

THE ROLE OF PATENTS IN KENYA'S ECONOMIC TRANSFORMATION

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SYNOPSIS

The success of the Bayh–Dole Act in the United States in 1980 on intellectual property (IP)—which provides for small businesses, non-profit organizations, and universities, to retain title to inventions made under federally funded research programs—inspired many countries in Africa. This case study examines Kenya's experience.

The Kenyan government adopted a Bayh-Dole Act equivalent in 1998 but that achieved little success in patenting, because government funding was too small to sustain research results, and management structures and policies on IP ownership were unclear. More recently, however, with the reinforcement of the Kenya Industrial Research Development Institute (KIRDI), which in 2012 became a competitive and reputable research body, patenting activities sharply increased. KIRDI employed IP experts to use IP as a tool to encourage commercialization based on protection, IP ownership, and the use of patent information. It also put the right IP structures in place.

Key findings: The use of patent information and innovation in universities and research and development (R&D) improved after KIRDI's mandate was strengthened. KIRDI puts the government on track to realize Vision 2030, which aims at creating employment, generating wealth, and securing mid-level industrialization.

Key lessons: Empowering public research institutes or universities to make African countries competitive in R&D and to conduct applied research useful to the economy is essential for catalyzing research, commercializing IP inventions, and shifting these inventions to productive use.

Main recommendations: African countries should ensure enough R&D funding for universities and allow them to collaborate with private enterprises and with foreign research institutes or companies. African states and regional bodies such as the African Capacity Building Foundation and the African Union should build up human resources to produce and retain competent, skilled staff from multiple fields, to include engineers, scientists, economists, marketers, and researchers with IP knowledge and who can tie research to patent information. They should also help researchers and private enterprises access inventions and find joint-venture partners, and help them file patents.

Introduction

The history of patents in economic transformation and their impact can be traced back to long before 1980. Most research in universities in the United States, for example, was funded by the federal

government, which used to retain the rights of all inventions produced by universities using government funding. It also retained licenses to all patents granted to the university (Levenson 2005).

This slowed, however, the transfer of technology from research laboratories in universities worldwide, including American universities, to the market, as many countries' government agencies and private sectors were reluctant to relinquish ownership of patents (Levenson 2005). Countries' government agencies granted nonexclusive licenses to anyone who wished to produce the inventions (Council on Government Relations 1999). The nonexclusive licenses were the major factor in suppressing the flow of technology, and so companies turned from the idea of manufacturing the inventions whose patents were owned by the government. In purchasing the license for a patent owned by government, a competitor could acquire the same license easily, then develop and sell the product (Levenson 2005). Through this practice, governments, via universities, acquired many patents, but only 5 percent of government patents were used by industry in the United States (Schacht 2005).

To improve matters, in 1980 the U.S. government adopted the Bayh–Dole Act, which allowed universities, small businesses, and nonprofit organizations to retain any “subject invention” made with federal funds, on condition that the institution retaining the title committed to commercializing the invention (Schacht 2005). Universities were required to share a portion of the royalties from the invention with inventors and use a portion of the royalties for laboratory purposes (Loewenberg 2009). This was good news for researchers: Getting royalties from their inventions motivated them to work hard, and they retained their jobs, leading to many inventions (Loewenberg 2009).

The act also stated that the government reserves certain rights to protect the public interest. The university retains a “nonexclusive, nontransferable, irrevocable, paid-up license to practice on behalf of the United States in any subject invention” (Thursby and Thursby 2003). The government had the right to require the contractor who owns either the title or an exclusive license to the invention to grant a nonexclusive license in any field of use to a

responsible applicant (a “compulsory license”). This right is reserved to protect the public from having a university withhold licenses for a patent that could affect public safety (Levenson 2005).

By the fact that the university is granted title to the invention, it can give exclusive rights (a license) of invention to a private firm to conduct R&D and commercialize the product. In this way the act works for all parties' benefit and creates incentives for research: the inventing university retains title to the patent, generates revenue through licensing to private companies that can create products and sell them to the market, and the government gains revenue from taxes from product sales (Schacht 2005). The public benefits from products and job creation. Universities earn royalties, shared between the innovator and laboratory.

Since the act was passed, the number of patents granted by universities increased in the United States. A decade ago, technology from academic institutions created about \$30 billion of economic activity annually in the United States, and some 250,000 jobs (Levenson 2005). About 2,200 new companies were formed between 1980 and 2005 based on the licensing of inventions from academic institutions in that country (Council on Government Relations 1999; Evtugun 2009).

The success of the Bayh–Dole Act attracted global attention, and many countries sought to emulate its success. Most developed countries succeeded in using an equivalent act, but quite a number of African countries (including Ghana, Kenya, South Africa, and Uganda) saw far less success (UNECA 2013).

This case study looks at how Kenya “domesticated” the Bayh–Dole Act, challenges, and the way the government addressed them. It suggests recommendations for African governments and other entities. A desk review of the literature from international and regional bodies, and from the Kenyan government, was the basis for the study's findings.

Some terms

What is a patent?

A patent is a legal document granted by states to an inventor giving him or her an exclusive right to prevent third parties, not having the owner's consent, from acts of making, selling, using, offering for sale, or importing products or processes covered by the patent (Idris 2003). The exclusive right gives the inventor a monopoly over the invention for 20 years to enable him or her to recover the R&D costs. The inventor gets monopoly rights to use, sell, license, and franchise his or her patent, and this right is territorial. However, the patent owner, inventor, or applicant must disclose the invention in a manner sufficiently clear and complete so that the invention can be used by a person having "ordinary skill" in the art. This requirement is critical as it is aimed at enhancing means of developing science (WIPO 2015).

What is patentable subject matter?

Patents are granted for a process, method, or product. Examples of patentable matter include the process or method of making a certain drug, the drug itself, and the method; and the process of making a certain machine and the machine itself. Patentable matter can also be the composition of matter or any new and useful improvement of any of these, such as a new use of a known compound (IP Australia 2012).

What subject matters are non-patentable?

A patent cannot be granted on scientific principles or theorems, ideas, or inventions contrary to morality like some biotechnology inventions, including a process for cloning human beings, a process for modifying the germ line genetic identity of human beings, and the use of embryos for industrial or commercial purposes, among others (ARIPO 2014).

As patent law advances, business methods, software games, and certain life forms such as plants are becoming eligible for protection under new patent laws in several countries. For example, software can

be protected using copyright laws, and plants can be protected under a new Plant Variety Protection law.

What are the criteria for patentability?

There are three mandatory criteria for patentability (WIPO 2015):

- (i) The invention should be novel or new (the same invention cannot already be in existence worldwide) meaning that it should not have been disclosed anywhere else (patents, journals, newspapers, conferences, and other public media) at the time the application is filed.
- (ii) The invention should be inventive, not obvious to a person skilled in that field of invention. For example, if the invention is for a drug, it should not be obvious to any pharmacist, or if it is a machine it should not be obvious to any engineer.
- (iii) The invention should be "industrially applicable," meaning that it can be functional, operative, or reproduced in the industry.

Patent rights are subject to a time limit of 20 years from the initial date of filing. After 20 years a patent falls into the public domain, which means anyone can use it free of charge. Moreover, patent rights are territorial. Therefore, patent applications should be filed nationally, regionally, and/or internationally.

What is patent information?

Patent information is a collection of patent documents published together to form a patent database. It includes the full description of how a patented invention works and the claims that determine the scope of protection, as well as details on who patented the invention, when it was patented, and reference to the relevant literature (WIPO 2015). About two-thirds of the technical information revealed in patents is never published elsewhere (WIPO 2015). As it includes granted and rejected patent information, patent information constitutes a major source of legal and technical solutions, extending over most of the domain of

technology. Each year about 300,000 new published patent documents are added to the 60 million patents of technological information, and are available to the public (WIPO 2015). This makes patent information the single most comprehensive collection of classified technological data (De Laet 2005).

Patent information helps in avoiding repetition and in saving resources. It is thus advisable for researchers, before conducting their research, to conduct a patent information search to see the current technology and start from there. Small and medium enterprises (SMEs) can use the patent information and start manufacturing products that have fallen into the public domain. Business people can use the patent information to trace business partnerships, either licenses or franchises. Lawyers or infringers want to know where the product is protected. And competitors watch each other's technology.

How patents generate knowledge

Patents can influence the production of knowledge in various ways (Guellec and Zuniga 2007):

- Patents provide protection and exclusivity. A patent is a policy instrument intended to encourage investors to continuously invest in research and subsequent innovative work that will put those inventions to practical use.
- They reveal new knowledge through disclosing inventions, and diffuse information such that other investors can develop innovations.
- Through market transactions and contracting (licensing), and commercializing technology, patents enhance the spread of technology and knowledge.
- Patents do not exclude third parties from using an invention. The system rather attempts to compensate for inefficiencies tied to market exclusivity. Revealing new knowledge through disclosure, patents help

make innovations efficient by avoiding needless duplication of R&D (Griliches 1990; Guellec and Zuniga 2007). Patents also facilitate transactions in technology, allowing firms to increase economic value gained from innovations. They also facilitate entry into research and production.

- Technology markets help diffuse public and private R&D outcomes, and encourage more competitive prices for consumers (Gambardella 2002). Patents are also crucial for diffusing network technology standards, which are vital for generating economic returns (Griliches 1990).
- Patents help reduce the gap between science and industrial innovation by assuring finance in the later stages of development; exploitation by the best-positioned firms (through licensing); and thus economic returns to research (Guellec and Zuniga 2007). A 1 percent increase in the strength of patent protection in developing countries correlates with an average 0.7 percent increase in domestic R&D (Hardy 2013).

Kenya case study

Intellectual property protection in Kenya

The Industrial Property Act of 1989 established the first independent patent system in Kenya. This act was superseded by the Industrial Property Act of 2001, which set up the Kenya Industrial Property Institute as an autonomous office to administer patents, utility models, trademarks, and service marks. Kenya joined the World Trade Organization on January 1, 1995 and became a signatory to the Agreement on Trade-Related Aspects of Intellectual Property Rights in 1995.

Why Kenya adopted a Bayh–Dole equivalent

At the start of the 1970s, the Kenyan government was allocating a reasonable amount of money as a share of gross domestic product (GDP) to universities

for R&D expenditure, but the rate declined to about 0.5 percent of GDP; the results were not as foreseen; and the number of patents expected from universities from government investment was always low relative to those in other sectors.

Once the government appreciated the importance of patents for economic development, it wove Bayh–Dole elements into its national IP policy for its research institutes and universities in 1998. The aim was to stimulate these entities to promote economic growth by supporting seeding innovation in the private sector. To achieve this goal, these entities were to use IP to encourage commercialization, based on three strands: protection, ownership, and management capability.¹

Yet the national IP policy was not clear on IP ownership and management structures. Public institutions were neither prohibited nor mandated to take ownership; they were left to themselves to adopt institutional policies to assert ownership, as long as they operated according to the basic requirements of national IP law. Given the lack of clarity, most universities struggled. For example, the University of Nairobi had to forgo IP rights for some innovations, which included a fermented milk product, a beer product, a disease-resistant pea variety, a potential AIDS treatment compound, a database of medicinal plants, and a potential AIDS vaccine (Graff 2007).

A study conducted using the database of the Kenya Industrial Property Institute on the filings, grants, and registration of IP protection showed it to have 2,388 patents (1990–2013), 1,392 industrial designs (1991–2014), and 396 utility models (1993–2013) (Nzomo 2015). Kenyan nationals filed 1,160 (48.6 percent) and foreigners 1,228 (51.4 percent) of the patents. Among the patents filed by nationals, companies accounted for 78.4 percent, individuals 9.5 percent, and universities and public research institutes a paltry 1.6 percent and 3.9 percent,

¹ Though some institutes in Kenya—such as the International Livestock Research Institute, adopted an IP approach (in 1998) and has an IP office at its Nairobi Centre—the University of Nairobi, Moi University, Jomo Kenyatta

respectively. Their poor performance stemmed from:

- Inadequate government funding for these institutions to conduct proper research.
- Lack of expertise in IP matters among universities filing patent applications to respond to the examiner’s queries.
- Failure to meet patentability criteria.
- Withdrawal of applications by applicants.
- Poor drafting of applications (Bolo et al. 2015).

For these reasons, universities and public research institutes contributed very little to the economy, encouraging many indigenous researchers to leave Kenya to work in universities in Botswana, Namibia, South Africa, and elsewhere (WIPO 2006; UNECA 2013). Many of those who stayed behind concentrated on teaching because students paid school fees, and universities had money and could pay relatively good salaries. Some researchers secured research funds from various sources, generally preferring to file a patent application as an individual or start a company and file in its name.

The government’s response

The government seems to have realized the importance of the missing funding for science, technology, and innovation, and began to concentrate its efforts on KIRDI, changing it into a competitive research organization (KIRDI 2016b). KIRDI was originally established as a National Industrial Institute under the Science and Technology Act, 1979 (repealed and replaced by the Science and Technology and Innovation Act, 2013) (Makokha 2015).

The government’s aim was to get KIRDI to play a bigger role in facilitating technology transfer to private micro, small, and medium industries

University, and the Kenya Agriculture Research Institute were slow to expand patenting (National Council of Science 1990).

(MSMIs), improving designs, and promoting product innovation, partly to promote manufacturing growth as a major step to achieving Vision 2030 and a manufacturing sector goal of 10 percent annual expansion (KIRDI 2016). The SME sector is very important to the economy, contributing about 30 percent of GDP (Mboya 2015). Elements in KIRDI's remit were to enhance technical support for innovation, new technology, new products, new or alternative processes, and alternative raw materials.

KIRDI's new mandate was to undertake R&D in all industrial and allied technologies including mechanical, civil, and chemical engineering; food; textiles; leather; ceramics and clay technologies; industrial chemistry; power resources; and the environment. It was also mandated to cooperate with the Ministry of Industrialization and with committees on research policies and priorities; cooperate with other institutions of higher learning in training programs in research; disseminate research findings that would have a positive impact on national development; and liaise with other research bodies within and outside Kenya carrying out similar research, providing patent information, consultancy, reverse engineering, advice on patentability of the invention, patent drafting, and advice on how to file a patent application (KIRDI 2011).

The institutional objectives are to enhance the national industrial technology innovation process as a strategy toward socioeconomic development; to contribute to the development of capacity for industrial research, technology, and innovation; to contribute to the creation of national wealth through the transfer of efficient technologies that are accessible to MSME enterprises in Kenya (Makokha 2015; Moturi 2014; Moyi 2014); to promote the development of a strong capacity for primary engineering to reduce dependence on imported plant machinery and spares (Moturi n.d.); and to facilitate access by local enterprises to business development services, including cleaner product and industrial technology information (Mboya 2011).

Implementing the new mandate

KIRDI aligned itself with the needs of society and tied its research to the public and private sectors. It therefore conducts R&D only on products that have the potential for generating economic development, industrialization, jobs, and poverty reduction. It targets MSMIs (Moturi and Ogada 2006) and aims to disseminate and transfer knowledge generated to society through extension services (Mboya 2015). KIRDI recruits experts in all technical fields, including IP and IP ownership, and motivation (KIRDI 2011).

KIRDI for a long time had concentrated on R&D with little emphasis on technology transfer to industry; but to align with the changing emphasis of technology transfer, KIRDI became a one-stop shop for technology and development, and for the transfer of technology to SMEs (Mboya 2015).

Structural arrangements

KIRDI has the following departments and offices.

Technological Transfer Office

The Technological Transfer Office, with the IP Department, helps researchers to carry out their research into developing products and processes that use local materials, and to commercialize them via companies. The IP Department searches for any relevant technology in the patent information database that can be used to process such materials into useful products.

In this way, for example, KIRDI helped develop a leather processing technology that was not patented in Kenya but that has enabled the processing of fish skin into exotic leather. The Office transferred the technology to a company in Kisumu County that produces the leather (KIRDI 2011). Another application was to develop cashew nut processing technology, where products were developed from cashew nut shell liquid. This project was transferred to a client on the coast to commercialize (KIRDI 2011). KIRDI has developed several technologies and subsequently transferred them to SMEs, including on animal feed, gum Arabic, and processed coffee (KIRDI 2016; Mboya 2015).

Intellectual Property Department

KIRDI's directors believe that a patent system catalyzes research, helps commercialize IP inventions, and shifts them to productive use. KIRDI thus uses patent information in all its research activities to avoid "reinventing the wheel," because the directors know that most technology information published and unpublished elsewhere is found in the patent information database (Ogada and Mboya 2009). The following points summarize the reasons that KIRDI uses patent information when conducting research (Mboya 2011; Ogada and Mboya 2009):

- To avoid wasting money for a technology that is already known.
 - To identify solutions for technical problems. For example, researchers in Kenya were working on a method of extracting artemisinin from *Artemisia annua* in 2007, but a search revealed that the technology was already known but not protected in Kenya (Ogada and Mboya 2009).
 - To help identify the patentability potential of R&D activities at early stages—a search of the patent literature helps determine whether the development is likely to be novel (for patenting) or whether, when it is commercialized, it is likely to infringe an existing patent (with reverse engineering).
 - To establish the state of the art when new research is initiated.
 - To identify R&D projects that can be funded for innovation (Ogada and Mboya 2009).
 - To monitor trends in R&D activities (technology, competitors in R&D, and early warning of future patterns).
 - To identify the literature; information on raw materials, procedures, processes, and by-products; and the best conditions under which to implement a new solution or an established one using a slightly different method.
- To evaluate technologies offered for acquisition, to evaluate technology available for licensing and offered for acquisition (and so choose between two technologies), and in this way to assess cases before starting research.

Monitoring the success of funded R&D depends on the number of patent applications and grants as indicators of the success of research. KIRDI had filed 10 patent applications by 2011 (Mboya 2011).

Business Incubation Services

KIRDI provides incubator facilities to SMEs to increase their survival rate. It offers capacity building to SMEs; transfers technology, skills, and information obtained from patent information for SMEs, helping them to access the market; supplies prefinance; and negotiates with the government on their behalf over SME markets and financial support. Since KIRDI started this service, the SME survival rate surged from 20 percent to 80 percent. From 2006 to 2015, more than 40 companies were incubated and established through the Business Incubation Services at KIRDI (Mboya 2015).

Pilot plant (spinoffs and startups)

KIRDI has created spinoffs to commercialize its IP inventions. Spinoffs are sources of new jobs and when bigger many export their goods or services. KIRDI also has startups created by outside investors based on IP assets generated by KIRDI's technologies. They include the Nyongara Biogas plant in Dagoreti-Nairobi; a honey processing plant in West Pokot; and gasifier, biogas, and bio-ethanol stoves developed by KIRDI with private "for-green" technologies (Makokha 2015). From 1979 to 2015, KIRDI set up more than 50 startups, and from 2006 to 2015, more than 10 joint ventures (Mboya 2015).

Common manufacturing and capacity-building facilities

These facilities offer training for SMEs in the leather sector, where it has supported and capacitated more than 2,000 SMEs. They also offer training in processing honey, soya beans, and fruits such as

pineapple. The common facilities in the leather sector established five companies from 1979 to 2015 (Mboya 2015).

Technology upgrading and commercialization (reverse engineering)

KIRDI uses technology in patent information to reverse engineer SME products brought by Jua Kali Association, upgrades them, and takes them to the Kenya Bureau of Standards to be accredited. For example, a welding machine from Jua Kali, which had low efficiency, and looked ugly and unsafe, was reverse engineered into an efficient and attractive machine by improving the core electric part, adding meter reading, and upgrading the casing, but using the standard in the selected components, protecting the improvement either by the patent or utility model and brand (trademark) and selling it at a reasonable price to locals, in turn creating work (Mboya 2015).

Funding

Under its strategic plan 2010–2015, KIRDI was meant to establish an enterprises entity to manage how it commercialized its technology and other revenue-generating activities. However, most of the funds still came from the exchequer (KIRDI 2011). The IP is commercialized and technology transferred through donations from donors funding projects with development partners, such as the United Nations Industrial Development Organization (UNIDO) and the Danish International Development Agency, through licensing, outright sales, joint ventures, spinoffs, startups, and technology upgrading (Mboya 2015).

Activities and outputs

According to KIRDI 2016 reports, the following are a few of the institute's achievements:

- (i) Arc-welding machines. Under the Research, Development (Reverse Engineering) and Commercialization Programme, and working with MSMEs, the institute completed and supplied 840 arc-welding

machines for use by Constituency Industrial Development Centres.

- (ii) Hospital beds. Under the same program and working with MSMEs, it completed 150 hospital beds for Kenyan hospitals.
- (iii) Soya bean processing. With UNIDO and the government of Japan, it has established three soya bean processing plants in Kisumu, Migori, and Bungoma counties.
- (iv) Honey processing. The institute has established a honey-processing plant in West Pokot County. It also continues to support MSMEs through common manufacturing services in processing and packaging of honey at its "South C" Facilities.
- (v) Tomato processing. KIRDI has started setting up a tomato-processing plant in Kirinyaga County.
- (vi) Green energy technology. It has developed several models of fuel-efficient gasifier stoves for domestic use and has partnered with Deutsche Gesellschaft für Internationale Zusammenarbeit with funding from the Global Alliance for Clean Cookstoves (United States) to establish a National Stove Testing Centre at KIRDI.
- (vii) Banana processing. The institute has established a banana pilot plant in Kisii County.
- (viii) Pineapple processing. It has set up pineapple processing plants in Homabay and Kericho counties.
- (ix) Fruit processing. It has established a fruit pilot plant in Uasin-Gishu County.
- (x) Technology training and capacity building. The institute continues to support MSMEs through technology capacity-building services in the following industrial technology disciplines, among others: food technology; mushroom production; animal

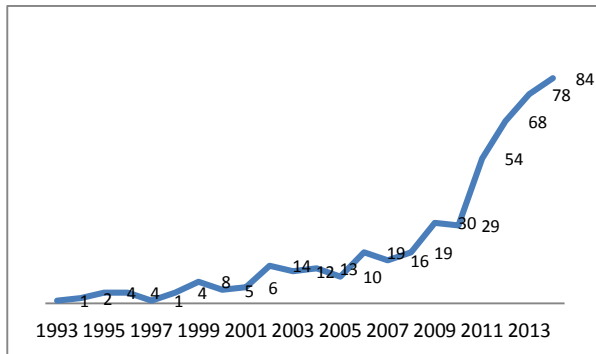
- feed formulation; leather goods design and manufacture; and soap and detergent making.
- (xi) Brick making. It has set up a brick-making plant in Nandi County.
 - (xii) United Nations Framework Convention on Climate Change (UNFCCC). The institute has been appointed, through the Ministry of Environment, Water and Natural Resources and the UNFCCC Secretariat as the national designated entity for Kenya. KIRDI is thus responsible for bringing into operation the Climate Technology Centre and Network in Kenya: to serve as the entity for developing and transferring technologies, and to act as the focal point for interacting with the Climate Change Technological Centre on requests from developing country parties on technology needs.
 - (xiii) Climate Innovation Centre in Kenya. KIRDI partnered with Strathmore University, PricewaterhouseCoopers, and the Global Village Energy Partnership (United Kingdom) in a consortium, and its bid won the right to host the Climate Innovation Centre in Kenya, with a World Bank grant of \$4.5 million.
 - (xiv) World Association of Industrial and Technological Research Organizations (WAITRO). The institute has been appointed by WAITRO as a regional focal point for East Africa, making it the coordinating agency for intensified collaboration among the region's research technology organizations for benchmarking, technology foresight, technology needs assessment, incubation, and adoption of cluster initiatives for enhancing regional competitiveness.
 - (xv) Animal feed. It has developed formulations of animal feeds using local raw materials to support MSMLs in animal feed production. A low-cost software package that facilitates quick processing of different low-cost feed formulations is available.
 - (xvi) Rosin and turpentine development from oleoresin. The institute carried out investigations and designed a production plant, which it has since established in Nakuru (KIRDI 2016a).

Assessment and outcomes

The use of patent information and innovation in universities and R&D improved after KIRDI's mandate on goals was strengthened. In 2015, Kenyan institutions were putting in place infrastructure that will further promote the use of patent information for R&D. By end-2015, the level of IP awareness had increased, with three universities with an IP policy in place; five R&D institutions with such a policy; three universities with technology transfer offices; two universities with technology transfer managers; two R&D institutions with technology transfer managers; one R&D institution with a technology business incubator; and one university developing a science park (Mboya 2015).

Further evidence of change comes from the increase in the number of utility model applications (figure 1), of which in 2015 Kenyan residents accounted for 99.6 percent of the total. Most applicants were individuals and SMEs—very few applications are from universities. This is because (as seen) most university researchers get very little funding. Most of the utility models filed were for electrical devices; advertising/display structures; energy-efficient cooking apparatus (such as biomass stoves); mechanical devices (such as pumps and welding machines); chemical preparation/treatment methods; and food supplements/herbal compositions (Njuguna 2015).

Figure 1: Number of utility model applications in Kenya



Source: Author, using figures from Njuguna 2015.

Summary and conclusions

Like most African countries, Kenyan universities and public research institutes followed the attributes of the Bayh–Dole Act in their institutional IP policy with the aim of generating patents to boost economic growth. However, they had little success in patenting and saw no significant economic gain, mainly because government funding was inadequate to sustain the research and IP ownership. Nor were the management structures clearly defined in the national IP policy. And so, many researchers left Kenya. The government understood the importance of R&D's contribution to the economy and began to empower KIRDI and transform it into a competitive and reputable research organization.

To implement its new mandate, KIRDI addressed IP ownership and its management structure, recruited different types of experts including IP experts who can use patent information in its research strategy, and increased innovation in the number of utility models for local applicants and local products of high quality. It also raised the number of spinoffs and startups, generating jobs and products for export; began to reverse engineer (also creating jobs); built capacity for incubated companies; and created markets for SMEs and public–private partnerships. The government has gained by taxing the resultant products, and society has gained from good products. The increase in utility model applications is

a good sign that people are aware of IP issues, and they are learning how to innovate.

Policy recommendations

For African governments to see an impact from patents on their economies, the following steps are recommended:

- African governments should follow the steps taken by the Kenyan government and empower one public research institute or university to make it competitive in R&D and do research of economic interest to society.
- African governments should give enough R&D funding to universities and allow them to collaborate with private MSMEs and foreign research institutes and companies.
- African states and regional bodies, such as the African Capacity Building Foundation, African Union, United Nations Economic Commission for Africa, New Partnership for Africa's Development, and others should ensure that they build the capacity of African human resources and retain them. To assure competent staff such as engineers, scientists, economists, marketers, and researchers who have IP knowledge, who can link research to patent information, and who can carry out reverse engineering, they should also help researchers and MSMEs to assess inventions and find joint-venture partners, and help them to file patents, industrial designs, and utility models.
- African governments and key stakeholders should ensure that their staff and researchers are highly motivated and committed. Performance contracting is recommended here.
- African governments should each have a technology transfer office and a manager who knows IP issues and can develop incubator services, including spinoffs and

startups. Regional capacity-building institutions are called on to support this area.

- African governments should also make sure that research is conducted on local natural products, to add value to local products.
- African governments should ensure that all universities and research institutions have an IP policy and IP department.
- Ministries of science, technology, and innovation need to remove obstacles facing universities and research institutes in Africa, and develop creative and adaptive policies to strengthen linkages, through financial support, between industry and these entities. This includes providing incentives for long-term cooperation between the two sides.

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