United Nations
Economic Commission for Africa

# Can a Stronger Patent Regime Result in Growth of Patenting Activities in Africa?

## Lessons Learned from Five African Countries

August 2015

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# Abstract

This brief report provides evidence on the question of whether as argued by its proponents, a strong patent regime can result in a rise in inventive capacity in least developed countries, particularly in African countries. It finds that stronger patent regimes would result in a rise in inventive capacity and patenting activities when such regimes are commensurate and are thus apt responses to actual and steady increases in the key pillars of the national innovation system, which mainly include research and development (R&D) expenditures (R&D intensity), R&D capabilities and business and market sophistication. The finding is based on a case study of five African countries: Algeria: Egypt; Kenya; Nigeria; and South Africa, from 1998 to 2013, and can inform other countries that are contemplating strengthening their patent regimes and encouraging inventive activities. Some innovation policy implications are discussed.

# Executive summary

In most developed and increasingly in some developing countries, the view that stronger patent regimes promote the growth of technical inventions — the backbone of technological innovation — has widely been established even though debate continues unabated on the incentive effects of patents among policy makers and academics. Strong patent regimes serve as incentives to encourage inventors and firms to commercially exploit their inventions in their home and foreign markets; as such regimes are associated with reduced risks of imitations and misappropriation by potential or actual competitors. Thus, strong regimes increase the rates of disclosure of scientific and technical information developed by inventors, firms, researchers for protection — a basis upon which further generic and proprietary knowledge and know-how can be built, developed and used for social welfare.

A weak patent regime is seen as a major disincentive to inventive activities and deters the rate of innovation globally, as well as slows international trade. This has been one of the major reasons behind the push for many decades to set up an internationally harmonized patent system, which has led to several bilateral and multilateral conventions. The most comprehensive of these agreements is the Trade-Related Aspect of Intellectual Property Rights (TRIPS), which was concluded by member countries of the World Trade Organization (WTO) in 1995. TRIPS provides a minimum set of standards for administering and enforcing intellectual property (IP) laws with the ultimate implicit aim of increasing the global capacity to invent, develop and transfer and use new technologies.

However, some developing countries — especially some in Africa — were and remain concerned that stronger patent regimes, particularly those outlined in TRIPS, could immeasurably constrain their technical learning processes and acquisition of technological capabilities due to their heavy reliance on knowledge and technologies developed in advanced economies. Others argue that complying with TRIPS could have a positive impact on the continent's innovative capacity and capability to absorb new technologies from the north, learn and develop endogenous technical capabilities

This dualism constitutes a serious dilemma to policymakers charged with responsibility to design optimal patent regimes that keep going knowledge production and use. Such design should be informed by clear analyses on how patents affect inventors' behaviours. Furthermore, it depends on how patent laws and enforcement provisions are aligned with the key pillars of national innovation systems.

This report is an attempt to clarify the effects of strong patent regimes on in inventive capacity based on evidence from five selected African countries: Algeria; Egypt; Kenya; Nigeria; and South Africa. Its ultimate purpose is to identify the outcomes and lessons and experiences emerging from these national experiences that can be transferred to other countries contemplating reform of their international property rights (IPRs) architecture. The major lessons learned and findings are outlined in box 1 below.

**Box. Major lessons learned from country experiences**

**Lessons learned**

1. To sustain or spur inventive capacity, the reforms to national patent regimes should be crafted in a manner suitable to the steady increase made in the key inputs and enablers of the research and development (R&D) system, such as R&D intensity, capabilities, and market and business sophistication.
2. Patent reforms should favour broader national priorities beyond the traditional short-term need to attract foreign direct investment (FDI), which are mostly geared towards supporting the traditional production system and thus, limit the prospects for innovation.

**National experiences**

**a) South Africa.** South Africa has a reasonably strong R&D system and innovative capacity. The reforms built on this foundation and were thus, to a large extent, suitable to the local need associated with increased R&D expenditures, capabilities and business and market sophistication. They have resulted in steady, rapid and significant growth in patent activities among national inventors.

**b) Egypt.** The reforms were, to a large extent, suitable to the local need, mainly R&D intensity, infrastructures, capabilities and outputs. They have resulted in a rapid and significant rise in the number of patent application by Egyptian nationals.

**c) Kenya.** The reforms moderately corresponded to the local need — growing R&D intensity, capabilities and outputs. They have resulted in sharp increase in patent applications, although the number of applications is a lot smaller than those submitted in Egypt and South Africa.

**d) Nigeria.** The reforms were beyond the level of local R&D intensity and infrastructures and outputs (proprietary knowledge); they only resulted in a very small rise in patent applications filed abroad between 2009 and 2011.

**e) Algeria.** The reforms were slightly beyond the local demand determined by R&D intensity, capabilities and outputs; they have resulted in a rapid, but small rise in the number of patents filed by Algerian nationals.

# Acknowledgement

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# List of acronyms

| | |
|---|---|
| BERD | Business expenditure on research and development |
| CBD | Convention on Biological Diversity |
| EU | European Union |
| FDI | Foreign direct investment |
| *GATT* | *General Agreement on Tariff and Trade* |
| GDP | Gross domestic product |
| GERD | Gross expenditure on research and development |
| M&A | Merger and acquisitions |
| NEPAD | New Partnership for Africa's Development |
| OECD | Organization of Economic Cooperation and Development |
| PCT | Patent Cooperation Treaty |
| PPP | Purchasing parity power |
| R&D | Research and development |
| STI | Science, technology and innovation |
| TRIPS | Trade-Related Aspects of Intellectual Property Rights |
| UNCTAD | United Nations Conference on Trade and Development |
| UPOV | International Union for the Protection of New Varieties of Plants |
| SASOL | South Africa Synthetic Oil Limited |
| WEF | World Economic Forum |
| WTO | World Trade Organization |
| WIPO | World Intellectual Property Organization |

# 1. Introduction

The role of stronger patent regimes in stimulating technical inventions and technological progress has been widely observed in most advanced economies. However, attempts to generalize such regimes globally, particularly in the South, has generated both optimistic and pessimistic views among policy scholars and practitioners over the past four decades. Optimists believe that a strong patent regime would increase the global rate of inventions (upon which the bulk of technological innovation is based) while pessimists fear that such a regime would only benefit advanced economies and result in significant decreases in patents from less developed countries, particularly from Africa countries, as they tend to rely heavily on technological progress made in the West. The present report outlines the findings of analytical work conducted to assess whether and when a strong patent regime can result in growth of inventive capacity and activities in some African countries.

The report helps clarify the effects of strong patent regimes on the inventive capacity of Algeria, Egypt, Kenya, Nigeria and South Africa, all of which made a number of changes in their patent regimes over the past two decades. It also provides *a brief analysis of the evidence emerging from a subset of these countries with an aim to identify and discuss the outcomes, as well as draws on lessons and experiences that can be transferred to other countries contemplating reform of their IPRs. A* patent index that defines patent strength is used in the discussion.

The analysis strongly draws from recently observed expansion in the volume of scientific and technical articles by nationals of these countries; the rise in R&D expenditures by private sectors; increased availability of scientists and engineers devoted to R&D; inflows of FDI (WEF, 2009; UNCTAD, 2014; AU-NEPAD; 2010), and sophistication of their market and business structures (WEF, 2010).

For this report, strong patents refer to the existence of modern and flexible patent laws and enforcement practices, in accordance with the TRIPS agreement that recommended the *minimum standards* to WTO member States to promote innovation, trade and global growth. Briefly, patents grant exclusive rights to inventor(s) or owner(s) for a limited period of time to exploit their inventions, in exchange for the public disclosure of the underlying information. They have an essential function of supporting learning, scientific and technical progress that is useful to society, although they can be misused by some anticompetitive inventor to frustrate this aim.

The author contends that weak patent regimes can be disincentives to R&D spending and, in the long run, slow the amount of inventions produced, as the ownership of intellectual assets can reduce the dissipation of related rents resulting from their commercial dealings, as also pointed out by Hall and Rosenberg (2010). Strong patent regimes can also limit misappropriation of related information by competitors and thus encourage further R&D spending. This assertion is partly based on the premise that the patent institution has a significant influence on the behavior of R&D investors, inventors and innovators.

Investors usually base their decisions to enter joint venture deals, pursue technology transfer and commercial exploitation initiatives, scale-up their investments and expand productions in different geographic locations on whether they can secure a monopoly on their IP and maximize return on their spending. A strong patent regime can play that role, in addition to promoting FDI inflows and technology transfer. They are not perfect appropriation mechanisms, but they are the best known and mastered options that have been widely used by modern societies from the mercantile period through the French revolution to nowadays.

Furthermore, strong patent regimes can provide significant incentives to the growing population of complementary users of complementary technologies to come together and transact with each other patented inventions and scientific discoveries, which are usually fraught with technical and commercial risks (Teece 1986; Mowery and Rosenberg, 1989; Nelson 2006). This is facilitated by the credibility of the threat of an injunction characterized by legal entitlement, which can best be supported by strong patent laws and enforcement provisions and practices and hampered by alternative liability rules. This bestows upon them a critical role in the knowledge generation and use.

The author also acknowledges that excessively strong patent regimes might distort the technological learning patterns of countries with scarce technical capabilities, particularly those with extreme shortages in R&D funding and as a result heavily rely on knowledge produced elsewhere.

This dualism constitutes a serious challenge to policymakers intending to design strong patent regimes that keep going knowledge production and use. Such design should be informed by clear analyses on how patents affect inventors' behaviours. Furthermore, it depends on how patent laws and enforcement provisions are aligned with the key pillars of national innovation systems. The experiences of these countries provide a learning opportunity for other African countries as they seek pathways to deliberately deploy technology and innovations to accelerate the transformation of their economies.

## 2. The global debate on the benefits of Trade-Related Intellectual Property rights on technological capabilities in developing countries

In this report, the strength of a patent regime is framed in the perspective of the TRIPS agreement, although manufacturers, inventors, researchers and funding institutions worldwide have been stressing the need to strengthen and harmonize national patents regimes for more than a century. Undoubtedly, there were other multilateral conventions that recommended strengthening of IP regimes in the past, but TRIPS represents the most comprehensive framework in terms of defining the rights that inventors are entitled to and enforcement mechanisms. Briefly, the TRIPS Agreement, which for the first time introduced IP into international trade in order to reduce some international trade barriers by deep alterations on the structure of the multilateral trading system, was concluded in 1994 at the end of the Uruguay round of trade negotiations by States Party to GATT. TRIPS provide a minimum standard for administering and enforcing IP laws. Some provisions of it on patents leave enough options for discretion to member States, highlighting exclusions from patentability and exceptions to the exercise of patent rights. The recommended standards of patent protection are minimal and could, accordingly, be beneficial to countries that benefit from increased flows of technologies or FDI. Flexibility is given to countries on some strict criteria, such as patentability, to reach the purposes of the agreement.

Article 7 (1994) of TRIPS emphasizes that the protection and enforcement of IPR should contribute to the promotion of technology innovation and the transfer and dissemination of technology to the mutual benefit of producers and users in a way that encourages social and economic welfare, and to the balance and of rights and obligations. Article 8 (2) emphasizes that appropriate measures, provided that they are consistent with the provisions of the Agreement, may be needed to prevent the abuse of IPR by right holders or use practices that restrain trade and international technology transfer. The enforceability of TRIPS through the WTO dispute settlement process remains less constraining on technology transfer; conflicting private and public interests are held in balance.
The Agreement on Trade-Related Aspects of International Property Rights holds all member States of the WTO to the same standards. However, some developing countries, especially African countries,

feared that TRIPS was likely to reduce their trade, especially of high technology exports, given the weaknesses in their IPR and the high cost of strengthening them. Others argued that TRIPS actually could have a positive impact on high technology exports from Africa if African countries actually strengthened their IPR. This might explain why some African countries have strengthened their IPR.

*Some compelling arguments supporting the need for strong patent regimes in developing countries is that multinational enterprises* tend to do the following: (a) expand their R&D operations abroad to increase their export earnings in the core areas that they excel in at home; (b) adapt their products and processes to foreign markets' needs; (c) provide technical support to offshore manufacturing plants; and (d) monitor and learn from new technology developments or other complementary capabilities.

The literature on international trade and innovation also contends that lower wages can be an incentive for multinational enterprises to shift their production to the South. It is also true that such companies seeking superior benefits can incur high risks of imitation, a process that requires additional investment from inventors, but can largely be discouraged or minimized by a stronger patent enforcement system (Schumpeter, 1950), lowering the risks feared by multinational enterprises. Stronger patent regimes can then facilitate production shifting from the North to the South, increasing an allocation of Northern resources to the South — a process that is very likely to provide inputs that can support industrial development in Africa. In this way, FDI can counterbalance the decrease in Southern imitation. The extent to which FDI is attracted will be one key indicator of the welfare of a strong IPR in host countries. *Overall, l*ess detailed analysis on the effects of TRIPS has been carried out on Africa; much of what is known has been drawn from a sparse survey of the owners of IP.

## 3. Methodology

The data for patent strength were based on the methodology of Park (Girnate and Park, 1997), which comprises a patent index. The index averages the scores obtained on the following five statutory categories of patent laws:

1. Membership in international treaties
    c. Paris Convention[1] and revisions
    d. Patent Cooperation Treaty (PCT)[2]
    e. Protection of New Varieties (UPOV)[3]
2. Scope of patentable inventions
    a. Pharmaceuticals
    b. Chemicals
    c. Food

1 Paris Convention for the Protection of Industrial Property was concluded in 1883. It established the right of priority that allows IP applicants to claim priority of an earlier application filed up to 12 months, when filing an application in countries other than the original country of filing (WIPO).

2 Patent Cooperation Treaty (PCT) was concluded in 1970. It is an international treaty administered by WIPO. The PCT system facilitates the filing of patent applications internationally. It also allows applicants to seek patent protection for an invention concurrently in each of a large number of countries by first filing a single international patent application. The granting of patents remains under the authority of the national or regional patent office; it is generally made through the regional phase.

3 International Union for the Protection of New Varieties of Plants (UPOV) is an intergovernmental organization established by the International Convention for the Protection of New Varieties of Plants (UPOV Convention), which was adopted on 2 December 1961. UPOV provides and promotes an effective system of plant variety protection, aiming to stimulate the development of new plant varieties for social welfare (WIPO).

d. Plants and animal varieties
e. Surgical products
f. Microorganisms
g. Utility models

3. Restrictions on patents
   a. Working requirements
   b. Compulsory licensing
   c. Revocation of patents

4. Duration of protection

5. Enforcement of the laws

**Provisions and practice**

The strength of patent regimes is provided by a patent index that gives scores on various categories of a patent law (Girnate and Park, 1997) as outlined in the section 1.2.

The scoring on the category (a) ranges between 0 and 3. It is based on whether the country is a signatory or a non-signatory of the three major international treaties. The scoring on the category (b) ranges between 0 and 7. It is based on the scope of coverage of the minimum patentable inventions (i-vii) and is equal to 0 for 0 coverage and 7 for coverage on all of the seven listed categories. The scoring on the category (c) ranges between 0 to 3. It is based on whether the three major restrictions (i-iii) are applicable in the patent policy and system.

The scoring on the category (d) ranges between 0 and 1. It is based on whether the full duration of the patent protection is 20 years from the date of application or 17 years from the date of grant. The scoring for enforcement is based on experts' opinions of national performances on patent protection. It is much similar to the World Economic Forum (WEF) approach on the strength in IP protection.

The actual value of patent strength ranges between 0 and 5, with 0 corresponding to the weakest and 5 the strongest national patent regime. The value of patent strength can vary according to changes made in the underlying statutory categories in a given period. They are available for most African and Organization for Economic Cooperation and Development (OECD) countries (Park, 2008). The statutory categories are detailed in the TRIPS Agreement.

In this first analysis, the countries selected are among the most actively involved in R&D activities from the major four regions of Africa, North, South, West and East. They are Algeria, Egypt, Kenya, Nigeria and South Africa. Other countries might be investigated in future studies.
Patent data were gathered from WIPO database (from 1998 to 2012), which has among the broadest coverage of patent activities from different regions of the world. The World Intellectual Property Organization (WIPO) has solid partnerships with patent offices from the developed and the developing world, and has long experience in providing capacity-building on IP administration, policy development, and in registering IP statistics from national and regional patent offices, including those from Africa. WIPO patent data cover different dimensions of patent activity, including incoming and outgoing filings, the share of filings in different technological fields, total patents in force, and the use of international IP systems by applicants. In the analysis, the patent filings is decomposed into the following categories: "resident" - domestic filings; "non-resident" - filings coming in from other countries and "abroad" - filings going out to other countries (WIPO).

The data on the major episodes and scope of reforms in patent regimes for selected countries are obtained from related patent acts or laws published in government gazettes and other officially accredited outlets. The data on changes made on R&D institutions, or other important input or enablers of the national innovation systems, such as human capital and business environment, are obtained from WEF, the United Nations Conference on Trade and Development (UNCTAD, 2014) and other standard sources.

# 4. Countries' experiences

## 4.1 Synopsis of institutional progress made to promote scientific, technology and innovation by the selected countries

Increasingly, African countries have been putting a lot of effort over the past 20 years in encouraging their national institutions to promote R&D and innovation systems. To a large extent, this effort has pertained to the R&D and innovation potentials on long-term growth. Across the continent, STI strategic plans have been upgraded; market and businesses systems were improved, resulting in varying levels of progress across the continent. Table 1 contains an outline of some of the changes made on selected key components of the innovations systems for the selected countries. The selected pillars are generally believed to play crucial roles in enhancing the performances of national innovation systems.

**Table 1. Progress made on some key components and enablers of the national innovation systems of the selected countries (2010)**

| | | Global ranking | | | |
|---|---|---|---|---|---|
| Key national innovations pillars | South Africa | Egypt | Kenya | Nigeria | Algeria |
| Quality of scientific research institutions | 29 | 111 | 40 | 115 | 110 |
| Researchers in R&D /million population | 52 | - | - | - | 55 |
| GERD (% GDP) | 35 | - | - | 111 | 80 |
| University-industry collaborative R&D | 25 | 96 | 40 | 87 | 119 |
| Company spending on R&D | 35 | 54 | 37 | 40 | 98 |
| FDI and technology transfer | 45 | 30 | 65 | 89 | 132 |
| Scientific and technical articles | 49 | 67 | 83 | 111 | 79 |
| IP protection | 24 | 58 | 87 | 88 | 109 |
| State of cluster development | 33 | 41 | 39 | 60 | 130 |

**Source: WEF (2009).**

As a follow-up to this section, a brief discussion on progress made by each country is provided.

**South Africa.** With a population of 50.5 million population, and a 277.8 GDP per capita (PPP$) (WEF, 2011), South Africa is the largest and most technologically advanced economy in Africa. The country is strongly committed to becoming more developed, and is ranked among the upper middle-income and emerging industrialized economies (HSRC, 2005). It has a strong manufacturing sector, which has been a major driver of innovation. Supported by its modernized and well-performing tertiary education sector, a network of dedicated public and private research institutions, the presence of multinational enterprises, a clear STI policy and strategy, the country has been making significant progress in its efforts to establish a vibrant innovation ecosystem.

Over the past decade, the county has significantly improved some of its key national innovation structures. Globally, its gross expenditure on R&D (GERD) (as % GDP) ranked 35, its quality of research institutions, 29, its university-industry collaborations, 25, its strength of investor protection, 9 and its state of cluster development, 33. It ranked 52 on researchers in R&D/millions population, 49 on scientific and technical articles, 35 on company spending on R&D, 45 on FDI and technology transfer and 24 on IP protection (WEF, 2009).

**Egypt.** Egypt is a lower middle-income country with a population of about 84.5 million and a GDP per capita (PPP$) of about 5,672.6 (WEF, 2011). The country has put a lot of effort in developing a vibrant innovation ecosystem, resulting in the following outcomes. Company spending on R&D in Egypt ranked 54; FDI and technology transfer, 30; scientific and technical article, 67; strength of investor protection, 55; and state of cluster development, 41. The linkages between universities and industries through, for example, collaborative R&D, were not strong enough to support the development of technical skills in universities and facilitate technology transfer from universities to businesses and increase innovation performance, as indicated by the low ranking (96) on university-industry. Egypt has developed good scientific and technical capabilities as showed by its global ranking (67) on scientific and technical articles. This indicates that a class of scientists and engineers of international standards have emerged, despite the substantial support needed by research and development institutions in utilizing effectively both its national scientific and technical outputs and the large inflows of technologies coming through FDI (WEF, 2000).

**Kenya.** Kenya is a low-income country with a population of about 40.9 million and a GDP per capita (PPP$) of about 1.572.6 (WEF, 2011). Globally, the country's state of cluster development ranked 39, company spending on R&D, 37, university-industry collaborative research and quality of scientific research institutions, 40. FDI and technology transfer ranked 71 and other selected indicators had low rankings, as indicated in table 3.0. The rankings suggest that Kenya has been instituting good practices to create a better environment that stimulates an innovation ecosystem. Among them is support extended to university-business linkages, which are crucial in fostering the development of technical skills in universities and university technology transfer. Other practices are financial commitment from the private sector to support R&D and innovative activities and partnering and the emergence of clusters that are crucial in supporting the development of firms (WEF, 2009).

**Nigeria.** This middle-income country has a population of 158.3 million (WEF, 2011). It performances with regard to the most important pillars of innovation structure have been low, with the exception of company spending, which ranked 40 globally. Efforts to develop better research and development institutions that can catalyze scientific and technical capabilities and innovation have thus far failed to produce visible outputs. University-industry linkages and the capacity to effectively utilize the available R&D expenditures from the private sectors are still limited (WEF, 2010).

**Algeria.** Algeria has a population of 36.7 million, a GDP (per capita PPP$) of $7,210.3 and a GDP ($ billions) of 183.4. Efforts made to improve the national innovation system have not yet elevated Algeria to be among the top performers globally. The quality of the scientific research institutions, which have higher concentrations of researchers, are very limited. These institutions can be associated with only small amounts of scientific and technical knowledge generated nationally. The linkages between universities and industry, as well as company expenditures in R&D, remain very weak. Unlike many other African countries, the FDI inflows are very weak (WEF, 2010); the reasons for this are a subject for future analyses.

## 4.2 Effects of patent regimes on inventive activities

### 4.2.1 The South African experience

#### 4.2.1.1 Major improvements made on the patent regime subsequent to enactment of Trade Related Aspects of Intellectual Property Rights

The experience of South Africa with regards to patent and other IP laws – which went through various amendments - are traceable to 1940s. One important result of such amendments includes the Patent Act No 57 of 1978, commenced in 1979, which aimed to promote learning, technology transfer and innovation across South Africa. Some important amendments made to support the pursued goals include: Patents Amendment Act No 14 f 1979; Patent Amendment Act No 67 of 1983; Patents Amendment Act No 44 of 1986; Patents Amendment Acts No 76 of 1988; General law Amendment Act No 49 of 1996; Intellectual property Law Act No 38 of 1997; Patents Amendment Act No 58 of 2002; and Patents Amendment Act No 20 of 2005.

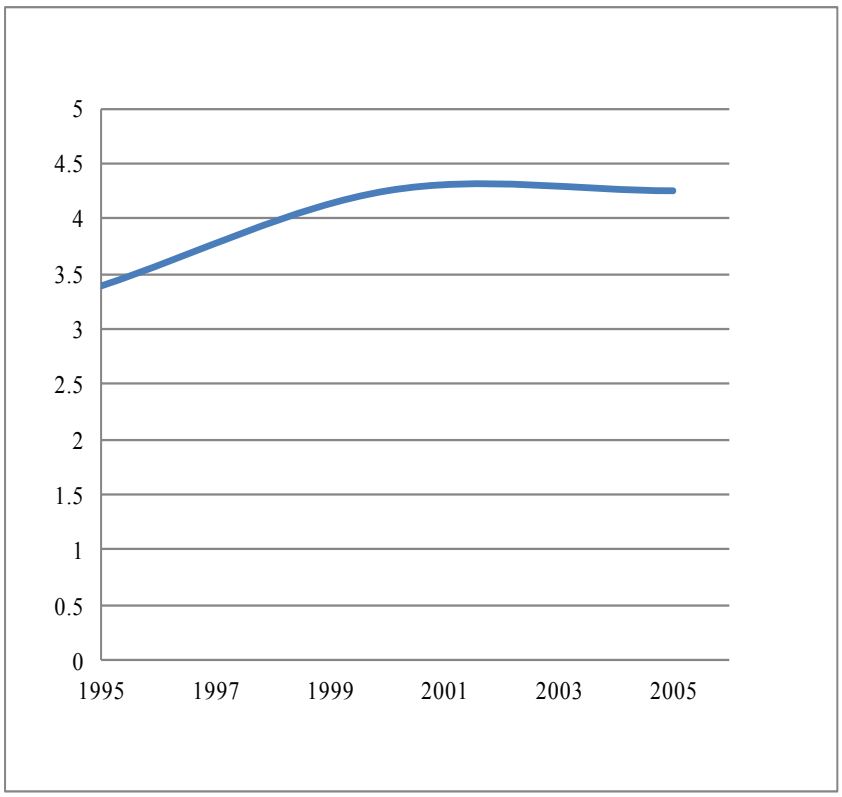
The most recent Act went beyond most minimum standards recommended by TRIPS, including, among them, the duration (20 years), coverage of chemicals, pharmaceuticals, plant varieties, indigenous genetic materials, compulsory licensing, and provisions on dispute resolutions and litigation on domestic and international patents. The most important WIPO-administered Conventions bilateral and multilateral treaties were entered into force beyond the TRIPS minimum standard. The Paris Convention was entered into force back in 1947 and the PCT, in 1975. After signing the TRIPS Agreement in 1995, South Africa carried out the following changes major changes in its patent laws.

- Amendments of (a) the Patent Act of 1978, in 2002 and in 2005, (b) the S&T Laws in 2011, (c) the Medicines and Related Substances Act No 59 in 2002, (d) the Medicine and Related Substances Act No 101 in 2002 and (e) the Nuclear Energy Act of 1993 in 1993
- Enactment of the implementing rules/regulations: (a) Patent Examination Regulations in 2003; and (b) Patent Regulations No R 6247 amended in 1978, in 2006
- Entry into force of the Convention on Biological Diversity (CBD)[4]

Figure 1 shows a summary of the evolution of strength of the patent regime of South Africa using the Park Index, which synthesizes both the changes made in the statutory patent laws and their enforcement.

4 Signed in 1992, CBD is an international treaty, which aims to facilitate the sustainable use of biodiversity components and fair and equitable sharing of the benefits arising from the utilization of genetic resources, including by appropriate access to genetic resources. This implies that all rights over those resources and technologies have to be taken into account and by appropriate the transfer of relevant technologies (WIPO).

Figure 1. Average patent strength



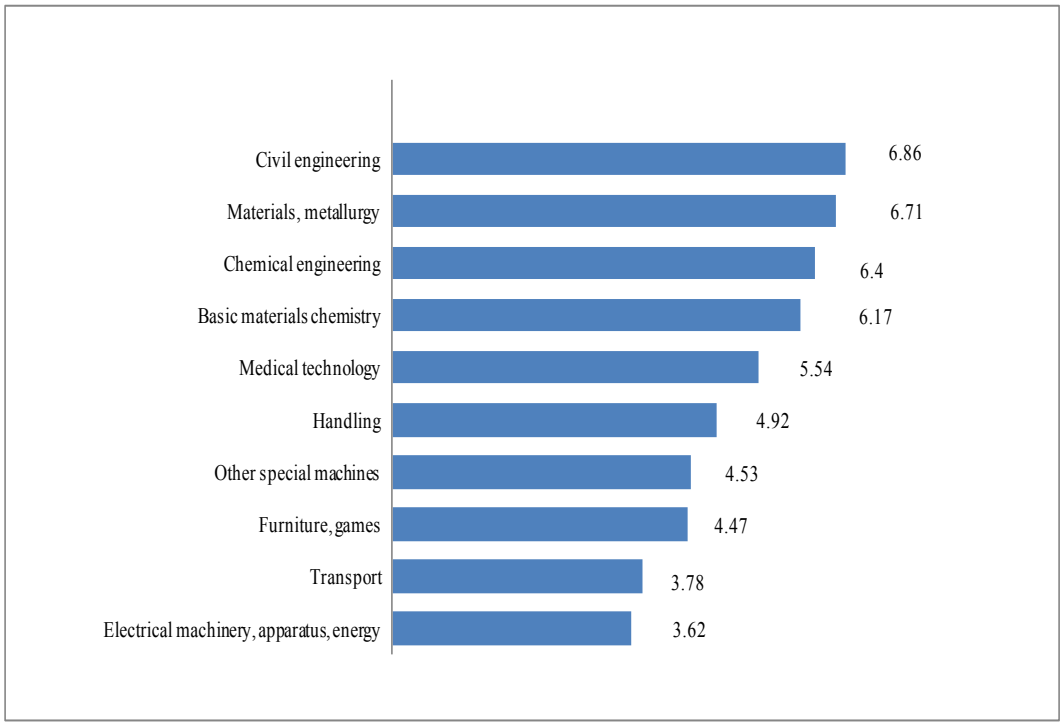

**Source:** Park, 2008.

A large part of these changes were rationalized and entered into force. The patent laws were then significantly enforced, elevating the patent strength to the standards of many countries of the developed world, as depicted in the steadily rising trend of the patent strength index in figure 1, which is largely consistent with experts' opinions on IP protection that ranked South Africa globally as follows: 23 in 2009, 24 in 2010, 27 in 2011 and 30 in 2012 (WEF).

#### 4.2.1.2 Effects of stronger patent regimes on patent applications

First, the fields of technology most patented in South Africa are identified and outlined in figure 2, which depicts the shares of patent applications by the top fields of technology between 1998 and 2012. Discounting the category others, such as unstipulated classes, the large shares of South African patents were in the medium-technology class, particularly in fields that were closely related to mining and mineral processing (materials, metallurgy, chemical engineering and basic materials chemistry), which accounted for 19.28 per cent of patent applications. Patents in the high-technology sectors, including medical technology, furniture and games, electrical machinery, apparatus and energy, accounted for 13.63 per cent, while those from the low-technology, including civil engineering and transport, accounted for a 10.64-per cent share.

**Figure 2. Shares of patent applications by top 10 fields of technology (1998-2012)**

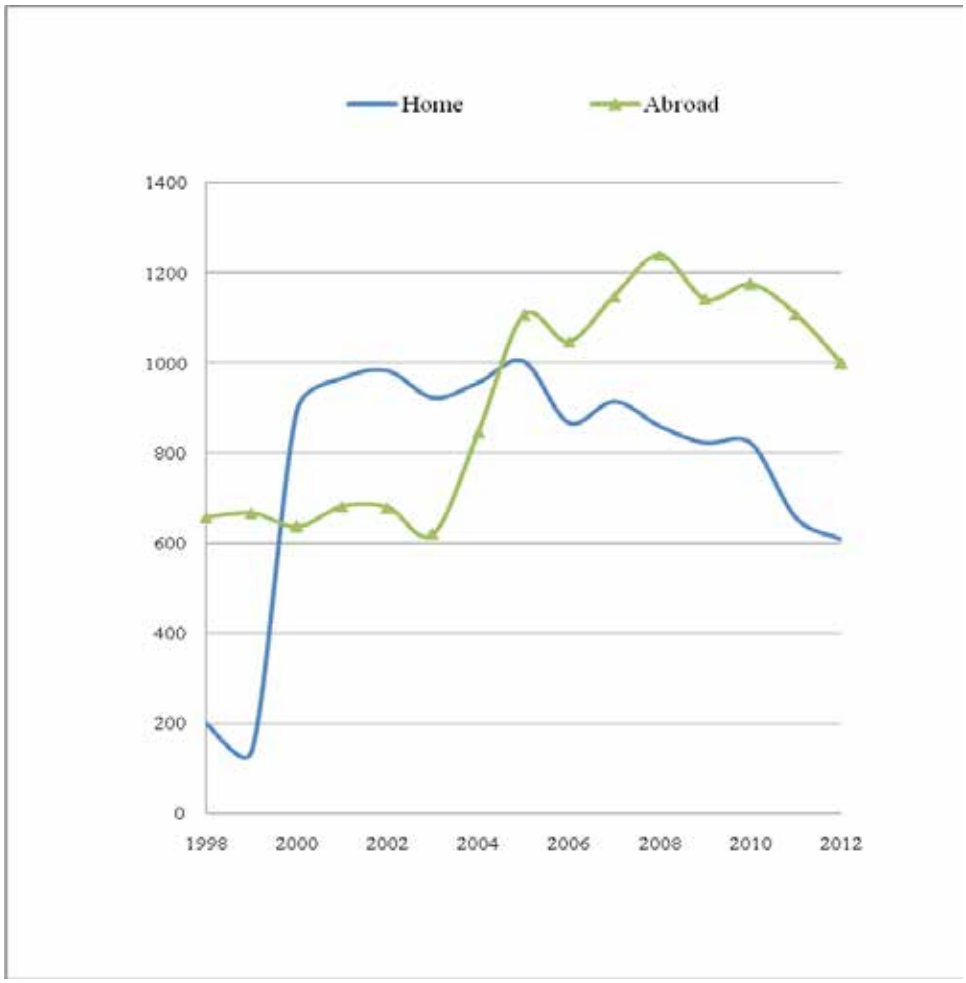



**Source:** WIPO.

Using data from WIPO, Park (2008), WEF and UNCTAD, the relationship between a stronger patent regime and inventive capacity measured through the number of patent applications made abroad and in the domestic patent office is explored. The analysis takes into account the end of apartheid in 1994, preceded by the gradual lifting of sanctions following the release of Nelson Mandela and other anti-apartheid leaders from prison, which opened up the economy to international investments, beyond FDI inflows.

Figure 3 (a) depicts the trends in patent applications made by South African nationals at home (in South Africa) and abroad, between 1998 and 2012. It was found that the volumes of patent applications rose steadily in accordance with the strengthening of the patent regime. This indicated that R&D activities and inventive capacity increased at a steady rate over the investigated period.

Figure 3 (a). Patent application by nationals

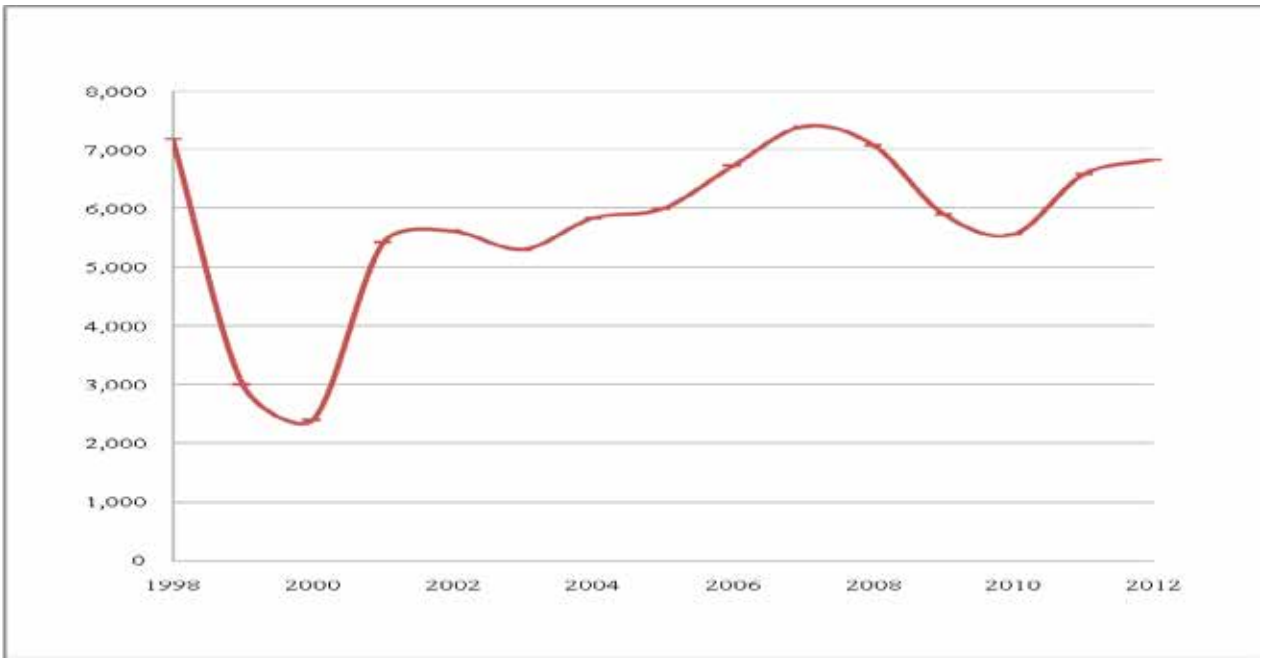



**Source:** WIPO.

The number of patents filed abroad was lower than that those filed at home during the period 1998-2004, when this trend changed drastically. The number of patents filed abroad increased dramatically from 2004 and equalled the patents filed at home (1000 patents) in 2005. It reached 1060 patents in 2012, while the number of domestic patents declined by 600 patents. The upsurge in patenting abroad could be attibuted to the propensity of SASOL Technology LTD to patent abroad (in the United States of America, the European Union and Asia), where it has been developing businesses (mergers and acquisitons, joint manufacturing, R&D) in chemicals, polymers, catalysis, and chemical engineering sectors over the past 15 years.

Figure 3 (b) also indicates that the overall number of patent applications filed by non-residents, including foreign multinational enterpises remained larger than those filed by South African inventors in South Africa and abroad. From 2005 to 2009, for example, patent applications filed by foreign inventors in South Africa were about fivefold those filed by South African inventors abroad. Overall, the number of patents filed by foreigners increased more rapidly that those filed by South African nationals in South Africa and abroad combined.

Figure 3 (b). Patent application by foregners




**Source :** WIPO.

The observed influx of patent applications by foreigners plus the steady increase in FDI inflows are indicators of technology transfer to South Africa following the strengthening of the patent regime, as discussed earlier. The government and private sector also extended large support to national R&D activities as indicated by the high levels of GERD and business spending on R&D, which could have contributed largely to the development of capabilities needed to absorb and utilize technology inflows through FDI (WEF, 2009).

Large gaps in exploiting the vast potential offered by the large inflows of technology through FDI and large business R&D expenditures and strong patent regimes are also worth noting. The volume of patent applications in South Africa should have been larger given the high standards of its R&D infrastructures, institutions and commitment to support the national innovation system. Altogether, the observed changes constitute enormous windows of opportunity to accelerate the accumulation of capabilities from technological knowledge coming from the rest of the world, which can be absorbed, adapted and applied to national and global needs.

The steady inflows of patent applications from foreign multinational enterprises and FDI in South Africa are a signal that these entities have R&D activities in South Africa, in addition to their expanding production operations in Africa. This assumption is further supported by the recently observed increase in co-authorships and co-inventions between South African and foreign researchers (Pouris and Ho, 2013; Lubango and Pouris, 2010). In the long run, these entities might become the major actors in R&D, engineering and technology development network activities.

In addition to attracting foreign multinational enterprises and patent applications, strong patent regimes have boosted capacity in South Africa to invent products and protect the corresponding patents from being infringed upon both locally and internationally, thus enabling them to be integrated into the international production systems in which they could be successfully introduced and part of their technologies could be protected. This is further reflected by the steady increase in export earnings from technology-intensive goods (UNCATD) The results suggest a need to increase the absorptive capacity of the local innovations systems, shift the share of patent activities to high-technology sectors that

appeared to be smaller (relative to that made in medium-technologies as outlined in Figure 2), as the former sectors are increasingly associated with high potential for greater returns on R&D investment.

## Summary of the findings and lessons learned

The reforms of the patent regime were, to a large extent, suitable responses to the local need associated with increased R&D intensity (expenditures), capabilities and activities:

- Steady, rapid and significant growth of patent activities among national inventors occurred as showed by the rising number of patents filed home and abroad.
- This effect could most plausibly be mediated by significant improvements made in the major components of the national innovation system: GERD, researchers in R&D per million population.

To sustain or encourage structural transformations in the national system of innovation, a much more flexible and stronger appropriation regime is needed. Such a regime must **favour more national priorities than the mere need to attract FDI inflows, which are mostly geared towards supporting the traditional production system, leaving narrow prospects to innovation.**

Reforms should be **commensurate with the level of internal need. In other words, responses should be suitable to the actual or very potential changes in the key inputs and enablers of the R&D system, including, among them, R&D intensity, capabilities (generation of both proprietary and generic knowledge), market and business sophistication (university-industry linkages).**

**South Africa** can pursue a number of options in its effort to increase the number of researchers in R&D centres. Through the increased number of centres, it would be in a better position to utilize the available resources and thus ultimately boost the national inventive capacity.

### 4.2.2 The experience of Egypt

#### 4.2.2.1 Major improvements made in the patent regime subsequent to the enactment of Trade-Related Aspects of Intellectual Property Rights

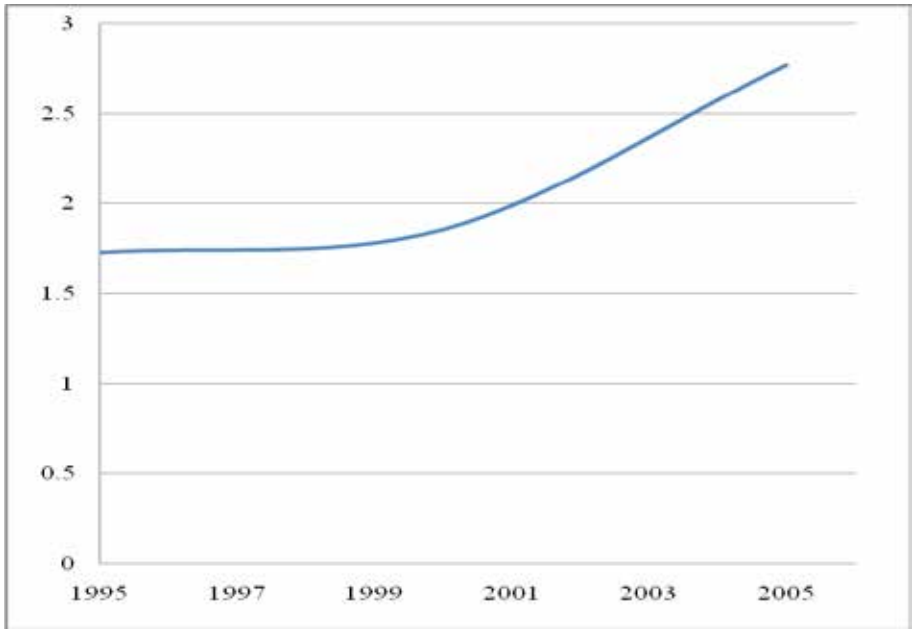
Egypt has had an intellectual property right system in place since the 1930s. The Paris Convention entered into force in 1951, PCT in 2003 and CBD in 1994 (WIPO). Very few amendments have been made in the patent laws after TRIPS entered into force in 1995.

Patents are regulated through Book 1 of Law No. 82 of 2002 governing protection of IPRs, that covers: (a) Law No 57 of 1939 pertaining to both trademarks and commercial data; (b) Law No 132 of 1949 pertaining to patents of inventions and industrial drawings and designs, with the exception of a provision of patents of inventions regarding foodstuff, related chemicals and pharmaceutical chemicals, which was scheduled to be repealed on 1 January 2005; and (c) Law No 354 of 1954 pertaining to copyright protection.

Book 1 includes laws on the protection of patents and utility models, layout-designs for integrated circuits and undisclosed information. The latest laws cover the most minimum standards recommended by TRIPS, including the duration (20 years), coverage of chemicals, pharmaceutical chemicals and compulsory licensing. Plant varieties are also protected and pertain to the laws included in Book 4.

Figure 4 shows the evolution of average patent strength of Egypt in which the changes made in the statutory patent laws are synthesized.

**Figure 4. Average patent strength**



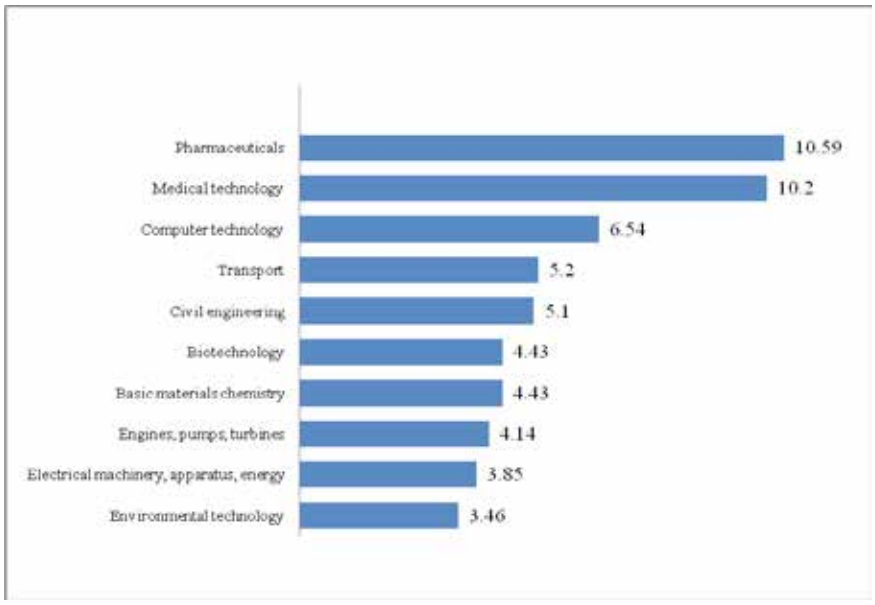

**Source:** Park, 2008.

Experts opinions on IP protection (that encompasses enforcement measures), ranked Egypt 60th in 2009, 58th in 2010, 67th in 2011 and 80th in 2012 globally (WEF). The rankings are consistent with the trends in the overall strength of the Egyptian patent regime displayed in figure 4, which takes into account both the laws in the book and the ways they are enforced.

#### 4.2.2.3 Effects of stronger patent regimes on patent applications

A large share of patents in Egypt (39.75 per cent) were in the high-technology sectors, including electrical machinery, apparatus and energy, engines, pumps and turbines, biotechnologiy, computer technology, medical technology and pharmaceuticals. The medium-technology sectors, including environmental technology and basic material chemisty, only accounted for 7.89 per cent of the patents, while the low-technology sectors, including civil engineering and transport, accounted for about 10.3 per cent, as outlined in figure 5.

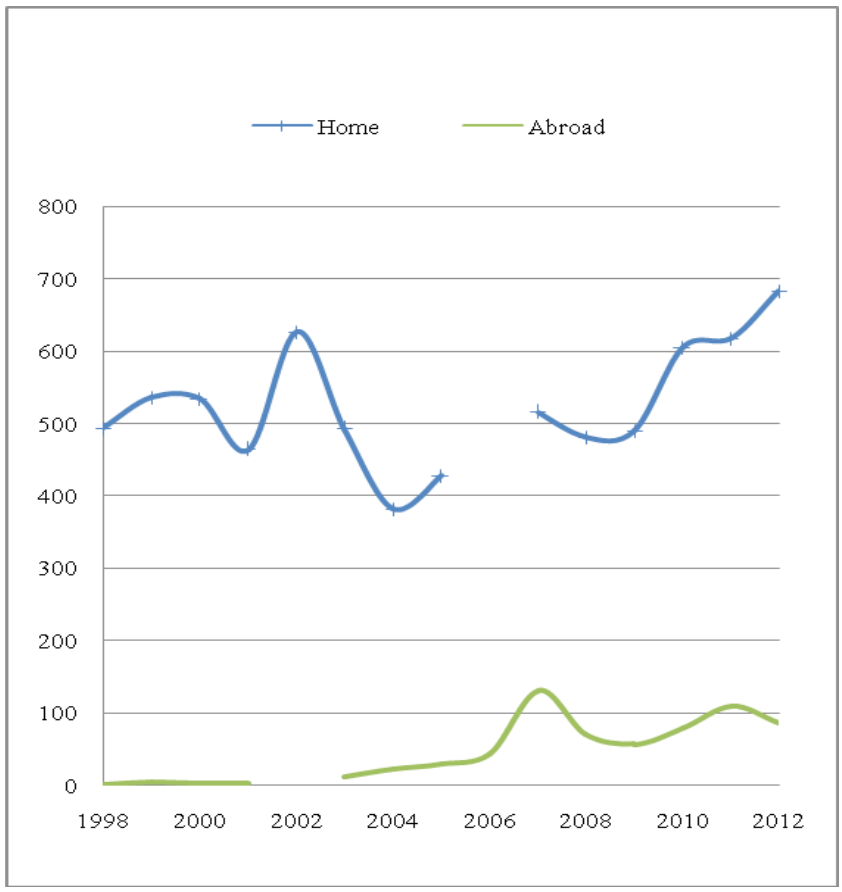
Figure 5. Shares of patent applications by top 10 fields of technology




**Source:** WIPO.

Figure 6 (a) depicts the trends in patents applications made by resident inventors in Egypt and abroad from 1998 to 2012. On average, the number of patent applications for all the categories increased steadily from 2004 onwards, in line with the increase in strenghth of the patent regimes depicted in figure 4.

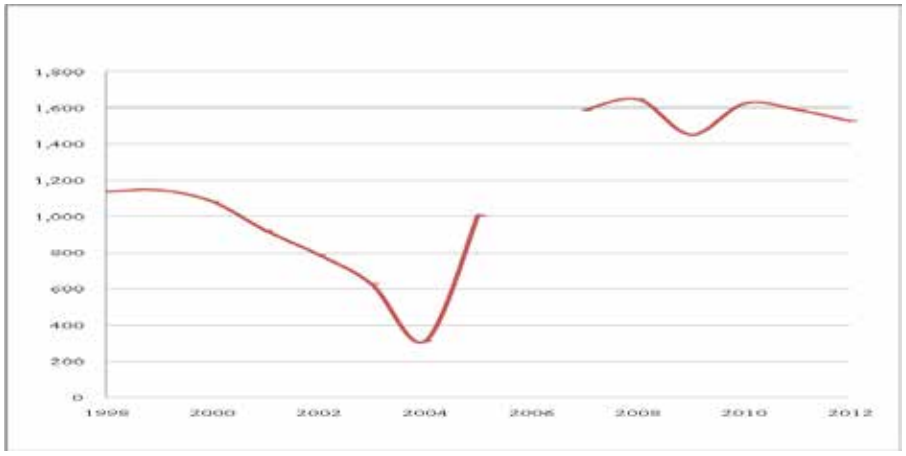
Figure 6 (a). Patent applications by nationals




**Source :** WIPO.

A moderate effect of patent strength on the average number of patent applications was observed during the period 1997–2003. This effect dropped between 2003 and 2005, then took off and increased dramatically from 2006 onwards. Possible reasons for the variations are a subject for future research.

**Figure 6 (b). Patent applications by foreigners**




**Source :** WIPO.

The overall number of patent applications submitted by non-residents in Egypt including foreign multinationals between 1998 and 2012 (figure 6 (b)) remained significantly higher than the number submitted by Egyptions in Egypt and abroad. In 2007, the amount of non-resident patent applications was threefold that of residents and about tenfold of the number filed abroad by Egyptian inventors. It was about 2.7 times higher than that of residents and about 9.4 times larger than that of the applications filed abroad by Egyptian inventors. This suggests that the stronger patent regimes encouraged a large influx of patent applications from foreign inventors in Egypt and promoted local R&D activities, including inventions.

## Summary of the findings and lessons learned

The reforms of the patent regime were, to a large extent, sufficient responses to the local needs, which consisted mainly of R&D intensity, infrastructures, capabilities and outputs
Stronger patent regimes have resulted in a rapid and significant rise in the number of patent application by Egyptian nationals. This is most probably due to the improvement made in the key components of the Egyptian national innovation system.

Egypt has developed good scientific and technical capabilities based on its global ranking (67) on scientific and technical articles, which is indicative of the emergence of a class of scientists and engineers of international standards.

However, the country's R&D institutions still need substantial support in order to adequately utilize both its national scientific and technical outputs and the large inflows of technologies coming through FDI (WEF, 2010).

### 4.2.3 The experience of Kenya

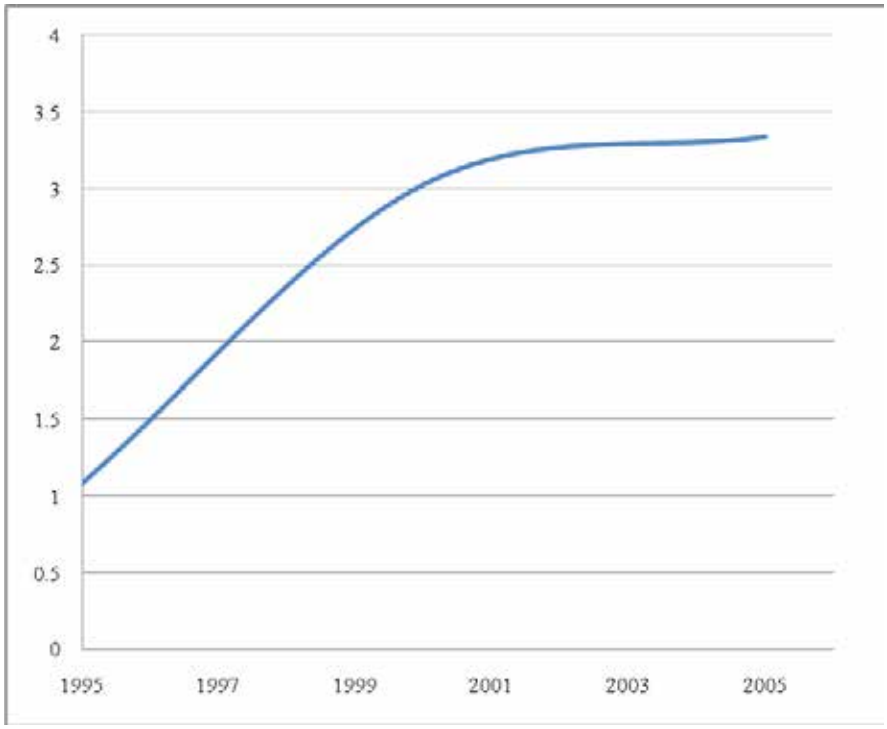
#### 4.2.3.1 Major improvements made on the patent regime subsequent to enactment of Trade-Related Aspects of Intellectual Property Rights

Patent applications and registrations made in Kenya are traceable in the repealed Patent Registration Act, chapter 508, of the Laws of Kenya of 1962. Under this Act, patents were provided in the United Kingdom of Great Britain and Northern Ireland and registered in Kenya. The Industrial Property Act, published in 1990, was brought into force in February of the same year. In 1993, proceedings of patent applications started after the implementation of the related regulations. In 2001, the Industrial Property Act was amended by Parliament to, among other things, provide for the promotion of inventive and innovative activities and facilitate the acquisition of technologies through grants and regulations of patents, utility models, technovations and industrial designs.

The Act defines patentable inventions, the duration of patent rights (20 years) requirements for disclosures, rights to inventors, owners, patent registration, grants, refusal, amendments and publication of the applications. It also outlines, among other things, the rights and obligations of the applicants and the owners, principles of contractual licenses, regulations of contracts and issues of certificates, compulsory licensing, grant and terms of compulsory licenses, transfer of compulsory licenses, and exploitation of patented inventions by the government or by the third persons and special provisions relating to utility models. Pharmaceuticals, chemicals and food products are all patentable. Important international treaties that were entered into include the Paris Convention in 1965, PCT in 1994, TRIPS in 1994 and CBD in 1994. The Industrial Property Act was enacted in 2001 and the implementing rules for IPR, in 2002.

Figure 7 contains a summary of the evolution of strength on the Kenyan patent regime using the Park index, which synthesizes both the changes made in the statutory patent laws and their enforcement.

**Figure 7. Average patent strength**



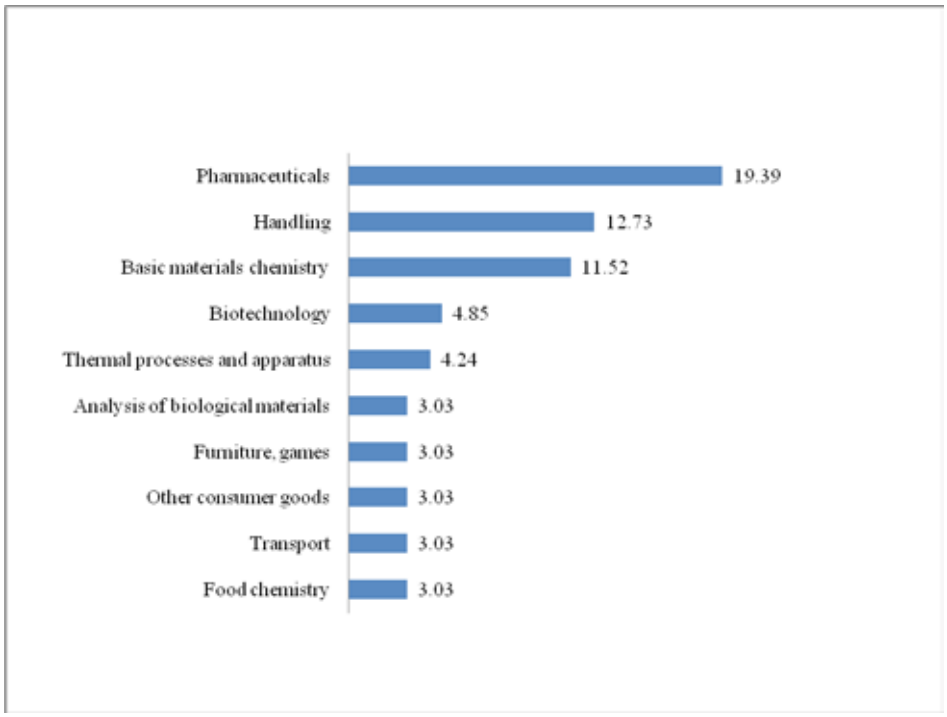

**Source:** Park, 2008.

The patent regime in Kenya has been strengthened, reaching the levels of many developed countries, from 2002 onwards, probably as a response to support the national aim to promote inventions, technology transfer, acquisition and innovation.

#### 4.2.3.2 Effects of stronger patent regimes on patent applications

Discounting the category others, a large share of patents made by Kenyan inventors, about 31.5 per cent, was concentrated in the high-technology sectors, including pharmaceuticals, biotechnology, thermal processes and apparatus, and furniture and games. The medium-technology, sector, including analysis of biological materials, other consumer goods and food chemistry, accounted for 9.09 per cent, while the low-technology including transport and handling accounted for 15.55 per cent, as outlined in figure 8. This distribution suggests a growing interest and move towards the high-technology industries over the period under investigation.

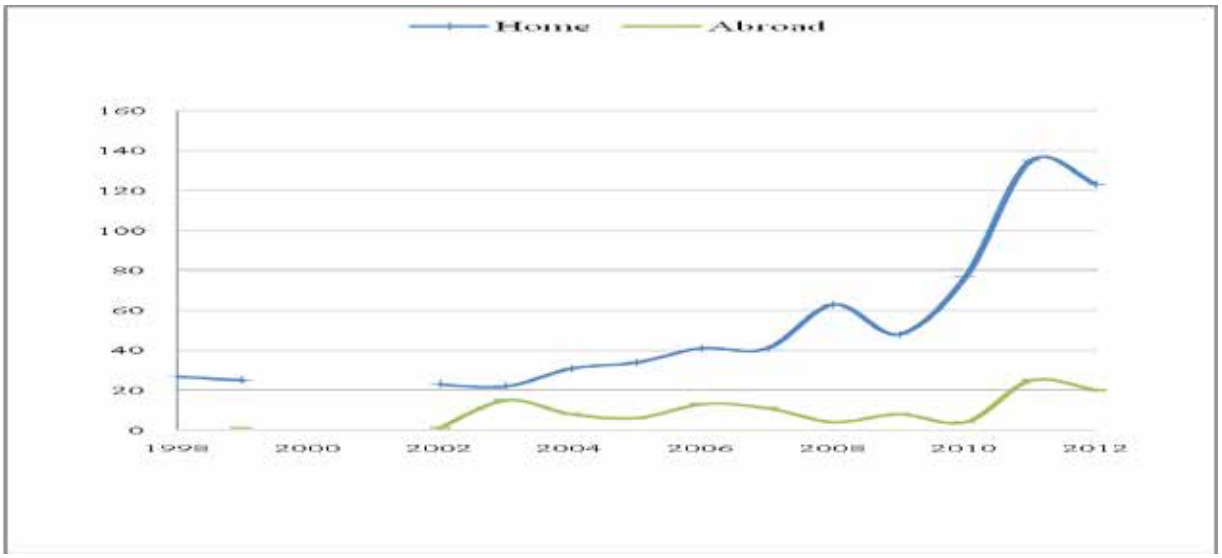
**Figure 8. Shares of patent applications by 10 fields of technology (1998-2012)**




**Source:** WIPO.

Visible increases in the number of residents and non-residents patent applications started in 2002 (figure 9 (a)). These applications expanded steadily from 2006 onwards, coevolving and converging in 2008. The number of resident patent applications reached a maximum of 135, while the number from non-residents was 105, in 2011. The overall number of patent applications made by Kenya nationals abroad increased, but fluctuated between 1 and 25 during the period 1998-2012.

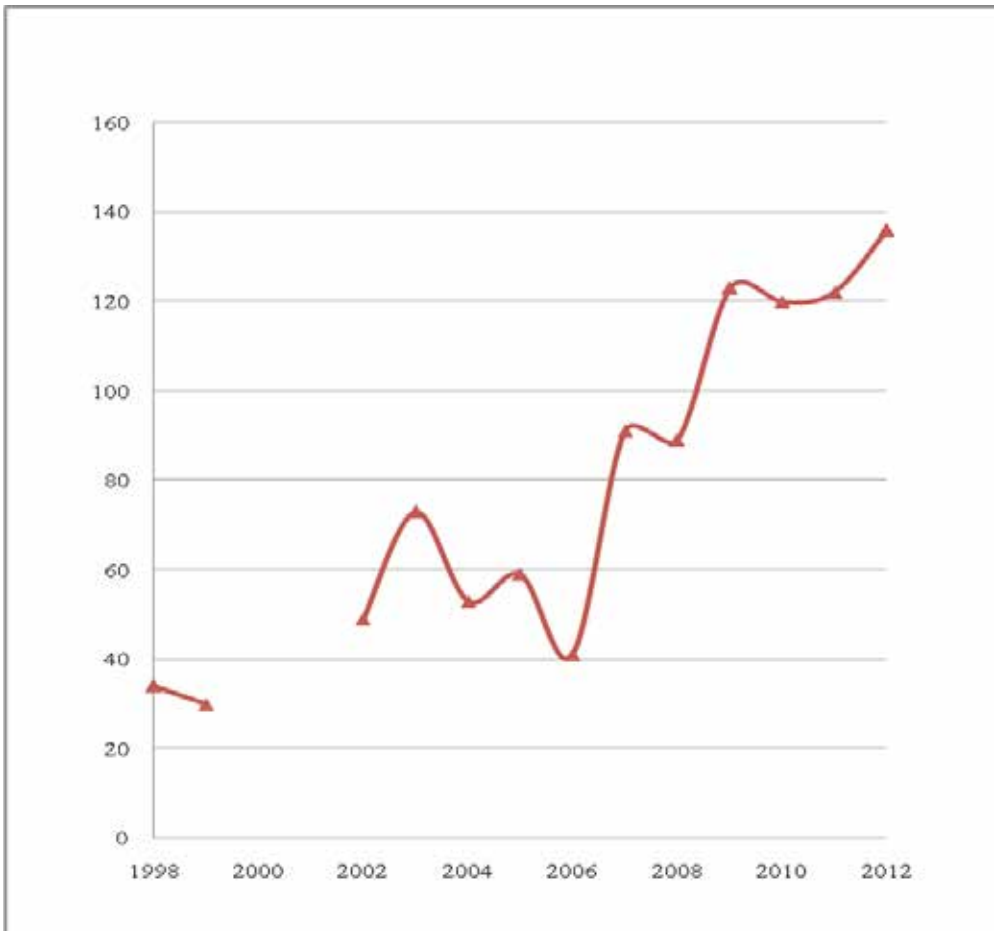
Figure 9 (a). Patent applications by nationals




**Source:** WIPO.

There data show a good correlation between strong patent regimes and the overall number of patent applications made by Kenyan nationals in Kenya and abroad, suggesting that stronger patent regimes encouraged the inventive capacity of national inventors.

Figure 9 (b). Patent applications by foreigners




**Source:** WIPO.

The high inflows of non-resident patent applications depicted in figure 9 (b) can also be regarded as a response of multinational enterprises to the stronger patent regime. Overall, the results suggest that there is a nascent capability to absorb and adapt technologies coming in through FDI, which can be sustained or encouraged through a stronger patent regime.

### Summary of the findings and lessons learned

The reforms of the patent regime moderately corresponded to the local need - growing R&D intensity, capabilities and outputs. They have resulted in rapid growth of patent applications, although at much lower rate than what was experienced in Egypt and South Africa. The overall improvements made in the key component of the Kenya innovation system were moderate and could very likely be due to the relatively smaller number of patent applications.

Kenya is a low-income country with a population of about 40.9 million and a GDP per capita (PPP$) of about 1, 572.6 (WEF, 2011). Globally, its state of cluster development ranked 39, business spending on R&D ranked 37, university-industry collaborative research and quality of scientific research institutions, 40 each. FDI and technology transfer ranked 71 (WEF, 2009). The country has been setting up good practices to create a better environment with the aim to stimulate an innovation ecosystem. These practices consist mainly of support to university-business linkages, which are crucial to the development of technical skills in universities and university technology transfer. Other ones are financial commitments from the private sector to support R&D and innovation and partnering and the establishment of clusters, both of which play a large role in supporting the development of firms. R&D capabilities have been growing rapidly, resulting in increased scientific and technical articles, as well as in some inventions.

Still, significant efforts to improve the enforcement of the patent law are needed, although such a drive should be carried out in tandem with increases in R&D intensities and relevant outputs.

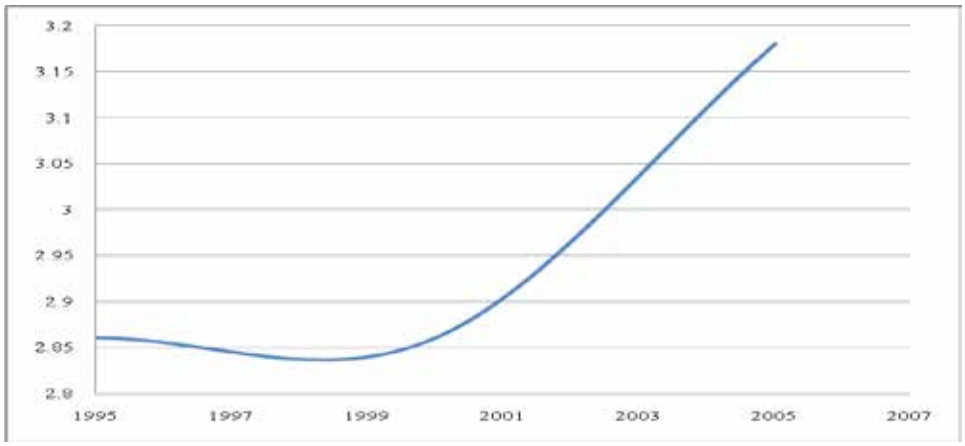
## 4.2.4 The experience of Nigeria

### 4.2.4.1 Major improvements made on the patent regime subsequent to enactment of Trade-Related Aspects of Intellectual Property Rights

In Nigeria, patents are protected under the Patent and Design Act, Chapter 344, of the Laws of the Federation of Nigeria, 1990, which includes the Patent Rules of 1971. This Act effectively repealed the Registration of United Kingdom Patent Act, the United Kingdom Design Act, the Patent Right Act of 1968 and the Patent Act of 1949 of the United Kingdom and amendments thereof. It makes comprehensive provisions for the registration and proprietorship of patents and designs in Nigeria and covers many standards recommended by TRIPS, including disclosure, patentable inventions, compulsory licensing (section 6 and 9), duration of protection (20 years), dispute resolution and litigations.

The most important changes made to the country's IPR system after TRIPS was entered into force in 1995 include the (a) council of Minister Resolutions No 1366 of 2003, which issued the implementing regulations for Law No 82 of 2002 on the protection of Intellectual Property Rights (related to the Patent and Design Act of 1990) and (b) PCT was entered into force in 2003. The Paris Convention was entered into force in 1951, the Strasburg Agreement and the WIPO Convention, each in 1975, and CBD, in 1994.

Figure 10. Average patent strength

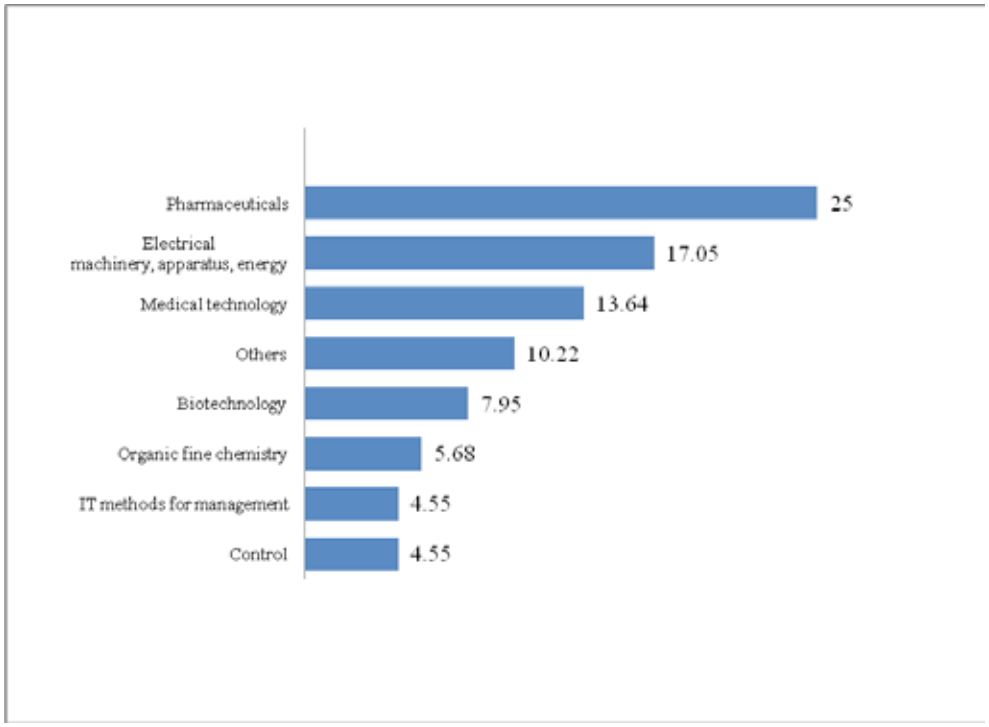



**Source:** Park, 2008.

Figure 10 shows the evolution of strength of the Nigerian patent regime using the Park index, which synthesizes both the changes made in the statutory patent laws and their enforcement. The major challenge in the regime remains limited enforcement of the laws in the book (WEF).

### 4.2.4.2Major improvements made on the patent regime subsequent to enactment of Trade-Related Aspects of Intellectual Property Rights

Figure 11. Shares of patent applications by top fields of technology (1998-2012)

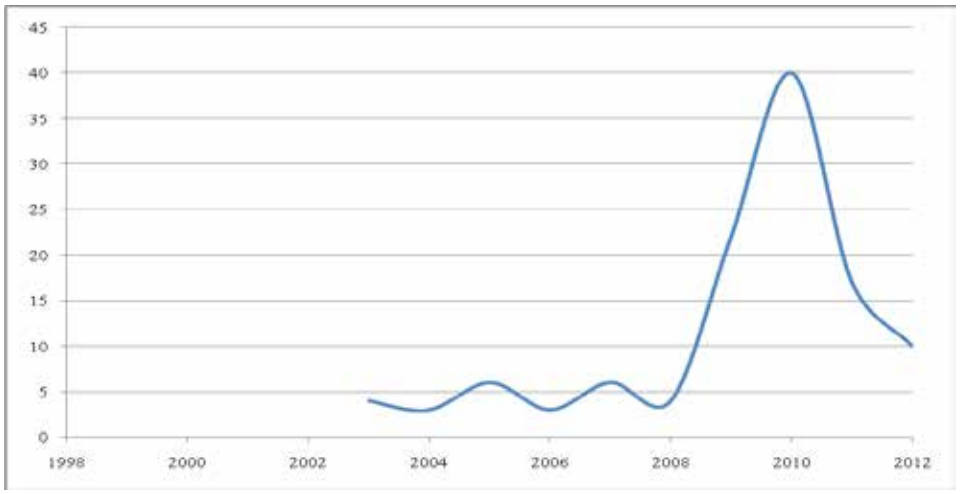



**Source:** WIPO.

Nigeria has a relatively small amount of patent applications, with the largest share, about 72.74 per cent, concentrated in the high-technology sectors, including pharmaceuticals, electrical machinery, apparatus and energy, medical technology, biotechnology, control and IT methods for management. The medium-technology sectors, including other consumer goods, organic fine chemicals and basic materials chemistry, accounted for 13.63 per cent, while the share of the low-technology sectors,

including civil engineering was, only 3.41 per cent. The share of others (unspecified) accounted for 10.22 per cent.

**Figure 12. Patent applications abroad**




**Source:** WIPO.

A strong association between patent strength and the average amount of patent applications made abroad occurred from 2008 onwards, although the total volume of such applications was extremely small. Resident patent applications were not visible on the WIPO database. One plausible reason behind the small amount of patents could be the shortcomings in the rules of laws, regulatory quality and enforcement of the laws in the book and weak R&D institutions (WEF). Inventors might have been inclined to file their patent applications elsewhere, where risks for infringements are lower. They also might have been inclined to file patents with foreigner inventors or owners in different jurisdictions.

## Summary of the findings and lessons learned

The patent regime was strengthened beyond the level of local R&D intensity and infrastructures and outputs (proprietary knowledge), but only a very small rise of patent applications was filed abroad between 2009 and 2011. The main components and enablers of the Nigerian innovation system did not yet reach the capacity to absorb the available resources and increase the inventive capacity.

Low performances were made on most important pillars of innovation structure, except company spending, which ranked 40 globally (WEF, 2009). Efforts to develop better research and development institutions in which scientific and technical capabilities can grow and innovation can flourish have not yet resulted in visible outputs. University-industry linkages and the capacity to fully absorb effectively utilize the available R&D expenditures from the private sectors were limited.

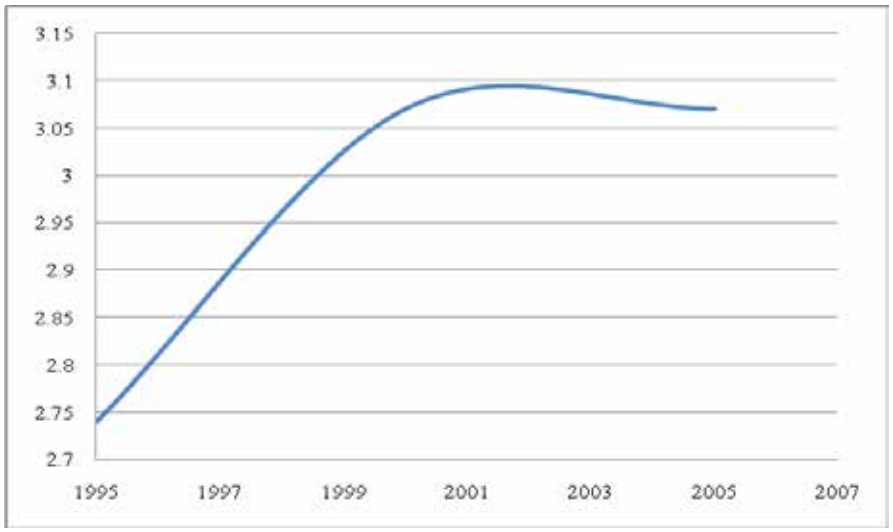
Massive effort is needed to elevate the key pillars of the national innovation system to effectively take stock of the level of patent reforms

## 4.2.5 The experience in Algeria

### 4.2.5.1 Major improvements made on the patent regime subsequent to enactment of Trade-Related Aspects of Intellectual Property Rights

The experience of Algeria with patent laws is traceable in the 1960s. In 1966, the Paris Conventions was signed and ratified in 1975. Patent applications and registrations are currently administered through Law No. 03-13 of November 2003, which defines, among other things, patentable inventions, the duration of patent rights (20 years), requirements for disclosures, publication of patent applications, rights to inventors and owners, examination procedures, transfer of rights, compulsory licensing, principles of contractual licensing, exploitation of patented inventions by government, revocation of a patent. Figure 13 shows the evolution of strength on the Algerian patent regime using the Park index, which synthesizes both the changes made in the statutory patent laws and their enforcement.

**Figure 13. Average patent strength**



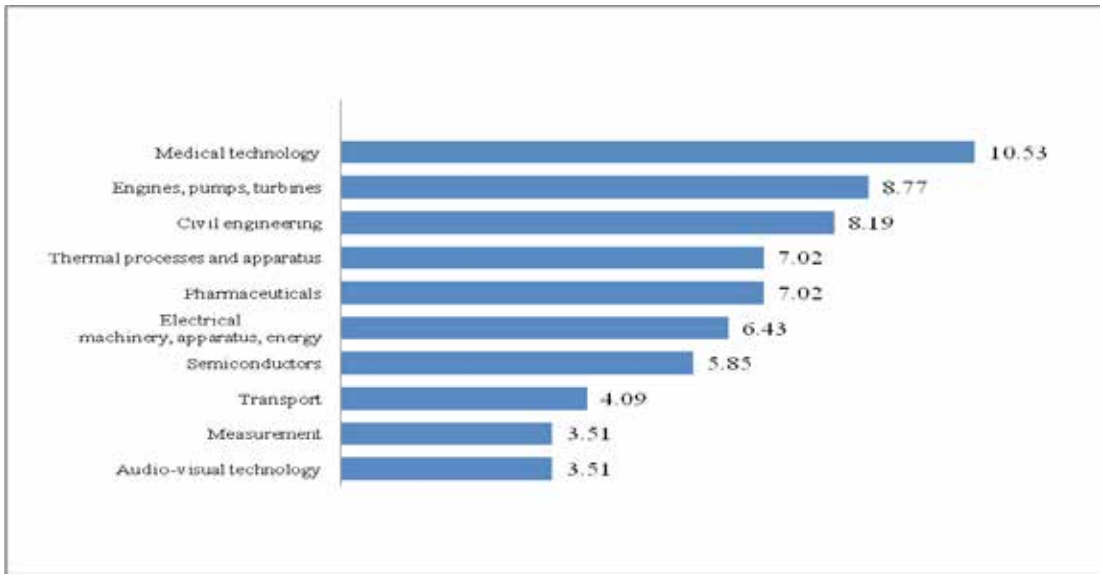

**Source:** Park, 2008.

An important implementation rule/regulation on patents is the executive decree No. 05-275 of August 2005, which lays down procedures for filing and granting patents. Important international treaties that were signed include PCT, which was entered into force in March 2000 and CBD, in November 1995, the International Plant Protection Convention, in 2005, the International Treaty on Plant Genetic Resources for Food and Agriculture, in June 2004.

### 4.2.5.2 Effects of stronger patent regimes on patent applications

Algeria has a relatively small amount of patent applications, with the largest share, about 52 per cent, concentrated in the high-technology sectors, including engines, pumps and turbines, thermal processes and apparatus, medical technology, pharmaceuticals, semiconductors, electrical machinery, apparatus and energy, audio-visual technology and measurements. The medium-technology sectors, including polymer chemistry and macromolecular chemistry, accounted for 7.2 per cent, while the low-technology sectors, including civil engineering, accounted for 8.3 per cent. The unspecified sectors (others) accounted for 36 per cent.

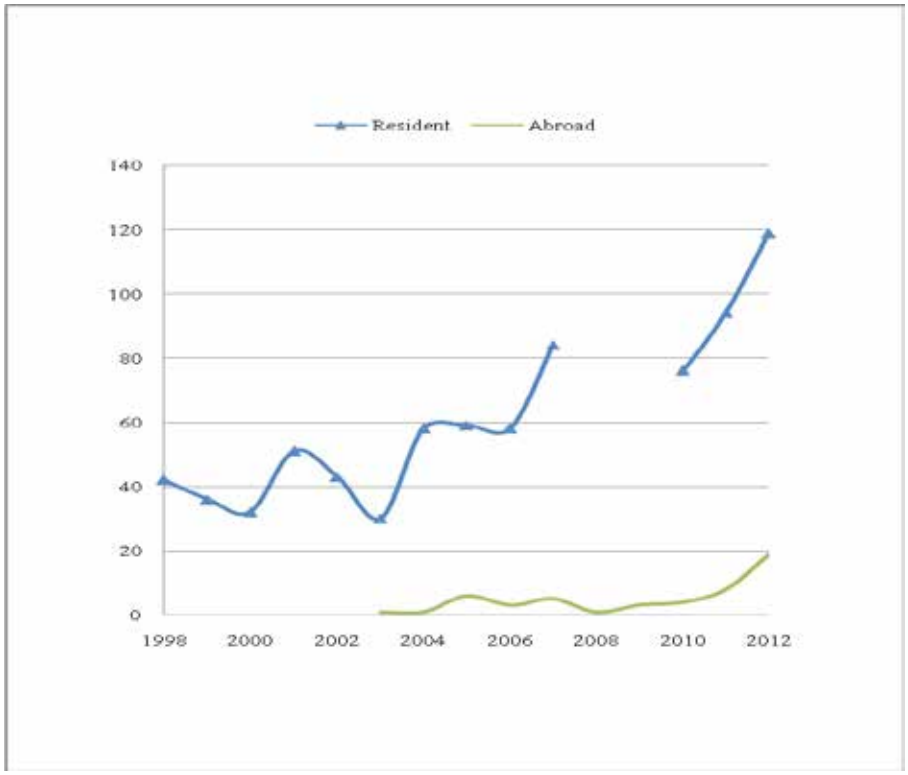
Figure 14. Shares of patent applications by top 10 fields of technology




**Source:** WIPO.

The number of patent applications made in Algeria by resident inventors increased for the most part steadily from 2003 onwards, while those made by Algerian inventors abroad remained very small.

Figure 15 (a). Patent applications by nationals

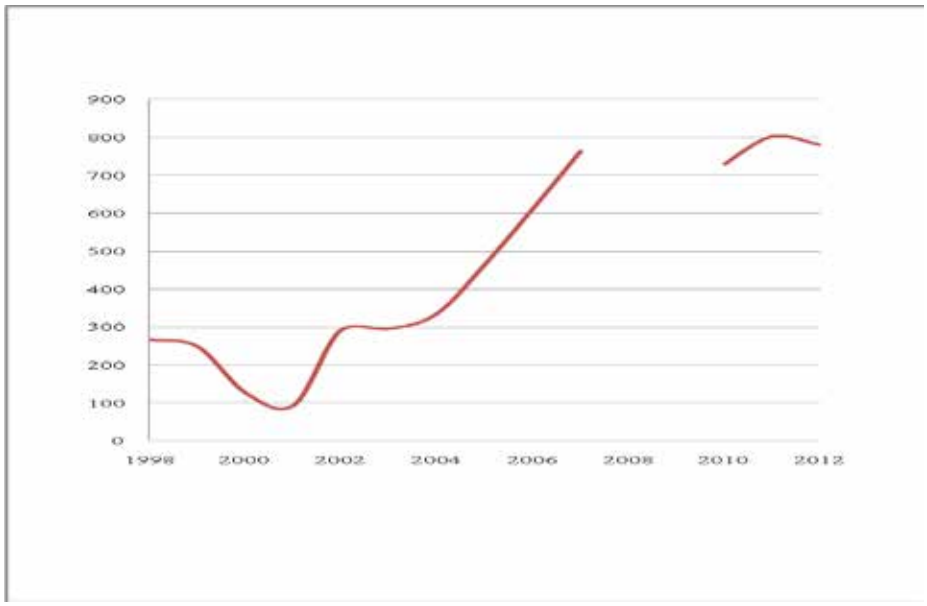



Source: WIPO.

The number of patent applications made in Algeria by foreign inventors increased steadily from 2001 onwards. The number of non-resident patents filed in Algeria increased from 300 in 2003 to 800 in 2012, while the overall number of patent applications filed by inventors residing in Algeria fluctuated between 50 and about 100 over the same period. The overall results suggest the existence of a stronger

association between patent regimes and inventive capacity of non-resident inventors (including multinational enterprises) than that what was observed for Algerian residents.

**Figure 15 (b). Patent applications by foreigners**




**Source:** WIPO.

### Summary of the findings and lessons learned

The reforms made in the patent regimes were slightly beyond the local demand determined by R&D intensity, capabilities and outputs; they have resulted in a rapid, but small rise in the number of patents filed by Algerian nationals. Efforts made to improve the national innovation system have not yet elevated Algeria to be among the top innovation performers globally. Despite the country's relatively high concentration of researchers, the quality of the scientific research institutions is very limited (WEF, 2009), with only a small amount of scientific and technical knowledge generated nationally associated with them. The linkages between universities and industry, as well as company expenditures in R&D, remain very weak. Unlike a number of other African countries, the FDI inflows are weak; reasons for this are subject for future analyses. Significant improvement in the key pillars of the national innovation system is needed to take stock of the level of patent reforms.

## Conclusion and recommendations

In the present report, the association between stronger patent regimes and growth of inventive capacity in selected African countries was investigated. This was measured based on patent filings by nationals in home and foreign patent offices. Also discussed were the institutional and other environmental changes needed to make stronger patent regimes a tool that enhances inventive capacity, which, in turn, leads to patentable inventions. Input for this discussion was based on data of WEF, WIPO and the mounting literature on national innovation systems.

Using cross-national patent data of WIPO, the associations between the strengths of patent regimes and the propensity of nationals from Algeria, Egypt, Kenya, Nigeria and South Africa to file patent applications in their domestic patent offices and foreign geographic jurisdictions (abroad) was reviewed.

The empirical results showed that improvements in the national innovation structures facilitated, to a large extent, the use of stronger patent regimes to expand inventive capacity, measured through patent applications in resident countries and abroad.

Additional findings showed that stronger patent regimes were associated with increases of FDI inflows and patent applications by foreign multinational enterprises, which indicates expansion of their activities in host countries. It must be noted, however, that stronger patent regimes could be costly to countries with very limited R&D intensities, skills and institutions needed to absorb and utilize fully the inflow of technology through FDI.

The experiences of these countries are important learning tools for strengthening patent regimes. National from countries that performed highly on R&D intensity (BERD and GERD), business sophistication (university-industry linkages) displayed higher propensities to file patent applications locally and abroad than those with weaker performances. The patent regimes of Kenya, South Africa and Egypt where the innovation system, including R&D intensity and capabilities, have reached a fairly good level of readiness as outlined by their high-quality rankings on many key pillars of globally (WEF, 2010). The inventive activities of Nigeria and Algeria did not increase significantly after their patent regimes were strengthened, most probably because the main structural pillars of their national innovation systems generally remained very low.

Overall, there is a strong need to build technological capabilities and institutions to absorb the inflows of FDI. Stronger patent regimes need to be developed in many African countries to coincide with the current interest to revitalize Africa integration and intra-African trade, to provide incentives to African inventors or manufacturers intending to export technology-intensive goods within Africa and to prevent imitation of their proprietary knowledge.

Changes in patent statutory laws are policy mechanisms that should be careful responses to specific actual or potential needs in R&D or national innovation system in order to sustain the pattern of knowledge generation and used in commercial goods. Stronger patent regimes should be established in countries that have in place the key pillars of the national innovation systems.

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