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PATENTING
in South Africa

SPECIAL REPORT 2007

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The Innovation Fund is an instrument of
the Department of Science and Technology,
managed by the National Research Foundation.

Analysis of the South African patent landscape

by

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1 June 2007

Acknowledgement

This analytical report presents the findings of a study carried out on South African patenting activity. The author heads up the Innovation Fund's Intellectual Property Management Office (IPMO) and the study was carried out by the author in that capacity. In undertaking the study and writing up the report, the author worked closely with several people and organisations. Enormous support was provided directly and indirectly by several people and organisations that shaped the final content and structure of this report. The author is grateful to CIPRO who provided access to their patent records for the analysis of trends at the South African Patent Office; and also to colleagues at IPMO and the Innovation Fund Commercialisation Office who reviewed earlier drafts of the report and provided valuable input. The author is particularly grateful to Dr Adi Paterson (General Manager: PBMR) who acted as an external reviewer in his previous role as Deputy Director General of the Department of Science and Technology, and also to the leadership and guidance provided by Dr Eugene Lottering (Executive Director: Innovation Fund). All errors and omissions remain the responsibility of the author.

Contents

South Africa ranks only 39th out of 162 countries* in terms of technological achievement, and it is clear that we are still largely perceived as an adopter, rather than an innovator, of technology. While R&D spend has grown considerably over the past few years – now R10,1 billion** per annum from public and private sectors – there needs to be a commensurate level of commercialisation before it impacts on the economy.

The following study was undertaken to provide a high-level insight into some of the issues affecting the South African patent landscape. It focuses on the period 1991 to 2005, and forms part of an analysis that is intended to be undertaken on a continuous basis to track South Africa's technological development within the knowledge-driven global economy.

* Technological Achievement Index (TAI) – United Nations Human Development Report, 2001
** Dr Neville Comins, CEO, Innovation Hub

Prepared by the Innovation Fund
Intellectual Property Management Office
(IPMO)

Executive Summary

Patenting is a critical step in the commercialisation of most research results leading to innovations that contribute to economic growth and benefit society. Some researchers within the academic community feel that the patenting process is difficult, too expensive and requires insurmountable administrative work and detracts from their ability to publish their research findings. As a result, some never protect their intellectual property and those who do often seek protection when it is too late, when possible novelty has been destroyed by publication. The proposition that the Innovation Fund offers is that there needs to be an appreciation that protection of intellectual property should always precede any publication. Patenting and publication can be viewed as two different, yet compatible, forms of knowledge dissemination on the basis that often they require the same research results as inputs. However, the value realisation is different, and it is for this reason that we submit that the two should co-exist.

'The differences in patent rates between the developed and the developing world represents one of the greatest "divides" of the knowledge age. Since patents represent one of the strongest forms of "intangible value" this is evidence of a major weakness in South Africa's ability to become a knowledge economy … At present, there is little appreciation for the value of intellectual property as an instrument of wealth creation in South Africa[1]'. This may be the reason why at least 50% of patent applications filed in South Africa emanate from abroad.

South Africa has a very low patenting rate, which has remained relatively stagnant since 1998.

The following report examines the South African patenting landscape over a 15-year (1991-2005) period and aims to communicate the commercial value that other countries see in local innovation, which so many South Africans do not.

Patenting intellectual property in South Africa is vitally important and the Innovation Fund therefore sees the need to highlight the structures and services that it provides through its Intellectual Property Management Office (IPMO).

This publication examines the South African patent landscape and compares this analysis with the patent-related findings within other countries.

The management of intellectual property (IP) emanating from publicly funded science and technology research institutions (higher education institutions (HEIs) and research councils) ("the Institutions"), has become increasingly important in order to ensure extraction of maximum value on the basis of the inputs, mainly public funding, and the usefulness of the outputs. In particular, the successful commercialisation of such IP, in the form of licences or joint ventures, including start-ups or spin-out companies, needs to be tracked and related to the inputs, in the form of funding and other strategic interventions, such as the Biotechnology Strategy, the R&D ICT Strategy, Advanced Manufacturing Strategy (AMTS), and the like. It has also become important to understand South Africa's intellectual property landscape (in particular patents) and how it is comprised, together with how it compares with those of some emerging and developed countries.

The pages that follow detail the results of a study that was undertaken to provide a high-level insight into some of these issues. This study is intended as part of an analysis that needs to be undertaken on a continuous basis to track South Africa's technological development within the knowledge-driven global economy. The correct use of patent analysis is a proxy for technological development, which is much more difficult to measure empirically. The comparison with developments in other countries represents a useful benchmark of competitiveness and future economic potential.

[1] *South African National Research and Development Strategy (2002)*

The study focuses on the period 1991 to 2005 and also includes various time-slices within this period. Searches were conducted using MicroPatent patent application and granted patent databases, which include the following databases: United States Patent and Trade Marks Office (USPTO), European Patent Office (EPO), the World Intellectual Property Organisation (WIPO) and its Patent Cooperation Treaty (PCT) Office known as the WO. Further, an analysis of selected records at the South African Patent Office is provided for the same period.

Key findings of the report

- South Africa has a very low patenting rate, which has remained relatively stagnant since 1998. Of the patent applications being filed in South Africa, at least half of them are increasingly being filed by foreign applicants, indicating low participation of South Africans in technological developments taking place in South Africa.
- Publicly funded institutions contribute marginally to the patenting activity at the South African Patent Office, with the Council for Scientific and Industrial Research (CSIR) – together with its subsidiaries – being the most prominent public sector participant in patenting activity in South Africa.
- Sasol and De Beers Group of Companies (in particular the now independent Element Six (Pty) Ltd) are the leading private sector companies in respect of patenting internationally by South Africans, as can be seen in Table I below.
- Furthermore, Table I shows that the CSIR and Mintek are the only public research institutions that have featured in the top 10 list of applicants in respect of patent applications published by the USPTO, EPO and WO, in the period 2001 to 2005, with Mintek having featured only once in 2004, and the CSIR having fallen out of the list in 2005.

TABLE I: Top 10 list of applicants/assignees of patent applications published by the USPTO, EPO, and WO in the period 2001 to 2005.

2001		2002		2003		2004		2005	
None*	24	None	28	None	39	None	24	None	29
Sasol Technology (Pty) Ltd	11	Windsor Technologies Ltd	12	Sasol Technology (Pty) Ltd	9	Sasol Technology (Pty) Ltd	5	Sasol Technology (Pty) Ltd	5
CSIR (including Technology Finance Corporation (Pty) Ltd and Implico B.V.)	7	CSIR (including Technology Finance Corporation (Pty) Ltd and Implico B.V.)	8	Element Six (Pty) Ltd	4	Element Six (Pty) Ltd	4	Element Six (Pty) Ltd	4
Scorpio Conveyor Products (Pty) Ltd	3	Sasol Technology (Pty) Ltd	6	GSBS Development Corporation	4	Trico Products Corporation	4	Supersensor (Pty) Ltd	4
Circuit Breaker Industries Ltd	2	De Beers Industrial Diamond Division (Pty) Ltd	4	Bruwer, Frederick Johannes	2	Mintek	3	Cobb International Ltd	3
Da Ponte, Manuel Dos Santos	2	Supersensor (Pty) Ltd	4	Chemical Services Ltd	2	CSIR (including Technology Finance Corporation (Pty) Ltd	5	Hall, Alethea Rosalind Melanie	3
Denel (Pty) Ltd	2	Adcock Ingram Ltd	2	CSIR	2	University of Pretoria	3	Power Logic Holdings AG	3
IPCOR N.V.	2	Anglo Operations Ltd	2	Enerkom (Pty) Ltd	2	Anglo American Corporation of South Africa Ltd	2	Eskom	2
Merlin Gerin S.A. (Pty) Ltd	2	Compaction Technology (Soil) Ltd	2	Evity (Pty) Ltd	2	Billiton Intellectual Property B.V.	2	Kowalczyk, Piort Leonard	2
				Hall, Alethea Rosalind Melanie	2			Lomold Corporation N.V.	2

** None – Patents unassigned in the name of the inventor.*

- What can be learnt from the two private sector group of companies, Sasol and Element Six, is the use of a portfolio approach to intellectual property protection, as illustrated by Figure I. This shows how the patent applications of Sasol are concentrated around areas representative of its core businesses. The CSIR does not exhibit any distinct portfolios, but a very diverse portfolio of patent applications. On the other hand, it is promising to see a portfolio approach in respect of patenting activities by the recently established Pebble Bed Modular Reactor (Pty) Ltd (PBMR).

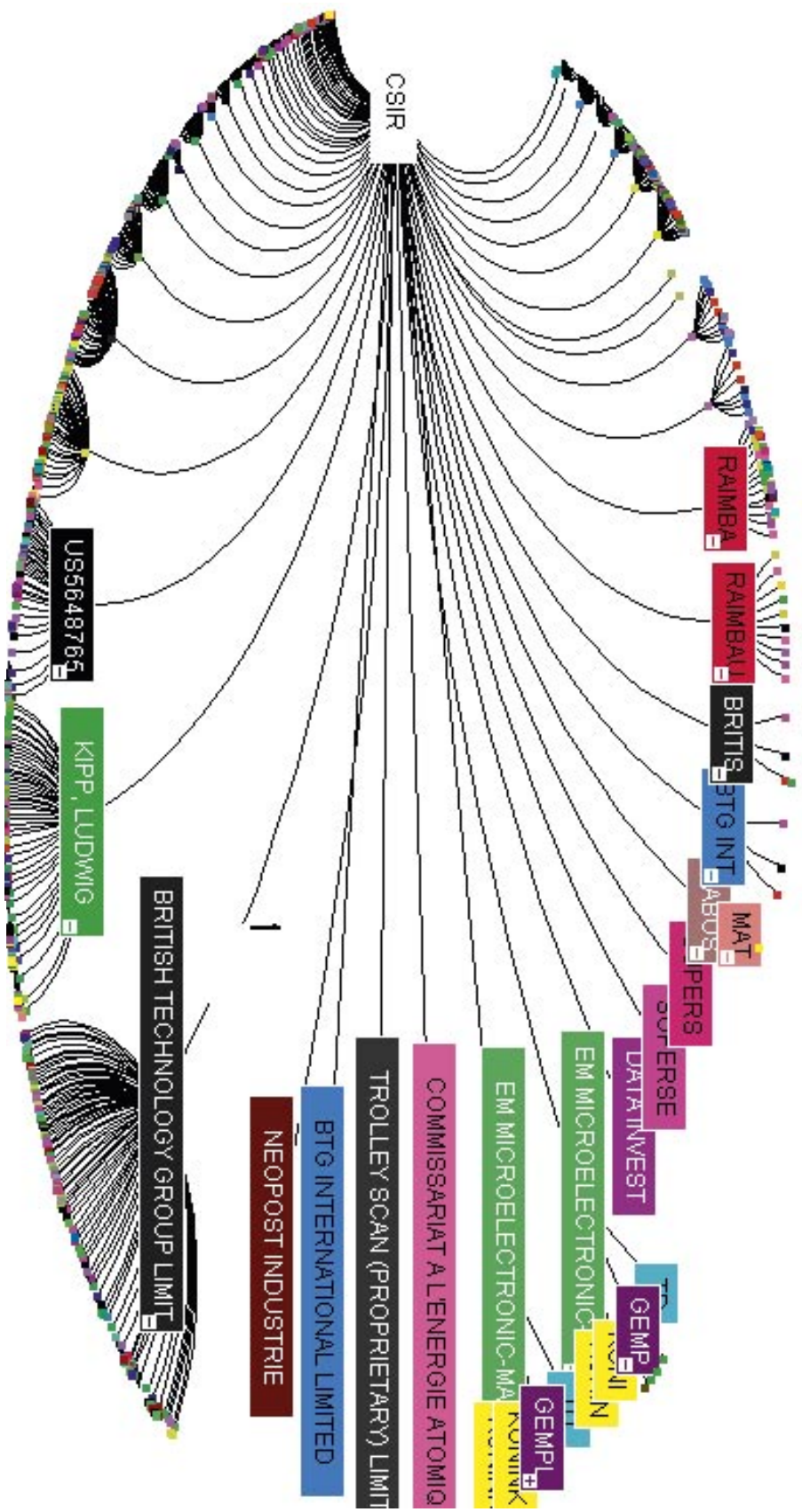
FIGURE I: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority (4 576) of which 93 were filed by the CSIR, 171 Sasol, and 35 by the PBMR. This map was generated from a full text analysis of 4 576 patent applications.

Sasol
CSIR
PBMR

- A country's distribution of patents by technology areas has proved to be a reliable indicator of a nation's strengths. An analysis of the top 10 major technology areas in which patent applications have been filed by South Africans internationally, as represented by the International Patent Classification (IPC) system, does not provide clear areas of strength, as no IPC code commands significant numbers (above 5%). The distribution of patent applications at the USPTO, EPO and WO and patents at the USPTO and EPO offer a useful insight into what appears to be the major areas of patenting by South Africans internationally.
- Citation analysis of patent applications published by the USPTO, EPO, and WO together with that of patents granted by the USPTO and EPO revealed the existence of a portfolio of patents emanating from the CSIR in the area of Radio Frequency Identification (RFID), which are featured in the most cited lists (Figure II). The portfolio has been assigned to an offshore entity, British Technology Group (BTG). Although the circumstances of such assignment have not been investigated further, the analysis illustrates a need to effectively manage South African intellectual property and provide support for its commercialisation so as to avoid what could be termed "IP leakage".
- The report also contains an analysis of patents granted to South African higher education institutions internationally and finds that a small number of applications are filed in the area of Biotechnology, in particular in classes A61K *(Preparations for medical, dental, or toilet purposes)* and C07C *(Acyclic or carbocyclic compounds)*.
- Further findings are contained in various sections of the report.

All figures and tables in the main body of the report, unless stated otherwise, represent results of searches and analysis carried out for the period January 1991 to September 2005.
The report also recognises that not all readers will have the same understanding of intellectual property, and provides an overview of the patenting process in Part 1.

FIGURE II: Citation tree of patent application EP0494114 originally filed in the name of the CSIR (truncated at level 3).



PART 1

Introduction

1.1 Background

It is generally accepted that a country's intellectual property in the form of the number of patents granted to its nationals, can be used as a proxy for both the extent of innovation and current and future economic growth potential.

In 2002, the South African government through its Department of Science and Technology (DST) published the National Research and Development Strategy (R&D Strategy), which among other factors, gave an indication of focus areas for South Africa's competitiveness and growth. It emphasised the need for patenting, in particular innovations emanating from publicly funded research institutions, namely higher education institutions (HEIs) and research councils. Since then, the R&D Strategy has been unpacked and various initiatives and sector strategies have emerged. These include: the Biotechnology Strategy, which gave rise to the formation of the Biotechnology Regional Innovation Centres (BRICs), the Advanced Manufacturing Strategy (AMTS), and the ICT strategy, which has given rise to the Meraka Institute.

The Innovation Fund has in the meantime launched three patent support and incentive instruments: (i) the Patent Support Fund (Research Institutions), which provides a subsidy for patenting costs incurred by publicly funded research institutions on a "wholesale basis"; (ii) the Patent Support Fund (SME) – an instrument for supporting patenting costs of Small to Medium Enterprises (SME), particularly those with Black Economic Empowerment (BEE) credentials; and (iii) the Patent Incentive Fund – an instrument based on the R&D Strategy, which provides monetary incentives to researchers at institutions for having secured a South African patent for their inventions.

At the time of writing this report, the DST had released a Framework for Intellectual Property Rights (IPR) emanating from publicly funded research, for public comment. The framework seeks to provide harmonisation in respect of intellectual property developed with public funds.

Thus, a comprehensive analysis of the South African patent landscape is an important process in not only understanding patenting trends but also in highlighting the strengths and weaknesses of our system of innovation, in particular the impact of the various initiatives, some of which are implementations of the R&D Strategy. Furthermore, a comparative analysis of the South African patent landscape with those of some of the country's trading partners, including some emerging and developed countries, provides insight into innovation and technological areas. This will indicate where national resources need to be devoted to address national priorities and either improve South Africa's global competitiveness or enhance its impact on the global economy.

The National Research and Development Strategy emphasised the need for patenting, in particular innovations emanating from publicly funded research institutions.

1.2 Scope of the study

This study has been carried out in part using the MicroPatent[2] Aureka and PatentWeb applications, which include databases of the following patent offices: USPTO (applications and granted), EPO (applications and granted), WIPO's PCT (WO), Japanese Patent Office (JPO), United Kingdom

[2] *MicroPatent is a subsidiary of the Thompson Scientific Group of companies, and provides intellectual property commercial databases through its two applications, Aureka and PatentWeb.*

When two parties have filed for patent protection for similar inventions, the person with the earliest priority date is deemed to have *prima facie* rights to the invention.

Patent Office (UKPO), and French Patent Office (FPO).

The analysis was confined to data at various selected international patent offices, namely, the EPO, the USPTO, and the WO. As the WO is not a patent granting office but merely a patent filing and prosecution office, and also owing to the fact that some of the patent applications at either the EPO and USPTO don't proceed to grant, analysis of both patent applications and granted patents was performed in respect of the USPTO and the EPO; whereas only patent applications were considered in the case of the PCT (WO) and the South African Patent Office. The JPO records were excluded from the analysis for two reasons: not all the records are in English, and different rules for granting a patent from an application (i.e. deferred examination) apply.

The study covered a 15-year period with specific data for the period January 1991 to 26 September 2005. The date of publication of the applications was used as a search criterion, with the result that only records indicating publications and patents granted in the above period would have formed part of the study.

Patenting procedure

As this report is intended to be more accessible to non-specialists and practitioners, a brief summary of patenting procedure for a simpler interpretation of the context of this report is provided. There are essentially three requirements for a patent to be granted for an invention and these can be summarised as being:

Novelty, meaning that the invention must be new in light of all information available to the public at the date of filing an application for the invention (the prior art), and not having been disclosed to the public prior to the filing of a patent application covering the invention;
Non-obviousness or having inventiveness, meaning that the invention must contain an inventive step and must therefore not be obvious to a person skilled in the relevant art, when taking all the prior art into account; and
Utility, meaning that it must be capable of use in agriculture, trade and industry.

When an invention meets these requirements, an application, typically a provisional patent application, which broadly describes the invention (in the case of South Africa), is filed. This application provides a priority date for the invention which is the earliest date of a patent application for an invention, according to the Paris Convention. It gives the applicant 12 months to carry out further development and validation of the invention before making a final decision whether or not to obtain final patent protection in any of the Paris Convention member states. When two parties have filed for patent protection for similar inventions, the person with the earliest priority date is deemed to have *prima facie* rights to the invention. The patent application for the person with a later priority date is deemed not to be novel in light of the application with the earlier priority date.

In terms of the Paris Convention, a complete application, which includes a set of claims, must be filed within 12 months of the priority date in all the member states of the Paris Convention in which patent protection is desired, failing which the right to claim priority lapses.

A set of claims is a set of numbered paragraphs at the end of a patent specification, whose purpose is to define the monopoly that the patent application claims. Patent applications filed in those relevant countries of interest may then proceed to a second stage, which is the granting of a patent in those countries, following examination according to the relevant national laws. The original 12-month period has since been extended to 30 and in some cases 31 months by the Patent Corporation Treaty (PCT) to the 125 member countries of the PCT. This implies that at the end of 12 months from the earliest priority date, a PCT application may be filed, which then provides a further 18 to 19 months for the applicant to indicate in which countries final patent protection will be sought.

A PCT application undergoes a search procedure by one of a number of searching authorities recognised by the PCT. An International Search Report (ISR) is often published with the application

at 18 months from the earliest priority date for the invention. The ISR provides a list of relevant prior art identified by the searching authority and also a patentability opinion in respect of the invention. The applicant is then presented with one of several options:

- amend the claims of the patent application in question and proceed to request examination thereof;
- request examination;
- do nothing further and file national phase applications prior to or at the end of the PCT phase; or
- abandon the application procedure if the ISR was such that the applicant would be unlikely to obtain patent protection due to there being relevant prior art, which clearly suggests that the relevant invention is not novel and/or inventive in light on the cited prior art.

A detailed description of the PCT procedure is available on the WIPO website (www.wipo.int).

A PCT filing is an international patent application and no patent is granted through the PCT process. Patents can only result when separate patent applications are filed at desired national patent offices at the end of the 30- and 31-month periods, as prescribed by the PCT system pursuant to examination and grant procedures of such offices. If an applicant does not claim priority from an application filed in any one of the convention countries, it is called a "non-convention" application. There are typically two types of patent systems: a deposit system and an examining system. The deposit system only examines the application as regards certain formalities, while the examination system examines the application for substantive requirements stated earlier in this report, namely novelty, inventiveness, and utility. The USPTO and EPO work on the examining system, whereas the South African Patent Office is based on a deposit system.

1.3 Research methodology

A search was conducted through the records at the USPTO, EPO and the WO, as represented in the MicroPatent databases, which are current with respect to the actual records at the relevant patent offices. In particular, the search was for patent applications and patents claiming priority from "local" filings at the patent offices of the countries of interest – in other words, patents and applications claiming priority from a South African application. In the case of South Africa, priority filings at the South African Patent Office can be linked to the WO, the USPTO and EPO. However, non-convention patent applications (applications or patents granted from applications filed in the first instance directly at the USPTO, EPO and the WO, not claiming priority from "local" priority filing) would not have been revealed by the searches conducted.

Typically, filing a non-convention application is an exception, the norm being to file a convention application claiming priority from a local filing, making use of the provisions of the Paris Convention. As non-convention patent application filings account for less than 10% of all filings at these patent offices, the exclusion of non-convention applications does not prejudice the use of convention-based applications and patents as a good proxy for the intellectual property landscape both in a particular jurisdiction and in comparison to global trends. However, patent filing strategies through the EPO also "cascade" into specific filings in the ±21 jurisdictions that are contracted into the EPO. Thus the EPO filings do not count as direct filings in national patent offices of the contracted countries and unless a granted EPO patent is ratified in the various European Union member states, within certain periods from the grant of an EPO patent, no enforceable patents result.

In addition to the abovementioned search criteria, names of entities and organisations, and also the International Patent Classification (IPC) codes, were used for some of the searches.

A detailed description of the PCT procedure is available on the WIPO website – www.wipo.int.

Furthermore, an analysis was conducted through the records at the Companies and Intellectual Property Registration Office (CIPRO), which hosts the South African Patent Office.

Schedules I to IV represent results of searches and analyses carried out for the period January 1991 to December 2005.

PART 2

South African patent landscape as illustrated by patent applications at USPTO, EPO and WIPO

2.1 Introduction

Unless indicated to the contrary, the analysis of the South African patent landscape was conducted for the period January 1991 to 26 September 2005, using MicroPatent databases.

Figure 1 is a composite map that illustrates South Africa's patent landscape as represented by patent applications at USPTO, EPO and WO, which claim priority from a South African (ZA) application. The map represents the patent applications as black dots on a contour map.

The relative distances between the black dots denote relationships; unrelated documents are further apart from each other, and documents that are more closely related are placed closer together on the map. The contours on the map represent groupings of similar patent documents. The different colours on the map represent the density of the documents, with the white or "snow-capped peaks" denoting higher density of documents with similar content. In this mapping of a technology landscape (given the long period and different offices) a higher concentration of documents represents a nationally important technological focus area that would likely be a source of industrial strength or comparative advantage at least in those sectors where patenting is a key mode of intellectual property protection.

In the search period, 4 576 patents were found, collectively, at the USPTO, EPO, and WO, which claim priority from at least one South African patent application. In this representation peaks are identified by three labels which define the similarities, for example:

- abrasives, particles, diamond;
- catalysts, olefins, support; and
- network, information, data.

These examples show the benefit of this type of analysis: although the first two labels could be anticipated by most observers of the South African patent landscape, the third is not as obvious.

The actual number of patent applications during this period could very well have been more than 4 576 owing to earlier practices at the USPTO in respect of publication of patent applications. Given the scale of these offices this is not a large number. However, it is important to note that USA patent applications only became published at 18 months from the earliest priority as from 15 March 2001. Thus applications filed at the USPTO more than 18 months prior to 15 March 2001, are not reflected in the results of the analysis. This explains the low distribution of USA applications in Table 1, which other studies have shown to be more popular as a patent destination than the EPO for South African patents.

FIGURE 1: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority (4 576).

TABLE 1: Summary of patent applications filed at the USPTO, EPO and the WO with a ZA priority published per patent office.

Publishing organisations	Document count	Percentage
WO	2 749	60,1%
EPO	1 318	28,8%
USPTO	509	11,1%
Total number of documents in group	**4 576**	

Table 1 shows the distribution of the 4 576 patent applications at the USPTO, EPO and WO. From Table I (see Executive Summary) it is evident that WO is the most dominant filing office used by South Africans, followed by the EPO. The larger patent application numbers at the WO are in part due to the nature of a PCT application which is a single international patent application and prosecution procedure. Similarly, the higher patent applications at the EPO could be based on the fact that a patent granted by the EPO can be ratified in a number of countries of interest within the European Union within a certain period of time after its grant. In this regard, the applicant only has to translate the claims of the patent to German and French and the full translation of the specification is deferred until the applicant has elected to ratify the patent in the countries whose official language is French or German. Patent applications at the USPTO during this period accounted for 11% of all applications.

Table 2 (overleaf) summarises the pace of patent application filings during the search period. There has been an increase in the number of filings each year, with significant increases being apparent in 2000 and 2004.

Year published	Document count	Percentage
2005	449	9,8%
2004	712	15,6%
2003	592	12,9%
2002	585	12,8%
2001	539	11,8%
2000	454	9,9%
1999	297	6,5%
1998	188	4,1%
1997	162	3,5%
1996	125	2,7%
1995	124	2,7%
1994	133	2,9%
1993	75	1,6%
1992	68	1,5%
1991	73	1,6%

TABLE 2: Pace of publishing per year at the USPTO, EPO and WO of patent applications claiming priority from a South African application.

South Africa acceded to the PCT on 16 March 1999. Thus, the significant increases in patent applications in the 1999/2000 period are, in our opinion, attributable to South Africans taking advantage of the opportunity to file PCT applications. Some of the increases in the 2001 data compared to 2000 can be attributed to the publishing of USA patent applications which, prior to 15 March 2001, were not published. As the search was conducted around September 2005, the data for 2005 is essentially incomplete and no conclusions can be made from the data for 2005 on their own.

However, Schedule I provides an overview of the patent application filing trends in the period 2001 to 2005 (which includes complete data for 2005). The trends suggest increases in filings in the USPTO, constant filings at the EPO, and declining filings in the WO since 2002. The highest number of patent applications at the USPTO and EPO since 2001, were in 2004.

Assignee	Document count	Percentage
None	431	7,4%
CSIR	93	1,6%
Sasol Technology (Pty) Ltd	90	1,5%
De Beers Industrial Diamond Division (Pty) Ltd	69	1,2%
Handelman, Joseph, H	65	1,1%
Windsor Technologies Ltd	42	0,7%
Pebble Bed Modular Reactor (Pty) Ltd	35	0,6%
Sasol Technology (Pty) Ltd	33	0,6%
Element Six (Pty) Ltd	29	0,5%
AECI Ltd	27	0,5%
Number of assignments in top 10 assignees	**914**	
Total number of assignments	**5 850**	
Number of documents after filter	**4 576**	
Total number of documents in group	**4 576**	

TABLE 3: The top 10 assignees of the 4 576 patent applications at the USPTO, EPO and WO claiming priority from a South African application.

As can be seen in Table 3, there is only one publicly funded institution, the CSIR, in the top 10 applicants/assignees. The documents which cite "None" as assignee are those filed and still in the name of individual inventors, and most of these are USPTO applications or WO applications filed in the name of South African inventors in order to access reduced filing and search fees. It

is a requirement at the USPTO that the patent application must be filed in the name of a natural person(s), namely the inventor(s).

Table 4 shows the top 10 applicants/assignees for the patent applications which cite a university as an applicant/assignee. Of the 72 patent applications which cite a university as an applicant/assignee, North-West University (formerly Potchefstroom University) represents 26,4% (19 applications), University of Cape Town 19% (14), University of Johannesburg (formerly Rand Afrikaans University) 12,5% (9), and the University of Stellenbosch 7% (5).

TABLE 4: Basic report representing top 10 applicants/assignees representing patent applications that cite South African universities at the USPTO, EPO and WO.

Assignee	Document count	Percentage
Potchefstroom University for Christian Higher Education	16	13,5%
University of Cape Town	14	11,8%
University of Pretoria	12	10,1%
Rand Afrikaans University	9	7,6%
University of Stellenbosch	5	4,2%
Medical Research Council of South Africa	3	2,5%
South African Medical Research Council	3	2,5%
North-West University	3	2,5%
University of Witwatersrand	3	2,5%
AECI Ltd	2	1,7%
Number of assignments in top 10 assignees	**70**	
Total number of assignments	**119**	
Number of documents after filter	**72**	

The listing of AECI Ltd and the Medical Research Council of South Africa/South African Medical Research Council is for patent applications in which these entities were co-applicants/assignees with a university. The South African Medical Research Council and the Medical Research Council of South Africa are the same entity, but have been cited as two different entities owing to the information provided by the applicants to the patent offices during the patent application proceedings. North-West University is the "successor" in title to Potchefstroom University of Christian Higher Education (PUCHE) whose totals can also be combined.

Schedule II provides a summary of the top 10 assignees of patent applications filed during 1991 to 2005, and in particular for each of the years 2001 to 2005. It is interesting to note that PBMR, with patent applications covering the pebble bed technology, features prominently in the top 10 applicants/assignees by number, in the search period and for each of the years 2002 to 2005. PBMR also leads the list for patent applications published in 2005. This appears to be an indication of the impact of significant state and private funding to the development of this technology. Furthermore, it could be argued that one of the reasons for this prominence could be related to a more proactive intellectual property management strategy in this developing sector.

FIGURE 2: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority (4 576) of which 93 were filed by the CSIR, 72 by South African universities, 22 by Mintek and 13 by the MRC.

- **CSIR**
- **SA Universities**
- **Mintek**
- **MRC**

In Figure 2, of the 4 576 patent applications in the search period:

- 93 were in the name of the CSIR (blue),
- 72 from South African universities (yellow),
- 22 from Mintek (green), and
- 13 from the Medical Research Council (MRC) (red).

Thus, the research institutions (universities and science councils) accounted for 4,37% of all patent applications during this period at the three patent offices.

South African publicly funded institutions accounted for 4,37% of all patent applications claiming priority from a South African application at the USPTO, EPO and WO.

2.2 Top technology areas as represented by patent applications

The IPC classifies patent applications/patents into eight broad technology areas:

A – Human necessities;
B – Performing operations, transporting;
C – Chemistry and metallurgy;
D – Textiles, paper;
E – Fixed constructions;
F – Mechanical engineering, lighting, heating, weapons, blasting;
G – Physics; and
H – Electricity.

Table 5 (overleaf) summarises the top 10 IPC codes in respect of the patent applications in the search period.

TABLE 5: Basic report representing technology fields as represented by IPC codes, covered by the patent applications at the USPTO, EPO and WO, by applicants claiming priority from a South African patent application.

IPC code	Description of IPC subclass	Document count
B65D	Conveying; packaging; storing; handling thin or filamentary material	168
A61K	Preparations for medical, dental, or toilet purposes	161
G06F	Electric digital data processing	122
B01J	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	95
C07C	Acyclic or carbocyclic compounds	95
E04H	Buildings or like structures for particular purposes; swimming or splash baths or pools; masts; fencing; tents or canopies in general	95
A63B	Apparatus for physical training, gymnastics, swimming, climbing, or fencing, ball games, training equipment	93
C22B	Production or refining of metals	86
A61B	Diagnosis; surgery; identification	84
B01D	Physical or chemical processes or apparatus in general	76
Number of occurrences in top 10 patent classes		**1 075**
Total number of IPC subclasses		**4 576**
Number of documents after filter		**4 576**

25% of patent applications by South African universities are in A61K *(Preparations for medical, dental, or toilet purposes)* and C07K *(Organic chemistry)*.

A country's distribution of patents by technical area has proved to be a reliable indicator of its technological strengths, as well as an indicator of direction in product development.[3] Schedule III provides a summary of the top 10 IPC codes in the period 1991 to 2005 and also for each of the years 2001 to 2005. From Table 6 and Schedule III it is clear that classes D, F, and H are poorly represented, suggesting that South Africa does not have established research activities, strengths or competencies in technology areas represented by these classes. The complicating factors with respect to Class F are that inventions falling into this class, developed by state institutions such as Denel and Armscor, would not have been protected by way of patents. Even the ones protected by individuals would have been required to be kept a secret in terms of the Armaments Development and Production Act 57 of 1968 (see S79 and S80 of the South African Patents Act 57 of 1978, attached as Annexure A), with the result that no international patent applications would have been filed.

Table 6 represents the top 10 IPC codes in the applications arising from universities. A comparison of Tables 5 and 6 indicates that South African universities are only represented in the top 10 IPC codes in respect of patent application in A61K and C07C, with the top 25% of the applications being in the Medical, Dental and Toilet purposes (A61K) and Organic Chemistry (C07K) fields.

TABLE 6: Basic report representing fields covered by the patent applications that cite South African universities at the USPTO, EPO and WO.

IPC code	Description of IPC subclass	Document count
A61K	Preparations for medical, dental, or toilet purposes	9
C07K	Organic chemistry	9
C12N	Micro-organisms or enzymes; compositions thereof; propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media	6
G01N	Investigating or analysing materials by determining their chemical or physical properties	6
H01L	Semiconductor devices; electric solid state devices not otherwise provided for	5
H03K	Pulse technique	5
C07C	Acyclic or carbocyclic compounds	3
A61N	Electrotherapy; magnetotherapy; radiation therapy; ultrasound therapy	3
C01B	Non-metallic elements; compounds thereof	2
C07F	Acyclic, carbocyclic, or heterocyclic compounds containing elements other than carbon, hydrogen, halogen, oxygen, nitrogen, sulphur, selenium, or tellurium	2
Number of occurrences in top 10 patent classes		**49**
Total number of IPC subclasses		**72**
Number of documents after filter		**72**

Schedule IV also shows the IPC classes for each university's patent application portfolio as well as the new name of the university pursuant to the merger of higher education institutions in South Africa during 2004/5.

Most of the small number of applications emanating from South African universities are in class A61 *(Medical or Veterinary Science; Hygiene)* and C07 *(Organic Chemistry)*.

Of interest is the different focus areas for each of the universities, with the University of Cape

[3] *http://www.nsf.gov/statistics/seind00/access/c7/c7s3.htm*

Town's patent applications being predominantly in code C07K *(Peptides)*; the University of Pretoria in code C07C and C07F *(Organic Chemistry)* and code A61K *(Preparations for medical, dental, or toilet purposes)*; and the University of the Witwatersrand code A61K *(Preparations for medical, dental, or toilet purposes)*; the University of Johannesburg G *(Physics)* and H *(Electricity)*. North-West University has a wide portfolio, which includes the following codes: A61K *(Preparations for medical, dental, or toilet purposes)*; C *(Chemistry and Metallurgy)*, H03 *(Basic Electronic Circuitry)* and G *(Physics)*.

Table 7 shows the top 10 IPC codes for patent applications filed in the name of the CSIR. Of the CSIR applications, A61 *(Medical, Veterinary Science and Hygiene)* represents the largest number *(see A61K, A61B, A61F)*. Almost 20% of the patent applications filed by the CSIR during this period were in the Medical, Veterinary Science and Hygiene sector (class A61), while 10% were in the Physics area (G class). These therefore indicate the main research strengths of the CSIR, or where significant patent portfolios could be developed.

IPC code	Description of IPC subclass	Document count
A61K	Preparations for medical, dental, or toilet purposes	13
G01N	Investigating or analysing materials by determining their chemical or physical properties	7
C02F	Treatment of water, waste water, sewage, or sludge	5
B27K	Processes, apparatus or selection of substances for impregnating, staining, dyeing, bleaching of wood or similar materials, or treating of wood or similar materials with permeant liquids, not otherwise provided for; chemical or physical treatment of cork, cane, reed, straw or similar materials	4
B60B	Vehicle wheels; castors; axles; increasing wheel adhesion	4
A61B	Diagnosis; surgery; identification	3
G01S	Radio direction-finding; radio navigation; determining distance or velocity by use of radio waves; locating or presence-detecting by use of the reflection or reradiation of radio waves; analogous arrangements using other waves	3
H04N	Pictorial communication, e.g. television	3
A43B	Characteristic features of footwear; parts of footwear	2
A61F	Filters implantable into blood vessels; prostheses; orthopaedic, nursing or contraceptive devices; formentation; treatment or protection of eyes or ears; bandages, dressings or absorbent pads; first-aid kits	2
Number of occurrences in top 10 patent classes		**46**
Total number of IPC subclasses		**93**
Number of documents after filter		**93**

TABLE 7: Basic report representing fields covered by the patent applications that cite the CSIR at the USPTO, EPO and WO.

Table 8 summarises the top 10 IPC codes for Mintek patent applications. None of these overlaps with the top 10 IPC codes in respect of patent applications as shown in Table 5. This suggests a lack of critical numbers of patents or emergence of a potential distinct portfolio. As can be expected, at least half of Mintek's patent applications are in C22B *(Production or Refining of Metals)*.

At least half of Mintek's patent applications are in C22B *(Production or refining of metals)*.

IPC code	Description of IPC subclass	Document count
C22B	Production or refining of metals (making metallic powder or suspensions thereof B22F 9/00; electrolytic C25); pretreatment of raw materials	12
C22C	Alloys	4
B22F	Working metallic powder; manufacture of articles from metallic powder; making metallic powder	2
B01J	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	1
B04C	Apparatus using free vortex flow, e.g. cyclones	1
C22F	Changing the physical structure of non-ferrous metals or non-ferrous alloys	1
H01T	Spark gaps; overvoltage arresters using spark gaps; sparking plugs; corona devices; generating ions to be introduced into non-enclosed gases	1
Number of occurrences in top 10 patent classes		**22**
Total number of IPC subclasses		**22**
Number of documents after filter		**22**

TABLE 8: Basic report representing fields covered by the patent applications that cite Mintek as assignee, at the USPTO, EPO and WO.

Typically, the mining sector tends to develop technologies in-house and protects these technologies by way of trade secrets as opposed to patents as they are intended to service its operations. The prevailing sentiment within this sector is that applying for patent protection has little value as it is difficult to police infringement of patents within the sector. Other reasons that may also explain this low patent output could include the maturity of the mining sector, a low culture of patenting

in general or reasons not known to the authors of this report.

Table 9 summarises patent applications in the name of the MRC. These are predominantly in C07K, A61K, and C12N, indicating the historical technology strengths of the MRC. There are very few patent applications in the name of the MRC during the period under study. This could be attributed in part to the MRC's research and funding model: the bulk of the research undertaken under the auspices of the MRC is carried out by researchers at other publicly funded institutions, whose institutions then have the right to file patent applications in their own name. The MRC has recently reviewed its IP policy and it is expected that the number of patent applications in the name of the MRC should increase in the coming years.

TABLE 9: Basic report representing fields covered by the patent applications that cite the MRC as assignee, at the USPTO, EPO and WO.

IPC code	Description of IPC subclass	Document count
C07K	Organic chemistry	5
A61K	Preparations for medical, dental, or toilet purposes	4
C12N	Micro-organisms or enzymes; compositions thereof; propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media	2
A23L	Foods, foodstuffs, or non-alcoholic beverages, not covered by subclasses A23B to A23J; their preparation or treatment, e.g. cooking, modification of nutritive qualities, physical treatment; preservation of foods or foodstuffs, in general	1
G06F	Electric digital data processing	1
Number of occurrences in top 10 patent classes		**13**
Total number of IPC subclasses		**13**
Number of documents after filter		**13**

40% and 30% of MRC patent applications are in C07K *(Organic chemistry)* and A61K *(Preparations for medical, dental, or toilet purposes)*, respectively.

2.3 Patent application landscape for selected companies and organisations

The portfolio of the leading private sector players, namely Sasol and De Beers Group of Companies (which includes Element Six (Pty) Ltd, formerly De Beers Industrial Diamonds (Pty) Ltd), has been analysed to understand their patenting philosophy.

Figure 3 (overleaf) is a map which shows the distribution of patent applications which cite De Beers as the assignee.

FIGURE 3: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority (4 576) of which 150 cite De Beers Group of Companies, including Element Six (Pty) Ltd as assignee.

■ **De Beers, including Element Six (Pty) Ltd**

In total, there were 150 applications located among the 4 576 patent applications, being 3,28% of all patent applications in the period under review. The concentration of the patent applications in a particular part of the map is an indication of focused R&D activities and patenting strategy of R&D outputs by the De Beers Group, in support of its core business activities and competencies.

FIGURE 4: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority, which cite Sasol Group of Companies (red) as assignee.

■ **Sasol Group of Companies**

Figure 4 shows the distribution of the 171 patent applications, representing 3,74% of all patent applications located during the search period, that cite Sasol as applicant/assignee. Similar to the trend seen in Figure 3 for De Beers, patent applications which cite Sasol are concentrated in specific areas of the contour map. These can be mapped to Sasol's core business activities and

competencies and indicate focused patenting activity in support of Sasol's core business activities and competencies.

Tables 10 and 11 summarise the main IPC codes for patent applications filed by Sasol and De Beers respectively.

Figure 4 (read together with Table 10) shows that most of the patent applications filed by Sasol are in support of its core business activities in the chemicals and fuels area. It appears that Sasol adopts a portfolio approach in protecting IP related to its core business.

TABLE 10: Top 10 IPC codes for patent applications filed by Sasol at the USPTO, EPO, and WO with a ZA priority.

IPC code	Description of IPC subclass	Document count
C07C	Acyclic or carbocyclic compounds	41
B01J	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	39
C10G	Cracking hydrocarbon oils; production of liquid hydrocarbon mixtures, e.g. by destructive hydrogenation, oligomerisation, polymerisation	22
C08F	Macromolecular compounds obtained by reactions only involving carbon-to-carbon unsaturated bonds	18
C10L	Fuels not otherwise provided for natural gas; synthetic natural gas obtained by processes not covered by subclasses C10G, C10K; liquefied petroleum gas; adding materials to fuels or fires to reduce smoke or undesirable deposits or to facilitate soot removal; fire-lighters	15
C02F	Treatment of water, waste water, sewage, or sludge	5
B01D	Separation	4
C01C	Ammonia; cyanogen; compounds thereof	4
C06B	Explosive or thermic compositions (blasting F42D); manufacture thereof; use of single substances as explosives	4
B29C	Shaping or joining of plastics; shaping of substances in a plastic state, in general; after-treatment of the shaped products, e.g. repairing	2
Number of occurrences in top 10 patent classes		**154**
Total number of IPC subclasses		**171**
Number of documents after filter		**171**

Sasol and De Beers adopt a portfolio approach to patenting, in support of their core business.

Similar to Table 10 for Sasol, Table 11 clearly demonstrates an alignment of De Beers Group of Companies, including Element Six (Pty) Ltd, with its core business, in the area of mining technology and synthetic diamond manufacture and use of synthetic diamonds in applications such as rock drilling, grinding, and related tools, as exhibited also by Figure 3 above.

TABLE 11: Top 10 IPC codes for patent applications filed by De Beers/Element Six at the USPTO, EPO, and WO with a ZA priority.

IPC code	Description of IPC subclass	Document count
E21B	Earth or rock drilling; obtaining oil, gas, water, soluble or meltable materials or a slurry of minerals from wells	22
B24D	Tools for grinding, buffing, or sharpening	18
B01J	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	16
C22C	Alloys	10
B22F	Working metallic powder; manufacture of articles from metallic powder; making metallic powder	9
B23P	Other working of metal; combined operations; universal machine tools	9
C09K	Materials for miscellaneous applications, not provided for elsewhere	7
B03C	Magnetic or electrostatic separation of solid materials from solid materials or fluids; separation by high-voltage electric fields	6
C30B	Single-crystal growth; unidirectional solidification of eutectic material or unidirectional demixing of eutectoid material; refining by zone-melting of material; production of a homogeneous polycrystalline material with defined structure; single crystals or homogeneous polycrystalline material with defined structure; after-treatment of single crystals or a homogeneous polycrystalline material with defined structure; apparatus therefor	6
B23B	Turning; boring	4
Number of occurrences in top 10 patent classes		**107**
Total number of IPC subclasses		**150**
Number of documents after filter		**150**

2.4 Comparative analysis of the patent applications of two private companies and the CSIR

Figure 5 shows a very diverse portfolio of applications for the CSIR, with Sasol and PBMR's portfolio of patent applications being concentrated in main areas of their respective core businesses.

FIGURE 5: South African Patent Landscape – Patent Applications at USPTO, EPO, and WO with ZA priority (4 576) of which 93 were filed by the CSIR, 171 Sasol, and 35 by the PBMR. This map was generated from a full text of the patent application document analysis.

CSIR
Sasol
PBMR

The diversity of the CSIR's portfolio is not surprising as the CSIR comprises a number of business units engaged in research in different technological areas, although there is a slight concentration of patent applications in the top left and right of the map. What is surprising is that there is not a single distinct focus area that represents a strong intellectual property base for the CSIR. As the protection of R&D outcomes by way of patents is a notable first step towards commercialisation, the lack of a critical mass of patents in the various research areas or activities could have the effect of not getting tangible outcomes of these research areas and activities which could benefit the nation at large. This applies to the HEIs as well. Policy makers should question whether public sector institutions should prioritise the development of specific and focused technology areas, which are aligned with some of the national strategies, such as the Biotechnology Strategy, and regional development strategies. Such a concentration of R&D efforts would foster the development of intellectual property portfolios in areas of national interest, thereby increasing South African innovations over time.

The same argument applies when one looks at the patent portfolios for HEIs and other science councils, such as the MRC and Mintek. Ideally, patent landscape analysis of the public sector should show alignment between research areas (as evidenced by patent outputs) to national strategies (as set out in the different policy documents). For example, an analysis should be carried out every five years for patenting activity in Biotechnology, ICT, Nanotechnology, based on related strategies, to assess outcomes and potential impact of the research activities.

The number of times a patent has been cited may be an indication of its technological significance.

2.5 Citation Analysis

An analysis of citations of patent applications originating from South Africa has also been carried out. A citation can either be a backward citation (where the relevant prior art has been cited as being relevant to an invention) or a forward citation (where during the process of searching and examining third-party patents, the searcher or examiner identifies the patent in issue as being relevant in assessing the novelty and/or inventiveness of the third-party patents). The number of times that patents cite other (typically third-party) patents can be used as a proxy for the importance and significance of that patent in the relevant technology area. According to Trajtenberg[4], '*During the examination process, the examiner searches the pertinent portion of the "classified" patent filed. His purpose is to identify any prior disclosures of technology … which might anticipate the claimed invention and preclude the issuance of a patent; which might be similar to the claimed invention and limit the scope of patent protection …; or which, generally, reveal the state of the technology to which the invention is directed … Thus, the number of times a patent document is cited may be a measure of its technological significance.*'

The number of citations can also be indicative of value, and could also potentially assist in unlocking value in a patent portfolio. This would be the case where the patent that is cited in third-party patent applications and patents, covers the underlying technology, with the citing patent typically being an improvement or development over the cited patent, such that a closer analysis of the two patents suggests the existence of a licensing opportunity for the cited patent.

Table 12 lists the top 10 forward citations of patent applications filed at the USPTO, EPO, and WO in the search period. As can be seen, the CSIR is the only South African publicly funded institution with patent applications featuring in the top 10 list. A closer look at these most cited patent applications from the CSIR, namely EP0494114 and EP0585132, shows that they were filed in 1992 and 1993, respectively. The analysis also revealed that the patent application EP0615285 was originally filed in the name of the CSIR and then later assigned to British Technology Group (Pty) Ltd (BTG) (in 1996). EP0494114 and EP0585132 have also since been assigned to BTG. The fact that these patent applications were assigned to BTG, a foreign entity, could indicate a lack of support, or a lack of required investment capital, for the further development and/or commercialisation of South African technologies. For completeness, abstracts of both of these patent applications are provided in Annexure B.

TABLE 12: Top forward citations of patent applications filed at the USPTO, EPO, and WO claiming priority from a South African application.

Document ID	Assignee	Cited by
EP0698987	Alcatel N.V.	70
EP0494114	CSIR	68
EP0421808	Mansvelt, André Peter	64
EP0615285	British Technology Group Ltd	57
EP0585132	CSIR	53
EP0609079	Sasol Chemical Industries (Pty) Ltd	51
EP0459781	Nanoteq (Pty) Ltd	43
WO970521	Sastech (Pty) Ltd	41
WO9847112	Stratex/Paradigm (UK) Ltd	38
EP0439410	Jakovljevic, Branimir	35
Number of citations in top 10 documents		**520**
Total number of citations		**3 735**
Number of documents after filter		**4 576**
Total number of documents in group		**4 576**

Table 13 (overleaf) shows the frequency of citations of patent applications, i.e. the highest citations per year. As can be seen, EP0494114, originating from the CSIR, is the highest ranked patent application based on frequency of citations, with EP0585132, being the third ranked.

[4] *Jaffe A B and Trajtenberg M; Patents, Citations and Innovations; The MIT Press, 2002.*

WO9701521, EP0609079, EP0921184, WO9901485, WO0020535, and WO0060029 cite Sasol as the applicant/assignee. Other than the patent applications originating from the CSIR, no other publicly funded institution has patent applications in the top 10 most frequent citations.

Document ID	Title	Year issued	Cited by	Average cites by year
EP0494114	Electronic identification system	1992	68	5,0
WO9701521	Process for producing oxygenated products	1997	41	4,5
EP0585132	Synchronised electronic identification system	1994	53	4,4
EP0609079	Process for producing liquid and optionally gaseous products from gaseous reactants	1994	51	4,4
EP0921184	Production of lubricant base oils	1999	28	4,2
WO0020535	Process for producing middle distillates and middle distillates produced by that process	2000	20	3,4
EP0598624	Detection of multiple articles	1994	25	2,1
WO0060029	Process for producing synthetic NAPHTHA Fuel and synthetic NAPHTHA Fuel produced by that process	2000	8	1,5
WO9624623	Propylene Pentene-1 Copolymers, method of preparation thereof and composition containing them	1996	14	1,5
WO9901485	Gas-phase polymerisation process for producing Propylene Pentene-1 Copolymers	1999	10	1,4
Number of citations in top 10 documents			**318**	

TABLE 13: Frequency of citation of the top 10 forward citations of patent applications filed at the USPTO, EPO, and WO, claiming priority from South African applications.

Figure 6 illustrates a forward citation tree for WO0020535 (from Table 13), with the citing patents being shown by different colours for different citing assignees/applicants. This citation tree has been truncated at a depth level of four. From Figure 7(a) and 7(b), it can be seen that WO0020535 is cited by Exxon Mobil, Shell, the United States Government, Chevron, Volkswagen, Daimler Chrysler, and Sasol itself. WO0020535 is directed to a process for producing middle distillates and middle distillates produced by that process. For completeness, the published abstract is provided in Annexure B.

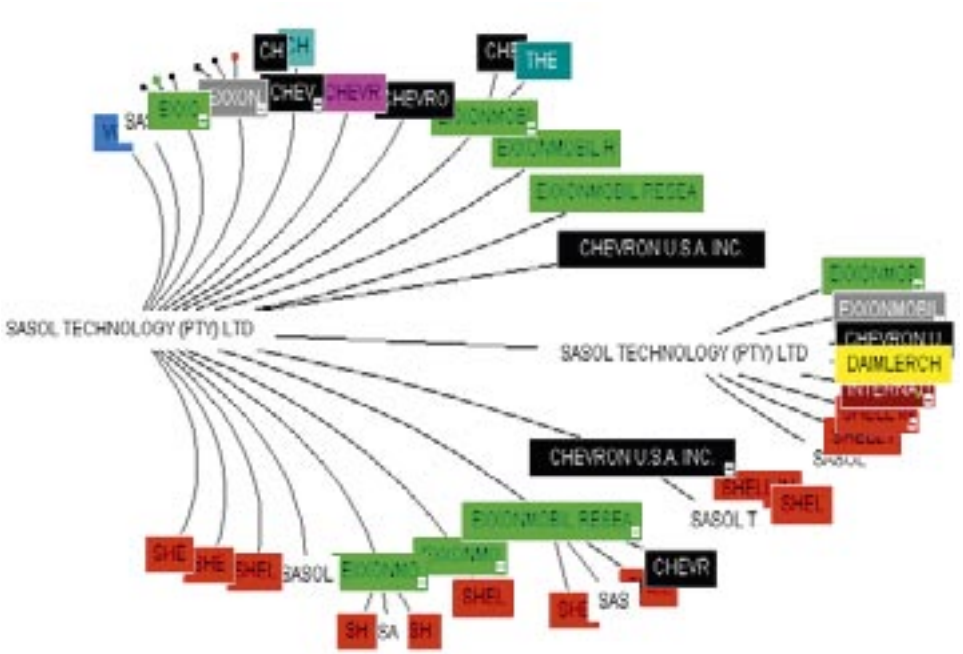


FIGURE 6: Forward citation of WO0020535 in the name of Sasol to a depth level of four, with different colours indicating different citing assignees/applicants.

Figure 7(a) illustrates a forward citation tree for EP0494114 from Table 13 with the citing patents being shown by different colours for different citing assignees/applicants. This citation tree has been truncated at a depth level of three as that was sufficient to illustrate the extent of citation. A full citation analysis of EP0494114 revealed that a total of 5 944 patent applications/patents cite it; of these, 61 patents/applications directly cite it, with the balance being linked to the 61, and hence

indirectly cite EP0494114. From the citation tree in Figure 7(a), it can be seen that EP0494114, which has since been assigned to BTG, is cited by numerous players in the electronics sector, including Motorola, Sharp, Sony Corporation, BTG, Xerox Corporation, Fujitsu, 3M Innovation, NCR, Hewlett-Packard, Accenture, etc.

Figure 7(b) shows a citation tree of US5726630 which was also assigned to BTG by the CSIR. Both EP0494114 and US5726630 cover RFID technology. The extent to which both these patents have been cited is a clear indication that they covered valuable technologies, and could have become a source of possible licence revenue for the CSIR. As we do not understand the circumstances under which they were assigned to BTG, and the extent to which BTG has used them to extract value, we are unable to comment further on their significance and impact. However, the extent to which they have been cited indicates that they are probably among the most significant patent applications that have originated not only from a publicly funded institution but from South Africa in general.

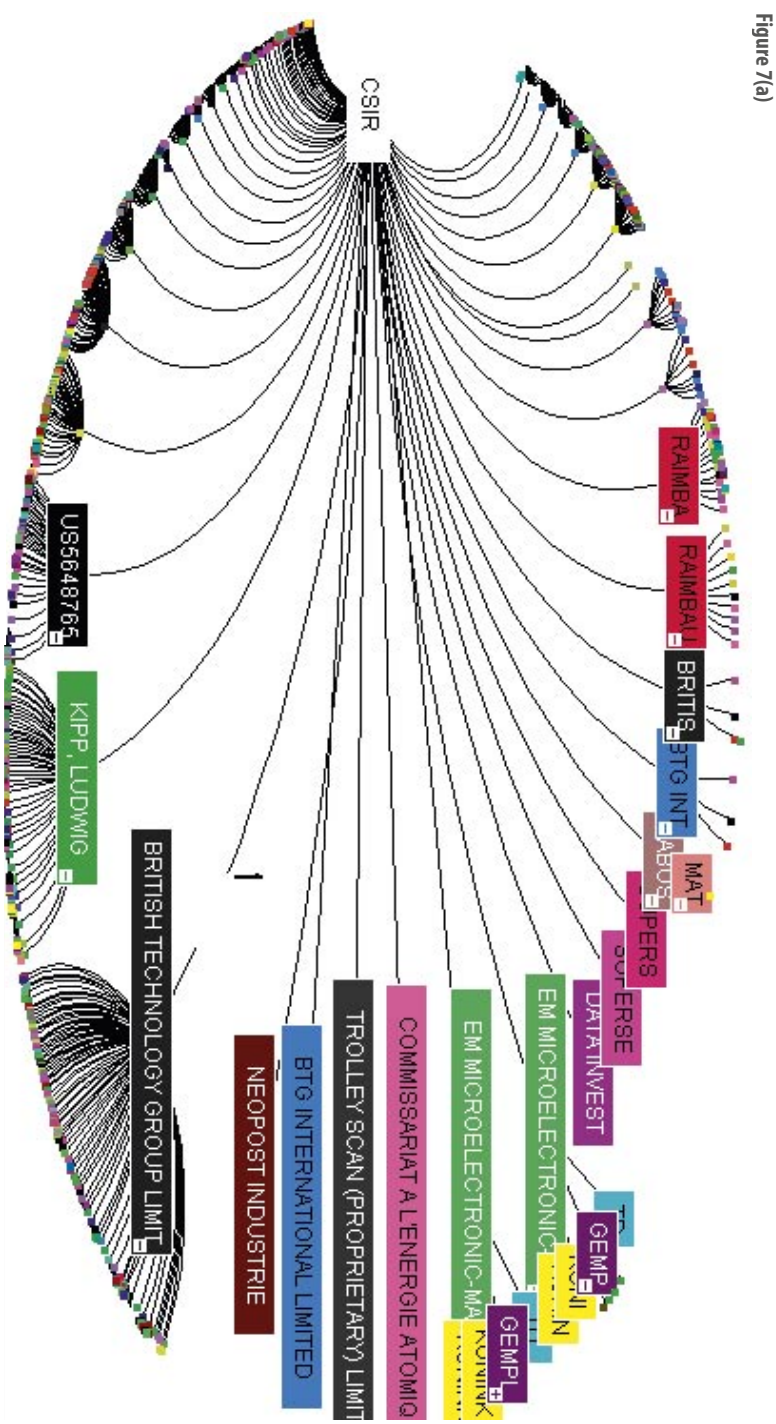
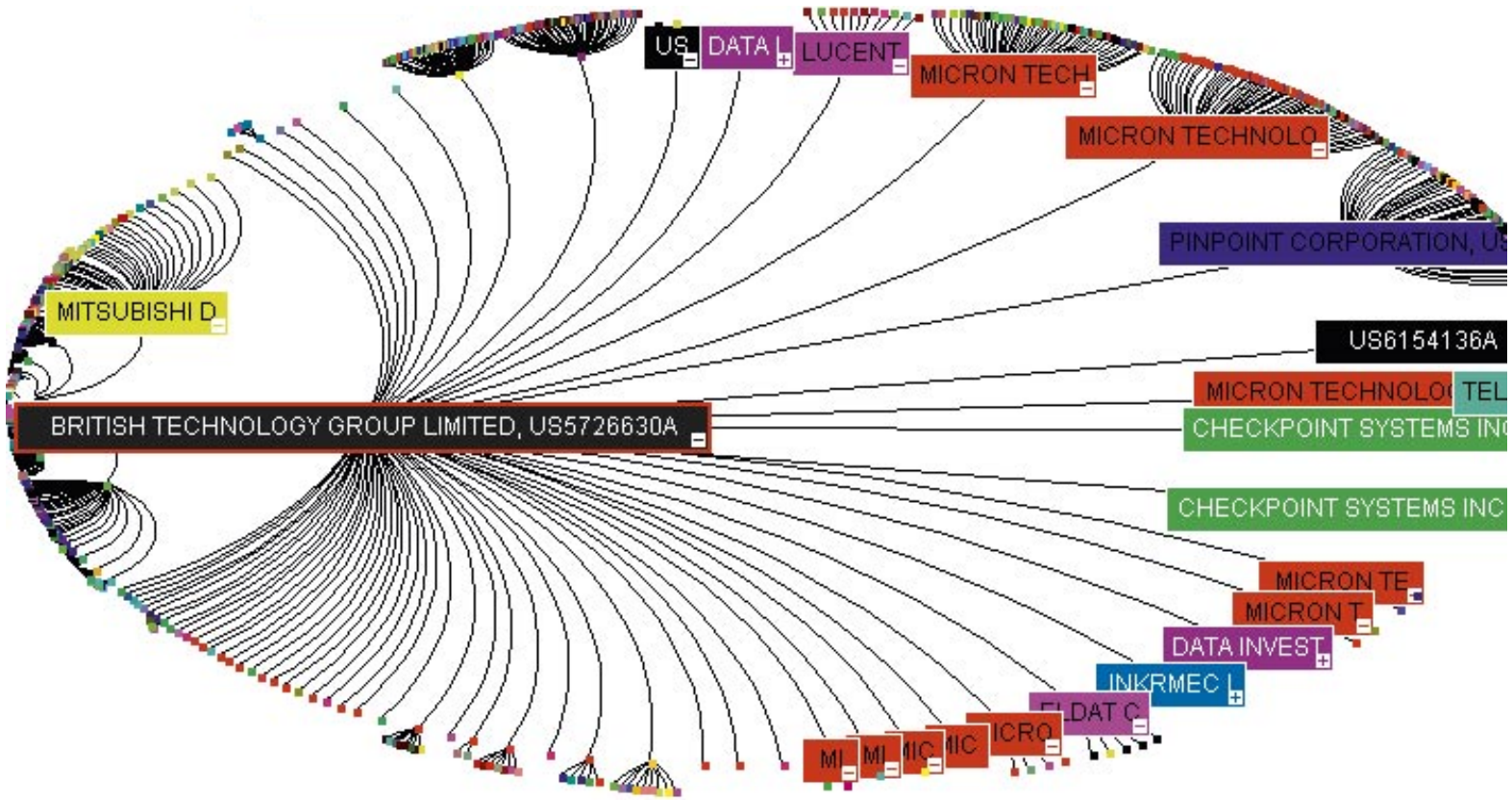


FIGURE 7: Forward citation of
(a) EP0494114 to depth level of three;
(b) US5726630 (shown as 1 in the first citation tree) to a depth level of two,
with different colours indicating different citing assignees/applicants.

Figure 7(b)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PART 3

South African patent landscape as illustrated by patents granted by USPTO and EPO

3.1 Introduction

Searches were conducted for patents that claim priority from a South African patent application granted by the USPTO and the EPO from January 1991 to 26 September 2005. The WO records were excluded as WO is not a patent issuing or granting office.

Figure 8 represents a map of the 2 051 patents issued or granted to South Africans by the USPTO and the EPO during the period of study, showing the main technology areas covered by these patents.

FIGURE 8: Map representing 2 051 patents claiming priority from South African patent application, granted at the USPTO and EPO.

Since 2003, Sasol and Element Six have each had at least four USPTO/ EPO patents granted per year.

Of the patents granted during this period, 1 367 were granted by the USPTO (approximately 100 patents per year), and 684 by the EPO (approximately 50 per year), as shown in Table 14. The

USPTO granted more patents to South African nationals during the search period, which is the opposite in respect of applications published in the same period, the anomaly being attributed to the USPTO applications that were not published prior to 15 March 2001.

Since 2001, the number of patents granted by the EPO has increased, and the number of patents granted by the USPTO has decreased. The exception is in 2005, where patents granted by the USPTO appear to have increased compared to the EPO in the previous year (see Schedule V).

Publishing Organisation	Document count	Percentage
USPTO	1 367	66,7%
EPO	684	33,3%
Total number of documents in group	**2 051**	

TABLE 14: Summary of patents granted at the USPTO and EPO from applications claiming priority from a South African application.

Source document list: South African Patent Landscape US EP granted.

Table 15 is a list of the top 10 applicants/assignees in respect of the 2 051 granted patents. The assignees are essentially the same as those mentioned in Table 2, with the addition of Mintek, another science council. The CSIR (including Technology Finance Corporation (Pty) Ltd, a subsidiary of the CSIR, established in terms of the Inventions Development Act 31 of 1962) and Mintek are the leading publicly funded institutions in respect of patents granted by the USPTO and the EPO during the search period. A more comprehensive breakdown of assignees per year is provided in Schedule VI, which shows the emergence of Sasol and Element Six as being the most prolific companies in respect of patents granted to South Africans. Sasol and Element Six have been the top two assignees in each of the years 2003 to 2005, each having at least four granted patents per year. Up until 2004, the CSIR is featured in the top 10 assignees, as can be seen from both Table 15 and Schedule VI.

There are no South African higher education institutions featured in the top 10. However, 12 patents, in total, were granted to South African universities during this period. Abstracts of the 12 patents granted to South African universities are provided in Schedule VII.

Assignee	Document count	Percentage
None	485	22,6%
De Beers Industrial Diamond Division (Pty) Ltd	78	3,6%
CSIR	53	2,5%
Sasol Technology (Pty) Ltd	38	1,8%
Circuit Breaker Industries Ltd	26	1,2%
Windsor Technologies Ltd	22	1,0%
Technology Finance Corporation (Pty) Ltd	21	1,0%
Mintek	17	0,8%
Implico B.V.	16	0,7%
Atomic Energy Corporation of South Africa Ltd	14	0,7%
Number of assignments in top 10 assignees	**770**	
Total number of assignments	**2 148**	
Number of documents after filter	**2 051**	
Total number of documents in group	**2 051**	

TABLE 15: Basic report representing top assignees, of patents granted by the USPTO and EPO claiming priority from a South African application.

Source document list: South African Patent Landscape US EP granted.

Over a 15-year period, only 12 patents were granted by USPTO/ EPO to South African HEIs.

3.2 Top technology areas as represented by granted patents

The top 10 IPC classes of the 2 051 issued patents mapped out in Figure 8 are summarised in Table 16.

A comparison of Table 16 with Table 5, which summarises the top 10 IPC classes in respect of patent applications published in the same period by the USPTO, WO and the EPO, reveals that the following IPC codes were not featured in Table 5: A61F *(Filters implantable into blood vessels; prostheses; devices providing patency to, or preventing collapsing of, turbular structures of the body, (e.g. stents; orthopaedics, nursing or contraceptive devices; formentation; treatment or protection of eyes or ears; bandages, dressings or absorbent pads; first-aid kits);* B24D *(Tools for grinding, buffing, or shaping),* B65G *(Transport or storage devices)*, and C02F *(water treatment, waste water, sewage, or Sludge)*. Thus, despite the most applications being filed in classes set out in Table 5, most patents were granted in the classes set out in Table 16, which should indicate the main areas of strength for South Africa in respect of potential trading or competitiveness on the global stage.

Schedule VIII provides a more comprehensive summary of the top 10 IPC codes in respect of patents granted at the USPTO and EPO, based on a South African priority filing, for each of the years 2001 to 2005. As can be seen from Schedule VIII, patents in C07C *(Acyclic or Carbocyclic Compounds)* increased from being ranked fifth in 2001 and 2002, to being the top IPC code in 2005. This can be attributed to patenting activity by Sasol. There has also been an emergence of patents in C22B *(Production or refining of metals; pretreatment of raw materials)*, which may be linked to the recent emphasis on beneficiation within the mining and minerals sector.

TABLE 16: Basic report representing fields covered by the patents granted at the USPTO and EPO to applicants claiming priority from a South African application.

IPC code	Description of IPC subclass	Document count
B01D	Physical or chemical processes or apparatus in general	68
B65D	Conveying; packaging; storing; handling thin or filamentary material	57
A61K	Preparations for medical, dental, or toilet purposes	56
E04H	Buildings or like structures for particular purposes; swimming or splash baths or pools; masts; fencing; tents or canopies in general	54
B01J	Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus	49
C07C	Acyclic or carbocyclic compounds	43
B24D	Tools for grinding, buffing, or sharpening	39
A61F	Filters implantable into blood vessels; prostheses; devices providing patency to, or preventing collapsing of, turbular structures of the body, e.g. stents; orthopaedics, nursing or contraceptive devices; formentation; treatment or protection of eyes or ears; bandages, dressings or absorbent pads; first-aid kits	35
B65G	Transport or storage devices	35
C02F	Water treatment, waste water, sewage, or sludge	33
Number of occurrences in top 10 patent classes		**469**
Total number of IPC subclasses		**2 051**
Total number of documents		**2 051**

There also appears to be a sizeable patent portfolio in A61 *(Medical or Veterinary Science; Hygiene)* comprising A61K *(Medical devices)*, A61F *(Filters implantable into blood vessels; Prostheses; Orthopaedic, nursing or contraceptive devices; Formentation; Treatment or protection of eyes or ears; Bandages, dressings or absorbent pads; First-aid kits)* and A61M *(Devices for introducing media into, or onto, the body)*. Of particular interest is the fact that IPC codes D *(Textiles and paper)*, F *(Mechanical Engineering; Lighting; Heating; Weapons; Blasting)*, G *(Physics)* and H *(Electricity)* are not featured in the top 10 list.

Figure 9 (overleaf) represents the same map of Figure 8, but with a distribution of the patents by selected applicants/assignees.

FIGURE 9: A map of the 2 051 patents granted at the USPTO and EPO showing distribution thereof by named applicants, claiming priority from South African patent application.

- **Sasol (73)**
- **CSIR (55)**
- **Element Six and De Beers (101)**
- **Mintek (17)**
- **MRC (4)**
- **NECSA (3)**
- **Universities (12)**

As can be seen from Figure 9 and Table 15, Sasol and Element Six/De Beers are the leading private sector companies with significant patent portfolios granted by the USPTO and EPO. Windsor Technologies Group is another private company with a patent portfolio of note.

A search through the company registration office records at CIPRO for Windsor Technologies Group did not reveal any records. From an analysis of the patents in the name of Windsor Technologies Limited, it appears that this company is incorporated in Nassau, Bahamas, by what appears to be one serial inventor, a Michael Windsor Symons who is a resident of South Africa according to the records. The other company that features in the top 10 list of assignees is Implico, which appears to have been incorporated in Amsterdam in the Netherlands. We understand that Implico was incorporated by the CSIR as an off-shore IP holding vehicle.

3.3 Citation analysis in respect of granted patents

TABLE 17: Top 10 forward citations of patents granted at the USPTO and EPO from patent applications claiming priority from a South African application.

Document ID	Assignee	Cited by
US5144660	None	101
US5586937	None	94
US5007207	None	93
US5566441	British Technology Group Ltd	91
US5519381	British Technology Group Ltd	72
US5214410	CSIR	69
US5726630	British Technology Group Ltd	65
US5316877	Technology Finance Corporation (Pty) Ltd	61
EP0494114	British Technology Group Ltd	60
US5537105	British Technology Group Ltd	54
Number of citations in top 10 documents		**760**
Total number of citations		**8 142**
Number of documents after filter		**2 051**
Total number of documents in group		**2 051**

Table 17 shows the most cited USPTO/EPO patents which claim priority from a South African patent application, in the search period. Other than the first three patents, the remaining patents in Table 17 were originally filed in the name of the CSIR and have since been assigned to BTG. US5144660 is directed to an invention for securing a computer against undesired write operations to, or read operations from, a mass storage device, and is in the name of one Anthony M Rose. This patent, which lapsed in 1996 due to non-payment of renewal fees, has been cited 101 times. According to the published abstract for US5144660, this patent was directed to *'a method of protecting a computer against "trojan" or "virus" programs, wherein a device is connected in the bus between the disk controller card and the disk drive of the computer. The device monitors the bus and alerts the user when any illegitimate write attempts to a protected area of the disk is detected'.*

TABLE 18: Average number of forward citations per year of the highest forward cited patents granted at the USPTO and EPO, which claim priority from a South African application.

Document ID	Title	Year issued	Cited by	Average cites by year
US5586937	Interactive, computerised gaming system with remote terminals	1996	94	10,2
US5566441	Attaching an electronic circuit to a substrate	1996	91	9,7
US5726630	Detection of multiple articles	1998	65	8,1
US6175217	Hybrid generator apparatus	2001	41	7,9
US5144660	Securing a computer against undesired write operations to, or read operations from, a mass storage device	1992	101	7,5
US5519381	Detection of multiple articles	1996	72	7,3
EP0494114	Electronic identification system	1996	60	6,4
US5007207	Abrasive product	1991	93	6,2
EP0609079	Process for producing liquid and optionally gaseous products from gaseous reactants	1998	45	5,9
EP0585132	Synchronised electronic identification system	1998	44	5,9
Number of occurrences in top 10 patent classes			**706**	
Total number of IPC subclasses			**2 051**	
Total number of documents			**2 051**	

In Table 18, the following patents, which were originally in the name of the CSIR, are featured in the top 10 list of the highest average citations per year: EP0494114, EP0585132, US5519381, US5726630, and US05566441. EP060909079 and US5007207 belong to Sasol and Element Six/De Beers, respectively. The remaining patents appear to belong to individuals.

The most cited patent emanating from South African universities, is US5994720 (the University of Pretoria), which has five direct citations. US5994720 is directed to an optoelectronic device formed in a chip of an indirect bandgap semiconductor material such as silicon, and the published

abstract of this patent is provided in Annexure B.

The citation tree for US5994720 is provided in Figure 10, which shows that this patent has been cited by patents from Intel Corporation and Mitsubishi, to name two. Mapping out of the claims of this patent with the claims of the patents that cite it, could provide an indication of the degree of overlap of the patents. A high degree of overlap could potentially provide an opportunity for licensing discussions for the patentee/assignee with the patentees/assignees of the forward cited patents.

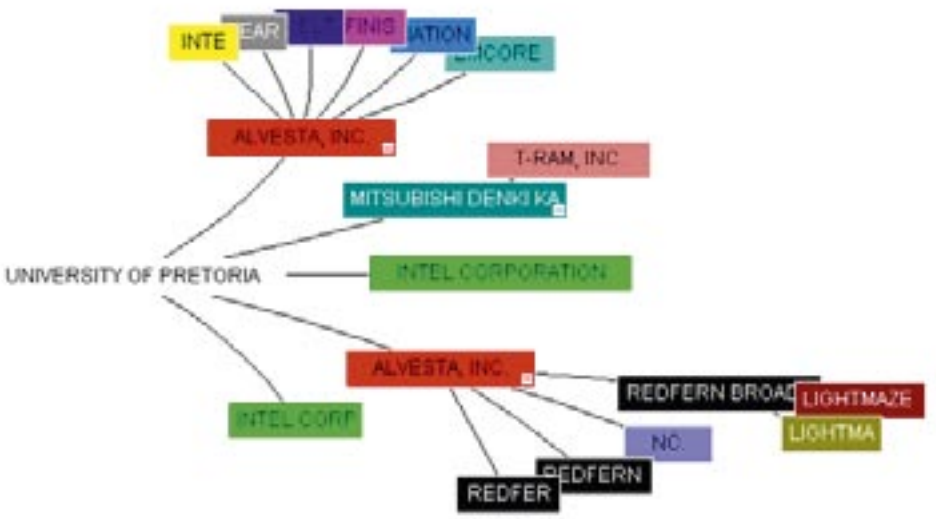


FIGURE 10: Full forward citation tree for US5994720 in the name of the University of Pretoria.

US5559036 (CSIR/North-West University) is the other patent in the name of a South African university that has forward citations, being cited twice. US5559036 is cited by two applications/ patents in the name of Skis Rossignol S.A. Patent number US5559036 is directed to a method and apparatus for the preliminary detection of abnormal levels of metabolites in the urine of a human or mammal. For completeness, the published abstract of US5559036 is provided in Annexure B.

PART 4

South African patent landscape as illustrated by patenting activity at the South African Patenting Office (CIPRO)

4.1 Patenting activity

An analysis of the patent data at CIPRO has also been conducted for the period 1998 to 2005.

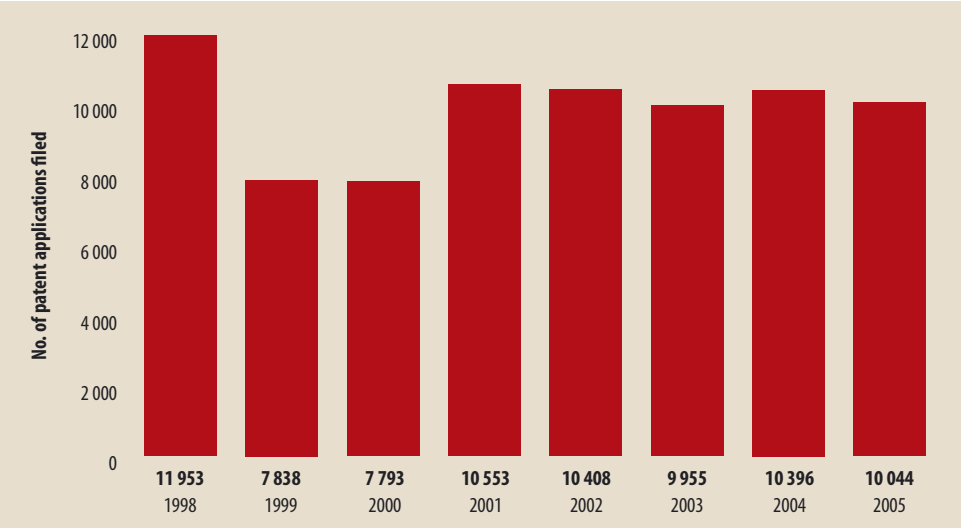


FIGURE 11: Total number of patent applications filed at the South African Patent Office.

Figure 11 illustrates the number of patent applications (provisional and complete) filed at CIPRO from 1998 to 2005. The data does not distinguish between provisional and complete patent applications. In future reports, an attempt will be made to provide details of patent registration certificates issued per year to show the number of patents granted by CIPRO annually.

On average since 1998, 10 000 patent applications are filed at the South African patent office each year.

In general, since 1998, the patent applications filed at the South African Patent Office on an annual basis have not exceeded 12 000 in number, or 272 applications per million population. In the period under review, the highest number of applications were received in 1998. In the subsequent year the number of patent applications dropped by a third, and thereafter the filing statistics have been fairly constant. The drop could be attributed to South Africa becoming part of the PCT system in March 1999.

Prior to March 1999, foreign applicants who wanted to obtain final patent protection for their inventions in South Africa had to file a patent application directly at CIPRO at the end of the

12-month convention period. After March 1999, foreign applicants could designate South Africa in their PCT patent application, leaving the final decision to be made 18 months later. The effect of this has been to delay the filing of a South African application by foreign applicants for the period provided under the PCT (i.e. initially a further eight months under PCT Phase I (where no demand for examination had been filed), and a further 18 months under PCT Phase II (where a demand for examination had been filed)). This is evident from the increase in the number of patent applications filed at CIPRO in 2001.

CIPRO is a non-examining office or deposit system office. This means that as long as patent application formalities have been complied with, a patent will be granted from an application accompanied by a complete specification. Determination of novelty and obviousness is left to the courts to decide, typically during patent litigation (infringement or revocation proceedings). Furthermore, the cost of obtaining a patent in South Africa is relatively low compared to most developing and developed countries. With patent filing costs in South Africa not being a constraint, increases in patent filings in the past few years were anticipated, in line with dramatic increases in patent filing at the WIPO and USPTO offices, which represent global technology development trends. Thus, a lack of increase in the number of patent applications filed at CIPRO can be attributed to one or more of the following reasons:

- a stagnant innovation system;
- a decline in research output within the Science and Technology sector;
- a perception that a non-examining or deposit system is not adequate for effective protection of IPRs;
- low IPR awareness; and
- the costs of filing complete patent applications being prohibitive to a large part of the population, considering that such costs are typically no less than R10 000.

It could also be argued that **the dti**'s strategy of combining the Patent Office into CIPRO has not been implemented to the benefit of the patent system, with the result that the profile of patenting and departmental prioritisation in this regard has been on the decline. What is clear is that there is a need to build capacity within the country, and in particular within CIPRO, to effectively support and promote patenting activities.

Patenting at the South African Patent Office has remained fairly stagnant since 2001.

FIGURE 12: Total number of patent applications filed at CIPRO in the period 2000 to 2002 and relative distribution of those applications by nationality of applicant.

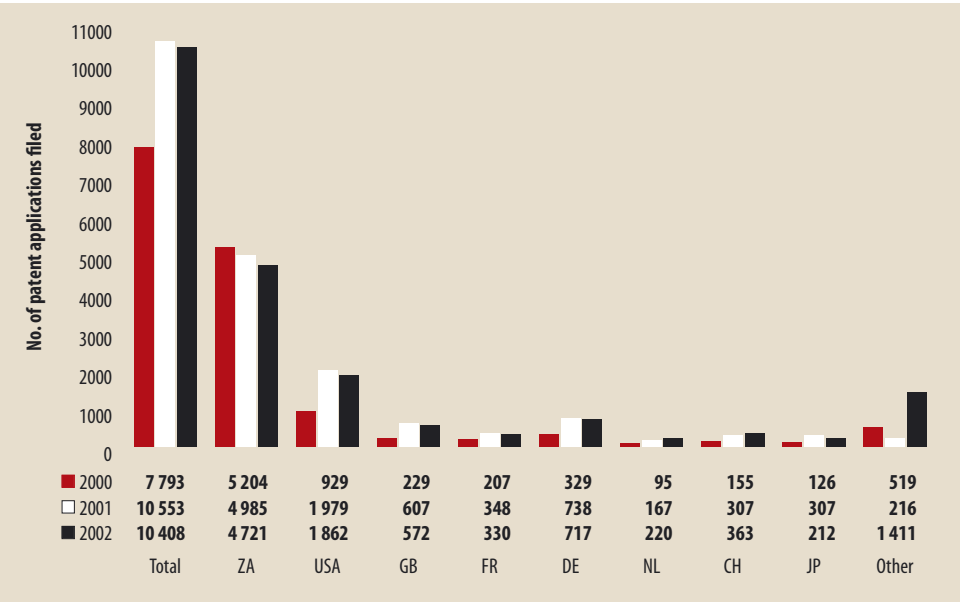


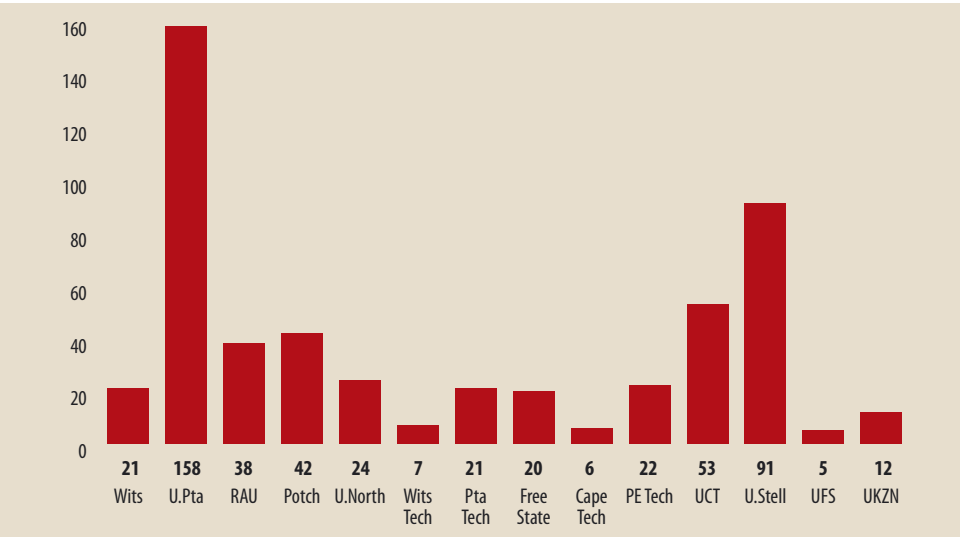
Figure 12 shows the patent applications filed at CIPRO from 2000 to 2002, together with a distribution in respect of the nationality of the applicants[5]. As can be seen from Figure 12, at least 50% of the patent applications filed at CIPRO in this period were filed by foreign nationals, with the biggest contributors being USA and German nationals.

At least 50% of patenting activity in South Africa is by foreign nationals, largely USA- and German-based.

Unfortunately it was not possible to obtain details on the foreign companies filing in South Africa, although indications from studying the records are that the largest foreign applicants at CIPRO are in the pharmaceutical sector. In the USA, about 45% of the patents granted by the USPTO are to foreigners[6]. Thus, CIPRO is presently characterised by being an inbound patenting office for foreigners, which shows that some foreigners view their inventions as being commercially viable in South Africa. The other way to look at this is that at present South Africa is probably a big importer of technology and exports far less than what it imports. The unavoidable consequence of foreigners dominating patent filings locally is South Africans being forced to take up licences from these foreign companies, which would have the effect of low net-licensing income.

4.2 Patenting activity of publicly funded institutions

FIGURE 13: CIPRO Patent Register entries citing higher education institutions in the period 1981 to 2004.



[5] *Data courtesy of the South African Patent Office (CIPRO).*

[6] *http://nsf.gov/statistics/seind02/c6s4.htm#c6s413*

Figures 13 and 14 show the total number of patent applications in the patent register at CIPRO, attributable to higher education institutions and science councils, respectively, in the period 1981 to 2004.

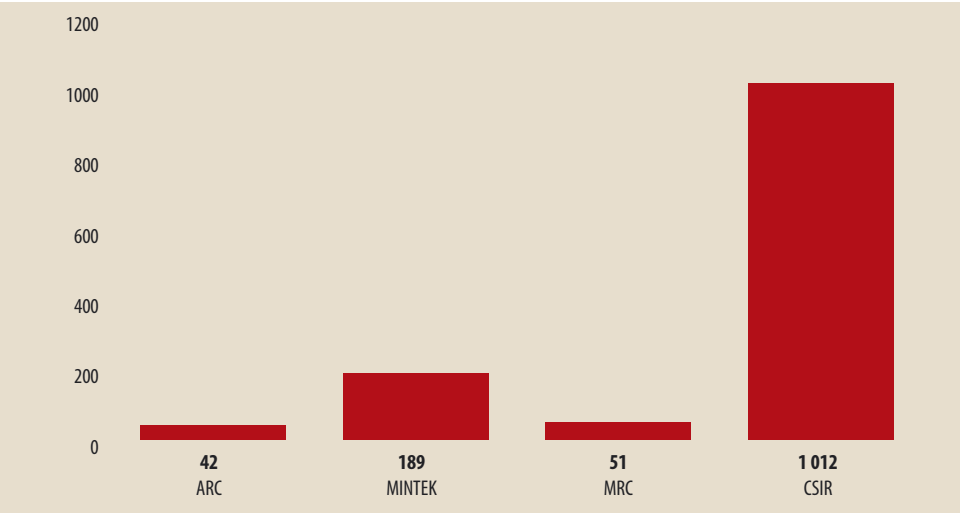


FIGURE 14: CIPRO Patent applications citing science councils in the period 1981 to 2004.

As can be seen in Figure 13, in this period a total of 520 applications were recorded, which equates to 23 applications per year. Given that the applications include both provisional and complete patent applications, this represents a very low patenting rate in respect of South Africa's publicly funded institutions.

In 2004/5, the Innovation Fund launched the Patent Support Fund to provide wholesale subsidies to institutions for costs incurred for patents/applications, which cite the institution as the applicant/assignee. Furthermore, a Patent Incentive Fund was put in place to incentivise researchers at publicly funded institutions to file patent applications and prosecute them to grant, at least at the South African Patent Office. A review of the effect of these two instruments on patenting activity in the country, and also the contribution thereto by publicly funded institutions, will be released as a separate report before the end of 2007.

Referring to Figure 14 in particular, the high patent applications in respect of the CSIR can also be attributed to a strong institutional IP policy on inventions emanating from research undertaken at the CSIR. The low numbers for the MRC can be attributed to the fact that the MRC's funding model and IP policy has in the past, to a large extent, relied on the institutions that it funds owning the IPR emanating from the funded research.

From the above analysis, it is quite clear that CIPRO is indeed a small office. The cost of filing patent applications at CIPRO, in particular provisional patent applications, is inexpensive as compared to most other coutries. Therefore there is an opportunity to utilise this office to obtain priority filings for global-based technologies, such as computer-implemented inventions and business method inventions. Furthermore, the relatively small size of CIPRO, which does not have a substantive examination system, offers an opportunity to introduce selective examination of patents in identified areas as a means of migrating to a fully examining system. In this regard, the authors are of the view that an area such as Biotechnology may be a good start to introduce patent application examinations, with CIPRO working with offices such as the EPO, JPO, and USPTO to carry out the examination whilst using these offices to develop its own capacity in this area.

PART 5

Discussions and conclusion

The analysis of the South African patent landscape reveals a small number of patent applications are filed originating from South Africa in the area of Biotechnology. Thus, there is potential to support commercial-isation of associated technologies by boosting the patent applications in this area.

South Africa's strengths lie in the areas defined by the top three IPC codes, namely B65D *(Conveying, packaging, storing, handling thin or filamentary material)*, A61K *(Preparations for medical, dental, or toilet purposes)* and G06F *(Electric digital data processing)*. An analysis of annual data since 2001 shows an increasing number of patent applications being filed in the following classes: G06F *(Electric digital data processing)*, C07C *(Acyclic or carbocyclic compounds)* and B01J *(Chemical or physical processes, e.g. catalysis, colloid chemistry; their relevant apparatus)*. A further analysis of the patent applications filed from 2004 to 2005 should provide key information as to the real contributors of these emerging fields, some of which have been identified in some parts of this report.

From an analysis of the top IPC codes for patent applications and patents emanating from universities, it would appear that potential strengths lie in the medical and electronics sectors.

Biotechnology is defined through the IPC system as comprising the IPC codes listed in Schedule IX to this report. A review of Schedule IV using the IPC codes for Biotechnology provided in Schedule IX, shows that at least 18 of the patent applications emanating from South African universities from January 1991 to September 2005, (i.e. 27% of the 67 applications), fall within the classification of Biotechnology. From this analysis, it can be concluded that there is potential for developing a strong Biotechnology sector in South Africa, using existing expertise at the Universities of Cape Town, Stellenbosch and Witwatersrand, where the 18 applications originated.

Furthermore, the analysis of the South African patent landscape reveals that a small number of patent applications are filed originating from South Africa in the area of Biotechnology (A61K, C07C). Thus, there is potential to support commercialisation of associated technologies by boosting the patent applications in this area.

It is probably a bit premature to make conclusions on the effectiveness of implementation of the various strategies (Biotechnology, Advanced Manufacturing, Information Communications Technology, etc). Nonetheless, the analysis that forms part of this report should provide a basis for future country and sector analysis.

An analysis of the most cited patent applications emanating from South Africa indicates that the most significant patent applications and patents are the ones that were originally filed in the name of the CSIR as applicant/assignee, and then later assigned to BTG, in what we are reliably informed was a sale of the RFID technology developed at the CSIR. The basis for the sale of the patents to BTG, a UK-based company, as opposed to exploiting them in South Africa, is unknown to the authors. Suffice it to say that it is possible that exploitation of these patents in South Africa could have provided significant value and could have also spun out new industries.

Sasol and Element Six are South Africa's most active corporate organisations, with both having a number of patents which are highly cited, thus indicating that these corporates might be world leaders in the areas covered by their patent portfolios. It is also worth noting that prior to 2003 De Beers Group of Companies (including Element Six (Pty) Ltd), would not have filed patent applications in its name in the USA as there was a pending anti-trust case against it by the US Federal authorities. It is possible that the actual number of patent applications published and patents granted to De Beers Group of Companies at the USPTO may be higher than the numbers identified in this report.

The lessons that can be learnt from Sasol and De Beers/Element Six is that there needs to be a portfolio approach to patenting by South African publicly funded institutions, so as to increase the success rate of commercialisation of intellectual property. The portfolio has to be built around areas of research strengths of each institution, but in alignment with national imperatives and strategies as published by various government departments, such as the DST, from time to time.

Whereas the focus of this initial report has been on broadly mapping out the South African patent landscape, it is important to assess the state of commercialisation of the South African portfolio. In this regard, the focus has been and will be on inventions emanating from state-funded institutions, as it is not easy to obtain information on inventions emanating from the private sector, which in essence file patent applications for a number of reasons, including defensive as well as offensive patenting strategies.

Often, a focus on patenting is criticised, with the critics saying that attention must be on commercialisation. We agree with the view that patenting for the sake of patenting is not adequate. Patenting needs to be aligned to a country's technology and/or growth strategy, with the result that in some cases the patent portfolios are fully commercialised, whereas in other cases the patent portfolios could be used as bargaining chips in negotiations or to access third-party intellectual property, for example, in the mobile telephone industry.

In a country where there has not been an active culture of patenting, massive efforts need to be directed towards developing such a culture, whilst at the same time directing efforts towards commercialisation of the patent portfolios. Thus, we aver that a debate about patenting is not complete without talking about commercialisation. We also submit that one cannot have a meaningful debate about commercialisation if there is no meaningful intellectual property portfolio to provide a monopoly and hence a competitive advantage. In the absence of a focused patenting strategy, the danger is that one finds oneself being locked out of certain areas by those who have managed to obtain patent monopolies, with the result that the only point of entry is through licensing in the background or base intellectual property. Thus, we argue for a culture of intellectual property awareness, protection and management, aligned with government's national priorities, which will result in patenting on the basis of commercial merit and for strategic reasons.

Future reports will focus on time slices and, in particular, how the patent landscape transforms itself in respect of focus areas identified by the government, as well as each of the publicly funded institutions' identified priority areas.

Sasol and Element Six are South Africa's most active corporate organisations, with both having a number of patents which are highly cited.

A portfolio approach should be adopted in respect of patenting research results to create 'fences'.

Schedule I

SCHEDULE I: Summary of patent applications filed in the USPTO, EPO, WIPO, with a ZA priority.

1991 to 2004		2001		2002		2003		2004		2005	
WO	2495	WO	385	WO	400	WO	391	WO	371	WO	355
EP	1239	EP	128	EP	115	EP	108	EP	204	EP	165
US	393	US	26	US	70	US	93	US	137	US	115

Schedule II

SCHEDULE II: Summary of assignees of patent applications filed in the USPTO, EPO, WIPO, with a ZA priority.

1991 to 2001		2001		2002		2003		2004		2005	
Sasol Technology (Pty) Ltd (46)/ Sasol Chemicals Europe Ltd (22)	68	None	18	None	49	None	83	None	182	None	153
Handelman, Joseph, H	65	Sasol Technology (Pty) Ltd	13	Windsor Technologies Ltd	14	Sasol Technology (Pty) Ltd	26	Sasol Technology (Pty) Ltd	21	Sasol Technology (Pty) Ltd	20
De Beers Industrial Diamond Division	63	De Beers Industrial Diamond Division	10	Sasol Technology (Pty) Ltd	12	Element Six (Pty) Ltd	14	CSIR	15	Pebble Bed Modular Reactor (Pty) Ltd	11
CSIR	53	Billiton Intellectual Property B.V.	8	CSIR	10	CSIR	12	Element Six (Pty) Ltd	13	CSIR	10
Windsor Technologies Ltd	26	Eskom	7	Pebble Bed Modular Reactor (Pty) Ltd	10	Pebble Bed Modular Reactor (Pty) Ltd	8	Kahn, Ari	10	Element Six (Pty) Ltd	8
Implico B.V.	25	Windsor Technologies Ltd	6	Balmoral Technologies (Pty) Ltd	7	Radical Waters (IP) (Pty) Ltd	7	Pebble Bed Modular Reactor (Pty) Ltd	9	Mathews, Edward Henry	6
Octrooibureau Kisch N.V.	25	Allison, Herman	5	De Beers Industrial Diamond Division	7	Eskom	6	Rand Afrikaans University	7	Detnet South Africa (Pty) Ltd	5
Dyer, Alison, Margaret	23	Balmoral Technologies (Pty) Ltd	5	Eskom	7	University of Cape Town	6	de Villiers, Malan	5	University of Cape Town	5
AECI	21	Fricker, Ronald, Kevin	5	Billiton S.A. Ltd	6	Van Dyk, André	5	NXCO International Ltd	5		
		Fundamo (Pty) Ltd	5	AECI Ltd	5						

Schedule III

SCHEDULE III: Summary of top 10 IPC codes for patent applications filed in the USPTO, EPO, WIPO, with a ZA priority.

1991 to 2001		1991 to 2004		2001		2002		2003		2004		2005	
A61K	78	B65D	155	B65D	22	B65D	21	A61K	28	B65D	34	G06F	30
B65D	72	A61K	149	C22B	22	A61K	20	B65D	28	G06F	25	B65D	20
B01J	55	G06F	103	A63B	16	G06F	20	G06F	24	A61K	23	C07C	20
A61B	46	B01J	89	G06F	16	A63B	15	E04H	18	A63B	20	A61K	18
C22B	46	E04H	89	G07F	14	C22B	14	C07C	14	A61F	19	B01J	17
A61M	43	A63B	84	B01D	13	E04H	14	C02F	12	E04H	18	A63B	13
B01D	43	C07C	80	A61K	11	G07F	13	H04L	11	C07C	17	G01N	12
A63B	39	C22B	79	C07C	11	H04M	11	A63B	10	B01J	16	A61F	11
C07C	39	A61B	76	A61B	9	A61B	10	B01D	10	A61M	15	B29C	11
E04H	39	A61M	70	C04B	9	B01J	10	G21C	10	E21B	13	G08B	11

Schedule IV

Summary of patent applications which cite South African universities at the USPTO, EPO and WIPO from January 1991 to 26 September 2005, classified according to institution and IPC subclass.

Primary International Patent Classes by SA Universities

SCHEDULE IV: January 1991 to 26 September 2005 universities list.

University	Primary Int. Patent Class	Document	Title
Rhodes University/AECI Limited	C12N 015/11	EP1220904	Micro-organisms, their use and method for producing d-amino acids
Subtotal – Rhodes University:			**1**
Potchefstroom University for Christian Higher Education	A61K 009/14	WO2002096393	Anorexic composition comprising calcium acetate
	A61K 031/085	WO2003024421	Triclosan dosage form
	B01D 033/58	WO2004035172	Method and apparatus for extracting liquid from a bed of granular solids
	B09B 001/00	WO2003045594	Medium and method for treating tailings of mining activities
	C01B 013/11	EP1156984	Method and apparatus for producing ozone
	C01B 013/11	WO0050338	Method and apparatus for producing ozone
	C23F 011/173	WO0121854	Corrosion inhibitor
	G01V 003/10	WO0052499	Foreign material sensor utilising a multipole magnetic field
	H01T 023/00	WO0156126	Air moving apparatus
	H03F 003/60	EP1214781	Low noise amplifier arrangement
	H03F 003/60	WO0120778	Low noise amplifier arrangement
	H03K 003/335	WO0223722	Transistor switching circuit
	H03K 003/354	EP1331735	Drive circuit and method for FET
	H03K 017/00	EP1264402	Drive circuit and method for MOSFET
	H03K 017/04	WO0163763	Drive circuit and method for MOSFET
Potchefstroom University for Christian Higher Education/CSIR	G01N 033/50	EP0580383	Fluid analysis
North-West University	A01G 009/14	WO2004077935	Plant protective cover
	A61K 031/085	EP1427400	Triclosan dosage form
	H01L 029/78	WO2004066395	Fast switching power insulated gate semiconductor device
	G06F 007/58	WO2005020064	A hardware generator for uniform and gaussian deviates employing analog and digital correction circuits
Subtotal – North-West University (formerly Potchefstroom University for Christian Higher Education):			**20**
Rand Afrikaans University	C08G 073/10	WO2004087792	Surface oxyfluorinated polymide, substrates coated therewith and composite material incorporating it
	F04C 029/04	WO2004036050	Fluid displacement device
	G01L 007/00	WO2004088264	Optical device for measuring fluid pressure
	G01N 021/45	WO2004088290	A fibre optic sensor for measurement of refractive index
	G02F 001/225	WO2004114010	Apparatus for equalising a spectrum of a broadband light source
	G06F	WO2004077208	Authentication system and method
	H01L 031/032	WO2005017978	Method for the preparation of group Ib-IIIa-VIa quaternary or higher alloy semiconductor films
	H04B 010/22	WO2004088884	Optical system and method for monitoring variable in rotating member
University of Johannesburg	H01L 031/032	WO2005017979	Group I-III-VI quaternary or higher alloy semiconductor films
Subtotal – University of Johannesburg (formerly Rand Afrikaans University):			**9**
University of Cape Town	C07C 381/00	WO2005021493	A method of isolating a thiol
	C07K 014/005	WO2005082929	Beak and feather disease virus sequences, compositions and vaccines and the use thereof in therapy, diagnosis and assays
	C07K 014/025	EP1506222	Chimeric human papillomavirus 16 L1 proteins comprising an L2 peptide, virus-like particles prepared therefrom and a method for preparing the particles
	C07K 014/025	WO2003018623	Papillomavirus proteins and pharmaceutical compositions
	C07K 014/025	WO2003018624	Vectors, constructs, and transgenic plants for HPV-11 and HPV-16L1 capsid protein
	C07K 014/025	WO2003097673	Chimeric human papillomavirus 16 L1 proteins comprising an L2 peptide, virus-like particles prepared therefrom and a method for preparing the particles.
	C07K 014/16	EP1572731	A method for the production of HIV-1 gag virus-like particles
	C07K 014/16	WO2004050691	A method for the production of HIV-1 gag virus-like particles
	H01L	WO2004068536	A thin film semiconductor device and method of manufacturing a thin film semiconductor device
University of Cape Town/Medical Research Council/University of North Carolina at Chapel Hill/ Alphavax Inc.	C07K 014/16	EP1309617	Process for the selection of HIV-1 subtype c isolates, selected HIV- 1 subtype isolates, their genes and modifications and derivatives thereof
	C07K 014/16	W00204494	Process for the selection of HIV-1 subtype c isolates, selected HIV-1 subtype isolates, their genes and modifications and derivatives thereof
University of Cape Town/The South African Medical Research Council	C12N 015/49	WO2003037919	HIV-1 subtype isolate regulatory/accessory genes, and modifications and derivatives thereof
	C12N 015/49	EP1444350	HIV-1 subtype isolate regulatory/accessory genes, and modifications and derivatives thereof
University of Cape Town/Water Research Commission	C02F 001/74	WO2003097539	Treatment of metal containing water by the addition of magnetite
Subtotal – University of Cape Town:			**14**

University	Primary Int. Patent Class	Document	Title
University of Pretoria	A61K 031/122	EP1194137	Naphthoquinone derivatives and their use in the treatment and control of tuberculosis
	A61K 031/495	WO9745120	Use of riminophenazines as antimicrobial and antimalarial agents
	A61K 031/70	WO2003002126	Anti-retroviral agent in combination with tea polyphenol for the treatment of viral infections
	C01G 025/06	WO0075075	Beneficiation of zircon
	C07C 050/12	WO0100554	Naphthoquinone derivatives and their use in the treatment and control of tuberculosis
	C07C 069/007	WO0123342	Phloroglucinol compounds
	C07F 019/00	EP1345951	A substance or composition for the treatment of cancer
	C07F 019/00	WO0246203	A substance or composition for the treatment of cancer
	G01N	WO2003087756	Chemical analysis of samples
	G01N 017/00	WO2005054820	Method and apparatus for monitoring biofilm formation
University of Pretoria/Boart Longyear Limited	F16F 013/26	WO2003104675	Vibration isolator
University of Pretoria/ Octrooibureau Kisch N.V.	H01L 033/00	WO9630952	Indirect bandgap semiconductor optoelectronic device
Subtotal – University of Pretoria :			**12**
University of Stellenbosch	A61N 001/00	EP1406693	Radiation application method and device
	A61N 005/00	WO2002092162	Radiation application method and device
	C12N 015/31	EP0827541	A method and nucleotide sequence for transforming microorganisms
	C12N 015/31	WO9636715	A method and nucleotide sequence for transforming microorganisms
	H03K 019/195	WO2002069498	Rapid single flux quantum programmable gate array
University of Stellenbosch/ Deciduous Fruit Producers Trust	B65D 081/20	EP1399373	Preservative gas generating device
University of Stellenbosch/South African Sugar Association	C12N 015/82	WO0132897	A high-level, stable, constitutive promoter element for plants
Subtotal – University of Stellenbosch:			**7**
University of Witwatersrand	A61K 038/18	EP1494702	Composition for stimulating de novo bone induction
	A61K 038/18	US20050153883	Composition for stimulating de novo bone induction
	A61K 038/18	WO2003079964	Composition for stimulating de novo bone induction
University of Witwatersrand/ Sellschop, Susan, Marietta	G01N 023/221	WO2005088283	Detection of diamonds
Subtotal – University of Witwatersrand:			**4**
Total number of documents	**67**		
Total number of documents in group (remaining five documents are in names of University of Washington and University of Edinburgh)	**72**		

Schedule V

1991 to 2001		1991 to 2004		2001		2002		2003		2004		2005	
US	1045	US	1309	US	98	US	92	US	95	US	77	US	81
EP	435	EP	642	EP	38	EP	64	EP	70	EP	73	EP	58

SCHEDULE V: Summary of patents granted in the USPTO (US) and EPO (EP) with a ZA priority.

Schedule VI

1991 to 2004		2001		2002		2003		2004		2005	
None	467	None	24	None	28	None	39	None	24	None	29
De Beers Industrial Diamond Division (Pty) Ltd	78	Sasol Technology (Pty) Ltd	11	Windsor Technologies Ltd	12	Sasol Technology (Pty) Ltd	9	Sasol Technology (Pty) Ltd	5	Sasol Technology (Pty) Ltd	5
CSIR (including Technology Finance Corporation (Pty) Ltd	72	Implico B.V.	4	Sasol Technology (Pty) Ltd	6	Element Six (Pty) Ltd	4	Element Six (Pty) Ltd	4	Element Six (Pty) Ltd	4
Sasol Technology (Pty) Ltd	34	CSIR	3	CSIR	5	GSBS Development Corporation	4	Trico Products Corporation	4	Supersensor (Pty) Ltd	4
Circuit Breaker Industries Ltd	26	Scorpio Conveyor Products (Pty) Ltd	3	De Beers Industrial Diamond Division (Pty) Ltd	4	Bruwer, Frederick Johannes	2	Mintek	3	Cobb International Ltd	3
Windsor Technologies Ltd	22	Circuit Breaker Industries Ltd	2	Supersensor (Pty) Ltd	4	Chemical Services Ltd	2	CSIR (including Technology Finance Corporation (Pty) Ltd	5	Hall, Alethea Rosalind Melanie	3
Mintek	17	Da Ponte, Manuel Dos Santos	2	Implico B.V.	3	CSIR	2	University of Pretoria	3	Power Logic Holdings AG	3
Implico B.V.	16	Denel (Pty) Ltd	2	Adcock Ingram Ltd	2	Enerkom (Pty) Ltd	2	Anglo American Corporation of South Africa Ltd	2	Eskom	2
Atomic Energy Corporation of South Africa Ltd	14	IPCOR N.V.	2	Anglo Operations Ltd	2	Evity (Pty) Ltd	2	Billiton Intellectual Property B.V.	2	Kowalczyk, Piort Leonard	2
		Merlin Gerin S.A. (Pty) Ltd	2	Compaction Technology (Soil) Ltd	2	Hall, Alethea Rosalind Melanie	2			Lomold Corporation N.V.	2

SCHEDULE VI: Summary of top 10 assignees of patents granted in the USPTO, EPO, WIPO, with a ZA priority.

Schedule VII

Abstracts of patents granted to

South African universities from 1991 to 2005

Document ID: EP1156984B1

Title: **Method and apparatus for producing ozone**

Abstract: A method of producing ozone comprises the steps of generating intermittent bursts of corona discharge in an electrode region 20.2, and passing oxygen-containing fluid through the region, thereby to cause ionization of the oxygen. The electrode is energised by a train of voltage pulses. Each pulse has a rise time of better than 2kV/100ns.

Assignee: Potchefstroom University for Christian Higher Education

Publication Date: 2003-11-26

Application Date: 2000-02-24

Intl Class: [7]C01B01311
Core: C01B01311 [2006-01]
Adv: C01B01311 [2006-01]

US Class:

Document ID: EP1194137B1

Title: **Naphthoquinone derivatives and their use in the treatment and control of tuberculosis**

Abstract: Naphthoquinone derivatives of Formula (1): wherein, R represents an OH group, methyl ether, ethyl ether or a similar ether; R1 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative; R2 and R3 each independently represent hydrogen or a group selected from: (A), (B), or (C) wherein R5 represents an OH group, methyl ether, ethyl ether or a similar ether and R6 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative; R4 represents hydrogen or a group selected from: (D), (E) or (F) wherein R7 represents an OH group, methyl ether, ethyl ether or a similar ether and R8 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative; or pharmaceutically acceptable salts thereof, are useful for the treatment and/or control of a tuberculosis in a patient caused by Mycobacterium tuberculosis.

Assignee: University of Pretoria
South African Medical Research Council

Publication Date: 2004-12-29

Application Date: 2000-06-22

Intl Class: [7]A61K031122; [7]A61P03106
Core: A61K031122 [2006-01]
Adv: A61K031122 [2006-01]

US Class:

Document ID: EP1345951B1

Title: **A substance or composition for the treatment of cancer**

Abstract: A substance for use in the treatment of cancer, includes a compound selected from metallocenyl β-diketones Mc-CO-CZ 1 Z 2 -CO- R. Mc is Fc (ferrocenyl), Rc (ruthenocenyl) or Oc (osmocenyl), R is H, alkyl or aryl and Z 1 and Z 2 are H, alkyl, aryl or substituted alkyl, ferrocenyl, the enol forms of the β-diketones and metal complexes of the β-diketones of the general formula M(β-diketonato)A 1, M(β-diketonato)A 1 A 2, M(β-diketonato)A 1 B 1 B 2, M(β-diketonato)B 1 B 2 and M(β-diketonato)B 1 B 2 B 3 B 4. M is Rh or Ir, A 1 and A 2 are cyclic dienes having 6 - 8 carbons, or linear alkenes having 2-7 carbons. B 1, B 2, B 3 and B 4 are selected from CO, P(R 1 R 2 R 3), P(OR 1)(OR 2)(OR 3), R 4 and X in which R 1, R 2, R 3 and R 4 are independently alkyl, phenyl or ferrocenyl, and X is a halide or a pseudohalide.

Assignee: University of Pretoria
University of the Free State

Publication Date: 2004-08-18

Application Date: 2001-11-29

Intl Class: [7]C07F01900; [7]A61K031295; [7]A61P03504; [7]C07F01702
Core: A61K03128 [2006-01]; C07F01700 [2006-01]; C07F01900 [2006-01]
Adv: A61K031295 [2006-01]; C07F01702 [2006-01]; C07F01900 [2006-01]

US Class:

Document ID: US5289259A

Title: **Apparatus for extracting a variable from two quadrature signals being functions of the variable**

Abstract: Apparatus 200 for extracting a variable from two quadrature signals, which are functions of the variable is disclosed and claimed. The apparatus is particularly suitable for use with a minimum configuration open-loop fibre optic gyroscope 100 to provide a signal (V. sub.out) proportional to the Sagnac phase shift, which is proportional to the rotation rate. OMEGA. of fiber loop 20. The apparatus comprises a trigonometric transformation circuit 30, a dynamic control circuit 32, a feedback loop 33, an adder and a feedforward loop 32.1. The adder, in use, adding an output signal of the dynamic control circuit and a signal in the feedforward loop to provide the signal (V.sub.out), with improved dynamic response. The apparatus also comprises a reset circuit 34 for extending the angular range of the apparatus. An adaptive reset circuit for improving the dynamic range of the apparatus is also disclosed.

Assignee: Rand Afrikaans University

Publication Date: 1994-02-22

Application Date: 1992-08-07

Intl Class: G01C01964; H03D00100
Core: G01C01972 [2006-01]
Adv: G01C01972 [2006-01]

US Class: 356463; 327003

Document ID:	US5559036A
Title:	**Fluid analysis**
Abstract:	A method and apparatus for the preliminary detection of abnormal levels of metabolites in the urine of a human or mammal. The method includes the steps of determining the amount of creatinine in the urine of the human or animal, measuring the total metabolites content in the urine, using the amount of creatinine in the urine as an internal standard to compensate for variations in the urine concentration, and comparing the total metabolites content in the urine with a reference value which corresponds to the expected total metabolites content in the urine of a person or animal who does not suffer from a metabolic disorder. The apparatus (10) includes an ultraviolet oxidation unit (16) for oxidising total metabolites in a urine sample to carbon dioxide, an organic carbon stripper (18) for stripping carbon dioxide gas from the oxidised sample, and a carbon dioxide detector (69) for measuring the amount of carbon dioxide produced from the sample.
Assignee:	CSIR Potchefstroom University for Christian Higher Education Lekratek Instrumentation
Publication Date:	1996-09-24
Application Date:	1994-12-05
Intl Class:	G01N03348 Core: G01N033487 [2006-01]; G01N03370 [2006-01] Adv: G01N033493 [2006-01]; G01N03370 [2006-01]
US Class:	436063; 422080; 422083; 436145
US Class:	514029; 514171; 51421004; 51425308; 514332

Document ID:	US5994720A
Title:	**Indirect bandgap semiconductor optoelectronic device**
Abstract:	An optoelectronic device (10) formed in a chip of an indirect bandgap semiconductor material such as silicon is disclosed and claimed. The device comprises a visibly exposed highly doped n.sup.+ region (16) embedded at the surface of an oppositely doped epitaxial layer (14), to form a first junction region (15) closed to the surface of the epitaxial layer. When the junction region is reverse biased to beyond avalanche breakdown, the device acts as a light emitting device to the external environment. When it is reversed biased to just below avalanche breakdown it acts as a light detector. The device may further include a additional junction region for generating or providing additional carriers in the first junction region, thereby to improve the performance of the device. This further junction can be multiplied to facilitate multi-input signal processing functions where the light emission from the first junction is a function of the electrical signals applied to the further junctions.
Assignee:	University of Pretoria
Publication Date:	1999-11-30
Application Date:	1997-12-05
Intl Class:	H01L03300 Core: H01L03300 [2006-01] Adv: H01L03300 [2006-01]
US Class:	257086; 257079; 257096; 257E33015; 257E33045; 257E33051

Document ID:	US6274311B1
Title:	**Method and nucleotide sequence for transforming micro-organisms**
Abstract:	An isolated nucleic acid molecule is provided which contains a sequence which encodes a protein which mediates the uptake of L-malate, succinate, and malonate, and expression vectors and host cells containing the nucleic acid molecules. The nucleic acid molecules are used to transform cells for use in mediating malate, succinic acid or malonate uptake in particular malate uptake during the fermentation of wines.
Assignee:	University of Guelph University of Stellenbosch
Publication Date:	2001-08-14
Application Date:	1998-05-28
Intl Class:	[7]C07H02104; [7]C07K00100; [7]C12N00118; [7]C12Q00168 Core: C07K01437 [2006-01]; C12G00100 [2006-01]; C12N00900 [2006-01] Adv: C07K01439 [2006-01]; C12G001022 [2006-01]; C12N00900 [2006-01]
US Class:	435006; 4350691; 43525411; 4352542; 43525421; 4353201; 530350; 5360237; 53602374

Document ID:	US6741126B1
Title:	**Low noise amplifier arrangement**
Abstract:	An amplifier arrangement (10) comprises an input node (24) and an output node (26). A plurality of amplifiers (20.1 to 20.4) are connected in respective parallel paths (28.1 to 28.4) extending between the input node and the output node. The input node divides an input signal S i (t) into signal S 1 (t) to S 4 (t) and feeds the signal parts along respective paths to the output node. The paths have equal propagation delays for the signal parts, to provide at the output node an output signal S o (t) comprising a coherent summation of the signal parts and an incoherent summation of noise.
Assignee:	North-West University
Publication Date:	2004-05-25
Application Date:	2002-09-26
Intl Class:	[7]H03F00368; [7]H03F00360 Core: H03F00360 [2006-01] Adv: H03F00360 [2006-01]
US Class:	330124R; 330054

Document ID:	US6835755B1
Title:	**Naphthoquinone derivatives and their use in the treatment and control of tuberculosis**
Abstract:	Naphthoquinone derivatives of Formula (1): wherein R, represents an OH group, methyl ether, ethyl ether or a similar ether, R1 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative: R2 and R3 each independently represent hydrogen or a group selected from: (A), (B), or (C) wherein R5 represents an PH group, methyl ether, ethyl ether or a similar ether and R6 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative: R4 represents hydrogen or a group selected from: (D), (E) or (F) wherein R7 represents an OH group, methyl ether, ethyl ether or a similar ether and R8 represents a methyl, ethyl or similar aliphatic hydrocarbon derivative: or pharmaceutically acceptable salts thereof, are useful for the treatment and/or control of a tuberculosis in a patient caused by Mycobacterium tuberculosis.
Assignee:	University of Pretoria South African Medical Research Council
Publication Date:	2004-12-28
Application Date:	2002-03-19
Intl Class:	[7]A61K03112 Core: A61K031122 [2006-01] Adv: A61K031122 [2006-01]
US Class:	514682; 514924

Schedule VIII

1991 to 2004		2001		2002		2003		2004		2005	
B01D	67	B01D	7	A61K	10	A61K	9	A61F	5	C07C	6
A61K	54	B01J	6	B01D	6	B01D	5	B65D	5	C22B	5
B65D	54	B65G	6	C04B	6	B01J	5	C07C	5	B65D	4
E04H	54	C02F	5	C07C	6	C07C	5	A61B	4	1303	3
B01J	46	C07C	5	B01J	5	A01N	4	A61K	4	2803	3
C07C	39	A61K	4	B23P	4	B65G	4	A63B	4	A47J	3
B24D	37	B65D	4	B65G	4	C02F	4	B01J	4	A61F	3
B65G	34	C22C	4	C22B	4	1005	3	C22B	4	A61K	3
A61F	33	A61F	3	G06K	4	A61M	3	E04H	4	A61M	3
C02F	31	C21B	3	A61M	3	C01B	3	G06F	4	B01J	3

SCHEDULE VIII: Summary of top 10 IPC codes for patents granted in the USPTO, EPO, WIPO, with a ZA priority.

Schedule IX

IPC codes for Biotechnology patents

Based on the data on patent applications by IPC subclass, Eurostat calculates data on patent applications in Biotechnology. The IPC subclasses used for the Biotechnology sector are listed in Schedule IX.

IPC code	Definition
A01H 1/00	Processes for modifying genotypes
A01H 4/00	Plant reproduction by tissue culture techniques
A61K 38/00	Medicinal preparation containing peptides
A61K 39/00	Medicinal preparation containing antigens or antibodies
A61K 48/00	Medicinal preparations containing genetic material which is inserted into cells of the living body to treat genetic diseases, gene therapy
C02F 3/34	Biological treatment of water, waste water, or sewage, characterised by the micro-organisms used
C07G 11/00	Compounds of unknown constitution: antibiotics
C07G 13/00	Compounds of unknown constitution: vitamins
C07G 15/00	Compounds of unknown constitution: hormones
C07K 4/00	Peptides having up to 20 amino acids in an undefined or only partially defined sequence; Derivates thereof
C07K 14/00	Peptides having more than 20 amino acids; Gastrins; Somatostatins; Melanotropins; Derivates thereof
C07K 16/00	Immunoglobulins, e.g. monoclonal or polyclonal antibodies
C07K 17/00	Carrier-bound or immobilised peptides; Preparation thereof
C07K 19/00	Hybrid peptides
C12M	Apparatus for enzymology or microbiology
C12N	Micro-organisms or enzymes; compositions thereof propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media
C12P	Fermentation or enzyme-using processes to synthesise a desired chemical compound or composition or to separate optical isomers from a racemic mixture
C12Q	Measuring or testing processes involving enzymes or micro-organisms; composition or test papers thereof; processes of preparing such compositions; condition-responsive control in microbiological or enzymological processes
C125	Processes using enzymes or micro-organisms to liberate, separate or purify a pre-existing compound or composition processes using enzymes or micro-organisms to treat textiles or to clean solid surface or materials
G01N 27/327	Investigating or analysing materials by the use of electric, electro-chemical, or magnetic means: biochemical electrodes
G01N 33/53*	Investigating or analysing materials by specific methods not covered by the preceding groups: immunoassay; biospecific binding essay; materials thereof
G01N 33/54*	Investigating or analysing materials by specific methods not covered by the preceding groups: double or second antibody: with steric inhibition or signal modification: with an insoluble carrier for immobilising immunochemicals: the carrier being organic: synthetic resin: as water suspendable particles: with antigen or antibody entrapped within the carrier
G01N 33/55*	Investigating or analysing materials by specific methods not covered by the preceding groups: the carrier being inorganic: Glass or silica: Metal or metal coated: the carrier being a biological cell or cell fragment: Red blood cell: Fixed or stabilised red blood cell: using kinetic measurement: using diffusion or migration of antigen or antibody: through a gel
G01N 33/57*	Investigating or analysing materials by specific methods not covered by the preceding groups: for venereal disease: for enzymes or isoenzymes: for cancer: for hepatitis: involving monoclonal antibodies: involving limulus lysate
G01N 33/68	Investigating or analysing materials by specific methods not covered by the preceding groups: involving proteins, peptides or amino acids
G01N 33/74	Investigating or analysing materials by specific methods not covered by the preceding groups: involving hormones
G01N 33/76	Investigating or analysing materials by specific methods not covered by the preceding groups: human chorionic gonadotropin
G01N 33/78	Investigating or analysing materials by specific methods not covered by the preceding groups: thyroid gland hormones
G01N 33/88	Investigating or analysing materials by specific methods not covered by the preceding groups: involving prostaglandins
G01N 33/92	Investigating or analysing materials by specific methods not covered by the preceding groups: involving lipids, e.g. cholesterol

SCHEDULE IX: IPC subclasses considered as Biotechnology sector.

Reference: www.oecd.org/document/3/0,2340,en_2649_33703_34962243_1_1_1_1,00.html and www.europa.eu.int/estatref/info/sdds/en/pat/pat_meth_hitech.pdf

Annexure A

S79 and S80 of Patents Act 57 of 1978

S79. Assignment of certain patents to the state.

(1) The proprietor of an invention relating to any armaments as defined in section 1 of the Armaments Development and Production Act, 1968 (Act No. 57 of 1968), shall, if called upon to do so by the Minister of Defence, assign the invention or the patent obtained or to be obtained for the invention to that Minister on behalf of the State.

(2) The assignment and any agreements therein contained shall be valid and effectual and may be enforced by appropriate proceedings in the name of the Minister of Defence.

(3) Where an invention has been so assigned, the Minister of Defence may, by notice in writing to the registrar, direct that the invention and the manner in which it is to be performed shall be kept secret.

(4) Every application, specification, amendment of specification or drawing received at the patent office relating to any invention in respect of which notice in terms of subsection (3) has been given, shall be sealed up by the registrar and the contents of such application, specification, drawing or other document shall not be divulged without the written permission of the Minister of Defence.

(5) The patent for any such invention may be made out in the name of the proprietor and sealed, but such patent shall be delivered to the Minister of Defence and not to such proprietor and shall be the property of the State, and no proceedings shall lie for the revocation of the patent.

(6) The communication of any such invention to the Minister of Defence or to any person authorised by him to inquire into the invention shall not, nor shall anything done for the purpose of the inquiry by such person, be deemed to be publication or use of the invention so as to prejudice the grant or validity of any patent for the invention.

(7) The Minister of Defence may by notice in writing to the registrar direct that any invention directed to be kept secret need no longer be kept secret, and thereupon the specification and drawings may be published.

(8) The said Minister shall pay to the proprietor of the invention or patent such reasonable compensation as may be agreed upon or as may, in default of agreement, be determined by arbitration or, if the parties so agree, by the commissioner.

S80. Minister may require inventions to be kept secret in certain circumstances.

(1) If the Minister is of opinion that in the national interest an application, specification, drawing or other document relating to any invention should be kept secret, he may order the registrar to keep the invention secret and to notify the applicant accordingly, and if any Minister of State desires to acquire such invention on behalf of the State, the provisions of section 79 shall as far as applicable apply, and for that purpose the reference in section 79 to the Minister of Defence shall be deemed to be a reference to the said Minister of State.

(2) Whenever any order issued by the Minister under this section is withdrawn, any steps which were prior to the date of that order taken under this Act in connection with the application which was the subject of that order, and which were interrupted in consequence of that order, may be proceeded with as if the interruption had not occurred, and any period which may have elapsed between the date on which that order was lodged with the registrar and the date of withdrawal thereof shall not be taken into account in the computation of any period of time prescribed by or under this Act.

(3) If the proprietor of an invention has suffered loss or damage by reason of that invention having been kept secret in pursuance of an order under subsection (1), the Minister shall pay to him such reasonable compensation as may be agreed upon or as may, in default of agreement, be determined by arbitration or, if the parties so agree, by the commissioner.

Annexure B

EP0494114 is directed to an Electronic Identification System. The published abstract is as follows:

Abstract: *An identification system comprises an interrogator and a number of transponders. The interrogator includes a transmitter for transmitting an interrogation signal to the transponder, and a receiver for receiving a response signal from the transponder. A micro-processor identifies the transponder from data in the response signal. Each transponder comprises a receiving antenna for receiving the interrogation signal, a code generator, a transmitting antenna, and a modulator connected to the code generator. On receipt of the interrogation signal the transponder repeatedly transmits a response signal containing data which identifies the transponder. The interrogator detects successful identification of any transponder and briefly interrupts the interrogation signal to indicate the successful identification. Each transponder includes a logic circuit responsive to a respective interruption in the interrogation signal to cease transmission of its own response signal.*

EP0585132 is directed to a Synchronised Electronic Identification System, and the published abstract for this patent is as follows:

Abstract: *The invention relates to an identification system comprising an interrogator and a plurality of transponders. The interrogator includes transmitter means for transmitting an interrogation signal to the transponder, receiver means for receiving a response signal from the transponder, and processor means for identifying the transponder from data in the response signal. Clock extraction means are further provided for extracting a transponder clock signal from the response signal which is used to synchronise the modification of the interrogation signal with the response signal from the transponder. Each transponder comprises receiver means for receiving the interrogation signal, a transponder clock generator, a code generator, transmitter means, and a modulator, connected to the code generator, so that on receipt of the interrogation signal the transponder transmits a response signal containing data which identifies the transponder. The interrogator is adapted to detect successful reception of a response signal from any transponder, to derive a synchronisation signal from the response signal of that transponder, and to modify the interrogation signal synchronously with the response signal to indicate successful reception of the response signal. Each transponder further includes means responsive to a respective modification of the interrogation signal to cease transmission of its response signal.*

Abstract of WO0020535 in the name of Sasol (Figure 8 citation tree):

This invention relates to middle distillates having good cold flow properties, such as the Cold Filter Plugging Point (CFPP) measured in accordance with the IP method (309), and a high Cetane number, as well as to a process for production of such distillates. More particularly, this invention relates to middle distillates produced from a mainly paraffinic synthetic crude which is produced by the reaction of CO and H 2, typically by the Fischer-Tropsch (FT) process. The middle distillates of the invention are predominantly isoparaffinic, the isoparaffins being methyl, ethyl and/or propyl branched. The invention also provides a diesel fuel composition including the middle distillates in accordance with the invention. A process for preparing the middle distillates is also included in the invention.

Abstract of US5994720 (Figure 12 citation tree):

A device comprising a visibly exposed highly doped n+ region embedded at the surface of an oppositely doped epitaxial layer, to form a first junction region closed to the surface of the epitaxial layer. When the junction region is reverse biased to beyond avalanche breakdown, the device acts as a light emitting device to the external environment. When it is reversed biased to just below avalanche breakdown it acts as a light detector. The device may further include a further junction region for generating or providing additional carriers in the first junction region, thereby to improve the performance of the device. This further junction can be multiplied to facilitate multi-input signal processing functions where the light emission from the first junction is a function of the electrical signals applied to the further junctions.

Abstract of US5559036

The method includes the steps of determining the amount of creatinine in the urine of the human or animal, measuring the total metabolites content in the urine, using the amount of creatinine in the urine as an internal standard to compensate for variations in the urine concentration, and comparing the total metabolites content in the urine with a reference value which corresponds to the expected total metabolites content in the urine of a person or animal who does not suffer from a metabolic disorder; whereas the apparatus includes an ultraviolet oxidation unit for oxidising total metabolites in a urine sample to carbon dioxide, an organic carbon stripper for stripping carbon dioxide gas from the oxidised sample, and a carbon dioxide detector for measuring the amount of carbon dioxide produced from the sample.