Patents and economic development in South Africa: Managing intellectual property rights

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Intellectual property rights systems are important policy instruments in the armoury of governments. They have the potential to have favourable or adverse consequences for the relevant national system of innovation, technology transfer, research and development and, eventually, economic growth. Whilst there is a debate related to optimisation of patent systems in the developed world, there is limited debate related to the approaches used in developing countries like South Africa. This article presents an effort to assess whether the South African non-examining patent system makes a contribution or if it is detrimental to the country's development. We found that the current intellectual property rights regime not only fails to support the objectives of the national innovation system but also that it facilitates exploitation by foreign interests and creates substantial social costs. Policy recommendations are provided.

Introduction

Intellectual property rights (IPRs) refer to rights conferred by governments for creations of the mind, both artistic and commercial. Artistic creations are covered by copyright laws, which protect works such as books, films, music, paintings, photographs and software and give the copyright holder exclusive rights to control reproduction or adaptation of such works for a certain period of time. Commercial or industrial intellectual property (IP) includes inventions, designs, trademarks and service marks, commercial names and designations. Industrial intellectual property rights are protected by patents, registered trademarks, registered industrial designs and integrated circuits and geographical indications ('appellations').

Whilst copyright does not prevent the same (or a similar) piece of work being created independently by two or more creators, industrial intellectual property rights do make such a distinction. Amongst the protective mechanisms, patents occupy a pre-eminent position. The complexity in their modus operandi and the high stakes surrounding their ownership in knowledge-intensive economies have made patents the primary vehicle of attention and debate internationally.

Starting in the early 1980s, the United States of America (USA) imposed strong pressure on developing countries with weak IPR laws and institutions through its 'Special 301' provision of US trade law. The Special 301 provision directs the US Trade Representative to investigate foreign protection of US intellectual property, negotiate higher IP standards and retaliate with trade sanctions if these negotiations fail. Using a number of designated threat levels – for example, countries could be placed on a 'watch list', a 'priority list', or 'designated' for such lists but not placed on them – the USA initiated Special 301 investigations of numerous Asian and Latin American countries. In response to the US investigations and European Union (EU) diplomatic pressure, a number of Asian and South American countries strengthened their patent laws and institutions, agreeing, amongst other things, to establish patent protection for new pharmaceutical products. Malaysia in 1986, Taiwan in 1986 and South Korea in 1987 were amongst the earliest countries in Asia to do so, with several other Asian countries, such as Thailand (1992) and China (1993), following in the early 1990s. Indonesia passed its first patent law in 1991 and amended it in 1997 to allow pharmaceutical product patents to be issued.

Whilst there is a substantial debate related to optimisation of patent systems in the developed world,[1,2,3,4] there is limited debate related to the approaches used in developing countries like South Africa. The objective of this article was therefore to assess the extent to which patent protection rights, as they are implemented in South Africa, promote or hinder economic development.

Patents – A difficult balance

Traditionally, legal scholars have had the greatest influence in the debate on intellectual property protection, particularly on issues relating to patents and case laws, and regulatory practices. However, as IPRs moved to occupy a central role in the knowledge economy (currently, the

amount of licensing contracts backed on patents is higher than US$ 100 billion worldwide), other professions, particularly economists, also entered the field.

The economic approach brings a different perspective in the debate related to patents. The legal approach addresses issues of fairness and of balance of rights, of internal consistency of the system and of consistency of patent law with other bodies of legislation. The economic approach, on the other hand, is utilitarian in nature, in the sense that the main focus is on the costs and benefits accruing to society (or to a particular group in society) from the functioning of the IPRs system. The economic approach does not see IPRs as a 'natural right' that the inventor should have but as a 'policy instrument' that the government should adopt in order to maximise the interests of society.

The primary theoretical objective of IPRs is to supplement market forces, which on their own do not lead to desirable levels of research and development or innovation. Broadly speaking, in an environment lacking adequate IPRs, inventors will not invent (or they will invent less than what is optimal) as they will receive few, if any, benefits from their creative work. To use an economic explanation, positive externalities are present, or arise, when property rights cannot be clearly assigned. Society benefits from inventions but the benefits to the inventors may not be reflected in the prices charged for the goods and services provided by the invention; hence invention activity is suboptimal.

The benefits of the IPRs system arise from its dual mission, that is, to encourage invention and to encourage diffusion of technology. The owners of the patents benefit from the exclusionary rights that they receive for a number of years and society benefits from the disclosure that becomes public knowledge. In other words, during the life of the patent, scientists and other inventors benefit from the disclosure of existing information and avoid repeating efforts to discover what is already known.

However, patents are not effected without costs. The costs arise from their modus operandi, which is to restrict the use of inventions and technology. Patents may create 'monopolies' which impose a price on customers that is higher than the marginal cost of production (economic inefficiency). Customers willing to pay more than the marginal cost but less than the monopolistic markup will not buy the product, even though they would be prepared to compensate society for the resources used in producing that good (i.e. the marginal cost). It should be emphasised that although IPRs confer the power to exclude the use of the specific product, process or work in question, there may often be sufficiently actual or potential close substitutes for such a product, process or work as to prevent the exercise of market power in markets.

The aforementioned rationale for patent protection – to increase the incentive to invent by conferring the right to exclude others from making, using or selling the invention in exchange for foregoing secrecy by publishing the invention and making the information available for others to build upon – is not cast in stone. There are theoretical reasons to question how substantial the incentive of patenting is and how broadly the incentive operates across industries. For example, the cost of disclosing the details of one's innovation to competitors through patent publication may be greater than the gain from patenting[5] and hence the invention will not be disclosed. Similarly, where innovation is cumulative, it matters how and to whom intellectual property rights are first allocated. Subsequent inventors and their incentives and disincentives for research and innovation are affected by the willingness of early patent holders to license each other in instances where inventing around the patents would be difficult. Thus, where innovators are followers, increasing patent strength could either increase or reduce their incentives to innovate.[6,7,8] In a similar way, Heller[9] argues that innovation suffers from gridlock, because too many people own pieces of one thing, that is, one innovation. He names this phenomenon the 'tragedy of the anti-commons'.

It should be noted that patenting can be an important strategic tool for firms, without being either a significant direct stimulus to research and development (R&D) or a source of technical information on the direction of R&D. An example is the case of semiconductors, where it is common for hundreds of patentable elements to be required for one product. As no one firm is likely to hold all the rights necessary for a product's commercialisation, mutual dependence on competitors' technologies encourages patenting primarily for the purposes of trading rights, usually by means of cross-licensing arrangements, and avoiding litigation. In such cross-licensing arrangements, one firm pays a royalty to the other firm, as a 'balancing payment' in order to avoid litigation. Guellec and Van Pottelsberghe de al Potterie[10] suggest that:

> The system is more and more widely seen as feeding excesses, such as 'patent trolling' (i.e. attorneys blackmailing operational businesses by threatening them with litigation over dubious patents) or 'patent thickets' (i.e. the foreclosure of a market by erecting a dense web of patents).

Obviously, such activities act as deterrents to R&D and innovation.

Maskus[1] investigated how IPRs affect decisions related to foreign direct investment (FDI) – an important means of technology transfer to developing countries. He argued that there are informational imperfections in the market for technology; for example, because a knowledge-based asset may be the potential subject of a valuable, but perhaps easily copied, licensing contract, the original firm may not wish to reveal its technology to unrelated licensees during contract negotiations for fear that the latter could simply decline the contract and copy the technology. The licensee, on the other hand, would be unwilling to sign a contract and agree to royalty terms unless they know the particulars and value of the technology.[1] This information imperfection implies that, other things being equal, firms would be more

likely to engage in FDI in countries with weaker IPRs and contract enforcement. An implication is that as IPRs in a particular nation become stronger, firms will tend to choose more technology licensing and joint ventures and less FDI. Maskus[1] suggests that:

> This is the one identifiable theoretical case in which the strength of IPRs would be negatively associated with FDI flows. However, as FDI decisions are not based only on IPR considerations, the conclusions are at best ambiguous.

An important concern involves the rapidly expanding domain of patenting inventions that are useful solely or primarily for further research.[11] Previously, these techniques and discoveries in most cases became part of the public domain of scientific knowledge, available without restriction for use by all investigators, especially when they were the products of publicly funded research at institutions of higher education. The tendency to protect research methodologies obviously restricts further research and invention. The concern has focused primarily on the field of biotechnology, where there has been an increase in patents on a variety of inputs into the process of discovering drugs or other medical therapies or methods of diagnosing disease, as well as in the tools of plant modification – genes and genetic sequences, drug targets and pathways, antibodies, and so forth.

In the empirical domain, there is a growing body of research investigating the relationship between patents and innovation across countries and time. Lerner[12] and Moser[13] found that instituting a patent system or strengthening an existing patent system did not produce more domestic innovation, although the latter did induce inventors from other countries to patent more in the country making the change. Strengthening an existing patent system may also induce foreign multinationals to transfer more technology to affiliates in the country.[14] A recent review of the National Research Council of the Academy of Sciences[15] in the USA states:

> One may legitimately question whether the impact of patenting on innovation and its consequences for social welfare are, on balance, positive outside of the handful of industries, such as pharmaceuticals, biotechnology, medical devices, and specialty chemicals where the benefits are well established, and possibly to a lesser extent, computers and auto parts.

Empirical research investigating the relationship between IPR regimes and R&D efforts has also made ambivalent findings, partly because the relationship is bidirectional. Arora et al.[16] found that patents had a positive impact on R&D expenditures in most industries, but particularly in the pharmaceutical industry. In the USA, an increase in the patent premium (associated with a stronger patent regime) by 10% would generate an increase in business R&D by 6%. The estimated effect is higher in biotechnology and pharmaceuticals and lower in semiconductors and electronics. Similarly, Kanwar and Evenson[17] investigated 29, mainly rich, countries from the Organisation for Economic Cooperation and Development for the period from 1981 to 1990. They found that the patents rights index had a positive and significant effect on R&D intensity, that is R&D per gross domestic product. On the other hand, Hall and Ziedonis[18] found that the stronger IPR regime related to the semiconductor industry during the 1980s did not affect the R&D efforts of the industry.

It appears that Machlup's[19] statement of more than 50 years ago in the Subcommittee of Patents, Trademarks and Copyrights of the Committee on the Judiciary – US Senate, is still relevant:

> No economist on the basis of present knowledge, could possibly state with certainty that the patent system, as it now operates, confers a net benefit or a net loss to society.

Intellectual property rights and economic development

Intellectual property rights have created particular debate in the context of economic development internationally. The economic well-being of a nation or region is linked closely to the availability of know-how and technology. Technological progress is an important determinant of productivity and income levels. Developing countries usually face limitations in their indigenous innovation capabilities and, hence, foreign sources play an important role in closing the gap. IPR may affect domestic efforts to innovate and at the same time they may influence FDI in trade, technology transfer, costs of licensing, R&D and so on. If direct investments, economic growth, employment, et cetera, can be influenced by the strength of IPRs in an economy, then governments may be able to exploit IPR policy in order to stimulate development.

Whilst the United Nations Conference on Trade and Development[20,21] has produced a number of studies calling for improvement in the ways in which patents and trademarks operate in the transfer of technology, the empirical literature is ambivalent on whether IPR supports economic development.

Lerner[12] studied significant changes in patent law in more than 70 countries over 150 years and correlated them with the number of patents granted in these countries. He found that, in general, strengthening patent rights generated an increase in patent filings from foreign assignees, but had no effect on filings by nationals. Kearney[22] asked business leaders from the world's largest 1000 firms to identify the most critical risks to their corporations when they invested abroad. At the top of the list were issues such as government regulation, a country's financial risk, and risk of political and social disturbances (each of which were cited by at least 60% of the respondents). Theft of IP was cited by only 17% of the respondents and was ranked 12th in the list of concerns.

Lippoldt[23] reviewed the relevant literature examining the empirical linkage between national IP environments, international trade, FDIs and licensing. He found overall that stronger IPRs tended to boost trade, FDI and licensing in developing countries. However, he emphasised that IP reforms alone would not bring about the desired effect

and that IPRs will be beneficial depending on a number of preconditions (such as effective educational systems, appropriate regulation, and an environment conducive to enterprise).

These findings echo the conclusions of Maskus[1] – that optimum protection varies according to industry and level of development. Maskus[1] identified two industrial complexes with interests in IPR. The 'patent complex' comprises pharmaceuticals, biotechnology and plant genetics. These industries have high fixed costs in inventing and marketing new products and they are vulnerable to competition through reverse engineering. The 'copyright complex' includes software, Internet content providers, electronic databases and recorder entertainment (music and films). These sectors are based on information technologies; they have high fixed costs, low marginal costs and they are vulnerable to rapid entry and cheap copying. As far as the level of development is concerned, Maskus[1] found evidence that the strength of IPRs rises endogenously with economic development. Low-income countries may choose to reduce the strength and scope of their IPR as they acquire better abilities to imitate technical information and establish production facilities based on that imitation. Middle-income countries find a growing interest in improving protection as their markets deepen and their capabilities to innovate become stronger. Protection accelerates rapidly at higher-income levels. Maskus' main conclusion is that 'the computations suggest that many developing countries are a long way from income levels that would encourage them to adopt stronger rights as a matter of course' and that the major short-term impact of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement is a transfer of economic benefits from technology importing to technology exporting nations (with the largest gains accruing to the USA).

Chang[24], like List[25], argues that developed countries have 'kicked away the ladder' that they had climbed to reach the world's top economic position so that the developing countries cannot use it and that recent IPR changes make development a lot harder. Chang[24] suggests that the developed countries refused to institutionalise patent regimes when they were in the development stage. Switzerland, for example, had no patent law of any kind until 1888. In 1888, patent law accorded protection only to 'inventions that can be represented by mechanical models'.[24] The clause excluded chemical inventions. At the time, the Swiss were 'borrowing' chemical and pharmaceutical technologies from Germany (the world leader in the field at that time). As a matter of fact, chemical and pharmaceutical substances could not be patented in most rich countries (i.e. Germany, Switzerland, France, Japan and the Nordic countries) until the 1960s and 1970s. Pharmaceutical products remained un-patentable in Canada and Spain until the early 1990s. Similarly, the Netherlands abolished its patent law in 1869, influenced by the anti-patent sentiment at the time:

> Exploiting the absence of patent law, the Dutch electronics company, Philips, a household name today, started out in 1891 as a producer of light bulbs based on the patents 'borrowed' from the American inventor Thomas Edison.[24]

During the 19th century, IPR regimes in today's rich countries did not protect foreigners' intellectual property. Further, Chang[24] argues that the recent changes in the IPR system – lowering the originality bar and extending patent life – have magnified costs whilst reduced the benefits. Developing countries have to pay more for each patent, of which the average quality is lower than before. Chang[24] argues that these changes have made economic development more difficult. As 97% of all patents and other IPR instruments are held by rich countries, the strengthening of the rights of IPR holders means that acquiring knowledge is becoming more expensive for developing countries. Furthermore, he states that the World Bank estimates that, following the TRIPS agreement, the increase in technology license payments alone will cost developing countries an extra US$45 billion a year – approximately 50% of all total foreign aid provided by rich countries.[26]

Chatterjee et al.[27] reviewed 45 studies investigating the effects of IPR in developing nations. They suggest that the theoretical literature identifies that 'in general, strengthening Southern IPR protection does not benefit the South and produces ambiguous results in the North'. Similarly, they argue that:

> The empirical literature confirms the complexity of the issue found in the theoretical literature; growth and welfare depend on many factors. There is some disagreement about whether in lower- and middle-income countries the correlation between IPR protection and innovation and/or growth is negative or zero.[28]

The issue of the economic effects of the Australian patent system was addressed by the 1982 study of Mandeville et al.[26] They concluded that the 'economic benefits of the patent system to the innovative process in Australia are not only small, but extremely subtle'. They suggested that[26]:

- The patent incentive is not an important determinant of measured domestic R&D activity but plays a small role for the small inventor.
- Patents apparently play a subtle role in connection with investment expectations and the transfer of technology to Australia.
- Patent information is a relatively unimportant source of R&D/technological information for domestic industry, small inventors and professional engineers. However, it is regarded as having some importance by large overseas-based multinational firms.
- The majority of patents held by domestic firms are said to produce a return but the absence of a patent system would be unlikely to affect production significantly.

Furthermore, their report identified a number of negative effects[26]:

- The high direct and compliance cost of the system which acts as deadweight to the innovative process by distracting resources from more useful activities.
- The occurrence of restrictive practices in patent licensing, which has the effect of dampening the already small domestic industrial R&D effort.

- Patent monopolies imply higher prices for consumers and industry as well as distortions in the allocation of resources.
- The mystique of the patent system can distract attention from the more important phases of the innovative process such as development and marketing.

Mandeville et al.'s study concluded that there was 'little room for doubt that the benefit/cost ratio of the patent system in Australia is negative or at the very best in balance'[26]. However, these costs and benefits were considered to be outweighed by the negative economic effects to Australia's international commercial relations, should the system be abolished.

More recently, the UK Commission on Intellectual Property Rights concluded in its 2002 report 'Integrating Intellectual Property Rights and Development Policy'[29]:

- There is some evidence that trade flows into developing countries are influenced by the strength of IP protection, particularly for those industries (often high technology) that are 'IPR sensitive' (e.g. chemicals and pharmaceuticals), but the evidence is far from clear.
- These flows may contribute to productive capability. But they may also be at the expense of domestic output and employment in local 'copying' and other industries. Developing countries with no or weak technological infrastructure, may be adversely affected by the higher prices of importing IP protected goods.
- The evidence that foreign investment is positively associated with IP protection in most developing countries is lacking.
- For more technologically advanced developing countries, IPRs may be important to facilitate access to protected high technologies, by foreign investment or by licensing.
- Achieving the right balance may be difficult for some countries such as India or China where some industries have the potential to benefit from IP protection but the associated costs for industries that were established under weak IP regimes as well as consumers are potentially high.
- Most of the evidence concerning the role of IP in trade and investment relates to those developing countries which are more technologically advanced. For other developing countries we conclude that any beneficial trade and investment effects are unlikely to outweigh the costs at least in the short and medium term.

Patenting in South Africa

Patenting in South Africa is regulated on the basis of the *South African Patent Act 57 of 1978*. The Companies and Intellectual Property Registry Office (CIPRO) is the custodian of all patent applications that are filed within the Republic of South Africa. An individual can privately file a provisional patent application. However, only a patent attorney can file a non-provisional patent application and assist in drafting the patent specification. The provisional specification affords temporary protection for 12 months; it can be extended for 3 months and it can form the basis for a complete patent application and for foreign patent applications. Once the invention has been fully developed and tested, a fresh patent application, with complete specification, is filed. If the product or process has already been technically complete from the start, only a complete specification is lodged.

South Africa is a non-examining country. The responsibility for ensuring that the application is valid resides with the applicant. This means that CIPRO does not investigate the novelty or inventive merit of the invention – only the forms or documentation are verified and not the substance of the product or process.

Currently, most of the patent-granting authorities, internationally, safeguard quality by requesting the following prerequisites for the granting of patents:

- Subject matter: refers to the requirement that an invention must fall into one of the categories that the patent law divides patentable subject matter into.
- Utility: an invention must perform a designed function or achieve some minimum human purpose.
- Novelty: an invention has to be novel.
- Non-obviousness: the knowledge in the technological field at the time of invention must not make the invention obvious to one of ordinary skill in that area.

The major difference between an examining and a non-examining system is the existence of examiners. The role of the examiner is to safeguard quality by:

- Reviewing the application to determine whether it complies with the basic formal requirements and legal rules.
- Determining the scope of the protection claimed by the inventor.
- Devising and performing a search of previously issued patents and other published literature to determine whether the claimed invention is both novel and not an obvious extension or variation of what is already known. Patent and non-patent literature (e.g. scientific, technical, business or other published literature) that is relevant to defining the claims or defeating the patent altogether is known as prior art. Patent applicants may submit prior art for consideration by the examiner or the examiner may be aware of pertinent prior art or discover it during the course of the search. Applicants are required to disclose prior art known to them that may be material to the examination of their applications.
- Examining the application to determine that the claimed invention was not known and would not have been obvious to a person of ordinary skill in the art at the time of invention based on the prior art found during the search, that the invention has utility and that the invention is described in such full, clear and concise terms as to enable a person of ordinary skills in the art to make and use it.

The South African approach has a number of adverse consequences. For example, the system may 'allow' the granting of patents which fall into excluded categories, it may create social costs through the monitoring of non-novel patents by the various stakeholders, it may create market

power for particular patent holders, and it may provide obstacles for further research and development in certain technological fields.

The issue of software-related patents is such a case. South Africa (section 25(2) of the *Patents Act No. 57 of 1978*), like countries in Europe, explicitly excludes computer programs from protection under the patent laws. The Act excludes: new discoveries; new scientific theories; new mathematical methods; new schemes, rules or methods for performing mental acts, playing games or doing business; and new computer programs and presentation of information. It should be emphasised that whilst TRIPS article ten mandates that computer software and data compilations are to be protected by copyright under the terms of the Berne Convention, it does not require that software programs be protected by patents. However, the South African challenge is that, as a non-examining country, the patent office does not check the validity of patents. The patent office only checks that payment has been made and that the correct forms are filled out. For this reason, software patents slip through the process illegally. Unlike a patent, which protects an invention not only from copying but also from independent creation, a copyright does not preclude others from independently creating similar expression. Hence, software companies prefer to protect their programs in both domains.

Microsoft's national technical officer, P. Maine, was quoted in an open debate held at the Freedom to Innovate South Africa workshop[28] on software and business method patents during January 2007 as saying that 'all Microsoft's patents had been filed (in South Africa) through government channels and were completely legal'. Similarly, a spokesperson from Novell was quoted as saying that Novell uses a 'proactive counter patenting' strategy in South Africa.[28]

It should be mentioned that, even though software patenting is not allowed in South Africa, software can be copyrighted, according to the *South African Copyright Act No. 98 of 1978*. In order to identify the share of possibly frivolous patents registered at CIPRO, we identified the number of applications and the number of grants in a number of intellectual property offices around the world (Table 1).

Table 1 shows that Australia and Canada grant less than 20% of the applications they receive. In China, the relevant share is 5% and in New Zealand it is approximately 10%. Assuming that South African conditions are similar to those in Australia and Canada, we can conclude that more than 80% of the current applications at CIPRO would have not been granted patents under an examining system.

A social cost created by the aforementioned approach is that companies wishing to protect their intellectual property rights in South Africa have to monitor patent applications of competitors in order to prevent them from gaining an unlawful patent or infringing on their own domains. Obviously, this creates a substantial cost to the economy as each company must monitor CIPRO, thus duplicating 'unproductive' activities.

TABLE 1: Number of patent applications and grants in selected intellectual property offices.

Country of origin	Number of applications	Number of grants
Australia	48 211	9464
Canada	54 446	7283
China	61 382	3494
Denmark	109 061	12 103
Finland	109 437	2315
France	112 631	50 448
Germany	175 595	55 053
New Zealand	35 137	3823
Switzerland	112 852	18 083
UK	148 209	44 754
USA	236 692	111 984
European Patent Office	97 943	39 646

The issue of non-examination also affects the scope of patents, that is, the breadth and number of claims. Patent applicants may use drafting language in such as way as to create a smokescreen that aims to hide the actual boundaries of the invention and to simultaneously increase the number of claims. Furthermore, such approaches pollute the prior art and increase the overall uncertainty. The European Patent Office (EPO) and the United States Patent and Trademarks Office (USPTO) set limits to the number of claims to be included in the same patent and set different fees for patents including more than a certain number of claims. For example, a European patent may not contain more than one independent claim in the same category (product, process, apparatus or use: Rule 29(2) of the European Patent Convention). The South African approach hides the breadth and number of claims contained in each patent. A consequence is that any statistics related to the number of local and international applicants are incomparable and are unreliable.

The registration approach makes the South African regime one of the cheapest in the world. Table 2 shows that South Africa is 20 to 30 times cheaper than the other patent regimes. This low cost opens the system to frivolous and useless patents, which increases uncertainty, increases search and monitoring costs by interested patentees and makes more difficult the dissemination of prior art by useful or real inventions. Moreover, the system creates an asymmetry, disadvantaging South African inventors. Foreign inventors are able to protect their inventions in South Africa very cheaply. South African inventors on the other hand, are usually unable to protect their inventions abroad because of the high costs involved. In order to validate the argument that South Africans are disadvantaged in protecting their IP abroad, we examined applications made to CIPRO by university professors. Patents by university professors were chosen in order to maintain certain minimum standards in the applications. It is expected that universities aim to maintain certain standards from such applications and professors are expected to be under pressure from their peers not to apply for frivolous patents.

We identified that during the 1996–2006 period, South African universities and their academics applied for 280 patents at CIPRO. Next we investigated whether those patents were protected abroad. Table 3 shows the technological orientation of the patents from the country's universities as well as their international protection.[30] We identified that only 58 of the 280 patents were protected abroad. Even though certain inventions may only require protection in the local market, it can be argued that international protection of 20% of academic patents is relatively low. We suggest that South African inventors are not able to protect their inventions abroad and they also run the danger of disclosing their inventions to foreigners by patenting only locally.

An important issue related to the modus operandi of CIPRO is the fact that there are no online search facilities for South African patents. Consequently all searches are carried out by hand (if at all) at the Patent Office through a card-based system. Although electronic patent searches may be performed on a contract basis on proprietary systems such as the *Electronic Patent Journal*, the approach is not supportive of the requirements of the public interest to disseminate the know-how of patents widely. It should be emphasised that the issue of disclosure is a key component of the patent system. It is the counterpart (payment) that society requests from the patentee in exchange for the exclusive rights of exploitation that the patent confers. Disclosure is examined by the examiners as a prerequisite for the award of patents. The publication (dissemination of the patent content) of patent applications and grants is currently a central mission assigned to patent offices internationally, which invest significant amounts for handling it by using the latest techniques.

In order to validate further the argument of opaqueness, we examined a random sample of 71 patents awarded to South Africans by USPTO during the 1998–2002 period. These patents constitute a 10% sample of the patents awarded to South Africans during the period. These patents used 726 other patents as prior art. Of the prior art patents, 68% were USPTO patents, 9% were EPO patents and 8.9% World Intellectual Property Organization patents. Only eight citations (1.1%) were citations to CIPRO patents. It is not surprising that South African inventors find their sources of information abroad rather than in the local patent office.

An important characteristic of patent systems is their strength. Park and Wagh[31] have developed an 'Index of Patent Rights' (Table 4) which is used in order to rank patent regimes internationally. The index is based on five criteria:

1. coverage (the subject matter that can be patented)
2. duration (the length of protection)
3. enforcement (the mechanisms for enforcing patent rights)
4. membership in international patent treaties
5. restrictions or limitations in the use of patent rights.

For each of these categories, a country is given a score ranging from 0 to 1, indicating the extent to which the country is strong in this aspect. For example, a score of 1 for the 'restrictions or limitations' category indicates that a country does not impose limitations on patent rights such as compulsory licensing. We suggest that the strength of the South African index is an unintentional effect of the non-examining approach. As we have argued, with appropriate drafting any idea can be protected by CIPRO (even when it is legally excluded), hence, there are no exclusions.

Table 4 shows that, overall, the USA has the strongest patent regime (with a score of 5), followed by Austria (4.71) and Germany (4.52). Out of 63 countries, South Africa (with a score of 4.05) is ranked twelfth, at the same level as France, Israel, Singapore, Switzerland, Belgium and Spain. Countries like China (2.48), India (2.18), Brazil (3.05), Hong Kong (2.90) and others have weaker patent regimes than South Africa. It should be emphasised that most of these countries have better abilities than South Africa in absorbing and producing technologies. The identified strength of the patent regime in

TABLE 2: Patent costs (Euros) in South Africa and other selected countries in 2007.

Country	Maintenance fees	Search costs
South Africa	254	61
Thailand	9866	44
USA	5943	2186
UK	4916	298
Singapore	3119	-
Australia	5381	579
Brazil	6416	279
Canada	3270	262
Germany	13 170	611
India	4914	93
Mexico	2325	518
Portugal	4322	-
South Korea	4914	401

TABLE 3: Protection of academic inventions locally and abroad (1996–2006).

Technical sector orientation	Class			
	Product development		Process development	
	CIPRO	Foreign	CIPRO	Foreign
Semiconductors microelectronics/ communications	12	4	16	2
Chemicals	18	9	20	13
Minerals/coal	1	-	18	5
Metal and metal products	10	-	9	-
Bio(technology)	24	4	26	5
Drug/pharmaceuticals	28	6	2	1
Immunoassays, pathology	1	-	3	3
Machine, tools armaments	10	-	10	-
Optics	3	-	3	1
Medical equipment/treatment	7	-	6	-
Water system hydraulics/ environment	-	-	4	-
Food and agriculture	-	-	4	2
Sea transportation	3	1	-	-
Diagnostics	-	-	9	-
Nuclear	1	-	7	2
Construction building	5	-	1	-
Acoustics	5	-	-	-
Others	11	-	3	-

Source: Lubango[30]
CIPRO, Companies and Intellectual Property Registry Office of the Republic of South Africa.

TABLE 4: A comparison of the scores of selected countries based on the Index of Patent Rights[a].

Country	Coverage	Duration	Enforcement	Membership of international treaties	Protection from restrictions on patent rights	Total
USA	1.00	1.00	1.00	1.00	1.00	5.00
Austria	0.71	1.00	1.00	1.00	1.00	4.71
Germany	0.86	1.00	1.00	1.00	0.67	4.53
The Netherlands	0.71	1.00	1.00	1.00	0.67	4.38
Sweden	0.71	1.00	1.00	1.00	0.67	4.38
Italy	1.00	1.00	1.00	1.00	0.33	4.33
Korea	0.86	1.00	1.00	0.67	0.67	4.20
UK	0.86	1.00	0.67	1.00	0.67	4.20
Denmark	0.86	1.00	0.67	1.00	0.67	4.20
Australia	0.86	1.00	1.00	1.00	0.33	4.19
Japan	0.86	1.00	1.00	1.00	0.33	4.19
Israel	0.71	1.00	0.67	1.00	0.67	4.05
South Africa	0.71	1.00	0.67	1.00	0.67	4.05
Singapore	0.71	1.00	0.67	0.67	1.00	4.05
Switzerland	0.71	1.00	0.67	1.00	0.67	4.05
Belgium	0.71	1.00	1.00	1.00	0.33	4.04
France	0.71	1.00	1.00	1.00	0.33	4.04
Spain	0.71	1.00	1.00	1.00	0.33	4.04
Iceland	1.00	1.00	0.33	1.00	0.67	4.00
New Zealand	1.00	1.00	0.67	1.00	0.33	4.00
Canada	0.57	1.00	0.67	1.00	0.67	3.91
Norway	0.57	1.00	0.67	1.00	0.67	3.91
Ecuador	0.71	1.00	0.67	0.67	0.67	3.72
Hungary	0.71	1.00	0.67	1.00	0.33	3.71
Sri Lanka	0.71	0.88	0.33	0.67	1.00	3.59
Czech Republic	0.86	1.00	0.00	1.00	0.67	3.53
Russia	0.86	1.00	0.33	1.00	0.33	3.52
Chile	0.86	0.88	0.33	0.33	1.00	3.40
Colombia	0.57	1.00	0.67	0.67	0.33	3.24
Zimbabwe	0.57	1.00	0.33	0.67	0.67	3.24
Venezuela	0.57	1.00	1.00	0.67	0.00	3.24
Bulgaria	0.57	1.00	0.33	1.00	0.33	3.23
Poland	0.57	1.00	0.33	1.00	0.33	3.23
Greece	0.86	1.00	0.67	0.67	0.00	3.20
Brazil	0.71	1.00	0.67	0.67	0.00	3.05
Kenya	0.71	1.00	0.67	0.67	0.00	3.05
Chad	0.71	1.00	0.33	0.67	0.33	3.04
Jordan	0.86	0.80	0.33	0.33	0.67	2.99
Madagascar	0.86	0.75	0.33	0.67	0.33	2.94
Argentina	0.57	1.00	0.67	0.67	0.00	2.91
Hong Kong	0.57	1.00	0.33	0.67	0.33	2.90
Senegal	0.57	1.00	0.33	0.67	0.33	2.90
Togo	0.57	1.00	0.33	0.67	0.33	2.90
Turkey	0.86	1.00	0.00	0.67	0.30	2.83
Peru	0.71	1.00	0.33	0.33	0.33	2.70
Romania	0.71	1.00	0.00	0.67	0.33	2.71
Bangladesh	0.86	0.80	0.00	0.33	0.67	2.66
Mexico	0.86	1.00	0.33	0.33	0.00	2.52
China	0.14	1.00	0.33	0.67	0.33	2.47
Egypt	0.71	0.75	0.67	0.33	0.00	2.46
Grenada	0.71	0.70	0.00	0.67	0.33	2.41
Somalia	0.86	0.75	0.00	0.00	0.67	2.28
Indonesia	0.57	0.70	0.33	0.67	0.00	2.27
Thailand	0.57	1.00	0.67	0.00	0.00	2.24
Botswana	0.57	1.00	0.00	0.33	0.33	2.23
Tunisia	0.57	1.00	0.00	0.33	0.33	2.23
India	0.14	0.70	0.33	0.67	0.33	2.17
Pakistan	0.86	0.80	0.00	0.00	0.33	1.99
Guyana	0.43	0.80	0.00	0.33	0.33	1.89
Guatemala	0.29	0.75	0.33	0.33	0.00	1.70
Nicaragua	0.00	0.59	0.00	0.33	0.67	1.59
Ethiopia	0.00	0.00	0.00	0.00	1.00	1.00
Mozambique	0.00	0.00	0.00	0.00	0.00	0.00

[a], The 'Index of Patent Rights'[30] is used to rank patent regimes internationally. The index is based on five criteria (coverage, duration, enforcement, membership of international treaties and restrictions) which are each scored 0–1 (lowest–highest).

this country, as well as the related shortcomings linked to the arguments by Maskus[1], Chang[24] and others discussed in the previous section, make it apparent that the current regime is detrimental to the country's developmental efforts.

Discussion and conclusions

In this article we have attempted to assess whether the patent system in South Africa assists in the objectives of development.

We suggest that the benefits of the patent system arise from its dual mission, that is, to encourage invention and to encourage the diffusion of technology, and its costs arise from its modus operandi, which is to restrict the use of invention or technology.

A review of recent literature indicates that there is growing evidence that the intellectual property rights in general, and the patent system in particular, do not bring the expected results. The operation of the patent system appears to be beneficial, in terms of R&D and innovation, only in specific industries (i.e. in the pharmaceutical and biotechnology industries) whilst it may have negative, or at best, ambivalent effects in other sectors and society at large. Strong IPR regimes may assist in technology transfer through licensing but may negatively affect foreign direct investments.

As we have indicated, in terms of economic development, a number of studies in Australia, Europe and elsewhere argue that strong IPR may be a constraint for development. A strong argument advanced by a number of authors is that European countries, the USA and, more recently, Asian countries have based their development on 'infringing' foreign technologies. Hence, the argument has been made that rich countries 'kicked away the ladder' that they climbed to reach the world's top economic position so that developing countries could not use it.

Analysis of the South African patent regime identifies that South Africa is a non-examining country, which means that CIPRO does not investigate the novelty or inventive merit of the invention – only the documentation, and not the substance of the product or process, is verified. Hence, applicants receive grants of patents on known or only trivially modified inventions that confer potential market power, may restrict access, raise prices and enable the patent holder to use litigation as a competitive weapon without providing incentives for making genuine advances or disclosing such advances to the public. In other words, granting patents for inventions that are not new or useful or that are obvious, unjustly reward the patent holder at the expense of real inventors, the consumer and social welfare. A comparative assessment indicates that a substantial number of grants would not have been awarded under a different regime.

The issue of non-examination also affects the scope of patents, that is, the breadth and the number of claims. Patent applicants may use drafting language in such a way as to create a smokescreen that aims to hide the actual boundaries of the invention and simultaneously to increase the number of claims. Such approaches pollute the prior art and increase the overall uncertainty.

Finally, the registration approach makes the South African regime one of the cheapest in the world (20 to 30 times cheaper than other patent regimes). This low cost opens the system to frivolous and useless patents, which increases uncertainty, increases search and monitoring costs by interested patentees and makes more difficult the dissemination of prior art by useful or real inventions. Moreover, the system creates an asymmetry disadvantaging South African inventors. Foreign inventors are able to protect their invention in South Africa very cheaply. South African inventors on the other hand, are usually unable to protect their inventions abroad because of the high costs. A sampling approach – indicating that only 20% of the CIPRO patents are protected abroad – confirms the aforementioned argument.

Another issue related to the modus operandi of CIPRO is the fact that no online search facilities exist for South African patents. Consequently, all searches are carried out by hand (if at all) at the Patent Office through a card-based system. Although electronic patent searches may be performed on a contract basis on proprietary systems such as the *Electronic Patent Journal*, the approach is not supportive of the requirements of the public interest to disseminate the know-how of patents widely and does not conform to international best practice.

It becomes apparent that not only does the current regime not support the national innovation system but that it facilitates exploitation by foreign interests and creates substantial social costs. We argue that the country's IPR regime rewards the patent holder at the expense of consumer welfare. As patent holders and patents are not always legitimate, neither producers nor users of IP benefit. The uncertainty related to the validity of disclosure and the lack of online information about the granted patents lead to the same consequences. Inventors have to spend valuable resources 'playing' a system that does not promote innovation and is detrimental to 'public good'.

It is important that the relevant authorities take action to bring the patent system up to international standards. Whilst the development of searching and examining capability is of paramount importance, the lack of appropriate skills may be a temporary obstacle. A possible solution is the Turkish approach. The Turkish Patent Office sends their applications to Russian, Danish, Swedish or European Patent Offices for novelty and examination searches and according to the results either awards or refuses applications.

Similarly, the relevant authorities should make available to the public through a website all the information disclosed in the patent applications. In this way, the benefits to the public, other inventors and society at large will also be supported. Finally, caution is required in the use of the relevant patent office awards as indicators of inventive capability.[32]

In the aforementioned context, it should be mentioned that the Department of Science and Technology has developed appropriate legislation – *Intellectual Property Rights from Publicly Financed Research and Development Act 2008* – in order to provide for more effective utilisation of IP emanating from publicly financed research and development. However, whilst the Act establishes the National Intellectual Property Management Office and the Intellectual Property Fund, it is silent on issues related to CIPRO's activities – probably because CIPRO reports to a different department (the Department of Trade and Industry).

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Authors' contributions

Both authors contributed equally in the production of this article.

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