security, continuous democracy and visible fight against corruption by the government.</p>	Telephone
Respondent 3	Former Director General of a Federal Government Agency in Nigeria	Respondent argues that there are no real innovations going on in Nigeria and that the impact of IPRs protection on innovation is	Face-to-face



		<p>more meaningful in an environment with strong economic standing. Respondent suggests that strong IPRs protection will ordinarily promote innovation. But this is only true in situations where the rights skills exists, proper awareness of the impact and importance of IPRs exist, and so on.</p> <p>Respondent further argues that although strengthening IPRs protection should promote innovation, Nigeria is not ready yet. To be ready in his view will entail fixing the education system, improving the judicial system, increasing awareness on the importance of IPRs protection and innovation. Basically the respondent is of the view that there is a strong correlation between investment in education and the rate of innovation.</p> <p>Respondent believes that FDI inflow may increase with stronger IPRs regime but the current status of IPRs is still enough to encourage FDI inflow other factors been equal. FDI inflow is good for the economy but Nigeria must put in place strategies and policies to learn and adequately take advantage of technology transfer.</p> <p>The respondent believes that Nigeria should have a utility patent system and encourage residents to develop around existing patents. He further asserts that there should be a robust plan to increase awareness on the importance of patenting and taking innovation to the market place. The right system and infrastructure should be put in place to enable innovation to be turned into viable products. He suggests that a focused education system will help promote innovation. The education curriculum must be geared towards promoting skills that will serve industrial needs. Education must match industry skills requirements. The present education system is weak and does not meet the skills requirements of industries.</p> <p>For IP protection to work effectively Nigeria must eradicate corruption. It must create a culture of creativity and hard work. It must first learn to imitate advanced technologies before strengthening its IPRs protection will make sense. It must create incentives to innovate (encourage individuals and firms to create products that will solve societal needs especially by adapting existing technologies).</p>	
Respondent 4	Current Director General of a Federal Government Agency in Nigeria	Respondent believe that the level of innovation in Nigeria is still very weak. And that, senior government executives should be responsible for championing innovation in Nigeria. He further opined that some things	Face-to-face

		<p>needs to be put in place first before IPRs protection will begin to have positive impact on innovation in Nigeria. These in his view include; human capital development, the right academic curriculum, sound lecturers/teachers equipped with the right teaching facilities, and there must be Internet connectivity at primary, secondary and tertiary school levels.</p> <p>Respondent argues that FDI will continue to flow into Nigeria irrespective of whether there is strong IPRs regime or not. FDI has been coming into the country long before Nigeria signed the TRIPS agreement. In fact IPRs protection cannot be said to have any real significance on the volume of FDI inflow into Nigeria.</p> <p>According to the respondent, for IPRs protection to have significant impact on the economic growth of Nigeria the following must be put in place:</p> <ol style="list-style-type: none"> <li>1. There must be sustained industrialization policy,</li> <li>2. Nigeria must have focused education system,</li> <li>3. There must be a national system of innovation,</li> <li>4. There must be strong investment in research and development, minimum should be 1% of GDP,</li> <li>5. Nigeria must invest in ICT in primary, secondary and tertiary institutions,</li> <li>6. There must be strong linkage between the academia and industry,</li> <li>7. Research to innovation must have a mentor in the person of the President of Nigeria. The President must lead innovation,</li> <li>8. Nigeria must choose certain focused areas. For instance oil and gas, agriculture, medicine, IT and solid mineral.</li> </ol>	
Respondent 5	A professor with research interest in economics and innovation systems in Nigeria	Respondent asserts, “if one thinks about patents, for instance, I [respondent] personally do not see their immediate relevance for innovation in Nigeria. We already know from extensive evidence that much of the innovative activities in most of the developing world involve incremental productivity-enhancing changes that have nothing to do with moving the global frontiers forward. Beside, marketing and organizational innovations are more highly pervasive compared to product and process innovation. In this sense, patents are useless and this sort of things doesn’t even derive from basic R&D let alone qualify for patenting. The really novel stuff we do are	Email

		<p>highly context-specific (like the patented sickle cell drug developed from local herbs).                      In this sense, patenting just takes the end product beyond the reach of local producers since they may not be able to afford licensing costs. In the specific case of the sickle cell drug (Niprisan it is called - if the name hasn't changed), it's patented and manufactured in the US and is hardly available in Nigeria where it was originally formulated. Talk of 'intellectual capital flight'! However, if one thinks about copyright, secrecy, trademarks, which, by the way are grossly under-researched, then it is hard to deny the importance of IP for firm-level innovation in Nigeria. To sum up, in the search for the relationship between IP and firm-level innovation in Nigeria, it is not a good idea to say there's none (and I would NEVER say so) but a lot more is to be learnt by broadly defining IP to include the more relevant ones considering the country's stage of development.”</p> <p>Respondent believes that strong IPRs regime should have a positive influence on FDI but without it foreign investment will still come in. However, It will give added advantage as foreign investors may find some of the skill sets useful</p>	
Respondent 6	Former Permanent Secretary of the Federal Republic of Nigeria	<p>Respondent does not see the immediate relevance of IPRs protection (particularly patent) to innovation in Nigeria. The respondent basically argues that using IP as a tool to encourage innovation at this stage of the country's development will be counterproductive. He thinks that systematic copying of western technologies will be a good start for the country. He suggests that the country should create incentives for those imitating so they can fine-tune the quality of their imitated products. He further suggests that the current funds accruing to the Raw material Development Council should be used to fund such incentives.</p> <p>The respondent does think that IPRs protection will have very marginal or no effect on the level of FDI inflow.</p>	Face-to-face
Respondent 7	Former Director General of a Federal Government Agency in Nigeria	<p>The respondent suggests that many inventions have been developed especially by Research Institutes but Government has not paid enough attention to the commercialization of such inventions. The practice is when a Research agency conducts a research the research findings must be forwarded to the HQ (headed by a Minister) who will then have to take further actions including seeking the President's approval. After the research finding stage and</p>	Telephone

		<p>subsequent transmission to the HQ not much really comes out of the research. A solution to this will be to perhaps ask the agencies to go about commercialization of their inventions. This, the respondent believes is more important at this stage for Nigeria than tightening IPRs protection. He argues that there should be a political will to promote and commercialize innovation among government research institutes and universities. Tightening IPRs will be of marginal consequence, as the system (especially government) does not show much interest in accepting new inventions.</p> <p>This respondent is of the view that FDI will still be attracted irrespective of the state of IPRs protection even though he thinks that it could increase FDI inflow marginally in some selected sectors.</p>	
Respondent 8	A scientist with research interest in IPRs and innovation in Nigeria	<p>This respondent thinks IPRs projection should be strong enough to make ideas and new creations (i) valuable (ii) not easily reproducible (iii) "sanctionable". He is of the view that every idea should have a price tag. Once someone uses it, they should pay for it, for example music aired on radio. He asserts, "even if my records [the record of the artist] don't sell, in so far as I get paid when radio stations air my music, I will be encouraged to produce new songs." He suggests that there should be stiff sanctions for people who imitate the works of others. It should carry the same penalty as stealing, because it is indeed stealing. Furthermore, the respondent believes that the country does not have the right tools and framework to measure the exact impact of IPRs on innovation and indeed its impact on the economy.</p> <p>The respondent doesn't think that just tightening IPRs regime will increase FDI. In fact, it may be counter-productive. He supports his view by stating that Microsoft, for example, only opened an office in Nigeria in a bid to capture more revenue, not with the aim of investment. He would rather suggest that the government puts up policies that will favor local producers, such that they have access to local and international market. And if foreign companies want to enjoy such privileges, they should be given conditions such as setting up production facility in Nigeria, employing a certain number of Nigerians, and show a plan for local capacity development.</p>	Email
Respondent 9	A senior executive in a telecommunication company in Nigeria	The respondent is of the view that tightening IPRs protection will have a positive effect on innovation. He is of the view that the rule of law especially IPRs laws creates a level-	Email and face-to-face

		<p>playing field for people in the business of innovation, from application/software development to entertainment.</p> <p>He believes that stronger IPRs regime, and indeed more robust judicial system, will definitely attract the right investments. Due to piracy and the long judicial process, many people are discouraged to invest in Nigeria. The world order has changed and we are increasingly driven by innovation and the knowledge economy. We have no choice but to protect innovation as our future existence is dependent on it. If not, people will simply migrate to other countries that value innovation.</p> <p>He further asserts that FDI will increase with tighter IPRs regime, as investors will be encouraged to invest as any idea they have can be registered and protected giving them the full confidence to pursue new ideas without fear of someone stealing or duplicating the ideas. With enforcement, confidence among innovations is stronger thus allowing them to take greater risks and benefit from the rewards of their effort. This can also drive and change the way the society (Nigeria) functions as people will become more innovative than being passive players in the market. People will focus on entrepreneurship rather than joining the civil service or oil companies.</p>	
Respondent 10	A director in a Nigeria government agency	<p>This respondent is of the view that strengthening IPRs protection will encourage innovation and also attract more FDI. He argues that weak IPRs laws will discourage innovation, and he thinks that the country needs more innovation than reverse engineering. He opines, “Copycatting is good but innovation is better. No nation truly develops without innovating.”</p> <p>He further suggests that the country needs to invest much more than it is currently doing in research. And further suggests that the entire STI (Science Technology and Innovation) program needs to be revamped. Strong IP regime goes hand in hand with strategic STI.</p> <p>The respondent is of the view that tighter IPRs regime will attract more FDI as it will give investors more confidence.</p>	Email
Respondent 11	Chief Executive of a Nigerian Telecommunication Company	<p>The respondent is of the view that strengthening IPRs regime will encourage innovation and bring about increase in FDI inflow.</p>	Email

		<p>The respondent supports his argument by stating that GLO Mobile (a successful indigenous telco) could only emerge after the regulatory environment and related incentives allowed foreign Telcos like MTN to come in and be successful. GLO could then do a combination of “copying” MTN but also creating a local version of a telco. The heavy use of Nigerian entertainment stars and personalities [by GLO] for advertising and marketing in the Telco industry appears to have been driven by GLO as an example. The same will probably go for industries that rely on strong IP regulation. Foreign players will dominate initially but local companies can then learn the ropes, modify, localize and give them a run for their money.</p>	
Respondent 12	An IPRs lawyer and business owner in Nigeria	<p>The respondent is of the opinion that tightening IPRs protection will encourage innovation. People that innovate will do so in the confidence that their innovations will be properly protected and their ideas will not be stolen. By so doing, if the innovation is commercialized, the innovator is sure of getting what is due to him/her.</p> <p>The respondent also thinks that IPRs protection will increase FDI inflow. This is because foreign investors are skeptical to invest in an environment where laws are not observed and enforced. It makes such an investment high risk.</p> <p>The respondent however, asserts that tightening of IPRs protection may not be the current best approach to boost innovation especially as the country is presently hugely technologically disadvantaged. The respondent thinks that country may be better off first by exploring other methods such as</p>	Email and face-to-face
Respondent 13	Medical Doctor and a former commissioner of health in one of the States in Nigeria	<p>The respondent argues that strengthening IPRs protection will encourage innovation. The respondent supports his argument by stating that Nigerians outside Nigeria shine in all spheres of human endeavour which goes to suggest that when Nigerians are in Nigeria they are held back by the lack of enforcement of laws especially patents. Also the lack of enforcement of existing laws means that bootlegging / piracy/ stealing of intellectual property is rampant in Nigeria at the moment. Therefore if existing laws are enforced Nigerians in Nigeria will let their enterprising and innovative talents flourish.</p> <p>The respondent also thinks that IPRs protection will attract more FDI. The respondent supports his view by stating that the rest of the world want to do business with</p>	Email

		<p>Nigeria (if only for being potentially by far the largest market in Africa) but that their biggest drawback is the image of Nigeria as a land where laws exist but are not implemented. So, if Nigeria can enforce existing laws and go on to strengthen them, foreign investment will definitely increase.</p>	
Respondent 14	An information technology expert in Nigeria	<p>The respondent believes that IPRs protection will increase the rate of innovation in Nigeria. He is of the view that if IP laws are strengthened and enforced accordingly, it will attract more innovative/creative personalities thereby increasing innovation in Nigeria.</p> <p>The respondent also thinks that IPRs protection will attract more FDI, as it will provide the needed security to investors. The respondent further asserts that tightening IP laws will not lead to “favoring foreign products”. Nigerians in his view are very innovative, this ingenuity is evident in their survival skills and what they are able to achieve with little or no support from the Government. Strengthening and enforcing IP laws will open up a new horizon that will guarantee good returns for ingenuity. This will spur interest from many Nigerians who want to make a living using their creative abilities.</p> <p>To conclude, Piracy is the killer of innovation. Hence a weak and unenforced IP law will only stiffen Innovation. Nigeria need not go too far to see the positive effects of a strong and enforced IP law on the economy of so many countries. He believes Nigeria has proven templates to follow and should as a matter of importance take steps to strengthen and enforce its IP laws rather than encourage imitations &amp; reverse engineering.</p>	Email
Respondent 15	Senior Executive of one of the major banks in Nigeria	<p>The respondent is not very sure the impact strengthening IPRs protection will have on the rate of innovation in Nigeria. He however, thinks that strengthening IPRs protection will cause more FDI to be attracted to Nigeria.</p> <p>The respondent supports his views by suggesting that reviewing and enforcing existing laws, both IP and other laws, will most likely increase FDI into Nigeria. The lack of enforcement of laws is a major challenge in Nigeria. This is a red flag, which international fund managers will avoid. The respondent made it clear that he is not very sure on whether increasing the current level of the country’s IPRs protection will have any strong impact on the level of</p>	Email

		innovation in the country.	
Respondent 16	Chief Executive of an Information Technology company in Nigeria	<p>The respondent is of the view that strengthening IPRs regime will encourage innovation in Nigeria. This in his view is particularly so as it will incentivize efforts and investments in research and developments of new ideas, solutions and innovations. Also because returns from innovation will be secure and not susceptible to hijack.</p> <p>The respondent also thinks that strengthening and enforcing IP laws will undoubtedly encourage FDI as it will boost investors confidence that monies invested in innovative initiatives will have secured returns.</p>	Email
Respondent 17	A business analyst in a private company in Nigeria	<p>The respondent is of the absolute view that strengthening IPRs protection will encourage innovation in Nigeria. She argues that there are some Nigerians that go abroad with their inventions because the IP laws are better there. For example, Chimamanda Adichie's books are all published abroad where the IP laws benefit her. She further suggests that because Nigerians know that their inventions can easily be copied, this discourages them especially if they cannot travel to another country and make use of their laws, as there is very little financial incentive to invent here.</p> <p>The respondent thinks that if IP laws are enforced in Nigeria, especially certain industries such as music and technological inventions where piracy and counterfeits is a major challenge, more foreign investors will be attracted.</p> <p>The respondent is of the opinion that outright tightening of IPRs laws should be a priority as against other strategies such as imitation. This is because according to the respondent Nigeria's weak IP laws (or lack of enforcement) discourages innovations or makes people go elsewhere. If they are strengthened, yes they will favor foreign products first but they will also encourage Nigerians to invent, and invent at home and not go off to another country. This will subsequently benefit Nigeria's economy.</p>	Face-to-face and email

From the responses obtained from the people interviewed it can be seen that the views are tilted to both sides of the argument, see table 23 above. Some of the respondents, 7 of them, are of the view that Nigeria is better of not tightening its IPRs protection yet as this will not exactly promote innovation and will not necessarily attract FDI inflows. They argue that there are other ways Nigeria can promote innovation and attract FDI other than by tightening IPRs protection. In summary these respondents argue that innovation can be encouraged by



putting plans and policies to improve the education system, improvement in the judicial system, provision of basic infrastructure, providing incentives for domestication of foreign technologies and so on. They further suggest that Nigeria should reach some level of technological development before it can begin to tighten its IPRs protection. And even at that the tightening process should be gradual and should not apply to all sectors from onset. These respondents also think that FDI will still be attracted, even with the present state of the country's IPRs regime, if the country is politically stable, security of life and property is assured, there is law and order and viable market.

Most of the respondents, 10 of them, think that strengthening IPRs protection in Nigeria will definitely increase the volume of FDI inflow as multinationals will be more confident to invest in Nigeria. They believe that it will give investors the assurance that the country enforces legal agreements, which will in turn give them the necessary incentives to invest directly or go into joint ventures with domestic Nigeria firms. One of the respondents in this category however, does not think that tightening IPRs alone will bring increase in FDI inflow. IPRs protection will only be effective in terms of attracting FDI inflow if it is combined with other government strategies and policies. All of them but one also thinks that strengthening IPRs protection will encourage innovation. Some of them argue that even though strengthening IPRs may not immediately favor domestic innovators, but rather favor foreign inventors, it will however, eventually favor domestic inventors. In essence no matter what the short term shortcomings of IPRs protection may be in the long run it will encourage domestic innovation and eventually spur economic growth.

## **Discussion**

Most of the respondents to the questionnaire admitted to having poor understanding of the subject of IPRs protection and its possible impact on innovation and FDI inflow in Nigeria. The implication of this is that the feedback obtained from the respondents may not give accurate assessment as to the relationship between the variables since they do not quite understand the dynamics of the workings of IPRs in Nigeria. The feedback obtained therefore, may be more of the way the respondents view or expect IPRs to function in Nigeria, which may not actually represent the way things are. So in essence these responses may not be a true reflection of the current status and impact IPRs have on innovation in Nigeria and it may not also reflect the current impact it has on FDI inflow. However, with the aim of validating and augmenting the responses obtained from the questionnaires, the interview method was used for a selected number of individuals. Even with that there is no guaranty as to the actual knowledge these individuals have with regards to the subject matter even though most of them claim to have reasonable understanding of the topic. Arguably from the research and the responses obtained it is obvious that a greater percentage of the interviewees have better understanding of the topic than most of the questionnaire respondents. This is largely because the interviewees were carefully selected and are individuals who one way or the other has dealt with issues pertaining to IPRs. Even as much as these interviewees may have substantial knowledge of the subject their views are quite divergent. These views are more or less the expected possible impact IPRs protection or lack of it will have on the level of innovation and FDI inflow into Nigeria and not necessarily the impact it has had. Most of the respondents in the primary research are of the view that tightening IPRs protection will encourage innovation and attract further FDI into Nigeria. From the responses to the questionnaire, it was clear that most of the respondents hold this opinion. With respect to the interview responses majority hold similar view. However, a few others think otherwise. These few are not exactly against tightening IPRs protection in Nigeria but they will rather that the country first of all strengthens its economic base and gain some level of advancement in technology before considering tightening its IPRs regime.

Unlike the case of the primary data analysis the findings of the secondary data analysis will be compared with the findings in previous literatures as highlighted in the literature review chapter. It is worthy of note at this point that even previous empirical studies give conflicting results as to the impact of IPRs protection on innovation and FDI inflow. For instance Kanwar & Evenson (2003) among others in their literature concluded that strengthening IPRs have significant positive effect on innovation and growth, whereas Sakakibra & Branstetter (2001) concluded otherwise. The results of the empirical analysis of the secondary data in this research generally reveal that IPRs protection has varying effect on the rate of innovation and FDI inflow depending on the economic standing of the country. All the above mentioned research results in the literature review one way or the other suggest that IPRs protection have varying impact on the economic development of a country depending on the income level and in some cases technological advancement of that country. Although the results from previous researches have varying views as to what point exactly IPRs protection begin to have real positive effect on economic growth, they all however establish that the economic status of a country is a major determinant of the impact IPRs will have on a country's economic development. The findings in this research reveal that indeed developing countries with GDP per capita above and below the data mean of US\$1806.26 in present prices behaved differently with respect to the relationship between IPRs protection and innovation and FDI inflow. Perhaps the countries with GDP per capita below US\$1806.26 may have other issues that are of more concern to them at the time than IPRs protection. However, it is possible that as these developing countries rise above a certain economic and technological advancement level they begin to be more aware of IPRs protection and see more reasons to strengthen their IPRs regime.

The findings of this research shows that IPRs protection has an interesting influence on the rate of innovation that can effectively take place in a developing country. If it is too tight it will negatively affect the level of innovation that can possibly take place in a developing country. It has to be relaxed to adequately encourage innovation. With respect to innovation, IPRs maintained a negative coefficient for GDPCAP below average and for the full data set but not for GDPCAP above average. It is however, only significant for GDPCAP above average and for the full data set. The negative coefficient of IPRs for countries with low GDPCAP implies that the tightening of IPRs protection will decrease the level of innovation in a typical developing country such as Nigeria. This is a clear departure from some previous researches. For instance Kanwar (2006) argues that having a strong IPRs system is capable of bringing about greater innovation in developing countries, which he argues will in turn bring about greater economic development. Strengthening IPRs could bring about increased innovation howbeit in developed countries; this some may argue can be extended to developing countries. However, it may not be the case as innovation that are suitable for developing countries, especially the ones with low GDPCAP, may not necessarily apply in developed countries (Kanwar, 2006). This research clearly shows that as was the case with IPRs protection in developing countries, innovation is only of importance to countries with GDP per capita above a certain level. The import of this is that developing countries with very low GDP per capita do not concern themselves with innovating. These countries may possibly have other issues of more importance to pursue at the time including seeking political stability, ensuring economic freedom, building robust education system, and having a better grasp of their economic strategies amongst others than focusing on innovation. They may perhaps want to first of all create a more conducive environment upon which innovation can thrive. In fact the SUR results further revealed that for a developing country to gain substantial traction in the area of innovation it must pay serious attention to education and trade openness (however trade openness returned with negative coefficients) as both were found to be significant with respect to innovation (howbeit only when the full data

set was used and for developing countries with high GDPCAP which implies not necessarily for Nigeria). Economic freedom is found to be important for countries such as Nigeria towards the encouragement of innovation. With these results from the SUR model and also from the fixed effect panel model one can then deduce that the proper management of IPRs protection is critical to Nigeria if it harbors any plans of promoting domestic innovation. With the coefficients reporting as negative in both models, it implies that Nigeria must first relax its IPRs protection regime until at least it attends reasonable level of technological development. However, the obvious lack of significance of IPRs protection with respect to innovation in low GDP per capita countries such as Nigeria can be attributed to several factors including the possibility that these countries may have weak intellectual property regime coupled with very weak IPRs enforcement policies. Some literatures such as Ginarte & Park (1997) and Lerner (2002) are of the view that developing countries provide weak IPRs because they have few innovations to protect and would rather prefer to benefit from imitations. Whereas developed countries provide strong IPRs protection because they have more innovations to protect. Whatever the case, for Nigeria to effectively embark on innovation and move its economy to the next level it must adopt policies that will enable it effectively learn from and take better advantage of technologies produced in more advanced countries.

Furthermore, analysis of the secondary data reveal that IPRs protection has varying effect on FDI depending on the economic status of the developing country. However, the level of IPRs protection was seen to have more significant effect with respect to FDI inflow in countries with GDPCAP below average (such as Nigeria) than in countries with GDPCAP above average. This implies that tightening IPRs protection will have more positive effect in the volume of FDI that will flow into Nigeria. This is consistent with previous researches especially Branstetter, Fisman, & Foley (2006) and Park (2008). They suggests that strengthening IPRs will bring about increased inflow of FDI and technology transfer into developing countries, which in turn will spur domestic innovation. The level of innovation has more significant effect on FDI inflow, howbeit with negative coefficient, in countries with higher GDPCAP. The import of this is that innovation is not an influential driver of FDI in developing nations such as Nigeria. It further implies that multinationals do not consider the level of innovation in Nigeria before they decide whether or not to invest in Nigeria. Some factors that they consider before making FDI investment in Nigeria include the economic status of the country. For instance economic status of developing countries was found to have more influence on FDI inflow for countries with GDPCAP below average than for countries with GDPCAP above average.

As can be seen above the reports from the analysis of both the secondary data (historic data obtained from various sources including the World Bank, WIPO, UNESCO etcetera) and the primary data (obtained from distribution of questionnaire and conduction of interviews in Nigeria) revealed some fascinating results. From the analysis of the secondary data it was discovered that for Nigeria, strengthening IPRs protection will not necessarily promote domestic innovation but may positively impact the inflow of FDI. However, when the primary data was analyzed the results show that individuals have varying opinion as to the potential impact tightening IPRs protection will have on innovation and FDI inflow in Nigeria. The differences in the results obtained when the secondary and primary data were analyzed is expected as individuals may have their own opinion on what should be but these individual views are not backed by facts except for the individuals who have either worked in policy making positions in government or participated directly or indirectly in research or IPRs regulation and enforcement. But because IPRs is not a widely understood topic in Nigeria (see appendix 5) many of the respondents may have given views that were more or less based on their individual perception and wishes but not with any real understanding of

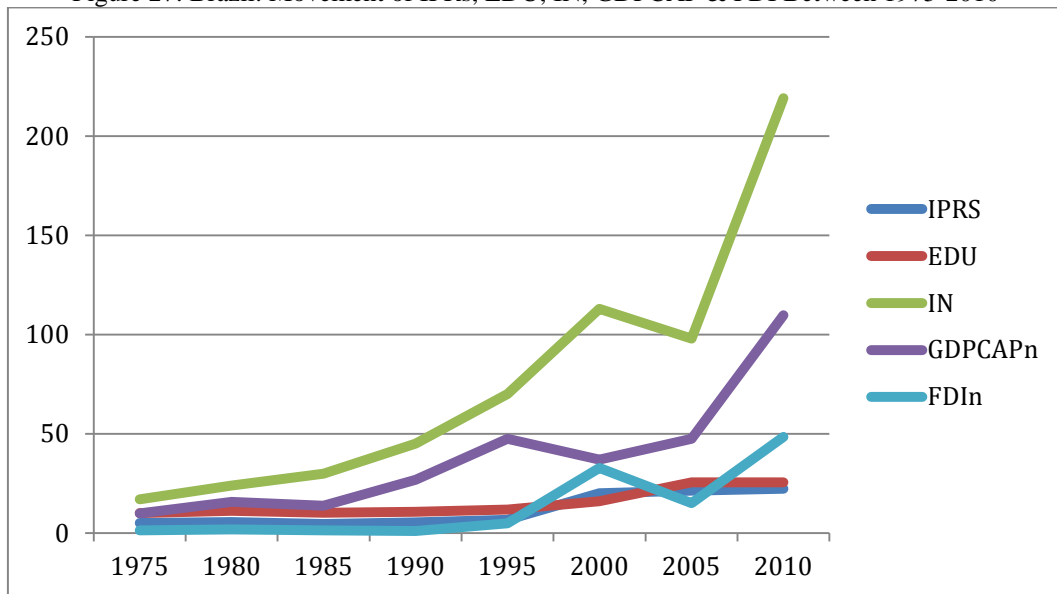
the dynamics of the workings of IPRs protection. One thing that is very important from the feedback obtained from the primary data especially from the questionnaire responses is that many Nigerians will welcome the implementation of a robust IPRs system; they are not averse to having a sound IPRs regime. This is a positive feedback for policy makers in rebuilding Nigeria's IPRs system and indeed the system of innovation. The next chapter, which is also the concluding chapter, will focus on recommendations as to how Nigeria can best explore IPRs system, such that will help boost its system of innovation and help attract more FDI.

## Chapter six: Lesson from the brics countries

Having observed from the previous chapter the relationship between IPRs protection, innovation and FDI inflow in developing countries this section of the paper will analyze the behavior of the BRICS countries in terms of the relationship between IPRs protection and economic growth using the same data as used in previous chapter. This section will briefly analyze how the BRICS countries' economies fared during pre-TRIPS and post-TRIPS eras. The graphs for each of the variables are adjusted to fit within the same area, hence the y-axis was modified and not the true value for each of the variables. However, the shape (particularly the slope) of each of the variable is a true reflection of the movement of the variable over the stated time period (1975 to 2010). Before, proceeding it is worth mentioning that correlation may not necessary imply causation. That is the fact that some of the variable as will be seen below could appear to move in the same direction (or indeed in opposite directions) does not imply that the variables have effect on each other or even influenced by the same factors. The section will subsequently consider ways Nigeria can learn from the BRICS countries and how it can possibly adapt these lessons to develop its economy.

### Brazil

Figure 27: Brazil: Movement of IPRs, EDU, IN, GDPCAP & FDI Between 1975-2010



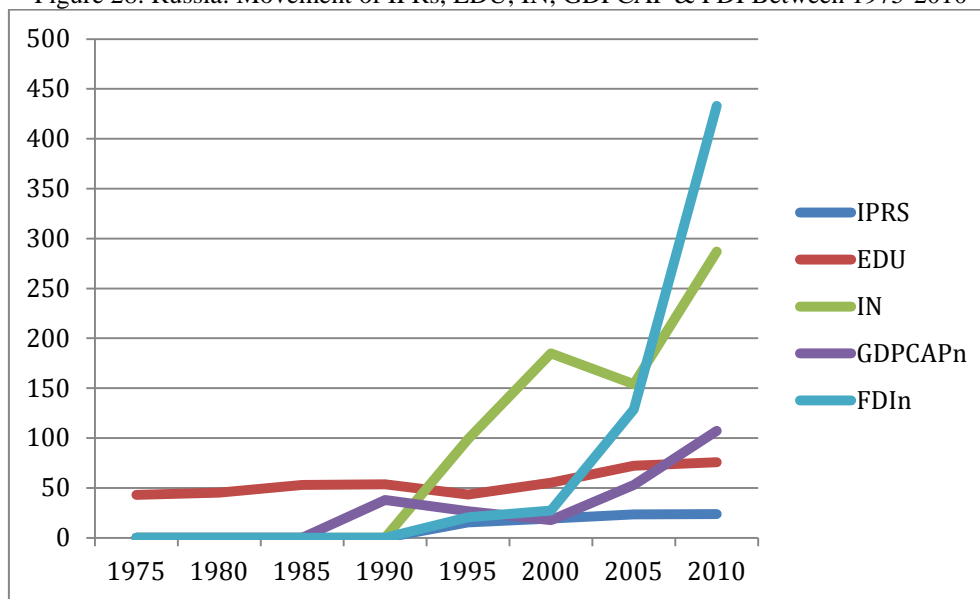
As can be seen from figure 27 above there is improvement in the level of IPRs protection after 1995, the year that Brazil ratified the TRIPS agreement. The level of protection of IPRs after 1995 was obviously better than what was obtainable before this period. The level of innovation measured by the number of patents filed by Brazilian residents in the United States rose steadily from 1975, took a dip between 2000 and 2005 but rose sharply afterwards. The economy has definitely grown significantly between 1975 and 2010, even though the growth has not been very smooth but there has been very noticeable progress. One may therefore, argue that the initial increase experienced by Brazil in its economy and in the level of innovation that took place is not exactly as a result of improvement in its level of IPRs protection. Even before it ratified the TRIPS agreement the country's economy has been growing steadily, in fact from the graph if at all TRIPS had any immediate impact it was a negative impact. Likewise the level of innovation that took place in Brazil before TRIPS was signed was very significant. This goes to show that other factors

including sound government policies and political will among others were responsible for the progress made by Brazil and not necessarily patent protection.

As can be seen from the chart above there appears to be a strong relationship between innovation and economic growth. As mentioned earlier it may be possible that economic growth is responsible for the corresponding strong level of innovation or even vice versa. Education and the level of IPRs protection in Brazil appear to go hand in hand with a correlation coefficient of 0.9254. This could mean that the level of education greatly affects the level of understanding and appreciation of IPRs subsequently leading to a greater protection of IPRs. This is expected, as improvement in the level of enlightenment in a society will bring about stronger insight not only to the importance and benefit of IPRs protection but the reason why it should be so. FDI also appear to be improving as all the other variables improve. There was significant improvement after 1995, although there was sharp decline between 2000 and 2005 before rising again. Several other factors may be responsible for the fluctuations in the volume of FDI inflow into Brazil. But the overall general increase after 1995 can be attributed to the fact that investors are more comfortable investing in economies that can guarantee some form of security for their intellectual assets. However, other reasons such as political stability and availability of the right market are strong factors that influence FDI inflow. And for a country such as Brazil the presence of good governance, political stability and sound economic policies has definitely contributed to boosting investor confidence over the last couple of years and not necessarily improvement in IPRs protection.

### Russian Federation

Figure 28: Russia: Movement of IPRs, EDU, IN, GDPCAP & FDI Between 1975-2010



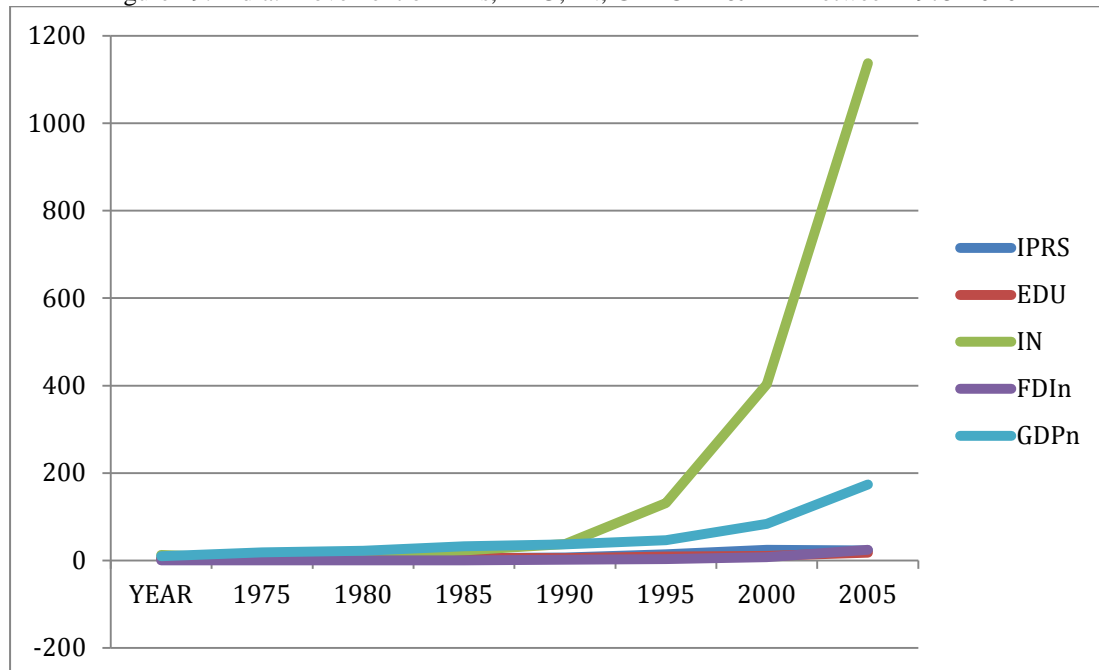
As can be seen from figure 28 above there has not been much increase in the level of IPRs protection in Russia since the early 90s (that is after the fall of the then Soviet Union). This is so as Russia only recently ratified the TRIPS agreement, actually this was done in 2012 and this research only considered changes in IPRs regime between 1975 and 2010. The amount of patent applications filed by Russian residents in the United States however increased steadily between the early 90s all the way till 2010, it only dipped slightly between 2000 and 2005. The economy of Russia has generally recorded significant growth within this period. It slowed down understandably just after the fall of Soviet Union (this was largely due to the recession suffered by Russia during the early 90s) but has increased steadily since 2000. From the foregoing, one can reasonably infer that the economic growth experienced by

Russia and the rise in the rate of innovation may not necessarily be a function of changes in the degree of IPRs protection but rather as a function of stability and good economic policies and strategies.

There seem to be some sort of co-movement between IPRs protection and education (but note that there may not be necessarily causation between these two variables). Perhaps as was the case in Brazil the improvement in education also has a positive impact on the recognition and appreciation of IPRs in Russia. The steady rise in FDI into Russia can be attributed to economic and political stability that even necessitated an upgrade in the country's credit rating as mentioned earlier. The further rise in FDI after 2000 is most likely connected with the improved confidence investors both local and foreign started having in Russia.

## India

Figure 29: India: Movement of IPRs, EDU, IN, GDPCAP & FDI Between 1975-2010



There appear to be increase among all the variables over the time period. As can be seen from the graph above (figure 29) there wasn't any noticeable changes in IPRs before the 90s but afterwards there was significant change in the level of IPRs protection in India especially after 1995 when India ratified the TRIPS agreement. Signing the TRIPS agreement meant that India basically accepts to tightening its level of IPRs protection. The economy of India represented by GDPCAP showed steady increase between 1975 and 2010, the growth was better after 2000 (as can be seen the average slope of the graph after 2000 was much steeper and positive). The rate at which Indians file patent application in the United States increased over the period, the increase is however more pronounced after 1995 (for instance the total patents granted in 1998 to Indian residents by the US Patent Office was 38 but rose to 1137 in 2010). From this even though there was growth in the rate of innovation in India the rate was much more significant after 1995 when India became a member of the WTO and signed the TRIPS agreement. So one may therefore, infer that there is likelihood that improvement in the level of IPRs protection had a positive effect on the rate of innovation in Nigeria. One may not however, say the same for economic growth as India's economy showed steady growth before the TRIPS agreement was signed, although there was some improvement in the rate of growth of India's economy especially after 2000. FDI seem to rise

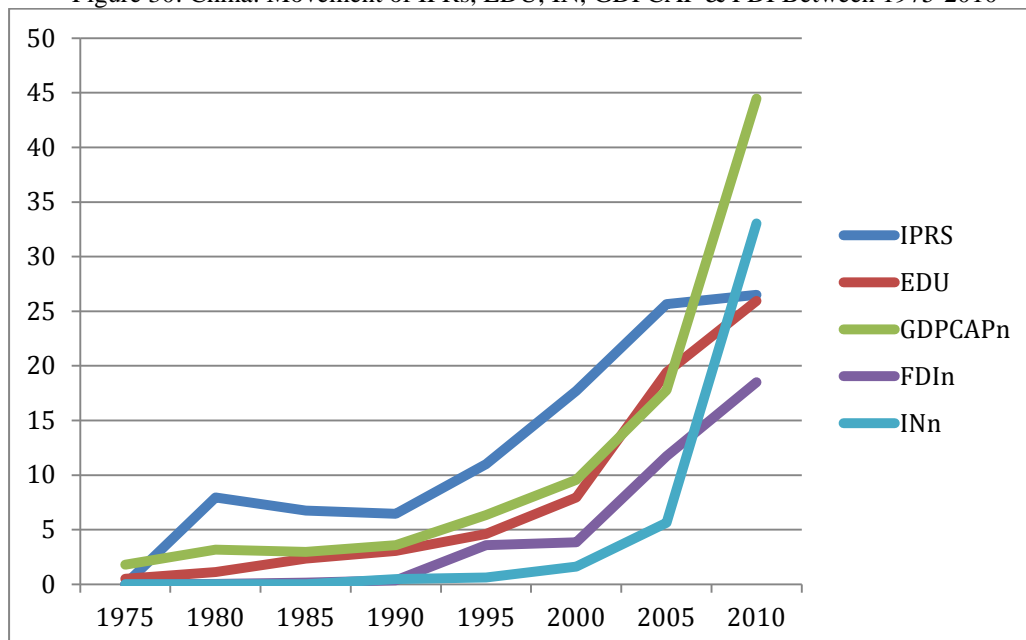
steadily with progress in the protection and enforcement of IPRs. This is expected, as both foreign and domestic investors will become more confident that their investment will be adequately protected.

Factors like progress made in education howbeit marginal compared to the level of innovation, may have contributed somewhat to the increased level of innovation in India. It is worthy of mention that one area that India has paid some reasonable attention to is the education sector. In its quest to grow its economy it has consciously made some improvements to its education system. Its highly educated workforce has contributed positively to the achievements reached in the high technology sector. In as much as there is some progress in the Indian education system, the progress is not wide spread as only very few percentage of the population receives good education while the rest of the population receives little or no education at all (Goswami, 2012). Progress made in education could create more awareness, understanding and appreciation of IPRs and it could also avail citizens the opportunity to learn and apply new ideas. All these will positively impact the level of innovation in the country.

And as mentioned earlier the strong growth in the economy may have also contributed in the increase in the level of innovation in India and/or vice versa. This increase in the level of innovation resulted in creation of new technologies. These new technologies when sold will generate income for India; even if India for now consumes most of its technologies at least it will cause a decrease in the volume of similar technologies imported to India. It is also possible that the increase in the economic wellbeing in India led to increase in innovation as earlier mentioned. As the income level rise and people develop appetite for more sophisticated and authentic products and services, individuals may begin to see opportunity in being more creative. This creativity could lead to the production of more innovative products that can then be patented.

## China

Figure 30: China: Movement of IPRs, EDU, IN, GDPCAP & FDI Between 1975-2010



As can be seen from the graph above (figure 30) there has been steady increase in the level of IPRs protection in China between 1975 and 2010. Although there was more noticeable increase after 1990 and this was later boosted by the signing of the TRIPS agreement by China but this was only in 2001. So in essence signing the TRIPS agreement was not the only factor responsible for improvement in the level of IPRs protection in China.

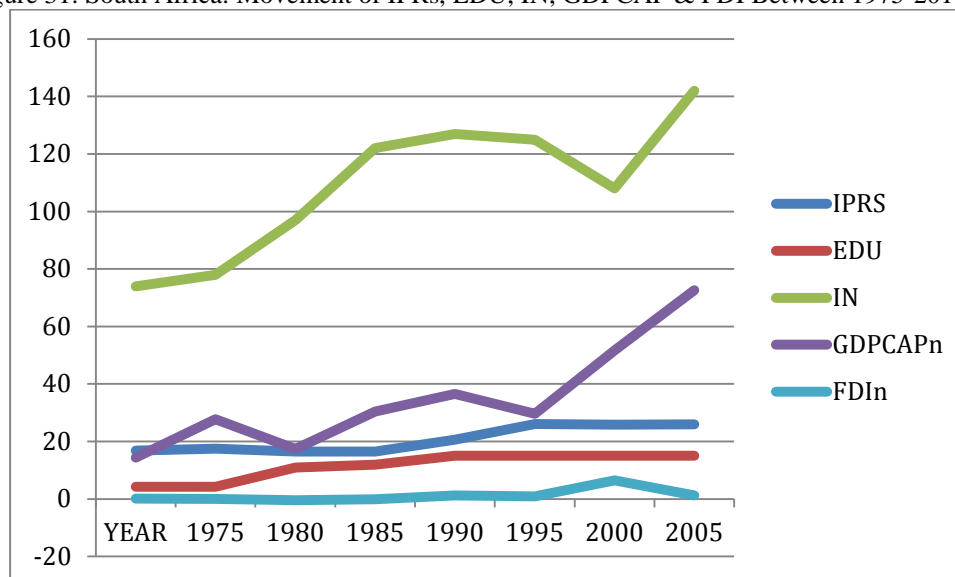


However, as stated earlier China was constantly accused especially by the US for not doing enough to enforce its IPRs laws. The volume of the patents filed by Chinese residents in the United States increased between 1975 and 2010; this is a measure of the rate of innovation in China. The rate of innovation was significant from the 80s but became more significant in the 90s. Likewise there was obvious growth in the Chinese economy between these periods. The graph shows a steeper positive change in the GDPCAP after the 90s. Even though during this period there was significant positive changes in the level of IPRs protection in China one should not be quick to conclude that this was what brought about increase in the level of innovation or increase in economic growth. China was accused repeatedly of not adequately enforcing its IPRs laws implying that even though the country had put in place patent laws it was not fully enforcing these laws and furthermore the country did not sign the TRIPS agreement until 2001. And before signing the agreement China continued to record increase in economic growth and some level of increase in the rate of innovation although the rate of innovation appear to improve significantly after 2001, the year it signed the TRIPS agreement. As concerning FDI inflow the country maintained steady increase in the volume of FDI it attracts even before the signing of the TRIPS agreement however, there appear to be more increase in FDI inflow after 2001. So in essence the increase witnessed by China in the volume of FDI inflow may not be attributable to IPRs protection. This is not to say that increase in IPRs protection may not have contributed but there are obviously other factors responsible for the increase.

As is seen from the graph it appears that the change in economic growth and changes in the rate of innovation go together. It is possible that the growth in the income level and general improvement in the economy encouraged innovation. On the other hand it is possible that the increase in the number of patent application perhaps as a result of better government policies and other factors helped to promote innovation, which in turn brought about technological development. And such technological advancement in turn promotes export of new technologies and also satisfies local demand thereby resulting in overall economic development. Also during this period there was steady improvement in the education system as there was steady rise in the level of protection of IPRs. In fact it seems like the level of change in the degree of IPRs protection goes together with the improvement in education. So one may suggest that there is a possibility that as the level of education improved individuals learn to accept, appreciate and respect intellectual property rights. And furthermore the increase in the investment made in education and favorable changes in government policies could all contribute to not only to understanding the value of IPRs but also aid innovation. The steady increase in FDI inflow to China can be associated with the confidence investors have in the system. Investors will be more confident to make at least certain level of investment in China knowing that they will receive reasonable level of returns largely due to the economic and political stability witnessed by the country. And more also, improvement in the country's IPRs system may further add another layer of incentive towards encouraging investment. However, there is still plenty of room for improvement in the IPRs regime of China especially as it concerns enforcement. There was generally obvious improvement in the economic growth of China, the level of innovation and the volume of FDI inflow after China ratified the TRIPS agreement in 2001. It is however, worthy of mention that these improvements may not necessarily be as a result of the signing of the TRIPS agreement (in fact it is possible that this may have very little or no effect), as other factors may also be responsible.

## South Africa

Figure 31: South Africa: Movement of IPRs, EDU, IN, GDPCAP & FDI Between 1975-2010



As can be seen from figure 31 above the level of positive change in the degree of IPRs protection in South Africa has not been very significant. It only made marginal improvement after 1995 that is after it ratified the TRIPS agreement. The change is marginal when compared to the standard of IPRs protection in South Africa prior to it becoming a member of WTO. There was significant change between 1975 and 2010 in the number of patent applications filed by residents of South Africa in the United States. This can be interpreted as a rise in the amount of innovation that takes place in South Africa. The change in the country's economy between 1975 and 2010 was also significant. From the pattern of the graphs there appear to be some degree of correlation between the level of innovation and economic growth but what seems to be obvious is that none of these two variables appear to be significantly influenced by the degree of patent protection. The degree of change in the economy and innovation does not exactly correspond with the level of improvement in IPRs protection. It is therefore, possible that improvement in South Africa's economy and in its level of innovation may be influenced by other factors including decent and disciplined financial management and other government policies. The changes in education appear to correspond with the rate of change recorded in the area of IPRs protection. This can be interpreted as follows; as the level of education rise, individuals and in turn companies begin to appreciate reasons for better IPRs protection and management. It is generally expected that as people get more educated and enlightened they will begin to have better understanding of the place and role of IPRs protection and management in the society. FDI seem not to follow any obvious pattern with respect to the other variables. It did not change much, rose slightly in 2000 but quickly went down in 2005. So IPRs protection cannot be said to have any real influence on the volume of FDI inflow in South Africa. One can therefore, infer that the amount of FDI inflow into South Africa may be influenced by factors other than the degree of IPRs protection.

### Adapting the lessons learnt to nigeria

From the previous chapter we have observed the relationship between IPRs protection, innovation and FDI inflow in developing countries and also from the last section we have briefly analyzed the relationship between these variables in selected countries (particularly the BRICS countries). This section of the paper will suggest possible ways a

developing nation can adopt and adapt the lessons learnt to transform its economy. Nigeria will be used as a case study in this chapter. However the suggestions can be applied to other developing countries with modifications where necessary. Nigeria presently according to the Global Innovation Index (GII) is ranked 123<sup>rd</sup> (113<sup>th</sup> among GII 2011 countries) having slipped 17 places from its 2011 position of 96. Even though this slip is partly due to the adjustments in the GII framework, poor policies on the part of the government was also a major contributing factor. As far as the GII is concern Nigeria is behind countries such as Ghana, Gabon, Mali, Cameroun, Burkina Faso and Senegal (Dutta, 2012). The paper recognizes that it is not sufficient for a country not to have any IPRs regime nor is it sufficient for a nation to just relax its IPRs regime for the purpose of growing its economy and with a focus of purely imitating foreign technologies. The paper will therefore, suggest ways that Nigeria can manipulate its IPRs regime to boost its economic wellbeing.

It is worth stating that while some countries such as Brazil, China, India and Singapore are making strong progress in the area of technology the same cannot be said of most Africa countries including Nigeria (Lall & Pietrobelli, 2002; and Muchie et al., 2003). Research has shown that for less developed countries to cover quick grounds and catch up with the developed economies they must engage in innovation (Lundvall et al., 2006; Lundvall, 1992; Lall & Pietrobelli, 2005; Schimtz, 2006; Von Hippel, 1988). Furthermore Guiliani & Bell (2005), and Lee & von Tunzelman (2004) have all shown that there is a positive interaction between development, learning and diffusion of knowledge. Economies that have policies that encourage interaction between citizens and organizations and between organizations themselves is likely to be more developed than one that does not. Lundvall & Borrás (1998) noted that economies that build linkages and encourage interactive learning between different classes of public and private actors with the aim of enhancing their technological capacities would end up building strong national, sectoral and regional innovation systems.

The nature of IPRs management and innovation system in a typical developing economy is a far cry from what is obtained in a typical developed economy (Arocena & Sutz, 2000; and Cassiolato et al., 2003). Less developed economies such as Nigeria are plagued with very poor socio-economic infrastructure (poor power supply, bad roads, and corruption among other militating factors), very weak institutional frameworks and the level of interaction between the institutions is also poor. Typically the level of legal and regulatory standards are weak and even where they exist the enforcement mechanisms are weak. More often than not many developing economies tend to have less diversified economic sectors with more focus on basic consumer goods such as clothing and food (Tybout, 2000). They are usually heavily dependent on imported manufactured goods. The level of interaction among firms and among other types of organization including universities, research institutions, and industries are often none existent or at best very weak. And even the very few firms that engage in imitation are often isolated. There are very weak or almost non-existent linkages between these firms and their partners in the value chain and the same applies to the relationship between the firms and research institutes including universities (Arocena & Sutz, 2001). The business environment in developing economies can be described as comprising mostly of very informal relationship between the various businesses. And small-scale enterprises and peasant farmers majorly dominate it. All these including the weak institutions mentioned earlier make up the innovative system of a typical less developed country such as Nigeria (Bertelsen & Muller, 2003). As pointed out by Muchie et al, (2003), Chaminade & Vang (2008) and Cummings (2008) about innovation systems in developing countries, it is fair to describe the innovation system in Nigeria as work in progress as Nigeria has most of the desired organizations in a typical innovation system framework. However, the linkage between these organizations for example the user-product, university-industry

linkages are still very weak and also the institutional frameworks that are necessary to promote innovation are fragmented and weak (Szogs, Cummings & Chaminade, 2009). While the paper will recommend ways that Nigeria can promote innovation, it will also suggest ways that Nigeria can improve its education system knowing that having the requisite manpower is critical to any sustainable innovation system. The BRICS countries as is seen above achieved reasonable growth in their rates of innovation without particularly 'over tightening' their IPRs system. These countries only started improving their IPRs system after they have attained a given level of economic development and their rate of innovation has significantly improved. In essence Nigeria must not exactly depend entirely on strong IPRs regime before improving its system of innovation. The next section therefore, will suggest ways Nigeria can improve its domestic innovation including having a robust national innovation system. Afterwards the paper will suggest how Nigeria can effectively manipulate its IPRs system to benefit its economy. As observed from the feedback from the interviews conducted and analysis of the secondary data FDI inflow will increase with better protection of IPRs but this is not necessarily the only factor of influence as observed with the BRICS countries. Having a stable political system, right regulatory framework, guaranteed security of life and property among others will boost investor confidence. This paper will however, pay more emphasis on recommending solutions on how Nigeria can better its innovation system and more effectively manage its IPRs regime for stronger economic development.

### **Improving domestic innovation in nigeria**

For Nigeria to promote innovation it must ensure that it creates a robust innovation culture. It must put in place policies that will ensure creation of knowledge and its proper diffusion, ensure the availability of adequate funding for R&D, restructure and refocus its education system, create incentives that will encourage firm level innovation, and learn from other countries. And furthermore, it will consider the importance of establishing a national innovation system, including the conceptualization of a national innovation system for Nigeria and the redefining of the proposed Nigeria national system of innovation.

### **Increase in R&D Spending**

Nigeria needs to increase its R&D spending if it has any intention of realizing the national agenda of becoming one of the top 20 economies in the world by the year 2020. Its R&D spending as at 2007 was merely 0.22 percent to the GDP compared to the world average which stood at 2 percent and was even lower than the average for sub-Sahara African countries which was 0.58 percent for the same period. So the amount of expenditure put into R&D by Nigeria is by no means sufficient to take the country to be among the top 20 economies by the year 2020. Putting this into better perspective the result shows that Nigeria fall short by far when compared to Brazil, Russia, India, China and South Africa (the BRICS countries). Brazil had a R&D expenditure as a percentage of GDP of 1.1 percent for the same period, Russia recorded 1.1 percent, India recorded 0.75 percent, China recorded 1.4 percent and lastly South Africa recorded 0.9 percent. For that same period Brazil had a total of about 658 people for every one million people that are engaged in R&D, Russia had 3274 people, there was no record for India as regards the number of people in R&D during that same period, China had 1077 people per one million people engaged in R&D and South Africa had 396 people. Nigeria on the other hand had only 39 people engaged in R&D for every one million Nigerians. Unfortunately Nigeria had record for only the year 2007 for the number of its citizens engaged in R&D according to the World Bank report. This limited our analysis as it would have been more preferable if we took like say 10 year period to study the trend and then compare it with the trend in say in the BRICS countries for the same time period. This would have helped reveal if there was an upward trend or downward trend or no change at

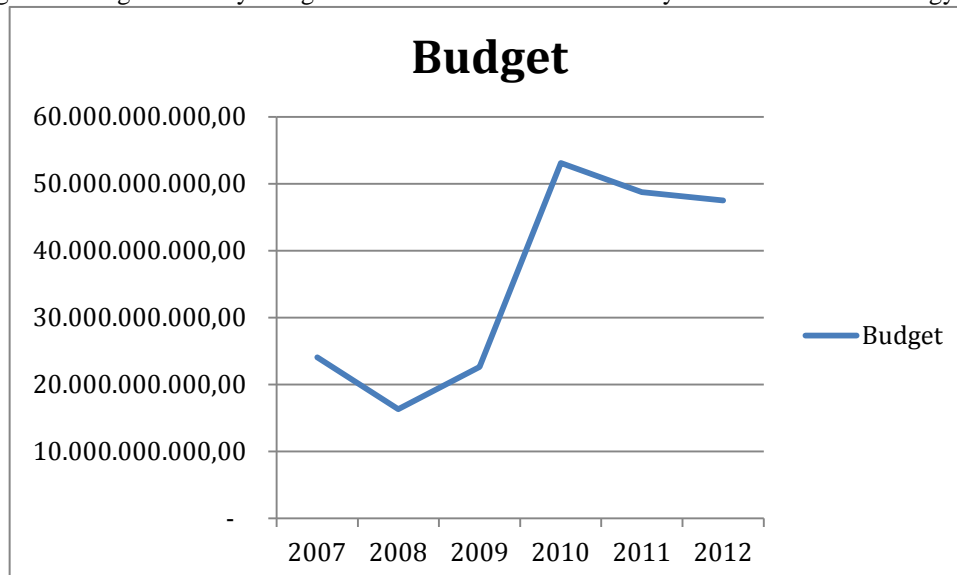
all. To test if there was significant change in the amount of money invested in R&D by Nigeria we will take a look at the amount appropriated by Nigeria in its yearly budget provision for the period between 2007 to 2012 to the Federal Ministry of Science and Technology (FMST). The yearly budgetary allocation to the Federal Ministry of Science and Technology for the period 2007-2012 is as stated in the table 24 and figure 32 below:

Table 24: Nigeria Yearly Budget Allocation: Federal Ministry of Science & Technology

Year	Budget Allocation
2007	24,076,639,846.00
2008	16,306,271,658.00
2009	22,619,439,683.00
2010	53,078,009,181.00
2011	48,731,185,732.00
2012	47,487,545,368.00

Source: Data obtained from the Nigeria Budget Office

Figure 32: Nigeria Yearly Budget Allocation for Federal Ministry of Science & Technology



Source: Obtained from various issues of FMST budget

From the funding made available to the Federal Ministry of Science and Technology it can be seen that there has not been drastic change from the budget allocation in 2007 to 2012 to move the country from its very poor R&D output to a more desirable output. The FMST's budget is used as a benchmark to assess the level of investment made by Nigeria in R&D as the Ministry houses over 15 research institutions. The Nigeria government must make a more concerted effort to improve on its R&D spending and to maintain some level of consistency in that respect. It should also improve the efficiency of its budget utilization by ensuring that the budget is applied to the right areas of R&D and also ensure that the budget implementation is effectively monitored.

### **Ensure Free Flow of Knowledge**

Another way Nigeria can improve domestic innovation is to ensure free flow of knowledge within its system and by promoting incremental innovation. One means by which Nigeria can ensure availability and flow of knowledge is by acquiring foreign technologies. Technology acquisition can be achieved through three broad ways: through the imitation of

foreign capital goods; through foreign direct investment and lastly through foreign technology licensing. The government can create an environment that can promote these channels of technology acquisition by ensuring it puts in place the right FDI policies; sound foreign technology licensing regulations and guidelines; and establishing and enforcing IPRs regimes. It is also the place of the government of Nigeria to contribute to the development of the requisite human and social capital necessary for the evaluation, selection, execution and modification of foreign technologies (Feinson, 2003).

Nigeria can choose to import capital goods from developed countries and then replicate the technologies locally, thereby using it as an avenue to keep up with international technology trend. It is worthy of note that this method of technology acquisition does not come with the requisite theoretical or practical knowledge on how to use and manipulate the technology. Nigeria would therefore, need to have the right base of human capital to be able to adequately use and effectively adapt the technology. Also international trade laws (especially for WTO member states such as Nigeria), IPRs laws and the high cost of imitating certain technologies can stand in the way of Nigeria freely imitating foreign technologies (Mansfield et al., 1981). All these may deter local firms from ever attempting to copy certain technologies. Nigeria therefore, needs to take into cognizance all these afore mentioned challenges in designing a sustainable policy framework for attracting foreign technologies. To acquire technologies through FDI Nigeria must put in place policies that are favorable to attracting FDI inflow into Nigeria. In establishing an FDI subsidiary or acquiring substantial shares in a Nigerian firm, the foreign firm may have to bring along qualified labor, establish new plants, observe foreign regulations and develop new and domesticated marketing plans (Saggi, 2000). By so doing the foreign company can help considerably in implementing the new technologies and during this period local Nigeria workers can gain a lot of theoretical and practical knowledge such that after a while they may be able to carry out the function of implementing the same technology and even improve on it. Nigeria can also go a step further to regulate the amount of foreign ownership in multinational firms. More local ownership will not only put more money in the hands of Nigerians but also create more opportunities for spillovers of new technologies to local firms. Nigeria can also acquire new technologies through foreign licensing, which basically is the leasing or licensing of foreign technologies to already existing local firms, giving them the right to use, sell and even reproduce a particular capital goods. The country can decide to put in place policies that can make foreign technology licensing more favorable to local firms, policies that give local firms the upper hand in a technology licensing agreement (Pack & Saggi, 1997).

Some of the policy measures put in place by Nigeria over the years to attract FDI inflow include: the adoption of the floatation exchange rate policy established in 1986 under the Structural Adjustment Program (SAP). It was on this premise that the Foreign Exchange Monitoring and Miscellaneous Provisions Act (FEMAMP) was enacted in 1995. Nigeria has also used investment incentives such as tax holiday, tax saving and removal of tariffs among other things such as pricing strategy to attract FDI into Nigeria (Tamuno & Maclean, 2008). Nigeria should however, review these policies including its tax holiday policy<sup>38</sup> and ensure they are consistent with the volume of FDI that will make significant impact in its economy.

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<sup>38</sup> Tax breaks can cause significant loss in potential revenue, and bring about distortion to the economy as the country is forced to give special treatment to businesses that qualify for tax break. There is also administrative cost of implementing such schemes to prevent abuse not forgetting the social cost of rent-seeking behavior and potential increase in corruption (Klemm, 2010). Recent reports have shown that the tax holidays granted by the Nigerian government has been heavily abused. Aremu (2014) recently opined that duty waivers granted by the government has contributed negatively in the development of the country. And further more the Nigeria Minister of finance also stated that 30 percent of businesses granted tax holidays in Nigeria have abused the privilege (Alumona, 2014).

And it should ensure that the FDI inflows go into critical sectors that will be most beneficial to the economy. Perhaps most important will be setting up the right frameworks that will enhance effective utilization of the FDI inflows. It could be that maximizing its current FDI inflow may be more important than attracting more and then not putting them into full use. For example the Federal Government of Nigeria and indeed the various State Governments within Nigeria should aim to improve their business environments by providing key economic and social infrastructure that in turn will lower the cost of doing business in Nigeria. This is one sure way of lowering the leakages that negatively impact on the efficient and effective utilization of the FDI that is attracted into the country.

Knowledge flow in Nigeria can also be promoted through technology utilization and diffusion. Having identified and acquired the right technologies government must put in place the right strategies that can help local firms utilize and diffuse these technologies throughout the country. This can be achieved by establishing systems (institutions and networks) such that have the capacity to absorb and disseminate the core knowledge behind the new technologies. These sorts of institutions and networks don't just come automatically. Government has to put in place the right incentives and policies to help in the establishment of both formal and informal networks that promote capacity building, standards and regulation, information flow, quality control, testing and so on. In Nigeria it is obvious that there is lack of proper diffusion of technological know-how. This is evidenced by performance disparities between similar firms within the same industry and that use similar technologies. This goes to show the difference in the firms' ability to effectively utilize technologies. As Nigeria's reliance on new technologies rises, it becomes more important for its workforce to have better understanding of the theoretical aspects of technological knowledge. Previously it was enough for people to attend trade schools or learn on the job. Even though these are still recommended it has become more critical if the country intends to be competitive to ensure its workforce undergo more intensive scientific management training (Nelson, 1990). Feinson (2003) suggested that countries with low literacy and weak higher educational system have huge problems assimilating new foreign technologies. This is due largely to the absence of essential human capital. Nigeria needs people with strong educational background at the university, secondary and primary levels. The workforce with good tertiary background will be able to assess and effectively monitor the implementation and subsequent modification of foreign technologies.

In as much as technology is changing at a fast pace, not all technological changes need to be dramatic. Some time slight increment in technology can have significant impact especially when it is adapted to suit the local needs, thereby improving productivity, quality of output and lowering cost. These sorts of incremental changes do not necessarily have to come strictly from research efforts but can come from the shop floor. For a country such as Nigeria the cumulative impact of these incremental technologies can be of immense benefit to the society (Dahlman & Nelson, 1995). This therefore highlights the extreme importance of utility models to a developing economy such as Nigeria (Ranis, 1990). This is not to say that engaging in formal and structured research and development program is wrong but as firms within the country attain a certain level of technological advancement and proficiency they can begin to engage in formal research and development activities. The point is focusing on formal research and development activities and tightening IPRs protection from the onset may discourage firms from taking full advantage of already existing technologies. But Nigeria must be at alert and should ensure that it does not discourage formal research and development programs and relax its IPRs protection for too long, as this may become counter productivity. It must know when to begin to encourage proper research and development and if it intends to be internationally competitive beyond merely boosting domestic innovation then it requires effective and efficient research and development labs to conduct reverse

engineering, and also be able to keep up with international technology trends. The knowledge obtained from the activities of these research and development labs can spillover into local industries where other firms can utilize it for the overall good of the country. So for Nigeria the strategy should be to first encourage incremental innovation as a means of promoting knowledge flow and later through focused R&D. And when it begins to look at formal R&D it should focus more on industrial R&D as this focuses more on “intermediation and support for the acquisition, assimilation, adaptation and improvement of technology obtained primarily from abroad” (Dahlman & Nelson, 1995). One may be tempted to ask that, what then becomes of the many research institutes and universities that are present in Nigeria? These should not be made away with rather they should be made to focus on improving on already existing technologies imported from abroad and carrying out reverse engineering where necessary. When the level of technological advancement of the country has reached a critical level it can then begin to refocus its attention on R&D in new areas.

None of the above strategies will be effective without the right human capital. Mytelka et al. (2001) amongst other have clearly demonstrated that the absorption capacity, which is the degree of technology diffusion, is heavily dependent on the level of education and training of a people. Dahlman & Nelson (1995) noted that for proper and sustainable technology diffusion to occur a robust human capital base must be present, such that is able to assess and decide on what technology is appropriate, for who and when that technology should be acquired and how it should be implemented. These they opined can be handled with a well-developed educational system. They further asserted that there are two critical levels at which investment in human capital must be directed, and these are the university level and the primary/secondary level. Dahlman & Nelson (1995) asserted that the university system is capable of churning out a workforce competent enough to monitor technology trends, assess how relevant the trends are to the current needs of the country and the firms within the country. Such a workforce can also help in developing the right strategies to take full advantage of these technology trends. The primary/secondary level on the other hand is critical in the sense that it creates the needed platform that will aid the quick diffusion and adoption of new technologies, help in ensuring local adaptation and improvement of these technologies and in general help to create greater awareness of these technology trends while also ensuring that the country takes full advantage of the technology (Dahlman & Nelson, 1995). For Nigeria to ensure effective diffusion and adaptation of new technologies it must strive to put in place the right human capital base. And this can be achieved by ensuring that it revamps its educational system such that is geared towards building requisite skills. See below on the description of the level of the Nigeria educational system and what should be done to rescue it and refocus it to promote more innovation and invariably spur economic growth.

### **Revamp its Education System**

As it stands the Nigeria education system does little to encourage innovation. Students are given little or no reason to carry out any form of innovation (Dauda, 2010; and Borishade, 2001). Efforts should be made to create the right environment in universities that will encourage innovation. To encourage and attract the right talents into research and innovation in the universities and research institutes, Nigeria may need to consider developing a project like the ‘One North’ project developed by Singapore that helped to create an environment that is conducive and supportive of innovation (tan, 2005). Nigeria should also look to develop more closely-knit research communities howbeit on a small scale but suitable enough for researchers both in the universities and research institutes to effectively interact and collaborate with one another and with peers abroad. It should also create strong linkages between the research institutes and the industries.



Dahlin (2005), Heckman & Klenow (1997) and Michaelowa (2000) see investment in education as very important to societies both at the micro-level and at the macro-level. They all noted that the direct effect can be seen in the increase in individual wage and furthermore increasing externalities can also be a resultant effect even though it may be an indirect effect. As already mentioned earlier it is through education that individuals can be equipped with the requisite skills, knowledge and competence that will enable them be more useful to the overall development of a nation. The level of investment in the education sector in Nigeria has consistently remained poor. According to a UNDP (2003) report public expenditure on education as a percentage of the gross national product is poor in Nigeria especially when compared to other developing countries. In 1960 the percentage was 1.5 for Nigeria and 1.7 between 1985-87. This is very low compared to Jamaica that recorded 4.9 and 7.5 and Malawi recorded 3.5 and 5.4 for the periods 1985-87 and 1995-97 respectively. The public amount spent on education has not shown any real sign of increase not even in recent years, see table 25 below.

Table 25: Profile of the Federal Government Spending on Education in Nigeria (1977-2007)

Year	Percentage Share of Education in Federal Government Expenditure		
	Capital	Recurrent	Total
1977	5.7	2.7	8.4
1980	6.4	4.0	10.4
1983	3.6	6.4	10
1985	1.4	5.1	6.5
1990	0.6	3.3	3.9
1995	1.3	3.8	5.1
2000	3.3	6.3	9.6
2005	1.8	4.5	6.3
2007	2.9	5.8	8.7

Source: Calculated by the author based on data from the Central Bank of Nigeria (various issues) *Annual Report and Statement of Accounts*, CBN, Abuja

As can be seen from the table 6.2 above there is obviously no deliberate effort on the part of government to ensure that there is increase in the percentage of education spending in federal government expenditure. The figure has remained highly inconsistent and as at 2007 the total percentage share of education in federal government expenditure stood at 8.7 percent a far cry from the recommended 26 percent by the United Nations Educational Scientific and Cultural Organization (UNESCO). This clearly shows that there is still a huge gap in the amount of investment required to move Nigeria's educational system to a level that will take its economy to a sustainable development level.

Smith (1937), Marshall (1930) and Schultz (1961) have all observed that there is a relationship between education and national development; likewise the empirical result from this research has shown a strong relationship between education and economic growth. Abidoun (2002) sees the effective nurturing, proper diffusion and application of knowledge in a society as the real tools that truly guarantee societal growth. Abiodun (2002) further asserts that education is very critical to sustainable nation building and should therefore, be given adequate attention. Nigeria in its early days recognized the importance of education in nation building and so embarked on establishment of sound educational facilities hence increasing its number of universities from 5 in 1970 to 24 in 1986 (Central Bank of Nigeria, 2007). By 2005 the number of tertiary institutions had risen to 128 even though it reached 139 in 1997. Likewise there was increase in the number of primary and secondary schools. The number of primary schools rose from 14,902 in 1970 to 59,340 in 2005 and for

secondary schools it went from 1,379 to 12,610 in 1970 and 2005 respectively, see table 26 below for more details. The number of enrolments in primary, secondary and tertiary schools also increased between 1970 and 2005. And table 26 also shows that the adult literacy level improved and stood at 62 percent in 2005. However, when one looks at the pupil per teacher ratio in primary schools one sees that all is not well with the Nigeria education system. This number increased from 34 in 1970 to 40 in 2005 and this falls short of the 25 recommended by the United Nations. The inconsistency in funding in the education sector as explained above and the lack of political will and lack of adequate policies have all contributed to the structural abnormalities, inefficiency and ineffectiveness seen in Nigeria's education sector today (Dauda, 2010). The output is graduates who lack the basic skills to contribute tangible value to the larger society by way of innovation and real productivity.

Table 26: Indicators of Educational Development in Nigeria (1997-2005)

	Indicators	1970	1986	1997	2005
1	Adult Literacy rate		49.8*	57	62.0
2	No. of Pupils per Primary School (000)	236	364	492	26,160
3	No. of Pupils per Teacher (Primary) (000)	34	44	52	40
4	No. of Pupils per Secondary School (000)	259	540	942	6,534
5	No. of Pupils per Teacher (Secondary) (000)	21	30	39	27
6	No. of Students per School (Tertiary Institutions) (000)	2894	5,658	2451	930
7	Percentage of Females in Educational Institutions				
	(1) Primary	-	-	43.5	53
	(2) Secondary	-	-	41.9	44
	(3) Tertiary	-	-	38.9	43
8	Number of Educational Institutions				
	(1) Primary	14,902	35,433	43,951	59,340
	(2) Secondary	1,379	5,730	7,311	12,610
	(3) Tertiary	5	24	138	128
9	Number of Enrolment at School				
	(1) Primary	3,515,827	12,914,870	21,161,852	26,160,000
	(2) Secondary	357,027	3,094,349	5,578,255	6,534,000
	(3) Tertiary	14,468	135,783	862,023	930,000

Source: Central Bank of Nigeria (2007) Annual Report and Statements of Accounts, CBN, Nigeria

Note: \*Means the value is for 1988

This invariably has led to decrease in industrial capacity utilization, caused steady increase in unemployment, caused structural imbalance in the society and brought about social insecurity and rise in the level of poverty (Borishade, 2001). Nigeria to solve its social and economic problems must take education seriously and commit the right amount of funding into education. And it should not stop at that it must put in place the right policies that will help take the education sector to a much higher level. Nigeria should understand that to have a sound innovation system that can contribute significantly to economic growth it must have people with the right skills. And these skills can be attained by consciously designing an education system that takes into consideration the present industrial deficiencies and also take into consideration the developmental direction the country desires to attain.

For Nigeria to successfully position itself to take advantage of global knowledge adapt such knowledge effectively and in turn create local knowledge it must have the right skills. It must therefore, strive to have the right system of education that will yield the right manpower. Apart from the obvious fact that government needs to commit more funds into education, Odiá & Omofonmwan (2007) suggested the importance of re-orienting teachers, parents and students/pupils with regards to examination malpractice and the importance of working as a team to ensure that the education system is refocused. This is very important, as many students have resulted to taking the 'short cut' to passing examinations instead of

studying. They rather cheat including paying teachers (Asinya, 2012), an act that is also encouraged by some parents. The resultant effect is students who are half backed. It is therefore, important that the issue of examination malpractice be checked and discouraged. Teachers should be severely punished if caught taking money from students in return for granting good grades. But the government as incentive and encouragement to teachers should also ensure that they are adequately remunerated. In the overall this task should not be left solely in the hands of the government, the school, the parents and the guardians should also be involved in promoting good conduct among teachers and students alike. It is also necessary to have more vocational and technical training centers across the country. This will help prepare interested individuals for specific trades, occupation or vocation. Government should get more serious in monitoring the activities of schools and ensure that they conform to set standards. For example the National University Commission (NUC) should regularly review academic curriculum and ensure they are up to date with current global trends. The NUC should also be adequately funded to implement and ensure that universities conform to established rules and regulations and also ensure that students conform to current academic and general schools rules and regulations.

It is also important that teachers/lecturers get adequate incentives and motivation to continue to work and focus on their jobs. They should receive adequate financial compensation, and given the right tools to deliver lectures. In general schools should be adequately equipped and the right quantity and quality of staff should be employed. There shouldn't be too many students to one teacher, the United Nations recommendation of 25 pupils to one primary school teacher should at least be adhered to. Furthermore schools should be equipped with modern learning facilities not only for the lecturers but also for the students. These should include basic Internet facilities, computers and so on. Government should also bear in mind that many Nigerians live below \$1 a day (UNICEF, 2005). For such a country it is obvious that many families will not have the funds to sponsor their wards to school. It is therefore advisable that the government subsidizes sufficiently primary and secondary educations.

### **Establish the Right Policies: Learning from other countries**

The economic development of a nation is largely influenced by its national innovation system; this system provides the platform for knowledge, invention and innovation to interact. It creates the environment for businesses, universities and government to co-exist and positively influence each other. And very core to any successful national innovation system is the level of R&D that takes place within the system. R&D in any national innovation system can be undertaken by businesses, universities and even government. An emerging economy such as Nigeria needs to choose the right strategy to derive the maximum possible amount of R&D efficiency and this will entail choosing the right mix of R&D between government, business and university. As part of the strategy to utilize national innovation system for economic development Nigeria can learn from countries like South Korea and Taiwan in the 1960s and more recently from China and India.

In the early 1960s South Korea was recorded as one of the poorest countries in the world with a per capita GDP that was less than that of Sudan and less than one-third of Mexico's (Greenhalgh & Rogers, 2010). South Korean firms were minimally involved in R&D contributing only 2.3 percent of the total R&D in the economy. Kim & Kim (2005) also noted that even the universities in South Korea did little R&D. Having understood these problems and seen the desire to transform its economy the South Korean government decided to embark on measures that will bring about real change. It started to setup standard and functional research institutes in the 1960s. The main objective for setting up these institutes were for them to understand foreign technologies including knowing the 'why' and 'how'

these technologies work. This enabled them to be able to carry out reverse engineering and technology transfer. These institutes were also tasked with the responsibility to train researchers for the private sector. The government also strengthened research in the universities by establishing the Korean Advanced Institute of Science Technology in 1971. The reason for this was for this institute to perform high quality research and train sound scientists (Greenhalgh & Rogers, 2010). By the 1970s the Korean economy has began to grow as a result of the drastic measures taken by the government to promote R&D. Government continued to encourage private firms to engage in R&D by giving them tax breaks and providing cheap finance. And it also continued to strengthen and promote the ability of research institutes and universities to engage in solid R&D throughout the 1970s and 1980s.

Taiwan took a similar measure like South Korea although Taiwan was not as poor as South Korea, as it had both better GDP per capita and education system (Greenhalgh & Rogers, 2010). The Taiwanese government like Korea recognized the importance of R&D in economic development, so in 1973 it established the Industrial Technology Research Institute (ITRI). The ITRI revolutionized the Taiwan economy such that by the year 2003 over 6,000 Taiwan patents were in force worldwide and it also helped to establish more than 30,000 local firms in Taiwan including the Taiwan Semi-conductor Manufacturing Company and the United Micro-electronics Corporation (Peng et al., 2006). One of the major differences between Taiwan and Korea approach was that while in Korea the industrial landscape was dominated by large corporations such as Samsung, Hyundai and Lucky Goldstar (LG), the Taiwanese focused on SMEs. The SMEs as one would expect were very dependent on government to be able to engage in reasonable R&D project. These SMEs often come together and form industrial clusters thereby facilitating better flow of knowledge.

China is another country that is revolutionizing its economy through the use of science, technology and innovation. Despite its very large population, it has been able to pretty much jump-start its innovation promotion approach in a similar way as Korea and Taiwan. It basically used (and still uses) technology coming from more technologically advanced countries such as Japan and the US. It also takes advantage of FDI and joint ventures. Because China has a relatively cheaper cost of production many multinational companies have outsourced their production to China. This has helped promote the transfer of knowledge and technology into China. China's growth was also boosted by its increased export abroad especially to the United States. China in order to rapidly learn from the knowledge and technology transferred to its shores had to increase its R&D spending. Lundin & Serger (2007) reported that China's R&D to GDP ratio increased from 0.6 percent in 1995 to 1.3 percent in 2005. However, since China's GDP between this period increased by more than 100 percent, it implies that its absolute R&D expenditure increased by more than 400 percent. This increase was largely driven by the increase in the amount firms spend on R&D, a figure that rose from 27 percent in 1990 to 68 percent in 2005 (Greenhalgh & Rogers, 2010). China's business environment was also made conducive to foreign multinationals as about 29 percent of China's manufacturing R&D were executed by foreign firms.

India increased its expenditures in R&D steadily between 1958 and 1987. Its R&D to GDP ratio rose from 0.17 percent in 1958 to 1 percent in 1987 but then declined to 0.7 percent according to Kumar (2001). India has focused a lot in expanding and extending science and technology education since its independence in 1947. This is such that by 1999 its universities had seven million enrolled students out of which two million were enrolled in technical subjects. This quest to promote the study of technical subjects combined with other policy initiatives to drive R&D proved very important in the establishment of two of India's most important industrial sectors; pharmaceuticals and computer software (Greenhalgh & Rogers, 2010). It is worthy of note that these efforts by the Indian government have brought

about significant improvement in both the software and pharmaceutical industries. However, the growth in the pharmaceutical industry after 1970 was quite significant. India introduced a new Patent Act in 1970 and this new Act removed patent protection on pharmaceuticals, chemicals and food and also reduced the duration of protection on other products and process inventions (Kumar, 2003).

Nigeria in the past understood the place of R&D in economic development. For this reason it set up quite a number of universities with special focus on technology and science. Some of these include the Rivers State University of Science and Technology; Federal University of Technology, Owerri; Federal University of Agriculture, Markurdi; Federal University of Technology, Minna; and many others. It also established a substantial amount of research institutes such as National Space Research & Development Agency (NARSDA), Project Development Institute (PRODA), National Agency for Science and Engineering Infrastructure (NASeni), National Research Institute for Chemical Technology (NARICT), Federal Institute of Industrial Research (FIRO). Some of these research institutes were originally intended to understand foreign technologies and be able to reverse engineer these technologies to suit domestic requirements. However, this has not been the case as most of these research institutes have not lived up to their expected mandates (Adeboye, 1995). So many reasons can be attributed to this failure not excluding the lack of vision on the part of government in understanding the place of R&D in economic development. Be that as it may the government should study how R&D helped transform Korea's economy, learn critical lessons from the Korea case and adapt it to Nigeria. Nigeria needs to strengthen its research institutes and if possible restructure them and give them new mandates based on present technological realities and advancements vis-a-vis the needs of the country. The government needs to ensure that proper funding provisions are made available to these research institutes. The present quest by the government of Nigeria to have a standing funding provision as contained in the recently approved Science Technology and Innovation policy is a step in the right direction. This policy intends to establish a National Research and Innovation Fund (NRIF), with a minimum of 1 percent of GDP and not less than 5 percent strategically sourced from the selected public, private and international organizations such as Raw Materials Research and Development Council (RMRDC), Tertiary Education Trust (TET) Fund, Industrial Training Fund (ITF), Petroleum Technology Development Fund (PTDF), Automotive Development Fund (ADF) and many others.

As is the case in China the Nigeria business environment should not only be conducive to FDI inflows and joint ventures but it should also be such that can stimulate R&D spending on the part of foreign firms. This will contribute to job creation, more investment in the economy and in general economic growth. Nigeria may need to consider the approach India adopted to improve innovation especially the strategy it adopted for its pharmaceutical industry. Nigeria may consider removing or relaxing the protection on certain products or industries with the intention of promoting innovation in that sector. The insignificant and negative coefficient of IPRs protection with respect to the rate of innovation in developing countries implies that it is not just enough to tighten IPRs protection in Nigeria when there are weak institutions, high rate of corruption, low interaction between universities, research institutes and industries, uncoordinated industrial clusters and weak socio-economic infrastructure. Nigeria should therefore learn from the common strategies adopted by these countries especially South Korea, Taiwan and recently China which is bringing in and learning from foreign technologies. Nigeria needs to perfect ways of effectively imitating and adapting foreign technologies. Furthermore, Since Nigeria has a lot of SMEs and entrepreneurs it may need to learn from Taiwan and adopt a strategy to effectively encourage and fund R&D projects among SMEs.

Nigeria can learn a few lessons from Singapore as well. It should strengthen its R&D system and build a culture of innovation in its universities. Singapore recognized the place of having a strong innovation system. It saw it as a strategic step in remaining competitive in the knowledge economy. For Nigeria to effectively follow the steps Singapore took it must build an overall culture of innovation and ensure stronger protection of IPRs after it has built the necessary skill base and gained some experience in replicating foreign technologies as already pointed out above. It should put significant amount of funds into university research and private sector research.

### **Encourage Firm Level Innovation**

Nigeria should move to put in place microeconomic policies to encourage firm level innovation. It should be noted that an increasing number of OECD countries are introducing subsidies for R&D (Greenhalgh & Rogers, 2010). The OECD countries are in competition on who will be the preferred R&D destination for foreign firms. Some countries have also adopted strategies such as providing grants for R&D and providing financing for certain types of research. Between 1971 and 2008 the volume of patents granted in the US grew from 81,790 to 182,901 (Greenhalgh & Rogers, 2010) as subsidies have been discovered to provide the right incentive for private firms to innovate. Likewise the European Patent Office recorded about three times increase in the number of patent grants between 1985 and 2005 (Hall, 2007). The US after the 1980 also recorded significant increase in the number of patent grants. For the US many commentators argued that the increase was as a result of the legal and policy changes that took place in the US patent system. The US Supreme Court gradually extended the coverage of patent protection starting from the 1980s to include biotechnology, software, business methods and scientific research methods (Hall, 2007). The 1980 Bayh-Dole Act also helped universities to become more active in patenting. A Court of Appeals for the Federal Circuit was created in 1982 to specially handle cases pertaining to patent infringements and validity. Furthermore in 1984 the Drug Price Competition and Patent Restoration Act allowed companies to have an extra five years for the time spent on seeking approval for a particular drug. Also in the 1990s the USPTO was commercialized, this some argued made the USPTO more efficient as examination costs were reduced and it was able to process more patents in less time. And lastly it increased the duration of its patent protection from 17 years to 20 years. All these policy and legal regulations many argue helped the US to generate more patents (Jaffe & Lerner, 2004; Bessen & Meurer, 2008).

Even though some may argue that increasing the number of patent grants may not necessarily mean that the environment is conducive for innovation and economic growth. It is however, a step in the right direction for a developing country such as Nigeria as granting more patents will mean a more vibrant economy where the firm level research is thriving, research institutes are active and the universities are actually involved in the matters of researching and coming up with goods and services that are relevant to the society. Private firms should be encouraged to innovate as the outputs of their investment in R&D are not only for their private consumption but also for the social benefit of the wider public. In fact Nadiri (2003) argues that the social rates of returns of R&D may range between 20 percent to over 100 percent depending on the industry. Encouraging R&D at the firm level will ensure that firms keep producing goods and services that are beneficial to the general society. Other ways government can support firm level R&D include incentives (but note that this has to be properly calculated to ensure it yields the desired result, does not distort the economy and that there is no abuse), direct subsidies, grants and by encouraging joint ventures.

Nigeria should strongly consider giving tax incentives to the domestic firms. The OECD (2002) even shows that 18 of its members use some form of tax incentives to encourage R&D. Giving tax incentives have shown to bring about significant increase in

R&D. Hall & Van Reenan (2002) in their work revealed that there is a \$1 increase in R&D for every \$1 of tax relief. Two main types of R&D tax incentives were deployed by some of the OECD member states. One was the 'level' tax incentive and the other was referred to as the 'incremental' tax incentive. The 'level' tax incentive entails giving tax relief on the total amount spent on R&D (some countries however put a limit to the amount of tax relief they are willing to give). The 'incremental' approach gives tax relief on increase on R&D over a defined base figure (Greenhalgh & Rogers, 2010). Each of these options has its merits and demerits. So countries choose the option that is more suitable for them at each point in time and this may include combining both approaches. Nigeria can choose any of these options. It may also choose to combine both options or totally adopt a new strategy that will take into full cognizance the dynamics of the Nigeria business environment.

Giving direct grants is another option that Nigeria should consider. Even though OECD (2007) reported that such grants are becoming less important as a source of financing R&D amongst private firms. It however, still remains a very important funding source for certain firms; take for instance the UK's SMART program that was specifically targeted towards SMEs. It can also be an important means of funding research in certain technologies take for example the case of United State's Advanced Technology Program. And lastly it can be used as a measure to encourage joint venture research as was the case in the UK's LINK scheme (OECD, 2006). Giving grants are not without its shortcomings. Some of the drawbacks include the problem of selectivity and crowding. The issue of selectivity arises as the government largely may end up selecting and awarding grants to the wrong businesses. This may be due to a faulty selection process or simply as a result of human bias. And crowding out can occur where and when the grant replaces private R&D spending (Jaffe, 2002). Whatever the negatives may be, Nigeria can design its R&D grant strategy such that takes into consideration these pitfalls.

The government can choose to offer prizes to individuals that come up with specific innovations. This approach has been in use for many years now. The British government in 1714 offered a prize for anyone that was able to invent a method for determining a ship's longitude as this was a major problem for ship navigation at that time (Bays & Jansen, 1995). In 1895 the Chicago Times-Herald offered a prize for the invention of a motor vehicle that could win a race of traveling a 54 miles course from down town Chicago to Evanston, Il and back (Bhushan, 2010). Nigeria could offer prizes in areas that require quick attention in the society. Nigeria is at the moment suffering from huge infrastructural deficit. It could for instance go out to offer prize for someone who can develop a cheap power system for rural dwellers, a system that will work using basic materials found in the rural regions of Nigeria and that will cost very little or nothing to the rural dwellers. This sort of prize giving is meant to spur people to develop new ideas that are socially beneficial. Some time private firms may not want to invest in some R&D activities that will yield outputs that are economically not profitable even when the inventions may be socially beneficial. To encourage them to go ahead with such investments it is either the government provides prize awards for such inventions, buyout the invention when it is done or provide direct grants to the firms as already mentioned above. Kremer (1998) suggests that government can go as far as buying out patents that have already been granted, the government can use an auction approach to get the baseline value of the patent. The universities in Nigeria should be encouraged to be more active in patenting and technology licensing. As mentioned earlier that the US 1980 Bayh-Dole Act made way for US universities to begin to participate more in patenting and technology licensing. As part of the process to ensure that the universities are more active in this direction the universities were made to establish technology transfer offices (TTO). The number of TTOs in the US increased drastically from 600 in 1980 to 3,278 in 2005. And correspondingly the annual revenue generated by US universities from

licensing rose from \$160 million in 1991 to \$1.4 billion in 2005 (Siegel et al., 2007). Nigeria has taken steps in this direction by establishing 30 intellectual property technology transfer offices (IPTTOs) in universities, Polytechniques and research institutes across the country. The aim according to information obtained from NOTAP's website ([www.notap.gov.ng](http://www.notap.gov.ng)) is for the IPTTOs to be positioned to be able to develop robust IPRs portfolios through patenting and technology licensing. The IPTTOs are also expected to design and develop ways of encouraging and rewarding individuals such that will spur more research work and partnerships. And setting up these IPTTOs will further help to strengthen the relationship and linkage between tertiary institutions, research institutes and industries. The government should strive to actually strengthen these IPTTOs further so that they are able to fulfill the reasons why they were setup. The IPTTOs should be restructured if necessary to ensure that they are fully positioned and equipped to deliver the core mandate of improving research focus, providing the needed incentives for science and technology based faculties to be more active, create additional sources of revenue to the universities and research institutes, and lastly to provide mechanism for wider diffusion of knowledge (Greenhalgh & Rogers, 2010).

The Nigerian government can also adopt some additional measures such as changing its procurement policy. The government of Nigeria some time during the term of one of its previous administrations (the administration of President Olusegun Obasanjo specifically) stated that the Federal Government Ministries should use made in Nigeria products including computer software (**Okwuke, 2012**). The aim at the time was to encourage local computer software development to be more innovative, develop more affordable software, and create employment for Nigerians and produce software that are more suited for Nigerian use (Momodu, et al., 2007). This move was later jettisoned and gradually government Ministries, Departments and Agencies returned to buying computer software including computer systems from anywhere in the world. However, the Nigeria government has recently started to reintroduce and enforce this policy (Adeniyi, 2012). The UK government has used change in procurement policy to promote domestic innovation, see NEST (2007). Edler et al. (2005) pointed out nine instances where European countries used changes in procurement policy to spur technological innovation. The Nigerian government can indeed use procurement policies to encourage domestic innovation among domestic firms.

For Nigeria to remain competitive in the global knowledge stage it must begin to advance domestic innovation. China has since realized the need to reform its economy and put in place policies that will encourage domestic innovation. It has however, encountered some obstacles in its quest to become a fully knowledge driven economy. This obstacle is due largely to its closed political system. For Nigeria to learn lessons from the progress China has recorded so far it needs to first of all develop a domestic innovation culture. Nigeria also needs to learn from China that it does not really pay to have a closed economy as it may become difficult eventually to integrate into the global economy. Nigeria at this stage should endeavor to put together factors and policies that will drive innovation. Nigeria should like China not be in a hurry to enact a very tight IPRs regime and other protection policies. It should first concentrate on factors that will strengthen innovation and then begin to strengthen IPRs protection at a later period. This will then enable the country to begin to carry out innovation in a more effective, structured and efficient manner. And this will further help it to develop more sophisticated innovations (Radman & Pellegrini, 2010).

Like Korea Nigeria should learn to develop an innovation system that is built around and driven by the private sector. Nigeria should develop skills and innovation base that is in consonance with the needs and requirements of the industry. The Nigerian government like the Korean government should transition from being a mere regulator to become more active in driving the economy. It does not have to take the role of the private sector but it should rather ensure that it provides the needed facilities say in terms of basic infrastructure that will



enable the private sector to thrive effectively. For example it should quicken its investment in information and communication technology infrastructure if it intends to achieve the desire of becoming a major player in off-shoring activities. Nigeria should strive to begin to invest in churning out the necessary skills such that will strengthen all relevant sectors of the economy. It should significantly build its knowledge capacity and technical base before going into the next phase of investing seriously in R&D. One key way that Korea built its firm level skill base is by imitating and diffusing technologies borrowed from more technologically advanced countries. Nigeria should encourage its local firms to invest more in R&D. Their investment in R&D should begin by concentrating on investing in research areas that will help in the imitation and assimilation of foreign technologies. This is a good way to jump start domestic innovation. Nigerian firms should begin to give special funding to R&D in universities and research institutes. Like Korea, Nigeria should equally encourage private firms to invest in the education sector. Private firms can for example fund specific research areas in the universities. This funding from the private sector will help augment the funding from the government and at the end of the day create adequate pool of funding for research in the universities (Radman & Pellegrini, 2010).

### **Importance of a National Innovation System**

This paper recognizes the importance of tertiary institutions, research institutes and indeed the government in providing the foundation for the development of science and technology such that promotes the process of innovation. This paper further recognizes the immense role business enterprises play in promoting innovation. But this will not be without the support from tertiary institutions, research institutes and the government. There should be seamless linkage between research institutes, tertiary institutions, government and industries. For example the government or a business can sponsor research projects in specific research centers or universities. The outcome of which the business can use to enhance its products and services, especially in a case where the research is directly sponsored by the business. At the end of the line it will be the consumer who will eventually over time get a cheaper and better quality product. For a nation to get individuals and firms to invest and continue to invest in research and development it must have an in depth understanding of how intellectual property rights protection system works. The IPRs protection system is a key portion of what is often referred to as the national innovation system (NIS). Having a sound innovation system is important if a nation plans to have the right policies, maximize innovation and in the overall create wealth. This paper going forward will analyze how a country such as Nigeria can put the right mechanism together such that will help establish a lasting and sustainable national innovation system.

What exactly is the national innovation system (NIS)? As shown in the figure below the NIS basically consists of three sectors namely industry (including financial institutions, agro-chemical, steel, fashion, entertainment etcetera), tertiary institutions (universities, poly-techniques, research institutions etcetera) and the government (at all levels including; federal, regional, state, local) interacting with one another, see figures 6.9 and 6.10 below. Each of the sectors has constant interaction with the other sectors while at the same time performing its own unique and separate function (Goto, 2000). It is an innovation system that takes into consideration the nation's current technological development vis-à-vis where it intends to be in the medium and long term. It includes policies that will help transform the nation without jeopardizing its sovereign integrity, present economic standing, the wellbeing of the citizens, and indeed the wellbeing of firms situated in that country.

Economists and policy makers see NIS as a tool for assessing and understanding the main factors responsible for the different economic advancement between developing and developed nations. They also see NIS as a tool that can be used to bridge the gap between the

developed and the less developed countries terms of developing robust conceptual framework that can help in the establishment of the right policies and requisite institutions (Feinson, 2003).

As pointed out by Niosi et al., (1993) the interaction or relationship between the main components of NIS may be technical, commercial, legal, social and financial as long as the ultimate aim of the interaction is to develop, protect, finance or regulate new science and technology initiatives. Lundvall (2000) noted that within a society one would always find continuous process of learning, searching, and exploring which together give rise to new products, new technologies, new forms of organization and even new markets. He went further to state that innovation is a gradual and cumulative process rather than a stage. Mytelka (2001) further noted that this process is non-linear but rather involves a complex and continuous interaction between suppliers, clients, universities, research institutes, regulatory bodies, banks, insurance companies and other stakeholders within a community. It is a huge eco-system that is social and at the same time dynamic (Lundvall, 2000). It is social as a result of the nature of the institution involved. And it is dynamic by reason of the linkages and interaction between the members of the NIS eco-system.

Why should Nigeria in this age of globalization and regional integration be bothered about its NIS? Why shouldn't it simply allow globalization to determine or say allow the African Union or Economic Community of West African States (ECOWAS) sub-region decide how it should go as far as innovation is concern. Sachs et al., (2001) observed that fore mostly there is strong correlation between poverty and geography and that most developmental gaps are geographically bounded. While the flow of financial capital may be easy across borders, the flow of knowledge is not that easy. This is primarily because unlike financial capital, knowledge is intangible. Human capital basically means tacit knowledge and such knowledge is difficult to transfer without the consent of the owner and sometimes it may even require moving people from one location to another. And this difficulty to move human capital is a key component of NIS. The other components such as tertiary institutions, government regulations and national resources are all largely location bound (Niosi, 2000). It therefore, makes sense that Nigeria looks at NIS at the national level. NIS framework and policies are already established in most developed countries but it is only a recent concept in developing countries such as Nigeria. In fact the draft NIS framework in Nigeria is yet to be formally approved.

The interaction between the actors in a truly innovation system is complex and non-linear. A robust policy that can spur true innovation should not be one that is based on "technology push" concept with the aim of strengthening science and engineering education in the universities neither should it be one that merely seeks to generate "demand pull" for local scientific and technological research (Mytelka, 2001). Rather the policies should be geared towards establishing local capacity to acquire, absorb and disseminate modern technologies. The policies should take into consideration the peculiarities of Nigeria. In developed economies such as the United States, United Kingdom, France and Germany the innovation system merely serve to maintain or improve an already established economic growth system, whereas a typical developing country like Nigeria is only aiming to at least first "catch up" with the developed economies. For Nigeria to duly catch up with the developed countries it must follow a holistic approach to IPRs management and see innovation as a critical factor if it is to achieve a sustainable economic development; sustainable in the sense that such development has to be continuous and not a onetime affair. If Nigeria therefore, intends to get to the top of the economic ladder and remain there it must develop an all-inclusive approach to IPRs and innovation.

Local firms in Nigeria must also adopt this sort of holistic approach in their internal IPRs management and innovation system. These firms should not merely focus on the

physical acquisition but they should strive to understand the how and why a particular technology works. Should a firm know only the “how” and not the “why” the firm may be limited as the firm may not be able to fix any technical problems that may arise from using a given technology. And the firm will not be able to modify and domesticate the technology to suite the local circumstances. Also should the firm know only the “why” and not the “how” it will not be able to effectively operate and utilize the technology (Dahlman & Nelson, 1995). Technology acquisition by local firms should therefore, be total. It must include both the “why” and the “how” the technology works. The Nigeria National Office for Technology Acquisition and Promotion (NOTAP) has the mandate to ensure that when Nigeria firms acquire new technologies that the firms not only just buy the technology but that there is a technology transfer as well from the foreign firm to the local firm. While NOTAP ensures that a technology transfer agreement is entered into between the local and the foreign firms, the local firm has the additional responsibility of ensuring that it truly understands the “why” and the “how” of the technology. On the other hand NOTAP can put more control on the frequency and type of technologies that get imported into the country. It can together with other relevant government agencies such as National Information Technology Development Agency (NITDA) work out a model to control say foreign software inflow into Nigeria. To encourage the local development of certain software NITDA can give incentives to local software developers to build such software. On its part NOTAP will cease to permit local firms to import such software from abroad but rather encourage them to patronize the local developers. Furthermore, government institutions should lead by example by using such software where applicable for their operations. This the government can ensure by establishing a mandate to that respect and enforcing the adoption and implementation of the mandate.

The NIS approach is a much more integrated and all encompassing system compared to the systems that only measure or view technological development in terms of input (for example funding put into research and development, funding of science etcetera) and outputs (number of publications, patents granted etcetera). The input/output approach looks at technological development of a nation from a static standpoint; it can provide a very static view of the level of innovation in a country. It takes it that there is a direct relationship between science (research and development) and industrial development; which is more investment in science will lead to more and better technologies and that this in turn will lead to industrial improvements and invariably economic growth. On the other hand the NIS approach assumes that there is a relationship between policies, institutions and the people that facilitate the flow of knowledge within domestic industries and across borders. And that this relationship is by no means static. The NIS approach further emphasizes a dynamic link between macro-economic, educational policies and innovation within a country. This holistic approach can be argued to be more favorable for policy makers to utilize as it enables them to easily identify the factors that need improvement within the network of interactive variables. From the analysis of NIS implemented in other countries it shows that while public institutions and academic bodies can support national technological efforts they should not be a replacement for technological efforts by domestic firms (Nelson & Rosenber, 1993). Lessons from already existing NIS structures suggest that to develop a sound national absorptive capacity for new technologies the nation in question must build human capital through education and training. And lastly economic policies must be fashioned to spur international competitiveness. Going forward Nigeria should not see NIS as meant for more advanced countries neither should it see it as an expensive and an unnecessary venture (Juma et al., 2001). Nigeria should therefore, go ahead and conceptualize a robust NIS structure that will take into consideration the various peculiarities of the Nigeria socio-economic and

political environment. It should take all that into consideration in designing an NIS system that can take it from a developing nation to a developed nation.

### **Conceptualizing a National Innovation System for Nigeria**

Developed countries are historically technology leaders while developing countries are technology followers. The key to development on the part of developing nations is to successfully close the technological gap between them and developed nations. This can be achieved by importing existing technologies and creating the requisite internal capacity to learn and improve on this existing technology (Feinson, 2003). The acquisition, absorption and effective diffusion of these existing technologies require huge investments in technological and social infrastructures.

In developing its NIS concept, Nigeria may wish to learn and probably adapt some strategies from Charles Edquist innovation concept called systems of innovation for development (SID). Charles Edquist basically suggests that SID is different from NIS in four key areas namely:

1. Product innovation are tagged to be more important and easily attainable compared to process innovation;
2. Focusing on absorption and diffusion is more important and beneficial to a nation than developing new innovations;
3. Incremental innovations are more important and easily attainable when compared to radical innovations;
4. And lastly he is of the view that it is much easier to achieve innovation in low and medium technologies than it is for high technologies.

Viotti (2001) described learning as it applies to developing countries as the process of technical change within a country achieved by diffusion and incremental innovation. In other words, learning can be said to be the absorption of already existing technologies produced elsewhere and the subsequent improvement on that technology and further adapting it to the local environment. For Nigeria learning will mean allowing existing technologies from say US, France, UK and Germany to fully diffuse into the system (that is fully absorbing the technology) and then creating further improvement on the technology in such a manner that it begins to solve specific issues in Nigeria. As suggested by Edquist at this its early stage of technological innovation Nigeria should focus more on building incremental innovations than radical innovations and this should be within the low to medium technology band than in high technologies. It is after it has mastered such incremental and low level technologies and achieved proper diffusion that it can begin to move to more sophisticated technologies.

### **Creating National Boundaries for NIS**

Nigeria should not fall into the trap of thinking that the entire country's social, economic, political and cultural activities can be included within the boundaries of the NIS. One may therefore, ask what then should be included? (Edquist, 2001). The country should start by defining the functional boundaries of NIS aside from the real functions of creating, disseminating and using innovation. Different researchers have expressed their views as to what they consider as the real or core functions of the NIS. For instance Johnson and Jacobsson (2000) listed five key functions needed in a technological system as:

1. Establishment and diffusion of new knowledge;
2. Provision of duration for the search process both to users and suppliers of technology. This entails helping them to understand the growth potential of a given technology;
3. Ensure availability of requisite capital and adequate competence;
4. Ensure that positive external economies are created; inspired by both market and non-market factors;

5. Guarantying the creation of markets where innovations can readily be traded. This may need to be simulated or created outright.

Rickne (2000) developed a more extensive list which like the one by Johnson and Jacobsson (2000) also contained active creation and absorption of knowledge, environment for knowledge diffusion and active learning, guaranty of market for new innovations and so on. Liu and White (2001) however, developed a somewhat different framework for the functional boundaries of an NIS, these include:

1. Research and development;
2. Implementation (manufacturing);
3. End-user (customers of the product or process output);
4. Linkages (bringing together complementary knowledge) and
5. Education

### **Redefining the proposed Nigerian National System of Innovation**

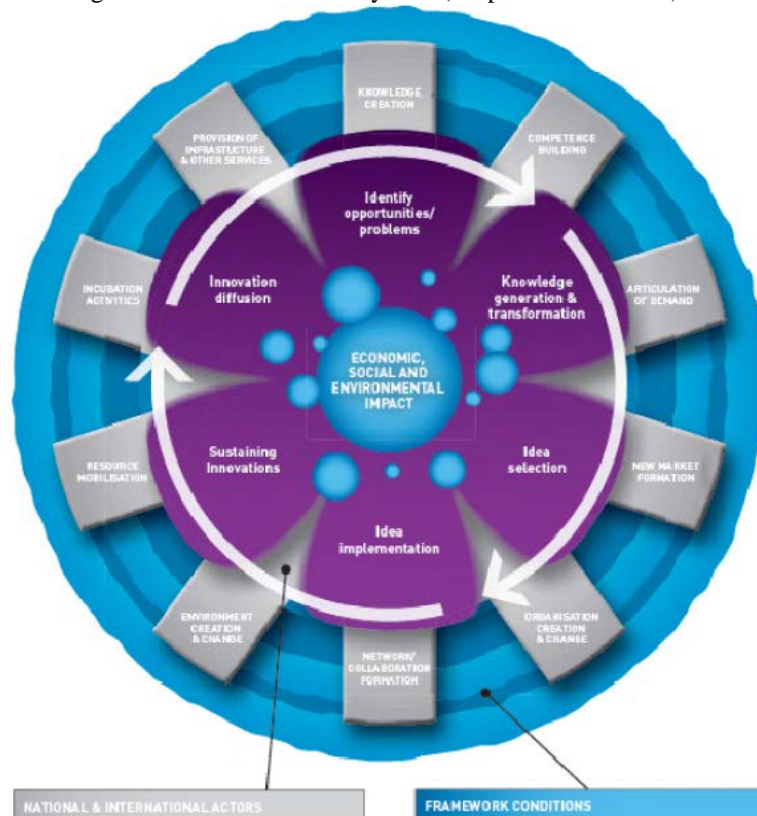
Having identified the key steps that must be taken to create an environment and system that truly promotes innovation, Nigeria must then move to incorporate all these steps into its innovation system. A typical innovation system has certain actors and linkages that make the system effective. The NIS system can be narrowly or broadly defined. Narrow NIS concepts include those institutions and policies that are directly involved in scientific and technological innovation. On the other hand a broad NIS concept takes a broader perspective of the NIS and includes components such as social, cultural and political systems of the country in question, in this case Nigeria. According to the OECD (1999) the narrow NIS comprises of five major components including:

1. Government: local, state, regional and the Federal government with all having varying levels of influence depending on host country's specific country dynamics. But collectively all play critical role in setting broad policy guidelines;
2. Building institutions such as the various research councils and research associations all acting as intermediaries between government and actual performers of research;
3. Private firms and the research institutes they finance;
4. Universities and research institutions that provide the actual knowledge and skills; and
5. Lastly other organizations both public and private that play defined roles in the NIS (public laboratories, technology transfer organizations, joint research institutions, patent offices and training organizations).

The broad NIS in addition to all the components of the narrow NIS includes all economic, political and other social institutions that have direct or indirect influence on learning, searching and exploring activities. These will include the nation's financial regulatory policies and institutions, labor markets, and so on. The diagram in figure 33 below shows how the narrow NIS concept is embedded within the broad NIS system. The efficiency of any NIS system is a function of how smoothly knowledge and resources flow between the narrow and broad levels of the NIS. The Nigerian National Centre for Technology Management (NACETEM) identified four key elements as the core components for the Nigeria National Innovation System (NIS). The elements are education and research, industrial production, finance and public policy and regulation. The study by NACETEM observed that the linkage between research agencies in the Federal Ministry of Science and Technology and industrial firms is very weak. NACETEM suggests that for this problem to be fixed there must be a complete policy overhaul on the part of the Federal Government of Nigeria ([www.nacetem.org](http://www.nacetem.org)).

The Federal Government of Nigeria has approved a national Science, Technology and Innovation (STI) policy for the Federal Ministry of Science and Technology (FMST). The mandate is therefore bestowed on FMST to ensure the development of a National Innovation System (referred to as the National System of Innovation according to the document 'Framework for the Nigerian National System of Innovation' see [www.fmst.gov.ng](http://www.fmst.gov.ng)). The Nigeria NIS framework as proposed by FMST has three key components; networks, innovation activities and framework conditions (financial environments, taxation and incentives, propensity to innovations and entrepreneurship, capacity building, mobility etcetera). These three components are expected to work together to produce and ensure the diffusion of innovations that have socio-economic and environmental value. The concept of the NIS as suggested by FMST is a modification of the OECD concept as represented in figure 33 below.

Figure 33: The Innovation System (adapted from OECD)



Some of the conditions set out by FMST in its quest to develop a robust NIS framework are to ensure that there is some level of regulation of the innovation environment, creation of new markets where necessary and to make sure existing markets become more efficient. The proposed framework recognizes the important role the government has to play if Nigeria is to have a truly sustainable NIS framework. The framework is expected to ensure that the right workforce with the right skills exists in Nigeria by putting together a sound education policy. It however, needs to ensure it has a well thought out strategy on how intellectual property can be protected by putting in place tailored IPRs laws and enforcement policy such that takes into consideration the current technological standing of the country. The IPRs regime should not be made to be too strong but rather be adapted and localized to address the developmental/technological gaps in the country. And furthermore, it needs to ensure that businesses have the right environment to operate by establishing a good regulatory framework. The overall role of the government as expressed by the FMST in the proposed NIS framework is as follows:

- Create conditions for innovation to flourish;
- Enable innovation and not to be involved in its management;
- Create the markets where necessary where innovative products can be sold and create conditions that will enable buyers patronize innovative products and processes;
- Provide the necessary political will;
- Facilitate innovation through human capital investment, policies and processes;
- Create vision, new partnerships and respond to new demands.

The proposed NIS framework is designed to have five innovation councils including the federal, sectoral, regional, state and local levels.

Federal Innovation Council (FIC) will develop a 10-year innovation roadmap for Nigeria and will come up with a framework that will achieve the following:

- Develop a Nigerian Innovation model centered on inclusive growth;
- Ensure that innovation is enshrined in culture of Nigerians starting from the grassroots;
- Establish the requisite policies that will inspire innovation;
- Develop and promote innovation attitudes among women and youth;
- Create the right eco-systems and atmosphere that will cause the development of inclusive innovation;
- Explore new collaborative approaches and strategies to foster innovation and also seek ways to expand and sustain innovations;
- Encourage innovations at all levels including federal, state, and local government areas. It is also expected to promote innovative activities in tertiary institutions, research institutes, corporate bodies (including SMEs) and even among government ministries and departments;
- Help seek and disseminate multi-disciplinary and globally competitive approaches to innovation that will help give Nigeria innovations a global edge;
- And finally the FIC will be responsible for organizing yearly Nigeria Innovation Summit/Round Table.

The FIC shall be chaired by a respected and accomplished entrepreneur with a science and technology background. He will be appointed by the Minister of Federal Ministry of Science and Technology. It is further proposed that the council shall have an international administrative board (made up of individuals drawn from the top six leading innovation countries of the world).

The NIS framework proposes the creation of sectoral innovation council (SeIC) across the various industrial sectors. These SeICs will develop roadmaps and strategies suitable for their sector and in line with the objective of the FIC. It is expected that various government ministries should setup SeICs specific to their sectors. Ministries are also encouraged to setup multiple SeICs taking into consideration the different departments and agencies under each ministry. The SeICs is to achieve the following:

- Initiate, promote and support innovation within its defined sector and prepare a 10 year roadmap;
- Establish an opportunity map in terms of innovation for the sector;
- Encourage women and youth in that sector to be involved in innovation and also encourage tertiary institutions, research institutions and enterprises in that sector to be innovative;
- Create incentives for innovation in the sector by for instance openly identifying and rewarding in the sector and popularizing such technological breakthrough;

- Organize events that will help spur innovation in the sector such as seminars, workshops, lectures and organize periodic stakeholder forum. Also create an effective means of ensuring the smooth dissemination of information; and
- Ensure the development of a robust innovation eco-system for the sector;

The composition in terms of council membership of each of the SeIC will comprise representatives from all stakeholders within the sector. This will include distinguished and established entrepreneurs, relevant professional bodies, people from the academia, and staff of the relevant government ministries, social entrepreneurs in the sector and so on.

This sounds like a good plan but setting up too many layers within the innovation framework will create exactly one of the problems the NIS is meant to eradicate which is bureaucracy. Having multiple SeICs within a ministry reporting to various heads who in turn report to the Minister or responsible director who also needs to report to the FIC will for sure create some bottlenecks. Even though the various SeICs are not expected to constantly run through the ranks to the FIC, they are at least expected to constantly ensure that they align with the objectives of the FIC. The many SeICs will require huge resources and if not closely managed may end up defeating the purpose. This paper therefore, suggests that Nigeria will be better of keeping its NIS framework simple and straight to the point. It does not have to delve into all sectors for a start. It could do well by selecting few very critical sectors and as it establishes its NIS framework it may begin to expand its scope and reach to other sectors.

The state innovation council (SIC) is proposed to be setup after an extensive consultation with the Nigerian Governors Forum ( a political association comprising of all the state governors in Nigeria). The SIC is expected to promote innovation in the respective states across the country including the Federal Capital Territory. The SIC is expected to bring about an increase in the efficiency and productivity of each of the state. It will create employment, boost economic growth and improve the welfare of the people living in the state. The SIC is expected to collaborate and align with the guidelines laid down by FIC. The functions of the SIC are quite similar with that of the SeIC except this time at the state level. Furthermore the composition in terms of membership of the SIC is to be drawn from accomplished entrepreneurs with businesses in that state, professional bodies with strong input on innovation, research and development institutions in the state including tertiary institutions, representation from small and medium scale enterprises, non-governmental organizations, youth groups, think tank and policy groups and so on.

As can be seen above the proposed setup of the state innovation council is already looking very political and cumbersome. The body that is expected to play a major role in the establishment of the SIC is the governors forum, a highly political body. The chances that the membership and objectives of the SIC will be politicized is very high. The state governments can do the research institutions, tertiary institutions and private organizations a lot of good if it focuses more on creating the right policies and putting in place the right infrastructures and favorable business environment that can spur innovation instead of overly politicizing innovation.

The NIS framework also proposes the creation of the regional innovation councils (RIC). These will comprise of states within a given geo-political zones (there are six such regions in Nigeria and each geo-political zone has a given number of states within it). This is obviously not necessary at all. Nigeria at the moment does not have regional government; it however recognizes the ix geo-political zones for purely political reason. Creating the RICs will really do innovation more harm than good. It will simply create further layer of bottleneck and waste of resources than help promote and spur innovation. The idea of the RICs should be dropped entirely.

Furthermore, the framework proposes the establishment of the local innovation council (LIC). This would be established in the various local government areas (LGA) in



Nigeria. This body will be responsible for encouraging and promoting innovation at the grassroots levels. It will ensure that innovation is geared towards meeting the needs of the people living in the LGA. The LICs are expected to give feedbacks and inputs to the SIC in their respective states. The LIC will help enhance the creation of job opportunities at the LGA, bring about better efficiency and productivity among individuals and small businesses in the rural communities. This move will help slow down rural-urban migration. The LIC will further help to facilitate the diffusion of new technologies among the rural people. The composition of membership of the LIC will be drawn from men and women who have distinguished themselves in various businesses within the LGA. And also like the membership composition of the other councils that is the SeIC, SIC the membership of LIC will also include individuals from higher institutions, research institutions, SMEs, non-governmental organizations and the like. Its functions are very similar to the functions of the SIC and the SeIC except that this time they are executed and restricted within the LGA.

To further ensure that each of the councils fully promote innovation they will all adopt five key strategies namely: platform; inclusion; eco-system; drivers and disclosure see figure 34 and table 27 below.

Figure 34: The Five Parameters of the Nigerian Innovation Strategy, Adapted from Nigeria's Draft Framework for the Nigerian National System of Innovation

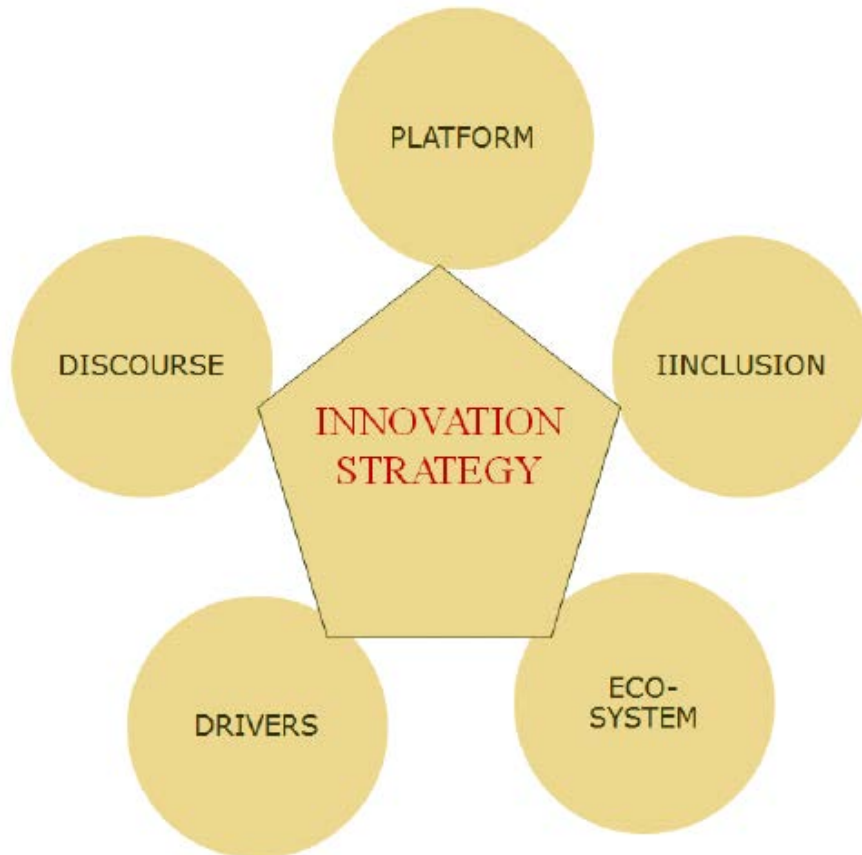


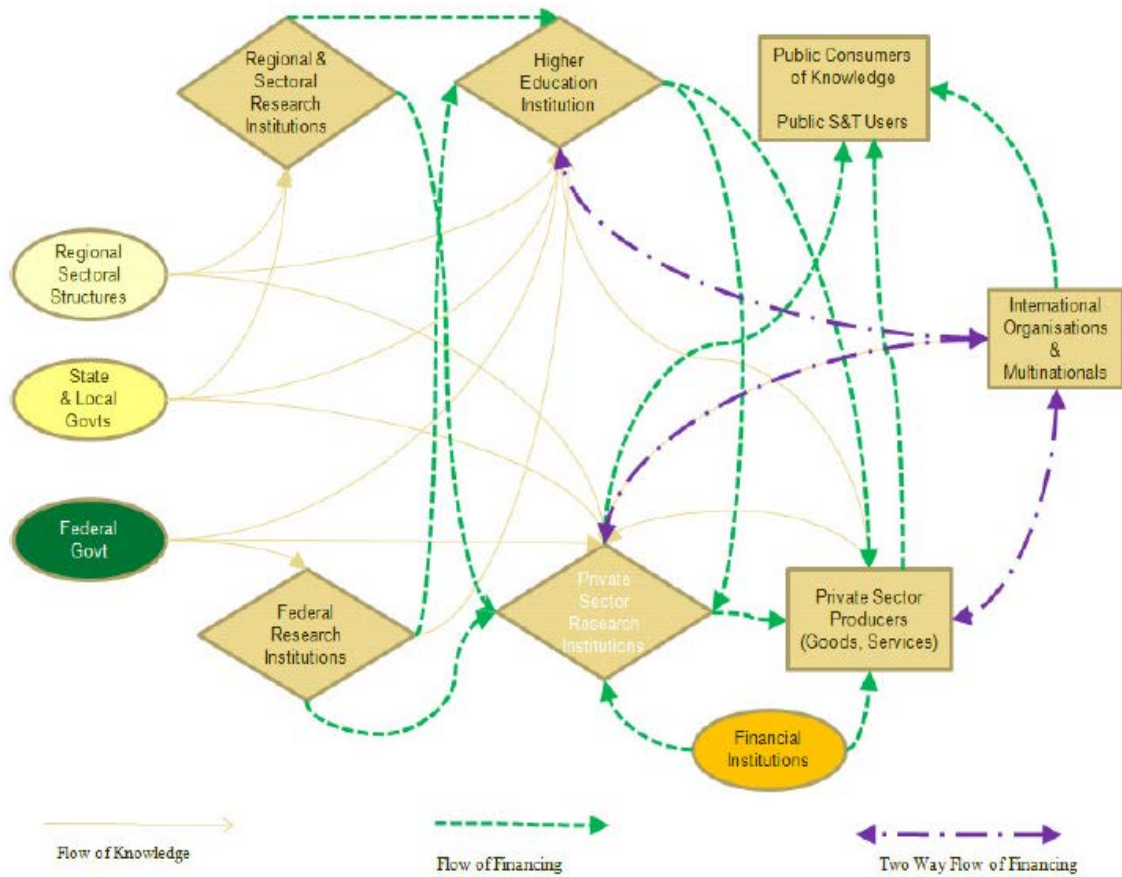
Table 27: The Five Parameters of the Nigerian Innovation Strategy, Adapted from

## Nigeria's Draft Framework for the Nigerian National System of Innovation

Platform	Inclusion	Eco-System	Drivers	Disclosure
<ol style="list-style-type: none"> <li>1. Products</li> <li>2. Services</li> <li>3. Organizations and institutions</li> <li>4. Processes</li> <li>5. Research and Development</li> <li>6. Science and technology</li> <li>7. Governance</li> <li>8. Social and Cultural</li> <li>9. Mindset</li> <li>10. Federal/State/Sectoral Councils</li> </ol>	<ol style="list-style-type: none"> <li>1. Awareness</li> <li>2. Access</li> <li>3. Affordability</li> <li>4. Availability</li> <li>5. Scalability</li> <li>6. Sustainability</li> <li>7. Quality</li> <li>8. Pervasive Growth</li> <li>9. Innovations for/by the people</li> <li>10. Innovations for the Bottom of the Pyramid</li> </ol>	<ol style="list-style-type: none"> <li>1. Incentives and Awards</li> <li>2. Innovation clusters at universities</li> <li>3. Innovative business clusters</li> <li>4. Ward based cluster</li> <li>5. Innovation in MSMEs</li> <li>6. Organizational autonomy and flexibility</li> <li>7. Policies and programmes</li> <li>8. New institutions and infrastructure</li> <li>9. Risk/Venture capital</li> <li>10. Intellectual property/patents</li> <li>11. Web and ICT tools</li> </ol>	<ol style="list-style-type: none"> <li>1. Green growth</li> <li>2. Multi-disciplinary</li> <li>3. Collaborative</li> <li>4. Transformative</li> <li>5. Generational change versus incremental change</li> <li>6. Durable versus disposable</li> <li>7. Need versus demand</li> <li>8. Nature versus nurture</li> <li>9. Locally versus relevant</li> <li>10. Globally connected and competitive</li> <li>11. Focus at the edge</li> </ol>	<ol style="list-style-type: none"> <li>1. Discussions</li> <li>2. Debates</li> <li>3. Seminars</li> <li>4. Conferences</li> <li>5. Best practices</li> <li>6. Alternative dialogue</li> <li>7. Re-thinking</li> <li>8. New ideas</li> <li>9. Media</li> <li>10. Innovation portal</li> </ol>

Source: Adapted from Nigeria's draft framework for the Nigerian national system of innovation. The idea behind this framework is to develop a model that goes beyond the usual research and development pattern in Nigeria which is typically without real defined focus and where research institutes keep researching or claim to be carrying out research in a specific area without tangible result and no timelines are followed. This new approach hopes to establish research platforms that are people focused, that is researches that are geared towards solving societal problems based on the needs of the people. The system will ensure the establishment of an innovation eco-system that will accommodate all actors in the public and private sectors. The system will further encourage and strengthen entrepreneurship and key innovation drivers will be identified and strengthened. The entire system is expected to work seamlessly together and create an atmosphere where knowledge can be shared and understood by all stakeholders. Bringing all the key components of the NIS together (that is research institutions, higher institutions, innovation councils, financial institutions, private sector, international organizations) an overall architecture for NIS is obtained as shown in figure 35 below and also see figure 36 below

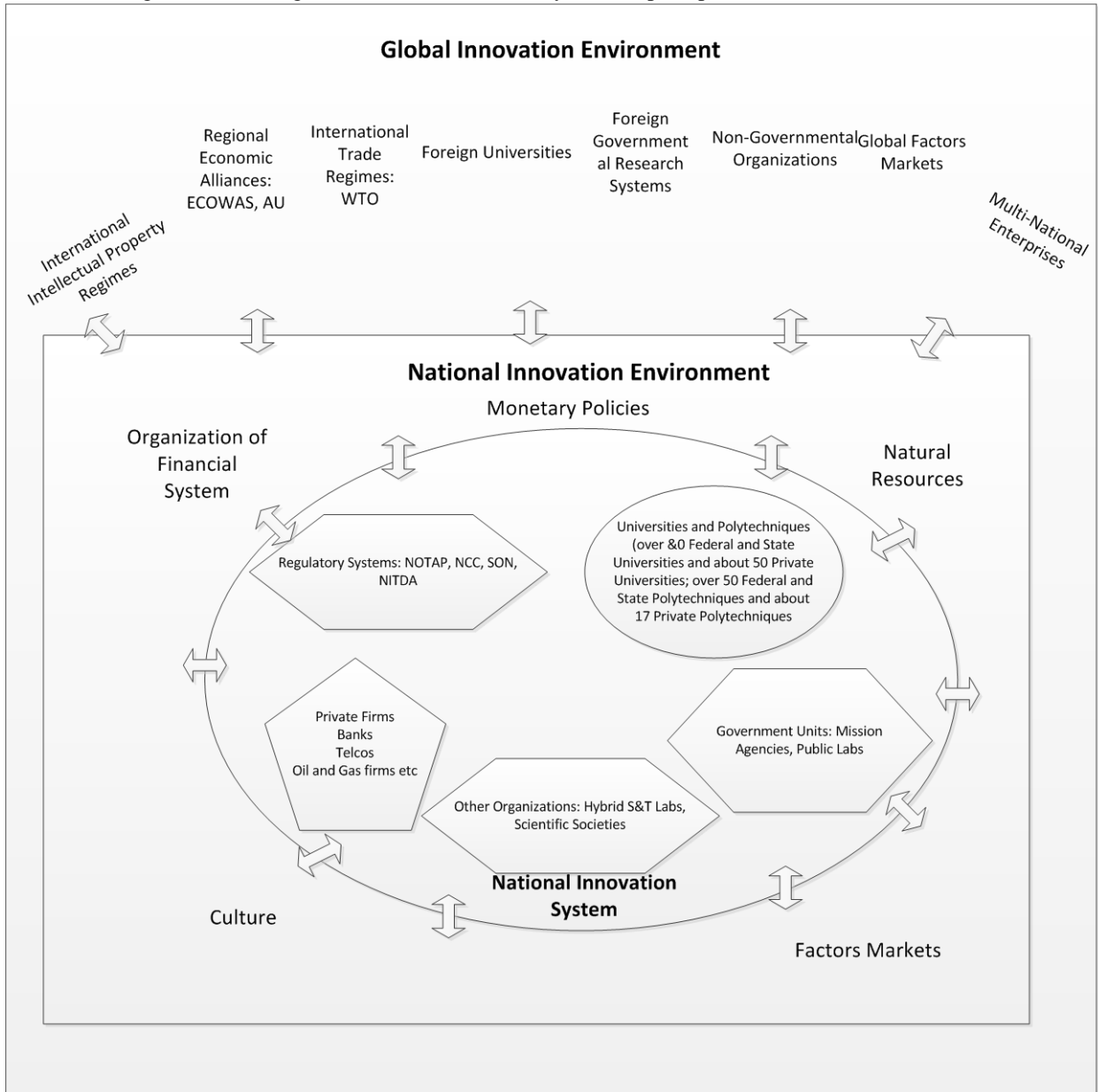
Figure 35: The Nigeria National System of Innovation (Institution, Knowledge and Finance)



Adapted from Nigeria's draft framework for the Nigerian national system of innovation

It is proposed that the NIS should be funded mainly through the federal innovation fund/foundation. This Fund/foundation is still in the process of been created as it is not yet created. It is expected that when (or rather if the Fund) is created it will be managed by the FIC. It is also proposed that the NIS will receive additional funding from collaborating with other innovation systems in other countries and also from government (Federal, State and Local), government ministries and departments, banks and other corporate bodies.

Figure 36: The Nigeria National Innovation System Map adapted from Feinson (2003)



## **Chapter seven: Recommendations and conclusion**

This chapter will summarize the strategies and policies that can be adopted by developing countries, using Nigeria as a case study, in order to fully maximize the potential benefits of IPRs protection. The paper will suggest possible recommendations in terms of policies and strategies that Nigeria can adopt to transform its economy using sound IPRs management and technological innovation as launch pad. The chapter will also make suggestions for future research and then comes to a conclusion.

### **How Nigeria can benefit from IPRs protection**

This paper wishes to point out that having a strong IPRs regime in a country alone cannot turn around the economic fortunes of that country. IPRs regime can only be effective when it is designed in such a way as to take cognizance of the level of technological advancement of the country. In essence for the IPRs system to be of a positive effect it must work in conjunction with other variables such as market openness, robust competition policy, and good manpower development strategy.

It is worthy of note that many sub-Saharan African countries have since adopted strong laws in the area of IPRs (although these laws are rarely enforced adequately). However, they have not recorded corresponding economic growth, as they attract very little FDI and receive few patents both at home and abroad. The performance is quite poor especially when compared to East Asia countries, most of which only recently reinforced their IPRs regime. The East Asia countries attract most of the FDI going to developing countries, and they record more patents both at home and abroad (Maskus, 1998a, b). It therefore, implies that it is not enough for a country like Nigeria to have sound IPRs laws. It has to aside from taking enforcement seriously also complement these laws with measures such as establishing pro-competition IPRs standards, ensure that the market environment is competitive, create complementary competition policies and develop internal capacity to create, absorb and use IPRs.

### **Establish Pro-competitive IPRs Strategy**

Nigeria as it stands today is a huge importer of technology. To reduce this trend the country has to put in place strategies and framework that will promote learning such that the citizens will be able to carry out incremental innovation on prior inventions. To achieve this, patent examiners could for example adopt the highest possible standards for non-obviousness for invention patents, make it a requirement that the content of patent application be disclosed early and limit protection to narrow patent claims. The whole idea is to ensure that local capacity is developed for effective absorption and utilization of technological information. And furthermore, that there is local capacity to embark on incremental invention around existing patents or patent applications.

As regards copyright the country could widen its protection under the fair use principles for research and educational purposes. The country as part of its strategy could permit reverse engineering of computer software programs with the aim of encouraging local software development. In essence while the country will prohibit outright copying of protected software programs, it will allow local developers to use selected components of protected software programs (Maskus, 2000a).

### **Build Local Capacities to develop, absorb and use IPRs**

For a country to maximally benefit from IPRs, it depends largely on its ability to build the relevant human capacities to develop, absorb and utilize IPRs. The country should have the ability to effectively adapt existing technologies to forms that can be beneficial to local

industries. And this can be achieved by having workforce with the right skills. These kinds of skills can be acquired through the right education; consciously ensuring that certain selected skills are acquired (Coe, et al., 1995). Furthermore, local companies should be encouraged to engage in focused research and development programs (Dougherty, 1997). There should be strong linkages between research institutes including universities and industry. Such ties will ensure that research institutes embark on research projects that are commercially, economically and socially viable. To strengthen this sort of ties there should be well-defined framework on how the accrued benefits will be shared between the research institutes and the enterprises in a manner that is mutually beneficial. And lastly financial institutions should be enlightened and brought on board to invest in research and development (Maskus, 2000a).

### **Ensuring that the market is competitive**

The gains of IPRs are more pronounced in countries with competitive market environments. The gains are not only larger in such markets, the risk of infringements are also much lesser. So as countries strengthen their IPRs system they should also fully liberalize their market. They should open up the market to international trade and investment, relax existing restrictions against service providers and deregulate the local market to further promote competition. From the foregoing one can deduce that economies with more open market structure are prone to experience growth from strong IPRs system than a closed economy. It is known that IPRs gives more power to the custodian of the right and such power can easily be abused in a closed economy than in an economy that is open to foreign trade (Harris, 1984 and Rodirck, 1988). Maskus (2000c) argues that it is indeed counterproductive to strengthen the IPRs system and at the same time run a closed market. If for instance a market is closed, a patent will be too powerful as there will be no or limited substitute products which in turn reduces consumer choices. If the market was to be open consumers will have alternatives. However, such opening of the market should be such that is not unfair to existing local enterprises.

Having an open market and strong IPRs system will encourage inflow of new technologies and FDI. With the right strategies as earlier mentioned above local companies can learn and adapt the new technologies to forms that are more beneficial to the economy.

### **Develop Complementary Competition Policies**

Intellectual property rights provide substantial protection to the right holders and these right holders could put these privileges to use in such ways that are abusive and probably anti-competitive. It is therefore, critical that a country reviews the possible areas that could lead to abuse and put in place measures to check such abuse. For instance monopoly pricing is an area of potential abuse, especially in a closed market. Another instance could be through horizontal licensing, where two or more firms license technology products among themselves and use the medium to fix prices. That is competing firms come together to embark on patent pooling and cross-licensing agreements between themselves with the aim of reducing competition and depriving other downstream companies that need the technology as key inputs for their products and services. Under such arrangements the licensee and licensor will take advantage of the system and fix prices and generally manipulate the market.

IPRs owners may choose to embark on anti-competitive activity using licensing agreements to prevent other firms from competing in a given market by raising the barrier to entry. A licensor could insist that licensees are tied to selling only their products. The licensee is tied to the licensor and even to future technologies. This could end up giving licensees dominant position in a secondary market and prevent other firms from entry especially if the licensor entered the market at a very early stage. It is imperative that

governments of developing countries establish policies that will check abuse of licensing agreement. These policies should take into consideration the peculiarities of the market including the market structures,

Thirdly IPRs owners should not be allowed to acquire other firms that own IPRs if such an acquisition will result in anti-competitive behavior. If the market anti-competition activities are not checked firms can acquire competing technologies and products with the purpose of stopping their commercial use or simply to be in control and manipulate the price of the technology. If it is perceived that two firms with competing technologies intend to go into a merger and that such merger will give the resulting company dominant position in the market such a merger should not be allowed to take place. Furthermore, IPRs owners should not be allowed to take advantage of opposition proceedings and intimidate other firms especially smaller firms that may not have all resources to engage in legal battle. Competition authorities should be sure to separate legitimate opposition of IPRs applications from those with ulterior motives.

### **Recommendations for future research**

This section suggests recommendations for future research. It looks at possible changes that can be adopted and made to future research in this field. This is based on observations seen during the course of this research. The suggestions made here is purely with the intention of ensuring that future research yield less unbiased results and generally produce improvement to this research and indeed previous researches as regards the relationship between economic development, innovation and intellectual property protection.

It is recommended that future research should use patents applications and patent granted in domestic jurisdictions instead of using the number of patent applications by residents of developing countries in the US Patent and Trademark Office (USPTO). Using the number of patents filed or granted domestically will give a better perspective to the actual level of innovation in that country. It will reveal the efficiency of the system of innovation; indicating if there is proper collaboration between the industries and universities. It is important to make certain that such a relationship exists, as that is the only way to measure the relevance of innovation to the economic wellbeing of that given country. Patent applications filed and granted abroad by residents of a country may not tell whether that innovation is relevant to the domestic country. But filing and receiving patent grant domestically could be evidence of local recognition and appreciation of the value of that patent to the domestic market. After all the patent laws of most countries provide that only innovations that are industrially applicable can be issued patent grant<sup>39</sup>. And it is when an innovation is domestically applicable that it can add significantly to the country's economic growth. A patent application that is granted abroad may have no real bearing or representation of the domestic industrial requirements and may therefore be of little or no value to the local community. The analysis and study of the trend of domestic patent application can give an indication on the growth in the level of domestic innovation. Such studies could enable a country investigate the actual factors responsible for spurring or inhibiting innovation. This is not to say that comparing the rate of innovation in one developing country such as Nigeria with other developing countries is wrong. However, identifying and understanding the factors that is responsible for domestic innovation is very

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<sup>39</sup> See for example the provisions of Nigeria patent and Design Act, Chapter 344 of the Laws of the Federation of Nigeria 1990. Section 1(1) Subject to this provision, an invention is patentable; (a) if it is new, results from inventive activity and is capable of industrial application; or (b) if it constitutes an improvement upon a patented invention and also is new, results from inventive activity and is capable of industrial application. Section 1 (2) (c) an invention is capable of industrial application if it can be manufactured or used in any kind of industry, including agriculture.

vital when it comes to suggesting solutions towards the enhancement of domestic innovation. This research has shown that different developing countries have their peculiarities and must put in place innovation system development strategies that will take into cognizance their unique economic standing. Thus developing countries may be better of conducting a proper study of their local innovation system and then comparing it with what is obtainable in other jurisdiction with the view of learning and improving their own system of innovation. The level of innovation in a developing country should not therefore be merely measured by the number of patents filed by residents in the USPTO or in any foreign country. It should be a measure of the number of patents applications filed domestically. Furthermore, the measurement criteria may take into consideration the actual growth in innovation activities that is the growth rate of domestic innovation. This will show the actual changes in the level of innovation in a developing country over a given period. It will be an easy way of comparing the changes in the level of innovation with the changes in other critical areas such as the rate of enrolment in tertiary education, changes in the number of industries, changes in the number of tertiary education, changes in electricity consumption and so on. So it is recommended that future research should consider using the number of patents applications or the number of patents granted to residents by the local patent office as measure of the level of innovation in a given country. This will give a better reflection on the quality and efficiency of innovation in each developing country. This will further eliminate any bias that may be contained in the analysis.

Future research should carry out research in more details on countries with very similar GDP per capita that is with GDP per capita within the same threshold. So for instance countries with GDP per capita below a given average as established in this research should be considered together. They should be compared and analyzed together. It is better for countries with such closeness in characteristics to be grouped together as this will help the research findings to be more focused and more consistent. The findings can easily be adopted and adapted by countries in that economic category to their specific economic situation. The results obtained under such circumstance will be more realistic than the result obtained in researches where broad ranges of countries are used. This research was conducted for an arguably narrow selection of countries, developing countries. But such countries in future research can be further grouped according to their income levels. The work by Adams (2010) was narrowed to Sub-Saharan Africa, and fortunately most of the countries analyzed by Adams had GDP per capita below a certain threshold but it could have been further narrowed using strictly income levels. Although this paper attempted to separate the data into countries with above average GDP per capita and countries with below average GDP per capita, this paper however recommends that future research should be more specific in terms of income level categorization. The differences in the results obtained for GDP per capita above and below average support the suggestions that future research should be further categorized along income levels. The world Bank country classification is a good guide as used in this research. This research used developing countries within which Nigeria falls. One of the reasons for using developing countries ( which is a combination of low and middle income countries) was so that the data set was large enough to guaranty the intergrity of the analysis. However, future research may want to use only specific income levels, that is considering low income countries separet from middle income countries. This may give a better perspective compared to using the average GDP per capita as seperator for low low and high income countries as is the case in this research. The income groups as classified by the World Bank is calculated using the 2011 Gross National Income (GNI). The groups are low income countries which includes countries with GNI of US\$1,025 or less; lower middle income which includes countries with GNI between US\$1,026-US\$4,035; upper middle income which includes countries with GNI US\$4,036-US\$12,475 and finally high income



countries with GNI of US\$412,476 and above. According to the World Bank the GNI for Nigeria in 2011 was US\$2,300 implying that Nigeria can be placed in the lower middle income band. Perhaps future study on the relationship between IPRs protection and economic growth in Nigeria may consider comparing the impact of IPRs on the economic growth of lower middle income classes. After which it can then analyse the behaviour of Nigeria's economy to IPRs protection and then compare it to the rest of the lower middle income countries. This will give a different perspective to the relationship between IPRs protection and economic growth in Nigeria. Future research may also consider using other parameters as proxy for the measurement of economic growth. This is particularly important taking into consideration some of the limitations of the GDP, including the fact that it is a monetary aggregate and takes minimal or no consideration to issues pertaining to distribution or the actual wellbeing of the residents of a given country. Another limitation is that it measures productive flows at the expense of measuring the real impact of productive activities on stocks (Commission on the Measurement of Economic Performance and Social Progress, 2009). Some of the other indicators that may be used include the human development index (HDI) ([www.hdr.undp.org](http://www.hdr.undp.org)) and the social progress index (SPI) ([www.socialprogressimperative.org](http://www.socialprogressimperative.org)). The HDI does not just measure how much a country earns in monetary terms but also measures the impact of those earnings on the lives of the people; it basically measures the level of social and economic development. The SPI measures the degree of access to basic human needs (nutrition and basic medical care; water and sanitation; shelter; and personal safety), foundation of wellbeing (access to basic knowledge; access to information and communications; health and wellness and ecosystem sustainability) and opportunity (personal rights; personal freedom and choice; tolerance and inclusion; and access to advanced education). Using such indicators as proxy to economic growth will give perhaps a more interesting perspective of the actual impact of IPRs protection and innovation on the economic wellbeing of a developing country.

Future research should not just stop at the impact of patent protection and enforcement and use that as a general measure of a country's IPRs regime. The various types of IPRs should be considered when measuring the extent of a country's IPRs protection and enforcement. This is particularly true as some countries may pay more attention to one type of IPRs protection above another. Therefore, using the degree of patent protection and enforcement as the only yardstick in assessing the degree of overall IPRs protection in a given country could be misleading. After all innovation is not just being able to create patentable ideas but innovation can occur in other areas of intellectual property such as in copyrightable ideas, in trademarks, and trade secrets as long as that idea is novel, original and of value to the society. Some countries have made some strong advances in certain areas that they may be better of consolidating their achievements in such areas as against promoting patentable ideas. Nigeria for instance has made strong gain in the movie and music industries. The country may be better of paying more attention on protecting copyright than any other intellectual property type. The country may therefore, choose to have tight protection and enforcement regime in that area while paying less attention to other areas. And invariably its enforcement agencies including its legal system may be more attuned to protecting and enforcing laws as regards that specific area of IPRs. This is not to suggest that countries should focus on only one area of intellectual property and neglect the others but as a matter of strategy they may be better of consolidating on areas of intellectual property where they have comparative advantage. And after the country has mastered that given area it can then shift to other areas. In measuring a country's level of IPRs protection therefore, one should not just take a blanket view. The measurement should take into consideration the country's intellectual property policy and overall strategic economic objective. The further import of this is that the IPRs index measurement criteria may need to be reviewed from strictly using

patent as a benchmark and incorporating other areas of intellectual property protection. Some of the indexes used in previous research for this measurement include the Ginaret and Park Index, the Economic Freedom of the World Index (The Fraser index)<sup>40</sup>, the Lee and Mansfield, Sherwood<sup>41</sup> index, the Rapp and Rozek index<sup>42</sup> and Seyoum index<sup>43,44</sup>. Most of these indices use patent as a representation of other intellectual property types. For instance the Ginarte and Park index is derived using strictly the features and characteristics of a country's patent system (Park, 2008). Even when other intellectual property types are used patent is given more attention. This was the case in the Sherwood index (1997) where patent was assigned higher points than the other intellectual property types. Using the extent of protection of patents and its enforcement as a proxy for other intellectual property laws is not entirely wrong but may not reflect the true position of IPRs status in a country. Ostergard (2000) argues that this may not be a true reflection of the economic impact of the extent of IPRs as for instance copyrighted software production and entertainment products may have significant impact on the economic position of a country as was pointed for Nigeria. And he further argues that some countries may pay more attention to other areas of IPRs other than patent. This argument is corroborated in Ostergard (1999) and Hettinger (1989). It is therefore, recommended that other types of intellectual property be taken into full consideration in developing future IPRs indices. And furthermore for a typical developing country such as Nigeria it is advisable that additional research be carried out to understand in more details the relationship between its domestic IPRs regime (considering each of the main areas of intellectual property: copyright and related rights; trademarks including service marks; geographical indications; industrial designs; patents; the layout-designs of integrated

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<sup>40</sup> The economic freedom index has been criticized that the relationship between economic freedom and economic growth is not robust and that the weighing procedure used to arrive at the final index is rather arbitrary (De Hann & Siermann and Heckelman & Stroup, 2000)

<sup>40</sup> Sherwood (1997) measure of IPR protection in addition to personal knowledge and experience also included professional interviews. The protection scores theoretically range from 0-103 and were developed for eighteen countries. The components considered and the corresponding points assigned include: Enforceability (25); Administration (10); Substantive Law: Copyright (12); Patents (17); Trademarks (9); Trade Secrets (15); Life Forms (6); Treaties (6); Public Commitment (3). The conditions for rating countries were derived from the US Chamber of Commerce Guidelines, but the relative weights assigned to each category were mainly obtained from the author's experience (Sherwood, 1997; Ostergard, 2000)

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<sup>42</sup> Rapp & Rozek (1990) in their work used patent laws as a proxy for IPR protection. The research analyzed the patent laws of 159 countries on a scale of zero to five, where zero represents countries with no patent laws and five represents countries whose laws are consistent with the minimum standards established by the US Chamber of Commerce Intellectual Property Task Force. Countries with no intellectual property protection laws score zero; inadequate protection laws or no law prohibiting piracy gets a score of 1; seriously flawed laws attracts a score of 2; flaws in laws, some enforcement laws gets a score of 3; generally good laws gets a score of 4 and lastly protection and enforcement laws fully consistent with minimum standards proposed by the U.S. Chamber of Commerce gets a full score of five

<sup>43,44</sup> Seyoum (1996) like Rapp & Rozeck and Sherwood indexes also used the US Chamber of Commerce's minimum standards for his criteria. He used the result of the survey sent out to IPR practitioners to construct a 0-3 scale IPR protection component. Furthermore, he established four variables (namely: patents; copyright; trademarks and trade secrets) after validating the response from the survey.

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circuits; and undisclosed information including trade secrets and test data) and its economic development. The impact of the various types of intellectual property on the economic growth of Nigeria should be measured.

### **Conclusion**

There have been several previous researches in the area of the impact of IPRs protection on economic growth in both developed and developing countries. However, the work done in this research is more extensive than previous researches. It used panel data collected over eight separate time periods; 1975, 1980, 1985, 1990, 1995, 2000, 2005 and 2010 covering a broader range of developing countries other than Sub-Sahara Africa countries and more than the 64 developing countries as used by Adams (2010) and Chen & Puttitanun (2005) respectively. It actually used a panel data of 81 developing countries. Most importantly unlike the previous researches it used a better IPRs index, one that did not only take into consideration IPRs laws as is the case with the Ginarte and Park index but also the degree of enforcement of IPRs laws. This was achieved by combing the Ginarte and Park index and the Fraser index as proposed by Hu & Png (2010).

Contrary to some views as seen in the literature review that increasing IPRs protection will bring about corresponding increase in economic development, the empirical evidence obtained from this research proves otherwise. It was seen that IPRs protection has negative and insignificant relationship with the rate of innovation in developing countries notwithstanding whether the developing country is within the low or high GDP band. It was also seen that IPRs protection is only significant in developing countries with low GDPCAP and not for developing countries with high GDPCAP. It is therefore, advisable that developing countries should not be in a hurry to tighten their IPRs system, as this may not be in their best interest. Developing countries must ensure that their level of technological advancement and economic growth reaches a comfortable level before they can consider tightening their IPRs system. But they can start by having a very basic IPRs regime such that can encourage initial FDI inflow. However, one thing is clear which is in implementing IPRs strategy developing countries must realize that there is no one-size-fit-all approach, as different countries have to take into consideration their own unique economic, social and technological standing before developing their IPRs policy. It is therefore imperative that a typical developing country such as Nigeria understands the real effect strengthening or weakening IPRs protection will have on its economy. This should be considered in view of the level of the country's technological advancement, the peculiarity of its business environment and the nature of the developmental policies it seeks to pursue. It is also worthy of note that having a strong IPRs regime in a country alone cannot turn around the economic fortunes of that country. For the IPRs system to be of a positive effect it must work in conjunction with other variables such as market openness, robust competition policy, and good manpower development strategy.

For Nigeria, to therefore to effectively take advantage of the potential benefits of IPRs protection it must first put in place the right policy framework that will help boost its economic and technological standing. As its economy rises and reaches a desired level it can then begin to gradually tighten its IPRs regime. It may consider adopting staggered approach, which is first tightening IPRs protection in areas where it has reached appreciable level of technological growth. Nigeria in achieving robust IPRs policy and ensuring it effectively encourages domestic innovation must complement its IPRs laws with other strategic measures. It may complement these IPRs laws with measures such as establishing pro-competition IPRs standards, ensuring that the market environment is competitive, developing complementary competition policies and developing internal capacity to create, absorb and use IPRs. Developing internal capacity will mean having a good education system that will

enable it learn from and adequately adapt new technologies to local needs. Even though Nigeria was used as a case study especially as it concerns developing the right IPRs policy framework that can enhance innovation and promote economic growth it is expected that every developing country should develop its own unique policies as it concerns innovation and IPRs protection. Blanket intellectual property policy and strategy should therefore not be adopted by developing country. They need to understand that there is varying impact of IPRs protection on their economies depending on their own specific country peculiarities.

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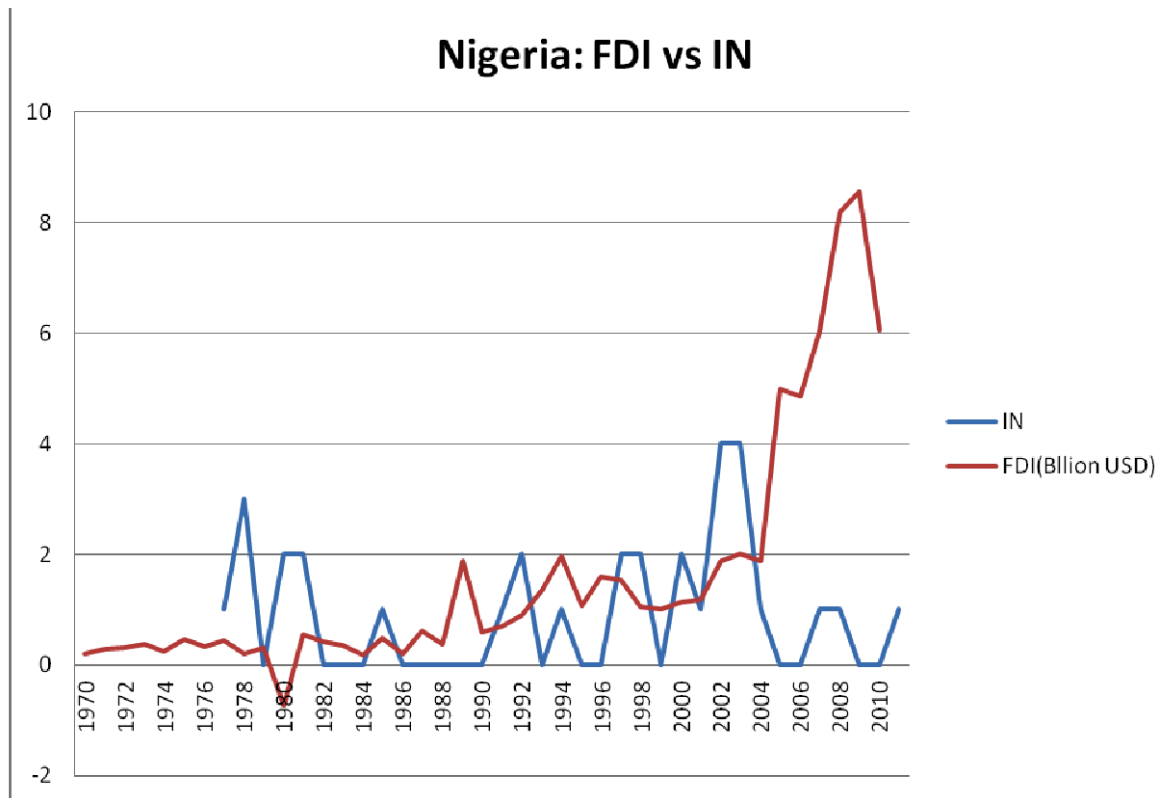
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**Appendix a: Nigeria fdi versus in**



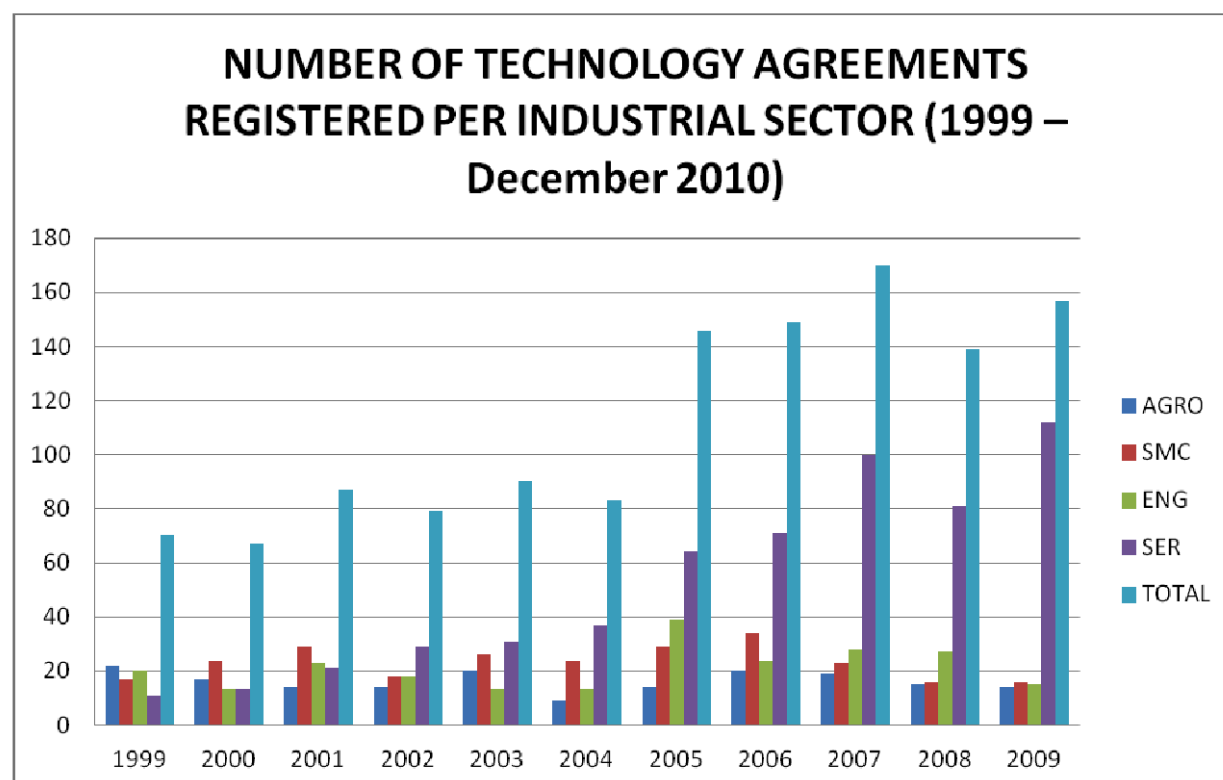
Correlation coefficients, using the observations 1970 - 2011  
 (missing values were skipped)  
 5% critical value (two-tailed) = 0.3044 for n = 42

IN	FDI	
1.0000	-0.1381	IN
	1.0000	FDI

**Appendix b: Number of technology agreements registered per industrial sector (1999 – december 2010)**

YEAR	AGRO	SMC	ENG	SER	TOTAL
1999	22	17	20	11	70
2000	17	24	13	13	67
2001	14	29	23	21	87
2002	14	18	18	29	79
2003	20	26	13	31	90
2004	9	24	13	37	83
2005	14	29	39	64	146
2006	20	34	24	71	149
2007	19	23	28	100	170
2008	15	16	27	81	139
2009	14	16	15	112	157
<b>Total</b>	<b>178</b>	<b>256</b>	<b>233</b>	<b>570</b>	<b>1237</b>

Source: <http://notap.gov.ng/content/technology-transfers>



## Appendix c: Summary statistics

Summary Statistics, using the observations 1 - 113  
(Missing values were skipped)

Variable	Mean	Median	Minimum	Maximum
GP_1970	1.55551	1.57500	0.000000	3.82500
GP_1975	1.56607	1.57500	0.000000	3.82500
GP_1980	1.71687	1.70000	0.000000	4.35000
GP__1985	1.79064	1.70833	0.000000	4.67500
GP_1990	1.87425	1.73000	0.000000	4.68000
GP_1995	2.64525	2.55833	0.000000	4.87500
GP_2000	3.14450	3.10500	1.05833	4.87500
GP_2005	3.43932	3.43333	1.20000	4.87500
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
GP_1970	0.891545	0.573152	-0.0900686	-0.421316
GP_1975	0.894808	0.571373	-0.0947955	-0.432353
GP_1980	1.01851	0.593236	0.0893071	-0.355505
GP__1985	1.07096	0.598087	0.211512	-0.215235
GP_1990	1.15849	0.618107	0.307568	-0.321222
GP_1995	1.08945	0.411853	0.108455	-0.528081
GP_2000	0.975025	0.310073	-0.0615872	-1.01470
GP_2005	0.832336	0.242006	-0.267837	-0.646551

## Appendix d: Research questionnaire

<https://www.surveymonkey.com/s/FDIandInnovation>

## Appendix e: results of regression using fixed effect panel model

### FULL Data Set

Model 1: Fixed-effects, using 648 observations

Included 81 cross-sectional units

Time-series length = 8

Dependent variable: DINCAP

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	-1.7867e-08	3.88769e-08	-0.4596	0.64600	
DIPRs	-8.32957e-09	8.18911e-09	-1.0172	0.30952	
DGDPCAP	6.13659e-11	2.74285e-11	2.2373	0.02566	**
DEDU	1.11741e-08	5.9796e-09	1.8687	0.06219	*
DTRADE	-3.17482e-09	1.06964e-09	-2.9681	0.00312	***
DFDI	-1.18538e-09	1.35137e-10	-8.7717	<0.00001	***
WTO	1.13673e-07	5.92478e-08	1.9186	0.05554	*

Mean dependent var	5.44e-08	S.D. dependent var	6.53e-07
Sum squared resid	2.15e-10	S.E. of regression	6.19e-07
R-squared	0.222614	Adjusted R-squared	0.103443
F(86, 561)	1.868017	P-value(F)	0.000017
Log-likelihood	8390.886	Akaike criterion	-16607.77
Schwarz criterion	-16218.54	Hannan-Quinn	-16456.78
rho	-0.134861	Durbin-Watson	1.857783

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(80, 561) = 0.578861$

with p-value =  $P(F(80, 561) > 0.578861) = 0.998536$



Model 4: Fixed-effects, using 648 observations

Included 81 cross-sectional units

Time-series length = 8

Dependent variable: DFDI

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-10.8657	11.383	-0.9546	0.34021	
DIPRs	7.02378	2.38306	2.9474	0.00334	***
DGDPCAP	0.0196072	0.00802915	2.4420	0.01491	**
DEDU	5.05306	1.74434	2.8968	0.00392	***
DTRADE	-0.655894	0.314614	-2.0848	0.03754	**
WTO	-13.5645	17.4057	-0.7793	0.43612	
DINCAP	-1.01748e+08	1.15996e+07	-8.7717	<0.00001	***

Mean dependent var	8.870850	S.D. dependent var	192.6685
Sum squared resid	18428905	S.E. of regression	181.2460
R-squared	0.232685	Adjusted R-squared	0.115057
F(86, 561)	1.978149	P-value(F)	2.64e-06
Log-likelihood	-4242.267	Akaike criterion	8658.534
Schwarz criterion	9047.763	Hannan-Quinn	8809.528
rho	-0.433731	Durbin-Watson	1.464264

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(80, 561) = 0.770774$

with  $p\text{-value} = P(F(80, 561) > 0.770774) = 0.926046$

### Scenario 2 using data set for gdpicap above the mean (1806.26)

Model 1: Fixed-effects, using 220 observations

Included 48 cross-sectional units

Time-series length: minimum 1, maximum 8

Dependent variable: DINCAP

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-6.48361e-08	1.42448e-07	-0.4552	0.64959	
DIPRs	-2.79661e-08	1.80982e-08	-1.5452	0.12419	
DGDPCAP	9.99685e-12	4.96002e-11	0.2015	0.84052	
DEDU	1.27466e-08	1.24925e-08	1.0203	0.30905	
DTRADE	-6.97646e-09	2.54577e-09	-2.7404	0.00681	***
DFDI	-1.20007e-09	2.23007e-10	-5.3813	<0.00001	***
WTO	4.00511e-07	1.90763e-07	2.0995	0.03728	**

Mean dependent var	1.54e-07	S.D. dependent var	1.05e-06
Sum squared resid	1.62e-10	S.E. of regression	9.87e-07
R-squared	0.327265	Adjusted R-squared	0.112477
F(53, 166)	1.523662	P-value(F)	0.023535
Log-likelihood	2761.144	Akaike criterion	-5414.288
Schwarz criterion	-5231.032	Hannan-Quinn	-5340.285
rho	-0.239731	Durbin-Watson	2.156747

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(47, 166) = 0.768156$

with  $p\text{-value} = P(F(47, 166) > 0.768156) = 0.854069$

Model 2: Fixed-effects, using 220 observations

Included 48 cross-sectional units

Time-series length: minimum 1, maximum 8

Dependent variable: DFDI

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-23.8048	45.7386	-0.5205	0.60344	
DIPRs	9.81993	5.80409	1.6919	0.09254	*
DGDPCAP	0.0158527	0.0158836	0.9981	0.31970	
DEDU	8.77379	3.96653	2.2120	0.02834	**
DTRADE	-1.38736	0.828905	-1.6737	0.09607	*
WTO	-31.6494	62.0234	-0.5103	0.61053	
DINCAP	-1.23774e+08	2.30006e+07	-5.3813	<0.00001	***

Mean dependent var	18.92840	S.D. dependent var	328.7277
Sum squared resid	16672841	S.E. of regression	316.9208
R-squared	0.295481	Adjusted R-squared	0.070544
F(53, 166)	1.313616	P-value(F)	0.099304
Log-likelihood	-1548.090	Akaike criterion	3204.179
Schwarz criterion	3387.435	Hannan-Quinn	3278.183
rho	-0.493379	Durbin-Watson	1.517952

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(47, 166) = 0.593008$

with  $p\text{-value} = P(F(47, 166) > 0.593008) = 0.981048$

### Scenario 3 Using Data Set for GDPCAP below the Mean (1806.26)

Model 1: Fixed-effects, using 428 observations

Included 76 cross-sectional units

Time-series length: minimum 1, maximum 8

Dependent variable: DINCAP

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-1.4323e-08	1.77687e-08	-0.8061	0.42075	
DIPRs	-5.40958e-09	5.20848e-09	-1.0386	0.29971	
DGDPCAP	8.63005e-11	4.76709e-11	1.8103	0.07111	*
DEDU	-3.15874e-11	4.02859e-09	-0.0078	0.99375	
DTRADE	-4.2778e-10	6.34326e-10	-0.6744	0.50052	
DFDI	-3.19373e-12	4.51623e-10	-0.0071	0.99436	
WTO	4.6671e-08	2.98034e-08	1.5660	0.11827	

Mean dependent var	3.19e-09	S.D. dependent var	2.76e-07
Sum squared resid	1.99e-11	S.E. of regression	2.40e-07
R-squared	0.388615	Adjusted R-squared	0.245488
F(81, 346)	2.715167	P-value(F)	1.48e-10
Log-likelihood	5962.147	Akaike criterion	-11760.29
Schwarz criterion	-11427.44	Hannan-Quinn	-11628.84
rho	-0.179903	Durbin-Watson	1.669295

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(75, 346) = 2.75828$

with  $p\text{-value} = P(F(75, 346) > 2.75828) = 2.13751e-10$

Model 2: Fixed-effects, using 428 observations

Included 76 cross-sectional units

Time-series length: minimum 1, maximum 8

Dependent variable: DFDI

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	-1.14856	2.11623	-0.5427	0.58766	
DIPRs	2.46544	0.606663	4.0639	0.00006	***
DGDPCAP	0.016505	0.00563199	2.9306	0.00361	***
DEDU	0.0880579	0.479532	0.1836	0.85441	
DTRADE	-0.0346277	0.0755356	-0.4584	0.64693	
WTO	-1.07145	3.55982	-0.3010	0.76361	
DINCAP	-45255.3	6.39952e+06	-0.0071	0.99436	

Mean dependent var	3.701083	S.D. dependent var	27.29571
Sum squared resid	282280.0	S.E. of regression	28.56288
R-squared	0.112714	Adjusted R-squared	-0.095003
F(81, 346)	0.542632	P-value(F)	0.999402
Log-likelihood	-1996.493	Akaike criterion	4156.987
Schwarz criterion	4489.835	Hannan-Quinn	4288.444
rho	-0.710403	Durbin-Watson	2.332206

Test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic:  $F(75, 346) = 0.227735$

with  $p\text{-value} = P(F(75, 346) > 0.227735) = 1$