INTELLECTUAL PROPERTY MANAGEMENT AND PROTECTION:
Low Intellectual Property Registration at Universities: A Case Study of the Durban University of Technology

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Intellectual Property Management and Protection: Low Intellectual Property Registration at Universities: A Case Study of the Durban University of Technology

by

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DECLARATION

I, Ramika Bansi, hereby declare that this thesis is the result of my own investigation and research and it has not been submitted in part or in full for any other degree or to any other University.

Ramika Bansi

DATE

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DEDICATION

I dedicate this work to:

My grandfather, **Ramkishun Bansi** for teaching me to persevere, and to face all challenges with humility. Your words were etched with wisdom.

Shivam Mayur & **Vyal Mrinal**, remember that the most mammoth task can be accomplished by doing it one step at a time! You make my life worthwhile, and your existence have been my guiding beacon in all my endeavours.

ABSTRACT

The purpose of this study was to investigate the low rate of registration of IP rights such as patents, trademark and design rights at the DUT, through a survey conducted with the academic research staff. Managing IP at a University of Technology today has new dimensions with the implementation of the IP Act 51 of 2008. Stimulation of the development and commercialization of technology within South Africa may benefit the country and its citizens. The knowledge economy indicates that research, development and innovation are fundamental prerequisites for achieving and maintaining competitiveness and sustained growth.

The researcher undertook to explore reasons for low IP registration as a means to increase such activity at the DUT. This study adopted both the qualitative and quantitative methodologies with questionnaires distributed to full-time academic staff in selected departments.

Factors that contributed to the gap between academic research and intellectual property registration were examined. This study investigates activities relating to patent registration, as well as the academic performance of researchers at DUT.

The literature reviewed indicated that factors affecting low intellectual property right activities at the DUT may be a lack of awareness, implications of the ownership provisions, funding and an effective institutional arrangement for the management of intellectual property.

This study identified strengths and weakness of DUT's IP management system. It is envisaged that the findings of the study will contribute to increasing IP registration at the DUT, in particular, and other UoT's in general. Low IP registration can be attributed to lack of understanding and awareness of the ownership provisions of the IP Act. The study highlighted lessons to be learned from universities in other countries and how the DUT's system can grow into an efficient and effective means of promoting national innovation and economic growth. In an increasingly global world, the ability to invent, design and manufacture goods and services that people want is more vital to our future prosperity than ever.

LIST OF ACRONYMS

AUTM	-	Association of University Technology Managers
BASCAP	-	Business Action to Stop Counterfeiting and Piracy
CIPC	-	Companies and Intellectual Property Commission
COGR	-	Council on Governmental Relations
CSIR	-	Council for Scientific and Industrial Research
DST	-	Department of Science and Technology
EPO	-	European Patent office
IP	-	Intellectual Property
IPR	-	Intellectual Property Rights
NIPMO	-	IP Management Office
OECD	-	Organization for Economic Co-operation and Development
OTL	-	Offices of Technology Licensing
PCT	-	Patent Cooperation Treaty
SABS	-	South African Bureau Standards
UoT	-	University of Technology
USPTO	-	United States Patent and Trademark office
WIPO	-	World Intellectual Property Organization

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CHAPTER 1

CONTEXT OF STUDY

1.1 INTRODUCTION

Intellectual property (IP) refers to creations of the mind: inventions, literary and artistic works, and symbols, names, images and designs used in commerce (WIPO Pub. 489). The law of intellectual property affords rights associated with the expressions, products, processes, or marks derived from knowledge. Intellectual property rights are most valuable to the world community because these rights encourage creative persons to invent things which will benefit the world at large and the inventors will receive remuneration or royal distribution income in return.

Copyright is automatic - no prior registration is required. Copyright is automatic when work is put down in some tangible form (Republic of South Africa: 1978). All other forms of intellectual property rights require some form of formal registration.

Higher education institutions worldwide have realized the importance not only of generating new knowledge through research and development programmes, but also of actively participating in applying and utilizing the knowledge and technology for new products, processes and services (Du Pre 2009:11).

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 (Sibanda 2007:30).

Developed and developing countries are seeking to increase the contribution that university research and development makes to national economic growth. This has led governments to restructure the institutional environment, usually through establishing clear intellectual property ownership policy in favour of universities, and by providing support programmes for the commercialization of technology.

Is intellectual property a critical issue at Universities of Technology? For years, higher education, an environment critically engaged with intangible objects, has been faced with questions about intellectual property rights (Kaplan 2009:2). It is hoped that the findings of this study will enhance IP management at the Durban University of Technology and contribute by developing a significant IP base for the South African economy in order to facilitate the development of human capital for innovation, and to provide a bridge between the formal knowledge base and the real economy.

1.2 RESEARCH PROBLEM

DUT's efforts in the correct management of IP protection would assist South Africa in being able to balance the two challenges of innovation for the public good and expand the country's R&D capacity, as intellectual property could be used as an instrument for wealth creation.

Speaking at the Licensing Executives Society International conference in Sandton in May 2010, Innovation Fund acting executive director and Technology Innovation Agency committee member, Sibanda (2008:3), explained that the level of poverty in South Africa must be kept in mind when publicly funded research was considered. South Africa should balance the two challenges of innovating for the public good and expanding the country's R&D capacity. He said that Intellectual property could be used as an "instrument of wealth creation".

Puri (2009:17) from the Australian Department of Primary Industry and Fisheries presented a paper at the Bio2Biz SA conference and stated that there was a need to protect IP that was developed in South Africa from being sold to overseas companies, and then being bought back in the form of goods invented in finished form, at a premium.

South Africa's IPR Act seeks to address the situation where IP, developed by researchers, lies idle at universities or is sold off to private companies, often overseas, with no benefit accruing to the university, the government or South African people.

Moore (2009:2) stated that the over-arching principle at play is that, where State funds have been used to generate IP, the State and the South African public should receive some benefit from that IP.

Under the new IP Act 51 of 2008, each institution (Universities, Science Councils, etc.) will have access to a Technology Transfer Office which will determine whether identified IP, developed using public funds, is protectable and worth commercialization.

There is a need to bring knowledge and know-how closer to each other to foster innovation (Kamoun, 2008). According to Wolson (2007), there is a need to influence research in universities to ensure quality inventions which are usable, relevant and with market potential (as shown in Figure 1.).

Figure 1. Strategic Focus of Innovation Effort

Source: Wolson (2007)

The explosion of intellectual property licensure for commercialization is widely attributed to the Intellectual Property Act No. 51 of 2008. With the assistance from the Intellectual Property Management Office (IPMO) at universities, there are numerous rewards to

commercial licensure of inventions and discoveries. Awareness of the role of the Intellectual Property Management Offices is explored for optimal utilization of resources and capacity with its objectives.

Intellectual Property Management Offices at universities contribute to the Universities' success by:

- Obtaining IP protection;
- Sourcing funds for strategic projects;
- Enhancing links to industry; and
- Enhancing regional economic development.

The creativity and inventiveness of people is the greatest asset and has always underpinned the economic success of countries. The purpose of this study is to investigate the reasons for low patenting and other IP activity at the DUT.

1.3 AIMS AND OBJECTIVES

An area in which the DUT seeks to give effect to its vision of being the leading University of Technology, is in its research and innovations endeavours. It has been identified that, despite DUT's research publication output, there seems to be a very low rate of IP registration and this results in the loss of potential income and loss of spin-off creditability for the institution.

Intellectual property registration is a critical step in the commercialization of most research results leading to innovations that contribute to economic growth and benefit society. Sibanda (2007:7) stated that some researchers within the academic community feel that the intellectual property 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. Sibanda (2007:7) also stated that 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 realization is different, and it is for this reason that the two should co-exist.

Among the different types of IP protection measures, patents are accepted internationally as a reflection of a country's inventive and technological achievements. Patents are used for monitoring and assessing national systems of innovation. In South Africa, patents are one of the technological indicators monitored by the Department of Science and Technology (Pouris, 2005:222).

Kasper, Heldingen and de Vries (1999:12) gave two approaches that can be used to assess the value of the research. These are:

- Analyzing the benefits the institution gets from the research carried out; and

- Identifying the downside risk the institution incurs if it does not carry out the research.

The purpose of this study is to investigate the low rate of registration of IP rights at the DUT such as patents, trademark and design rights through a survey conducted amongst the academic staff at the institution.

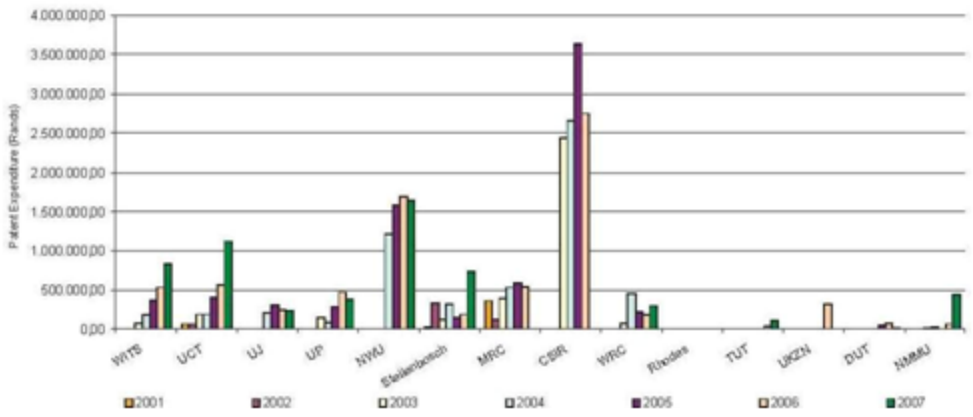

Figure 2: Patent Expenditure by the institutions

Source: Sibanda (2007)

Figure 2 summarizes the patent expenditure by certain institutions in the review period which was from 2001 up to, and including, 2007. A comparison of patent expenditure shows that, for most institutions, there has been little success in their patent portfolios by academic institutions in particular.

The aim of this study is to explore reasons for the low rate of registration of intellectual property rights at the DUT, such as patents, trademarks and design rights, with a view to increasing the number of registered Intellectual Property rights. This research project will also investigate the low rate of IP activities as well as the problems associated with IP compliance, through the use of questionnaires.

The sub-objectives of the study are to:

- Determine why university research does not generally result in IP registration;

- Determine perceptions of supervisors/researchers as to whether they can identify the potential of intellectual property that can arise from students' or their own research;

- Determine the level of awareness among staff and their perceptions regarding intellectual property legislation and university's IP Policy, and

- Determine the nature of problems experienced by staff relating to IP registrations.

This study is significant in that it aims to encourage the registration of IP rights (especially patents) and IP activity for the DUT.

1.4 SIGNIFICANCE OF THE STUDY

This study will identify the strengths and weakness of DUT's intellectual property management systems. The findings of the study will contribute to efforts to increase IP registration by DUT, in particular, and by other UoT's in general. The study also highlights the lessons to be learned from the experiences of universities in other countries and how the DUT's system can grow into an efficient and effective means of promoting national innovation and economic growth.

There is a wealth of data available on how US universities IPMOs function. South African universities have only recently, with the promulgation of the new IP Act, begun to focus on IP systems. Therefore, relatively little data exist to directly compare the scope and impact of South African universities IP systems with that of the US.

The researcher has selected a representational cross-section of the DUT's departments involved in innovation research. The research will be carried out in order to address the following questions in an empirical manner:

- Why university research does not result in IP registration?

- Can supervisors/researchers identify the potential intellectual property that can arise from students' or their own research work?

- Are researchers aware of the intellectual property legislation and the DUT's IP Policy, and what are their perceptions thereof?

- What is the nature of problems experienced by researchers relating to intellectual property registration?

Any improvement in intellectual property registration could result in increased opportunity for the commercialization of IP, thereby generating income for the institution.

1.5 SCOPE OF THE STUDY

This study will be conducted at the Durban University of Technology. This survey will focus on patents, trademarks and design rights at the Durban University of Technology.

1.6 LITERATURE REVIEW

The literature review sets out a broad theoretical framework in relation to intellectual property management practices globally and nationally. Mowery, Sampat and Ziedonis (2004:16) argue that the increased focus on the commercialization of university research has, however, at least in the US, gone beyond the licensing model, influencing the change in the nature and culture of university research. This change was reported to have increased secrecy, leading to less sharing of research results, and a shift in academic research from fundamental to more applied research areas.

Cloete, Nel and Theron (2006:561), as cited by Sibanda (2008:7), are of the view that one of the reasons for low patenting activity by South African universities is that "Research is not been carried out with commercialization in mind and therefore lacks market focus."

According to Pradhan (2009:11), since 1980, American universities have developed more than 5,000 companies, 1.25 products per day and this has led to the creation of over 260,000 jobs. In addition these efforts have contributed to over $40 billion dollars

annually to the American economy. He implied that university patents as a category of intellectual property was the sole contributor of these economic benefits.

Merwe (2008:1) states that, in an attempt to advance South Africa's innovation capacity, the Government has created a public funding agency, the Technology Innovation Agency (TIA), to bridge the innovation gap between the local knowledge base and the productive economy. The objectives of the new agency are to stimulate the development of technology-based products, services and enterprises; to develop a significant technology base for the South African economy, to facilitate the development of human capital for innovation; and to provide the primary bridge between the formal knowledge base and the real economy.

The South African Technology Innovation Agency Act No. 26 of 2008 (Republic of South Africa, 2008) defines technological innovations as the application in the practice of creative new ideas, which includes inventions, discoveries and the processes by which new products and services enter the market, and the creation of new businesses. Commercialization means different things to different people. The Australian Institute of Commercialization defines it as the "transfer of ideas (IP) into successful economic outcomes"(Puri 2009:4).

As expressed in the Intellectual Property Rights from Publicly Financed Research & Development Bill 2008 (IPR Bill, 2008), which came into effect on the 2 August 2010 in South Africa, its primary goal is to ensure that intellectual property outcomes of publicly financed R&D are protected and commercialized for the benefit of the people of South Africa - be it social, economic, military or some other benefit.

According to Hammersla (2006:3), there are three major types of IP protection:

- **Trade Secret:** information that is a secret or not generally known in the relevant industry and that gives its owner and advantage over competitors. Trade secret protection exists as long as the information has value, is kept a secret or confidential by the owner, and is not lawfully and independently obtained by others. Trade secrets include product formulas (such as Coco-Cola), patterns, methods, techniques, manufacturing processes and compilations of information

that provide a business with a competitive advantage. Quinn (2009:2) confirms that a trade secret is any valuable business information that is not known and is subject to reasonable efforts to preserve confidentiality. A trade secret will be protected from misappropriation and exploitation by those who obtain access through improper means or who breach a promise to keep the information confidential.

- **Copyright:** Copyright protects the physical expression of ideas. Immediately an idea is given physical form, for example, a piece of writing, a photograph, music, a film, a web page, it is protected by copyright. There is no need for registration: Protection is automatic at the point of creation (Bobbitt, 2006; Loggie et al 2007; Zhang and Carr-Chellman, 2006). Both published and unpublished works are protected by copyright. Copyright is a law that gives you ownership over the things you create. Be it a painting, a photograph, a poem or a novel, if you created it, you own it and it's the copyright law itself that assures that ownership. Gupta (2008:15) confirms that the ownership that copyright law grants comes with several rights which include:

    - The right to reproduce the work;
    - To prepare derivative works;
    - To distribute copies;
    - To perform the work; and
    - And to display the work publicly

- **Patent:** According to Quinn (2009:6), a patent for an invention is the granting of a property right to the inventor, issued by a patent office, which is a non-commercial entity. There are three very different kinds of patents in the United States: (1) a utility patent, which covers the functional aspects of products and processes; (2) a design patent, which covers the ornamental design of useful objects; and (3) a plant patent, which cover a new variety of living plant. A further explanation by Gupta (2008:11) is that a patent is a concise and elaborate

> means of protection for inventions of new and improved products and processes that are capable of industrial application. A patent is a form of intellectual property that is novel, non-obvious, and useful. The inventor is given the exclusive right to prevent others from making, using and selling a patented invention for a fixed period of time, in return for the inventor's disclosing the details of the invention to the public. Patents are granted by national offices. For example, the US Patent and Trademark Office (USPTO) and Companies and Intellectual Property Commission (CIPC) in South Africa. When a patent is granted, the invention becomes the property of the inventor, which can be bought, sold, rented or hired (McMaul 2009:6).

Among the above mentioned types of IP protection measures, patents are accepted internationally as a reflection of a country's inventive and technological achievements. Patents are used for monitoring and assessing national systems of innovation. In South Africa, patents are one of the technological indicators monitored by the Department of Science and Technology (Pouris, 2005:223).

There has been a global trend in which research institutions have become more aware of the commercial value of their Intellectual Property (Benneworth, 2001:236). This has typically led to increased activity in the area of formalizing the intellectual property rights (IPR's) of universities, the formation of Technology Transfer Offices (TTO's), and an attempt to either license IP to commercial entities or to create spin out companies based on the university IP (Hindle & Yencken, 2004:801).

Intellectual property is a key component in research collaborations between universities and industry. Commenting on the draft South African regulations, Moore (2009:1), director of the Intellectual Property and Technology Transfer Office at the University of KwaZulu-Natal, stated that the intention of the Act is to address the situation so that intellectual property developed by researchers does not lie idle at universities. He also added that this type of research should not be sold to private companies and more importantly not sold overseas with no benefit accruing to the university, the government and to the people of the country.

According to Sibanda (2007:3), researchers need to appreciate the fact that the protection of their intellectual property should precede publication.

Sibanda (2007:28) stated that a contributing factor to the low patenting rate at universities could be that incentives are based on publications. This means that the more one publishes the more chances one has of being promoted. He added that the message to publicly funded institutions is that patenting and publishing can be done at the same time. The commercial value of the invention must be considered, and an assessment should be made of possible intellectual property that requires protection prior to publication.

One of Sibanda's (2007:2) key findings, in a report entitled "Analysis of the South African patent landscape", was that South Africa currently has a very low rate which had remained stagnant since 1998. In addition, about half the patent applications filed in South Africa emanated from abroad.

According to the United Nations, South Africa currently ranks 39th out of 162 countries for technological achievement, and is seen more as an adopter of technology than as an innovator (Sibanda, 2008:20).

Speaking at the start of public hearings on the Technology Innovation Agency Bill, Science and Technology Director-general, Phil Mjwara stated that South Africa had also not been "100% up to speed" in the way it managed intellectual property rights. He stated further that the situation found in South Africa is that most research is exploited internationally. This exploited technology then transfers back from overseas into local industry. This type of situation should not be the case if intellectual property is correctly managed in accordance with the legislation. It was reported by the government department, Technology Innovation Agency (TIA) (2009), at the same public hearing, that a lack of capital is holding back innovation in South Africa.

1.7 RESEARCH METHODOLOGY AND DESIGN

1.7.1 RESEARCH DESIGN

There are two approaches to research, namely, qualitative and quantitative. The distinction between the qualitative paradigm and the better known quantitative paradigm lies in the quest for understanding and for an in-depth inquiry (Coombes, 2004: 30). This statement is supported by Babbie and Mouton (2001: 270) who explain that, with qualitative research, the primary aim is an in-depth description and to obtain a better understanding of actions and events that are undertaken by an organization.

This study adopts a mixed method approach, using both the qualitative and quantitative methodologies. The study will entail a survey through the use of questionnaires to determine the reasons for the low rate of IP registration activity at the DUT.

The questionnaire determines levels of awareness of IP legislation and the DUT's IP Policy; the researchers' ability to identify potential IP that can arise from research; reasons for research not resulting in IP registration; and the nature of problems experienced by researchers relating to IP registration.

1.7.2 TARGET POPULATION

Welman, Kruger and Mitchell (2005: 52) explain that the population can consist of individuals, groups and organizations. The target population for this study will include all full-time academic staff from selected departments at the DUT.

1.7.3 SAMPLING DESIGN

1.7.3.1 QUESTIONNAIRE

A prepared questionnaire will be the instrument used to collect data from selected academic staff. A purposive sample comprising of 136 academic staff from the DUT will be selected. The sample will include all full-time academic staff members from the selected departments, as listed below:

- Two departments under the Faculty of Health Sciences, namely, Dental Science (12 academic staff members) and Emergency Medical Care and Rescue (10 academic staff members);

- One department under the Faculty of Applied Science, namely, Biotechnology and Food Technology (13 academic staff members); and

- All 9 departments (101 academic staff members) of the Faculty of Engineering and the Built Environment will be included.

1.7.4 STUDY TYPE: CASE STUDY

For the purpose of this study, a case study approach will be utilized.

Case study research excels at bringing us to an understanding of a complex issue or object, and can extend experience or add strength to what is already known through previous research. Researcher Yin (1984:23) defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.

A case study is a document history of noteworthy events that have taken place in a given institution. Case studies involve in-depth contextual analysis of similar situations in other organizations, where the nature and definition of the problem happen to be the same as experience in the current situation. Case studies usually provide qualitative rather than quantitative data for analysis and interpretation (Sekaran, 2003:16).

This study will focus on the DUT as a case study since the researcher is a full-time member of staff at the DUT.

1.7.5 DATA COLLECTION

In conducting this study, both primary and secondary sources of data will be used to achieve the study objective. Primary data according to Saunders, Lewis and Thornhill (2003:21), is usually collected through interviews and questionnaires. A questionnaire will be used to collect primary data for this study. The secondary data will be obtained from literature reviews of relevant books, journal articles, documents and legislation.

1.7.6 ANALYSIS OF DATA

A software program (PASW) Statistics version 18.0 will be used to assist in the analysis of the quantitative data.

The qualitative aspects will be analyzed by the researcher. Thematic analysis will assist in interpreting the results derived from the questionnaire schedules. Common themes will be identified and analyzed.

1.7.7 OUTLINE OF CHAPTERS

This study will consist of five chapters:

Chapter One will provide background information, a statement of the research problem and the objectives as well as the rationale for the study.

Chapter Two will comprise of the literature review relating to intellectual property registration activities and the management thereof at universities.

Chapter Three outlines the design and method of this research; the sampling techniques used; the different kinds of questions used; and the distribution of the questionnaire. Details of the method used to analyze the data will be summarized.

Chapter Four will present the findings of the empirical investigation. Detailed analyses of the findings accompanied by graphic and numerical tabulations are also presented in this chapter.

Chapter Five deals with the recommendations and conclusions drawn from previous chapters and the data analysis. The chapter concludes with suggestions for future research.

1.7.8 CONCLUSION

This chapter described the nature of information and the type of research activities to be carried out in the study. The next chapter reviews related literature on intellectual property registration activities and management thereof at HEIs. This study will assist the DUT in establishing reasons for the low intellectual property registration activity and assist in possible methods to overcome related issue, thereby increasing registration activity.

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

The background to this study was set out in the previous chapter. Saunders, Lewis and Thornhill (2003:21) indicate that literature review is a preliminary research step that helps to generate and refine research ideas and it forms part of a research project. They further state that knowledge does not exist in a vacuum and work only has value in relation to other people's work and findings.

In the present chapter, literature relating to intellectual property generally, as well as the management thereof, will be reviewed. A brief overview of the different forms of intellectual property is included. Particular attention is given to patents as it is the intention of the researcher to explore and investigate the reasons for the low patenting activity at DUT. Legislation relating to IP management, particularly the new IP Act 51 of 2008, will also be reviewed, as well as the impact of such legislation on IP registrations at universities.

This chapter concludes with an examination of the challenges that are faced by Higher Education Institutions relating to registration and management of intellectual property assets.

2.2 WHAT IS INTELLECTUAL PROPERTY?

Intellectual property law, according to Govindjee et al. (2007:4), protects the intellectual property rights of people who have created something original and potentially profitable. Ideas, inventions and written works; as well as chemical, business or computer processes, and company and product names and logos, are all categories of intellectual activity covered by intellectual property law.

Sun and Baez (2009:7) maintain that intellectual property refers to valued, intangible creations of the mind. The law of intellectual property affords rights associated with the expressions, products, processes or marks derived from knowledge. Hammersla (2006:1) describes intellectual property as taking the form of copyright for original expressions, patents for inventions and discoveries, trademarks for distinguishing names or symbols; and trade secrets for information held from the public to give an entity a competitive advantage over another person or organization

According to the World Intellectual Property Organization (WIPO) Publication (No. 489) (2009:3), the concept of intellectual property, very broadly, means the legal rights which result from intellectual activity in the industrial, scientific, literary and artistic fields. Countries have laws to protect intellectual property for two main reasons. One is to give statutory expression to the moral and economic rights of creators in their creations and the rights of the public to access those creations. The second is to promote, as a deliberate act of Government policy, creativity and the dissemination and application of its results as well as to encourage fair trading which would contribute to economic and social development.

WIPO (2009:3) further explained that intellectual property law aims at safeguarding creators and other producers of intellectual goods and services by granting them certain time-limited rights to control the use made of those productions.

The Convention Establishing the World Intellectual Property Organization (WIPO), concluded in Stockholm on July 14, 1967 (Article 2(viii)), provides that “intellectual property shall include rights relating to:

- literary, artistic and scientific works,
- performances of performing artists, phonograms and broadcasts,
- inventions in all fields of human endeavor,

- scientific discoveries,
- industrial designs,
- trademarks, service marks and commercial names and designations;
- protection against unfair competition,

and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."

The areas mentioned as literary, artistic and scientific works belong to the copyright branch of intellectual property. Performances of performing artists, phonograms and broadcasts are usually called "related rights", that is, rights related to copyright. Inventions, industrial designs, trademarks, service marks and commercial names and designations constitute the industrial property branch of intellectual property. Article 1(2) of the Paris Convention for the Protection of Industrial Property (Stockholm Act of 1967) (the "Paris Convention") includes "the repression of unfair competition" among the areas of "the protection of industrial property". The said Convention states that "any act of competition contrary to honest practices in industrial and commercial matters constitutes an act of unfair competition" (Article 10*bis*(2)).

WIPO (2009:4) defines "industrial property" as covering inventions and industrial designs. Inventions are new solutions to technical problems and industrial designs are aesthetic creations determining the appearance of industrial products. Industrial property includes trademarks, service marks, commercial names and designations. The object of industrial property typically consists of signs transmitting information to consumers, in particular as regards products and services offered on the market, and that the protection is directed against unauthorized use of such signs which is likely to mislead consumers, and misleading practices in general.

In the South African context, intellectual property which is protected by the law includes design protection, trade secrets, patents, trademarks and copyright.

2.2.1 Design Rights

According to the SABS Design Institute (2008:4), design protection provides the registered owner of the design with monopoly rights for a period of 10 years (functional designs) and 15 years (aesthetic designs). This prevents competitors from importing, making, using or disposing of products covered by the registered designer. Design law varies from country to country, but the key feature common to all is that registration is essential before one obtains the right and that the design must be new on registration. According to Adams and Adams (2010:3), for the duration of the design rights the proprietor has exclusive creation, duplication, distribution, marketing, and commercial exploitation rights. The effect of a registered design is to grant the registered proprietor, for the duration of the registration, the right in South Africa to exclude other parties from making, importing, using or disposing of any article included in the class in which the design is registered and embodying the registered design or a design not substantially different from the registered design such that he shall have and enjoy the whole profit and advantage accruing by reason of the registration. The rights conferred by a design registration are governed by the South African Designs Act 195 of 1993 (SAIIPL, 2010).

2.2.2 Trade Secrets

According to Hefter and Litowitz, cited by Reamer et al. (2008:2), **a trade secret "**is the information that is secret or not generally known in the relevant industry and that gives its owner an advantage over competitors". Trade secret protection exists as long as the information has value, is kept a secret and confidential by the owner, and is not lawfully and independently obtained by others. Examples of trade secrets include product formulas, patterns, methods, techniques, manufacturing processes and compilations of

information that provide a business with an advantage over their competitors. The formula for Coco-Cola and the KFC recipe are the most famous trade secrets (Reamer et al 2008:11).

2.2.3 Patents

According to Smit and van Wyk (2007:1), South African patent law is governed by the Patents Act no. 57 of 1978 and its amendments. In simple terms, a South African patent may be granted for an invention that is:

- New (Novel);
- Inventive; and
- Useful

If the invention meets these three requirements, generally, a patent may be granted for the invention in terms of South African patent law.

Bellis (2009:1) states that a patent gives an inventor the right to exclude all others from making, using, importing, selling or offering to sell his/her invention for up to 20 years without the inventor's permission. This gives the inventor the opportunity to produce and market his/her idea, or license others to do so, and to make a profit. In the United States, a patent is issued by the United States Patent and Trademark Office or USPTO after reviewing a patent application. A United States patent only protects and provides exclusive rights in the United States. Similar patent protection is offered by the Companies and Intellectual Property Commission (CIPC) in South Africa (Sibanda, 2007:3). WIPO (2009:17) refers to a patent as a document, issued upon application, by a government office, which describes an invention and creates a legal situation in which the patented invention can normally only be exploited (manufactured, used, sold, imported) with the authorization of the owner of the patent. An invention may relate to a product or process. A patent is the right granted by the government to an inventor to exclude others from commercially exploiting the invention for a limited period, in return

for the disclosure of the invention, so that others may gain the benefit of the invention. The disclosure of the invention is an important consideration in any patent granting procedure.

2.2.4 Trademarks

The South African Institute of Intellectual Property Law (2010), describes a trademark as a "mark" given in the South African Trademark Act and includes any sign capable of being represented graphically, including a device, name, signature, word, letter, numeral, shape, configuration, pattern, ornamentation, colour or container for goods or any combination of the aforesaid. In South Africa, trademarks are governed by the Trade Marks Act. No. 194 of 1993 as amended by the Intellectual Property Laws Amendment Act. No. 38 of 1997.

According to Bellis (2009:2), a trademark protects words, names, symbols, sounds or colours that distinguish goods and services. Trademarks, unlike patents, can be renewed forever as long as it is being used in business. The roar of the MGM lion, the pink of the insulation made by Owens-Corning (who uses the Pink Panther in advertising by permission from its owner), and the shape of a Coca-Cola bottle are familiar trademarks. These are brand names and identities and are important in marketing a product or service. Trademark rights may be used to prevent others from using a confusingly similar mark, but not to prevent others from making the same goods or from selling the same goods or services under a clearly different mark. According to the United States trademark law, trademarks protect the creator of a unique phrase, design, image, word, name or logo so other legal entities cannot use them. This enables the goods or services of the owner to be distinguished from that of competitors, providing a mechanism for managing brand names, company names and product attributes such as quality and durability. WIPO (2009:489) describes a trademark as, any sign that individualizes the goods of a given enterprise and distinguishes them from the goods of its competitors. Clearly consumers need to be given the guidance that will allow them to consider the alternatives and make their choice between competing

goods. The goods must be named. The medium for naming goods on the market is precisely the trademark. The big “M” and the tag-line “I’m lovin’ it” are trademarks that belong to Mac Donald’s (Bellis, 2009:4).

2.2.5 Copyright

Smit and van Wyk(2007:4) state that copyright in South Africa, like in most other countries, differs from other forms of intellectual property in that it is not a right that needs to be registered (except in the USA). Unlike patents, trademarks or registered designs, copyright vests in the author of a work once the work is created in a material form. According to Bellis (2009:4), copyright protects works of authorship, such as writings, music and works of art that have been tangibly expressed. In the United States, the Library of Congress confirms that copyright lasts for the lifetime of the author plus 70 years after the death of the author. In terms of South African law, copyright subsists for 50 years after the death of the author and is governed by the Copyright Act No. 98 of 1978, as amended. South Africa is a signatory to the International Berne Convention which obliges it to give recognition and protection to copyright works from signatory countries. WIPO (2009: 40) defines Copyright law as that part of the law which deals with rights of intellectual creators. Forms of creativity are concerned with mass and public communication, not only printed publications but also such matters as sound and television broadcasting, films for public exhibition in cinemas and computerized systems for the storage and retrieval of information. Copyright law protects only the form of expression of ideas, not the ideas themselves. Copyright is automatic once written down in some tangible form, unlike all other forms of IP protection that requires formal registration (Rosenblatt, 2008:11).

Taking the above discussion forward, an intellectual property right or law gives one exclusive rights over one’s creation. Since it is one’s intellectual property, it can be sold, traded and dealt with like any other asset one may own (Rosenblatt, 2008:11).

2.3 INFRINGEMENT OF INTELLECTUAL PROPERTY

Connett (2007:326) explained that a patent infringement consists of the unauthorized making, using, offering for sale or selling of any patented invention, or importing any patented invention during the term of the patent. The word “infringement” means an encroachment on the domain belonging to a patentee who may sue for relief in the appropriate court. The patentee may ask the court for an order to prevent the continuation of the patent infringement and may also ask the court for an award of damages because of the patent infringement.

Smit and van Wyk (2007:2) explains that in order to be successful in an infringement matter in South Africa, a patentee must show that an infringing device, system, apparatus or method includes the entire essential or at least one independent claim of a patent. In defence, an alleged infringer can deny infringement or rely on the invalidity of the patent on any one of the grounds set out in Section 61 of the Patents Act 57 of 1978 and/or on use prior to the priority date of the patent in question.

According to the South African Patents Act, an infringer can counterclaim that the patent in question is invalid and request the Commissioner of Patents to revoke a granted patent. In order to more effectively address the problem of counterfeiting and piracy, South Africa enacted the Counterfeit Goods Act 37 of 1997 which provides for procedures to investigate, seize and eventually (in appropriate cases) destroy counterfeit and pirated products. Based on the complaints lodged by the U.S. Trade Representative, the South African government improved and enforced its laws by conducting raids on suspected counterfeit and pirated goods (Ramsden, 2011:12).

In order to be valid, the claims of a South African patent must be novel and inventive and all formal requirements ought to have been complied with. The novelty requirement is an absolute requirement. For example, an invention as claimed should be new anywhere in the world, not just in South Africa.

The immense adverse economic and social impact of intellectual property theft requires that combating counterfeiting and piracy become a priority for society, and not just the rights holder. Unless governments, business and citizens make a coordinated effort to uphold the intellectual property system, society will not reap its benefits (BASCAP).

2.3.1 TYPES OF INFRINGEMENT

WIPO (2009:6) states there are several ways in which an infringement of patent rights might arise. In the first instance, there may be an instance where a patent is deliberately infringed by a third party without any attempt to avoid the infringement. This will either be straight copying of the invention or else involve minor variations or modifications thereof. With this form of infringement, there is generally no argument as to whether or not there is infringement. If all the features of the patented invention have been copied, then there must be infringement, and the only matter to be resolved is whether the claims of the patent are valid.

The second instance arises where the infringement is deliberate, but some attempt has been made to avoid the appearance of infringement. Although, third parties may be genuinely trying to design around the patent, still making use of the basic idea of the inventor, the result does not always clearly fall outside the scope of the claims of the patent. This is the most common form of infringement faced by patent owners and it gives rise to the most litigation.

A third situation is the case of ‘accidental infringement’. There may be several companies who have been asked to tender for a contract to solve a particular problem or to achieve a certain result, and in so doing may come up with similar ideas to that which may have been involved in the patented invention. Although the patent owner may feel that his invention has been copied, the third party has, in fact, arrived at a similar if not identical solution via a different route.

2.3.2 ELEMENTS IN THE ESTABLISHMENT OF INFRINGEMENT

Stern and Hooper (2004:4) point out that the South African Patents Act states that, in order to establish infringement, the patent owner must prove all of the following elements:

- The carrying out of a prohibited act;
- The prohibited act must have been done after the publication of the patent application, or the issuance of the patent where no early publication occurs;
- The prohibited act must have been done in the country where the patent has been granted; and
- The prohibited act must be in relation to a product or process falling within the scope of a claim of the patent.

2.4 IMPORTANCE OF INTELLECTUAL PROPERTY PROTECTION

Almost everyone in society is a user and potential creator of intellectual property. Its protection, through a system of national and international rules called intellectual property rights, is necessary to provide incentives and financing for innovation and creation, which in turn lead to economic, cultural and social progress. Protection for intellectual property also encourages the production and dissemination of knowledge and a wide range of quality goods and services. Intellectual property rights add value for consumers and can provide a guarantee of source and quality (BASCAP, 2005:8).

Shapiro and Hassett (2005:1) point out that “countries with weak IP protection receive less direct foreign investment; and the investment they receive is less technologically sophisticated”.

Phaswana and Tanziani (2010:1) further support the above statement by stating that intellectual property constitutes an important consideration for the intellectual property rights (IPR) owner and country. They confirm that IPR is frequently a highly regarded factor for a multinational company looking for new opportunities and in deciding whether or not to invest in a particular country. It stands to reason that any company will be reluctant to put their products or technologies on the market in a country where their rights will not be protected. The results of weak IPR laws will be the loss of competitive and marketing advantage and thus loss of profits and investments. According to Mansfield (2009:1), the temporary monopoly of a patent offers three basic advantages:

- It gives the inventor an incentive to invent;
- In obviating secrecy, it allows for early disclosure of invention, thereby accelerating innovation; and
- It protects the inventor's investment in the research and development required for invention and innovation.

Joshi (2011:2) confirms and adds to Mansfield's points above by highlighting the following:

- To provide incentive to the individual for new creations;
- Providing due recognition to the creators and inventors;
- Ensuring material reward for intellectual property; and
- Ensuring the availability of the genuine and original products.

Shankerman and Pakes (1986:384) in Montobbio (2007:3) cautioned that most patents have very low economic and technological value, while a few of them are extremely

valuable. Patent citations are therefore used to measure the economic and technological value of a patent. Citations are particularly reliable because they have a legal value. Trajtenberg (1990:183) and Albert, Avery, Narin and McAllister (1991:257), as cited by Montobbio (2007:4), are among the first scholars to empirically demonstrate that highly cited patents have higher economic and technological importance.

Khota and Stern (2005:3) express the view that employing IP as a strategic tool in product development warrants an “IP Product Protection-Matrix approach (Figure 3.) This approach applies each aspect of IP law to particular products or services, providing protection on various levels and, in this manner, collectively creating significant barriers to entry.

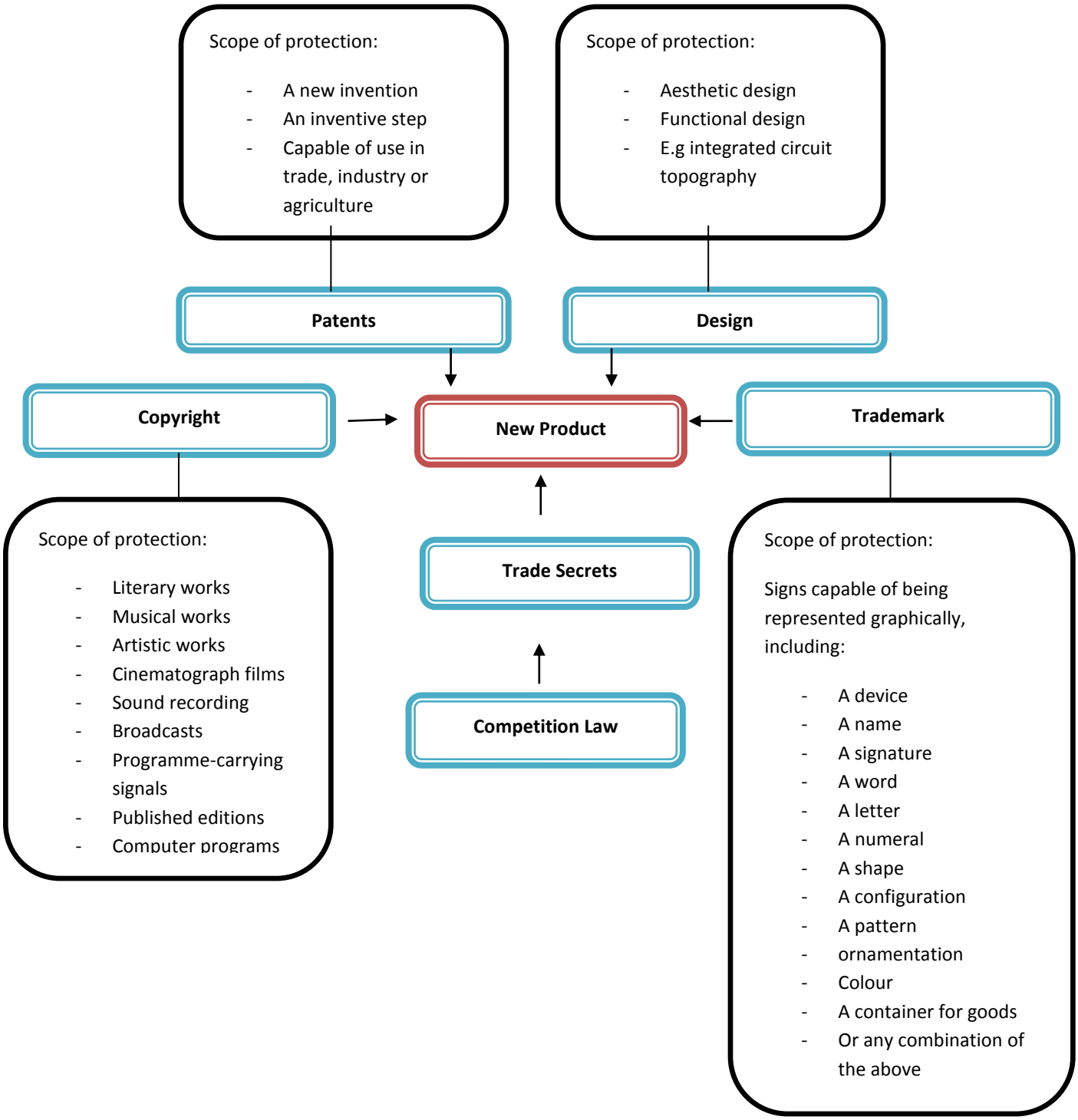

Figure 3. Leveraging intellectual property for strategic advantage in product development. Source: Khota and Stern (2005:2).

Phaswana and Tanziani (2010:2) confirm that the strength or weakness of protection of intellectual property in the developing economy seeking foreign investment has a strong impact on foreign direct investment. Intellectual property rights play an important role within the whole regulatory system, which includes other elements such as competition rules and trade policies.

South Africa was a signatory member of the WTO/TRIPS Agreement in 1994. Legislation was enacted for trademarks and designs: the Trade Marks Act 194 of 1993 and the Design Act 195 of 1993, and the comprehensive Intellectual Property Laws Act 38 of 1997(Phaswana and Tanziani, 2010:2).

Intellectual assets represent one of the strongest forms of intangible value impacting on the knowledge and learning economy (DST, 2002). Understandably, industry partners want the assurance that confidentiality will be paramount. This explains why industry organizations rate protective attitude as a significant barrier. In reaction, more and more universities are starting to implement pro-active 'portfolio management to generate revenue from their intellectual property' (Haase, 2004:16-17).

Intellectual property protection contributes to economic growth in both developed and developing countries by stimulating innovation, cultural diversity and technical development as part of a larger policy framework. Properly used, intellectual property rights can also be key tools for the alleviation of poverty through trade (BASCAP, 2005:11).

Among the many types of IP protection measures, patents are accepted internationally as a reflection of a country's inventive and technological achievements. In South Africa, patents are one of the indicators monitored by the Department of Science and Technology (Pouris, 2005:18).

The importance of IP protection has been discussed in the literature above and it is the key to any country's economic development. Perceived hindrance as a result of IP protection is briefly discussed below.

2.4.1 Perceived Hindrance as a Result of IP Protection

In an arena where the encouragement of monopolies in improvements by means of IP rights makes information a valuable commodity, thus making the borrowing of ideas to innovate more expensive, there has been a significant number of concerns by market proponents that IP protection may inhibit research and development (Drahos and Braithwaite, 2002:37). Such fears include, for example, the fear that genomic patents would disrupt biological research, that copyright extension into the digital networked environment will not be beneficial (especially in the field of education), and that patents covering business methods will retard the anticipated benefits for science and civil society from the development of e-commerce and the Internet. The main concern is that the IP system locks up new knowledge and information for lengthy periods, conflicting with the need of science to gain new information and disseminate that knowledge at minimal cost to benefit society (Dickinson, 2007:12; Drahos and Braithwaite, 2002:37). Dickinson (2007:12) identifies the following reason for the perceived hindrance of research and development (R&D) as a result of IP:

- Failure of government to benefit from the commercial exploitation inventions emanating from government-funded research has been attributed to a lack of motivation by universities to turn their research findings into marketable products. This was remedied through the passing of the Bayh-Dole Act and has resulted in the creation of more than US$30 billion of economic activity, 250 000 jobs and 2 200 new companies a year (Dickinson, 2007:12) as a result of the commercialization of new technologies emanating from academic institutions.

According to Spoor & Fisher (2009:1), 'Intellectual property' refers to the protection of the producers of the products of human creativity that encompasses the 'originality of new products, the confidentiality of know-how and the distinctiveness of names, trademarks and set-up'.

2.5 PATENTING PROCEDURE

According to Sibanda (2007), there are essentially three requirements for a patent to be granted for an invention. These can be summarized as being:

- **Novelty (new),** 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 (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 (useful),** meaning that it must be capable of use in agriculture, trade and industry.

When an invention meets the above requirements, an application, typically a provisional patent application which broadly describes the invention (in the case of South Africa), is filed. Pouris (2005:17) briefly explains the outline of the Patent Cooperation Treaty (PCT) procedure, which includes the following steps:

- **Filing:** The inventor files an international application, complying with the PCT formality requirements, in one language, and s/he pays one set of fees;

- **International search:** One of the world's major patent office identifies the published documents that may have an influence on whether the invention is

patentable, and establishes an opinion on the invention's potential patentability;

- **International publication:** As soon as possible after the expiration of 18 months from the earliest filing date, the content of the international application is disclosed to the world;

- **International preliminary examination:** One of the world's major patent offices may, at the inventor's request, carry out an additional patentability analysis, usually on an amended version of the application;

- **Entry into the national/regional phase:** After the end of the PCT procedure, the inventor starts to pursue the grant of the patents directly in the countries in which s/he wants to obtain them.

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

2.6 PROTECTION OF SOUTH AFRICAN PATENTS INTERNATIONALLY

In terms of the South African Patent Act 57 of 1978, the Companies and Intellectual Property Commission (CIPC) is the custodian of all new patent applications that are filed within the Republic of South Africa. A South African patent enjoys protection only within the territorial limits of South Africa. In order to ensure that the invention enjoys protection in other countries, a separate patent application has to be made in each of the country in question. The application procedures, regulations in respect of patentability, and the period of patent protection differ significantly from country to country (Matthee, 2007:11).

Since 1999, South Africa has been recognized as a member of the Patent Cooperation Treaty (PCT) of 1970. Under the PCT system, only one patent application needs to be lodged in a PCT country in order to enjoy preliminary international protection of the

patent rights. This protection is then valid for twenty (20) months (and in some cases for up to thirty (30) months) from the date of registration of a preliminary patent in the first PCT country of registration. The extended period affords the inventor, or the holder of his/her rights, enough time to conduct thorough market research and product development without incurring unnecessary legal and especially translation costs. The PCT system effectively defers costs, with the inventor still being protected by the law while choosing countries for final registration more deliberately, undertaking translation more selectively, and containing legal costs in general. The PCT system only applies to patent rights in the PCT countries (Matthee, 2007:13).

2.7 COPYRIGHT

Copyright comes into effect automatically on completion of the work. Unlike other categories of IPR, no registration is necessary. According to the South African Copyright Act 98 of 1978, copyright normally vests in the creator of the work, except in the case of an employee who creates the work in the normal course and scope of his/her employment with the employer, in which case it vests in the employer. In the case of literary works, musical works and artistic works, copyright remains in force for the life of the author and a period of 50 years after his/her death. In the case of photographs, sound recordings, cinematograph films, computer programmes (software) and other works, the term of copyright is normally 50 years from the time that the work was first made available to the public.

With South Africa being a member of the Berne Copyright Convention, a South African author enjoys copyright protection of his/her work not only in South Africa, but also in all countries which subscribe to the Berne Convention (WIPO, Publication 489:63).

2.7.1 OWNERSHIP OF COPYRIGHT

Ownership of copyright created in an employment context is governed by Section 21 of the Copyright Act. An employer or a person who commissions a work becomes the owner of the work in which copyright subsist in the following circumstances:

Where the work "is made in the course of the author's employment by another person under a contract of service or apprenticeship, that other person shall be the owner of any copyright…" (Section 21(1)(d); and "where a person commissions the making of … and pays or agrees to pay for it in money or money's worth, such person shall be … the owner of any copyright" (Section 21(1)(c).

2.8 IMPACT OF THE IP ACT 51 OF 2008 ON RESEARCH AND DEVELOPMENT IN SOUTH AFRICA

Gray (2009) understood and explained that the act was designed to ensure that all publicly funded research gets intellectual property protection for the purposes of commercialization.

Phaswana and Tanziani (2010) stated that South Africa has had at all times, because of its colonial past, a modern intellectual property rights (IPR) law system and has been continuously amending it to be in line with international developments and best practice. South Africa is regarded as an investment gateway into Africa as one of the most advanced and productive economies on the continent. In the 1990's, there was an increased understanding that as an emerging economy, South Africa's IPR was a crucial element of the institutional infrastructure which encouraged private investment and economic growth. Then, in 2010, certain IPR laws were amended, including a provision modeled after the U.S. Bayh-Dole Act, which led to the emergence of the IP Act 51 of 2008.

Gray (2009:1) highlighted her interpretation of the definitions and provisions of the Act as follows:

- The central provision of the Act is that universities carrying out research from public funds have to assess and report on all research carried out in the university that might have the potential for IPR protection and commercialization. According to Act 51 of 2008, such research initiatives would be owned by the university (Section 2(2)(a)).

- If the university /researcher do not want to lock down the IP in the research, then this decision has to be made according to the guidelines provided by the National IP Management Office (NIPMO) and it has to be notified of this decision (Section 4(2)). NIPMO then reviews this decision and can, if it disagrees with the university, acquire ownership of and obtain statutory protection for the IP in this research. The university and its researcher no longer have the right to make their own decision on the impact of their research (Section 4(3)).

- Research funded by private organization only counts as not being publicly funded if the full cost of the research is covered, including all direct and indirect costs (Republic of South Africa 2008:51). Therefore, no objections would be raised. A funder can wholly own the IP generated if they pay for the R&D conducted by universities according to a 'full cost model' (i.e. inclusive of direct and indirect costs as defined in the regulations).

Kahn (2009:2) commented that the government's desire to encourage innovation was commendable, but felt that the legislation seeks to do this through the use of patents and intellectual property, a route that has been unsuccessful overseas and which was seen as having a stifling effect on research and innovation. Her broad review of the legislation she felt was sufficient to show that, should it be passed, it will create a worrying precedent for future research, development and innovation, not to mention academic freedom.

2.9 Requirements in terms of the Intellectual Property Rights Act 51 of 2008

According to Gumbi (2010:332), the South African research and development strategy (R&D Strategy 2002) refers to the need to develop a:

> …clear approach to intellectual property that arises from publicly financed research, enhance national capacity to manage intellectual property (especially intellectual property derived from publicly financed research) and strengthen the initiatives for the commercialization of intellectual property.

According to the R & D Strategy (2002), there is an urgent need for the creation of a proper framework and enables legislation relating to the management of intellectual property arising from publicly financed research. This [legislation] will define the 'playing field' for publicly financed research and research that is undertaken in parastatal institutions.

This section will discuss the aims of the Department of Science and Technology (DST) that will encourage the development of local intellectual property (IP) by providing public funding.

The Intellectual Property Rights from Publicly Financed Research and Development Act (IPR Act) was enacted in December 2008. The aim of this Act is to ensure that intellectual property emanating from publicly financed research and development is identified, protected, utilized and commercialized for the benefit (whether social, economic, military, or any other) of the people of South Africa. The objectives of this Act are:-

- To provide for a more effective use of IP emanating from publicly financed research and development,
- To establish the National Intellectual Property Management Office and the Intellectual Property Fund, and

- To provide for the establishment of institutional TTOs and other related matters.

According to Gumbi (2010:332), in order to fulfill the above requirements, higher education and research institutions will be expected to establish monitoring and evaluation (M&E) systems to track their IP management and technology transfer activities, as they will have to report to the National IP Management Office. Data collection and reporting is only half the work, because analysis of the reported data is necessary to identify trends and assess actual performance against predetermined targets or external benchmarks.

From this it may be concluded that the legislation will also ensure that the country and the innovators will benefit from the IP being developed into commercial products.

Minister of Science and Technology Mosibudi Mangena (2009:1) says, "We recognize that IP is an instrument for economic growth and the improvement of the quality of life." Legislation is part of the DST's broader research and development (R&D) programme. The initiative aims to develop a strong base of research expertise and development of novel ICT products and services. According to Minister Mangena (2009:2), the legislation not only provides an enabling environment for IP creation, protection and management, it also supports the commercialization of IP by providing greater clarity on the ownership generated through publicly financed research. This creates a trend. Depending on the size of the funding, innovators will know exactly how much revenue they are entitled to with regards to product sales.

The legislation will have a framework for the establishment of capacity to ensure local institutions are better able to identify, protect and commercialize IP arising from research conducted by their institutions. Minister Mangena (2009:1), further added that the investment in human capital development is in line with the department's national R&D Strategy, which, among others, puts enormous value on human capital and canvasses for the spirit and practice of innovation to be treated as a national asset.

As stated by Van Zyl (2011:594), an innovation opportunity presents itself in the emerging relationships between South Africa and Brazil, Russia, India and China, as formalized by the recent invitation for South Africa to join these BRIC countries. Other areas where local innovation should make an impact are centered around healthcare policies; the impact of global changes on the livelihood of communities; and the way in which the financial crisis in the 'developed world' affects trade and aid. South Africa has responded to these challenges by introducing a number of measures, as mentioned by Van Zyl (2011:594) below:

- Firstly, the 'Ten-Year Innovation Plan of South Africa' was conceived by the Department of Science and Technology in 2008 to 'help drive South Africa's transformation towards a knowledge-based economy, in which the production and dissemination of knowledge leads to economic benefits and enriches all fields of human endeavour'.

- Secondly, the National Industrial Policy Framework Industrial Policy Action Plan announced in 2007 sets out the government's broad approach to industrialization in the context of the Accelerated and Shared Growth Initiative for South Africa, and has set the target of halving unemployment and poverty by 2014 through accelerated growth of at least 6% from 2010 onwards.

2.10 BAYH-DOLE ACT

According to Gray (2009:20), one outcome of the knowledge economy innovation thinking in the DST has been the formulation of Bayh-Dole-style legislation, passed in late 2008 as the Intellectual Property Rights from Publicly Funded Research and Development Act.

The statement above by Gray confirms that the IP Act 51 of 2008 was modeled around the Bayh-Dole Act and it is for this reason that the researcher discusses the Bayh-Dole Act in detail below.

Kim (2010:180) stated that the Act had accelerated technology growth in the U.S. and permitted the government to capitalize on research discoveries through commercial exploitation. She reported that Australia, India, Japan, Korea, Taiwan, Switzerland, Germany, France, Turkey, The United Kingdom and Brazil, all have different legal, social and economic infrastructures, yet have been seeking to emulate the spirit of the Bayh-Dole Act to obtain the positive effect it has brought to the U.S. economy.

Sun and Baez (2009:80) explain that the Bayh-Dole established a uniform system for intellectual property in respect of federally funded research to non-profit universities as listed below:

- A uniform patent agreement with federal agencies;
- An opportunity for non-profit organizations, including universities, to file for patent protections of discoveries and inventions;
- A reward system for inventors, which includes sharing proceeds;
- A non-exclusive license to the federal governments;
- “March-in” rights (or access) to technology not used for commercial activities;
- A mandate that discoveries and licenses remain in the United States; and
- Rights of universities holding the patent to assign exclusive licence to the technology.

U.S. Patents Awarded to 100 Academic Institutions with the Greatest R&D Volume: 1972-1991.

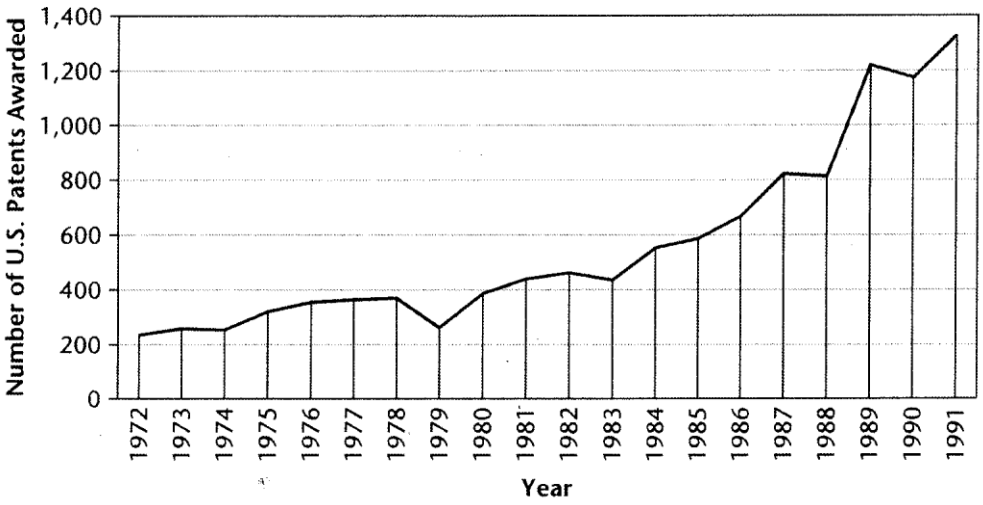

Figure 4. Source: Depiction of NSF data on patents awarded to U.S. universities Source: National Science Board, 1993:81.

University patent activity increased significantly after the Bayh-Dole Act was passed (Dai, Popp and Bretschneider, 2005:19). By 1995, the number of patents issued to these institutions increased to 587, and by 1991, more than thirteen hundred patents were issued to the same institutions (see Figure 4).

Ramirez (2004:361) maintains that upon the law's enactment, many touted that the Bayh-Dole Act nearly single-handedly accelerated higher education's participation in commercial enterprises and patent activities. According to Boettiger and Bennett (2006:321) and Nelson (2007:14), although, in practice, this law may not have accomplished as much as is attributed to it, it appealed to many universities that sought to patent academic research. It also serves as a reminder of academic research's commercial potential through patenting and licensing activities. Thus, at the very least, the law advanced its purpose of commercializing research and spurring on technological innovation through patent and licensing activities at American universities (Sun and Baez, 2009:81). Dai et al (2005:581) mentioned that their research results

proved that the Bayh-Dole Act spurred university patenting and fostered technology transfer, but did not induce additional applied research at universities. Bayh (2011:183) maintains that the long-term economic growth of most countries is linked to technology development and innovation. The Bayh-Dole Act aimed at encouraging the transfer of technology from research institutions to the private sector, where it could be employed in activities that stimulate economic growth.

Bull (2006:332) added that some opponents of the Act contend that all research should be conducted for the sake of science and human progress, and are consequently opposed to introducing economic incentives into the research process. These opponents argue that exclusive licenses lead to monopolies and higher prices; that taxpayers should derive the benefits from federal funded research and that such research should not unduly benefit foreign industry.

Dr Allen (2008:151) indicated that, in 1979, the U.S. economy had stagnated while the world was moving in the direction of a knowledge economy, and that knowledge needed to be protected. Since universities in the U.S. concentrated on early-stage research and did not attempt to create the end product, something had to change. The Bayh-Dole Act was passed in the US in 1980 to encourage technology transfer. According to Dr Allen (2008:167), over the last 20 years after the passing of Bayh-Dole, companies are now working with universities to turn early-stage research into marketable products.

2.10.1 IMPACT OF THE BAYH-DOLE ACT

After 1980, universities in the United States responded and started creating Offices of Technology Licensing ("OTL"). Only twenty three universities had OTL's prior to Bayh-Dole. Starting in 1983, the rate of creation increased dramatically and today, all major research institutions have an OTL (Losie and Stevens, 2010:185).

A survey conducted in the US by the AUTM (2010:18) revealed that the income earned by universities from licensing has increased substantially, from $7.3 million in 1981 to

$3.4 billion in 2008. Despite the high level of income, technology transfer is still a money losing proposition for most universities. Two factors account for this:

- Income is highly concentrated in a few “big hits.” 24 percent of the $3.4 billion in income reported in 2008 was reported by Northwestern University.

- The majority of the income that is generated (60 – 80 %) is distributed to the inventors for their personal benefit and to the inventors’ laboratories and colleges to be spent on research (both of which the Bayh-Dole requires) to incentivize them to participate in the technology transfer process. Only a small portion is used to offset the costs of technology transfer.

From the above literature, one can conclude that each university’s technology transfer office is not expected to generate huge income in the initial few years of set-up unless successful exploitation or commercialization is achieved. Further, the success of the American universities does provide an incentive for South African universities.

2.11 CHALLENGES FOR SOUTH AFRICA

In principle, Bull (2006:333) states that the Bay-Dole Act encourages research institutions to secure IP protection for inventions (in particular in high technology industries, such as biotechnology, semi-conductor, software, chemical and pharmaceutical industries). The research institutions then license these inventions to private entities, which in turn further develop the technology to a stage where it is suitable for commercialization. Furthermore, research institutions are required to share

licensing revenues with the inventor and to use the remaining profits for scientific research and education.

Gray (2009:20) says that the DST's Innovation Strategy is built on a widely held belief that the Bayh-Dole Act has made U.S. universities and their researchers rich and helped fuel the growth of the U.S. This view is challenged by evidence that the Act has resulted in financial benefits for very few universities and the registration of a large number of upstream patents has resulted in patent thickets that have impeded innovation rather than helping it (Chardonnens 2010:262).

Kaplan (2009:10) expressed the view that the resources committed to R&D in South Africa are commensurate with other countries at similar stages of development and have been increasing significantly. Business accounts for a very significant and rising share of expenditure on R&D. The number of personnel engaged in research locally is lower than that for many comparable countries and, in recent times, has risen only slowly. This reflects the high cost of skills engaged in research, which in turn is a consequence of the limited supply of the skills needed.

In a study of 20 innovative high technology firms in South Africa, the absence of an examining patent office was listed as a constraint on innovation (Breitenbach 2006:11). Lodging a patent with the Companies and Intellectual Property Commission (CIPC) and obtaining a South African patent is straightforward and inexpensive. However, most innovators are looking to global markets and CIPC does not undertake any search for prior art. As a result, obtaining a local patent provides no indication of whether this patent could succeed in any other dispensation. Consequently, innovative firms which are contemplating any attempt to exploit global markets will have little incentive to secure a local patent. They accordingly undertake a time-consuming and difficult process of engaging local patent lawyers who then instruct patent lawyers abroad to file (Kaplan 2009:12).

Kaplan (2009:15) indicated that South Africa's innovation system is at a critical juncture. It is therefore important to understand what role IPRs have played and can play in the

current context. However, it is possible that a time-lag may occur until policy changes begin to have an effect on outputs. He highlighted that a constraint being faced by South Africa is a limitation in the number of skilled R&D professionals.

Bull (2006:331) maintains that South Africa has recognized the need to increase its rate of technology development. South Africa's current annual patent rate is only 2.5 patents per million people per year, compared to 779 in South Korea and 75 in Australia. It is this fact that is driving the focus on investment in patenting and research (Bull, 2006:332).

Researchers Anastassios Pouris (2009:14) of the Institute for Technological Innovation at the University of Pretoria and Anthipi Pouris of the National Research Foundation, argue that, while foreign inventors are able to protect their inventions in South Africa very cheaply, the same does not apply to local researchers who battle to protect their inventions abroad owing to far higher costs. In addition, local registration does not automatically confer international patent protection. Analyzing data based on university patent registrations, the authors show that only 58 out of the 280 patents registered in South Africa by academics between 1996 and 2006 (only 20%) of cases secured international patent protection.

Kaplan (2009:17) expressed the view that the resources committed to R&D in South Africa are commensurate with other countries at similar stages of development and have been increasing significantly. Business accounts for a very significant and rising share of expenditure on R&D. The number of personnel engaged in research locally is lower than that for many comparable countries and, in recent times, has risen only slowly. This reflects the high cost of skills engaged in research, which in turn is a consequence of the limited supply of the skills needed.

The Organization for Economic Co-operation and Development (OECD), identified a looming crisis in two areas. Firstly, the large engineering gap between supply of design and managerial and technical capabilities on the one hand and the demand for such resources being generated by the increased rate of investment across the economy. Secondly, there was a limited supply of university graduates capable of undertaking

research. Unless this is addressed, the entire innovation system will be constrained (OECD, 2007:7).

Pouris and Pouris (2011:22) suggest that South African inventors are not able to protect their inventions abroad and that they also run the danger of disclosing their inventions to foreigners by patenting locally only. Furthermore, they state that the current system creates substantial social costs and fails to meet the international standards relating to the disclosure of information pertaining to patent applications and grants. They call on South African authorities to bring the patent system up to international standards. Analyzing data based on university patent registrations, the authors show that only 58 out of the 280 patents registered in South Africa by academics between 1996 and 2006 in other words, only 20% of cases secured international protection.

In South Africa, patenting is regulated by the South African Patent Act 57 of 1978 in term of which the Companies and Intellectual Property Commission (CIPC) is the custodian of all patent applications. Because South Africa is a 'non-examining country', CIPC has no responsibility for examining and establishing the novelty or inventive merit of each application - with a number of "adverse consequences" for the efficacy and quality of the system (Pouris and Pouris 2009:27).

2.12 THE ECONOMIC IMPORTANCE OF INTELLECTUAL PROPERTY ASSETS

The importance of intellectual property assets are highlighted in the section below, particularly from an economic point of view.

Invention (the discovery of new ideas) followed by innovation (the implementation of new techniques) drives economic growth (Kamoun 2008:2).

The trend that new intellectual property drives economic growth is further highlighted by the World Intellectual Property Organization (WIPO) (2008:4) which states that “IP assets have economic value because of its ability to generate financial benefit from

technologies, products and services". WIPO also states that "by the use of the word assets", IP managers and policy makers understand that IP is not just afforded a legal right but also contains economic benefit that belongs to its owner. IP cannot be protected and developed without human capital. Economic development is being driven largely by intellectual property. WIPO (2008:4) states that the combination of intellectual property and human capital is a potent economic force in today's knowledge-based economy".

Murray (2007:1) adds that IP is an economic asset and has been known to enhance growth in many ways. Companies can gain royalty revenue from engaging in licensing their assets to 3rd parties, which has become an amicable method. Khota and Stern (2005:1) state that legislation relating to copyright, patents, trademarks designs and competition, all of which form part of IP, is a tool that must be exploited by product developers to create competitive advantages in the knowledge economy. Leading companies tend to innovate, originate and develop rather than administer, emulate and maintain (Bennis, 1989:3). For this reason, the leaders are best able to exploit IP as a strategic lever to protect their organization's competitive positioning and create additional competitive advantage generated from their knowledge creation activities (Khota and Stern, 2005:2).

WIPO (2008:7) further states that universities have also used IP assets to support their budgets and to sustain continued education and research. The dramatic growth in university IP licensing is illustrated by Stanford University which, in 1970, set up a one-person pilot technology licensing programme that generated US$55,000 from merely three technologies.

Pavitt, Grupp and Griliches (as cited by Montobbio 2007:3), argue that patent data are an extremely useful and rich source of information. Many papers have assessed the use of patents as economic indicators for at least two decades. Patents can be used to analyze the technological activities of inventors, firms, regions and countries. He further indicates that patents show a high level of correlation with R&D at the firm level. This suggests using patents as an 'input' indicator that is measuring the technological effort

of companies and non-firm organizations to create new products and process (Montobbio, 2007:3).

The above discussion draws attention to the importance of intellectual property for the economic growth of companies, higher education institutions and the country at large. This is illustrated by the following case study:

A team of scientists led by University of Johannesburg (formerly Rand Afrikaans University) scientist Professor Vivian Alberts achieved a breakthrough after 10 years of research in the field of solar technology. The South African technology has been patented across the world (Steenkamp 2006:2). The invention has been commercialized in Germany and is reported to have created a large number of job opportunities. Considering the energy crises South Africa has been undergoing in recent years, this invention would have had a positive effect on energy saving and the creation of job opportunities in the country of invention. Puri (2009), maintained that there was a need to protect IP developed in South Africa from being sold to overseas companies, and then buying back the goods invented in finished form at a premium.

From the above discussion, it is evident that industry and higher education collaborations is encouraged by the importance of intellectual property assets. The following points confirm this.

2.13 UNIVERSITY-INDUSTRY COLLABORATION

The benefits of the University-Industry collaboration, as described by the Council on Governmental Relations - US (COGR-US, 2000), take many different forms for instance:

- Basic Research : Basic research is seen as a major role of universities, while applied research and development is more common in industrial laboratories.

- Graduate education : industry-funded university research and internships

enhance graduate education by providing faculty and students with a better understanding of industrial problems;

- Increased awareness : Collaboration with industry enhances academia's understanding of the challenges facing industry by exposing the university faculty to industrial concerns and industrial approaches to research;

- Cost-effectiveness : Collaboration, whether singly or with several in consortia, provides a cost-effective means of doing research whereby funds invested are leveraged by the contributions of other participants;

- Government Funding : By design, alliances between university and industry partners are required for federal funding to be obtained in certain competitive situations; and

- Business Opportunities - The Bayh-Dole Act has spawned a university technology transfer industry in which universities protect the intellectual properties resulting from research and license them for commercial applications.

Looking at the various forms of research, it can be concluded that universities play an important role in transferring research results to industry. This in turn encourages the registration of intellectual property. Having examined the economic importance of intellectual property and the various industry/university collaborations, one understands more clearly that technology transfer has a two way advantage for both parties. In biotechnology and other science-based industries, universities are recognized as a primary source of new business opportunities.

Therefore, the next section will address intellectual property and higher education.

2.14 INTELLECTUAL PROPERTY AND HIGHER EDUCATION

The role of higher education with regard to the management of intellectual property is discussed in this section.

Van Zyl (2011:594) expresses the view that research turns money into knowledge, whereas innovation turns knowledge into money. This simplistic description of the difference between research and innovation makes the key distinction between producers of knowledge on one hand, and social and economic entrepreneurs on the other. A more formal definition by the Organization for Economic Co-Operation and Development (OECD 2007:8) states that an innovation is the implementation of a new or significantly improved product (goods or service) or process, a new marketing method, or a new organizational method in business practice, workplace organization or external relations. This definition extends the concept of innovation beyond the pure economic realm to that of social and organizational renewal, which is especially important in the African context.

Macdonald (2009:16) states that a university needs to be seen as a source of technology for industry. Patent registration has long been valued as a performance indicator, a measure of real output from research rather than a mere input (Pavitt, 1998:2). Patents are also valued for the latitude it affords the manipulative (Meyer and Tang, 2007:417). Universities that could not otherwise claim to be first rank can use patents to make just that claim (Washburn, 2005:2). Once studies began to accept patents as a valid indicator of a university's technological output, the precedent was set for other studies (Powers and McDougall, 2005:6).

Poyago-Theotoky et al. (2002:12) commented that academic scientists who are engaged in entrepreneurial activities are more secretive and are more likely to deny request from fellow academics for research results. It was also found by Poyago-Theotoky et al (2002:11) that "evidence appears to contradict the conventional wisdom

that university technology licensing reduces the quality and quantity of basic research performed by academics". This is in agreement with a study of licensed technologies at the Universities of California, Stanford and Columbia, which similarly concluded that there has been little effect on the content of academic research (Mowery et al 2001:6). Similarly, Louis et al. (2001:7) found that the "entrepreneurial faculty has higher productivity than the non-entrepreneurial faculty". Zucker and Darby (1996:6) reported that "star scientists in biotechnology had excellent research performance after becoming involved in commercialization".

From the preceding discussion, despite the contradictory evidence found, the benefit to both research institutions and industry has been mutual, and far more benefitting to society at large.

According to Poyago-Theotoky et al (2002:10) "universities can also benefit from reverse technology transfer (i.e. technology transfer that flows from firms to universities), enabling academic scientists to conduct better experiments, as a result of their interactions with industry scientists".

In addition to higher education institutions' roles in providing education and conducting research, universities are expected to fulfill a third role, of making social contributions. Their activities are contributing to the creation of IP in the whole of society, endeavor voluntarily and in positive ways to develop human resources, and disseminate research and research results. Universities are expected to clarify the ownership and handling of IP that has resulted from their research, as well as to implement the strategic management and utilization of IP.

It is clear that higher education and industry collaboration has had contradictory evidence, yet has positively impacted on licensing and exploitation from reverse technology transfer.

In the next section, patenting activity at higher education institutions will be further examined.

2.14.1 PATENTING ACTIVITY AT HIGHER EDUCATION INSTITUTIONS

Universities are patenting more than ever before. However, if it is to make money, they are not succeeding. They seek to demonstrate their relevance to the needs of industry. Yet, there is evidence that the university's determination to patent may actually impede technology transfer to industry and poison relations. There is a general danger that patenting will divert resources from the traditional activities of the university, benefiting the commercial at the expense of the intellectual (Macdonald 2009:3).

The concept of commercializing academic research through patenting activity started after a 1907 invention at Berkely. At that time, Frederick Cottrell of the University of California patented his electrostatic precipitator, a device that removed particles from the air. His invention and subsequent patent sparked attention in higher education because it initiated the commercialization of academic research (Metlay, 2006:3; Mowery and Sampat, 2001a:344, 2001b:783). After rolling out his invention in 1912, Cottrell established a patent management organization which marked the start of a new era: the commercialization of academic research (Sun and Baez 2009:68).

2.14.2 Technology Transfer

According to Sun and Baez (2009:73), the activity that we now call **"technology transfer",** is not a new phenomenon. For many years it has been commonplace within the business sector of the economy to engage in transfers of information or manufactured devices, prototypes or materials, by means of a legal instrument or through the provision of services or through direct sales. Within the last twenty years, universities have picked up and adopted that label for certain of their own activities.

Etzkowitz et al. (1998:6) mentioned that although it is true that patenting cannot guarantee a university that its technology and future technology transfer will be a success, it can however help protect its future potential. It is important to note that before joining the patent race, universities should consider how the patents can be valuable for them and whether these patents can be valuable for society as well. Striukova (2009:3) adds that patents play an integral role in technology transfer. Therefore, it is important for universities to know what their value is and where the value resides. As mentioned, technology transfer has been taking place for many years. However, the passing of the intellectual property legislation which brought about the question of ownership has created a further awareness at academic research institutions.

2.14.3 PATENTING CHALLENGES FOR UNIVERSITIES

The results of a survey by Baldini (2009:3) relating to patenting activity at Italian universities show that those obstacles to university patenting activity were attributed to the following: lack of support mechanisms (including insufficient reward for researchers, lack of a TTO; lack of funds to cover patenting costs); commercialization problems, too heavy teaching and administrative duties; and personal/cultural problems (related to the scarce knowledge of institutional-level patent regulations and to the “open science” mentality of the university).

In general, there is a low rate of patenting by South African institutions at both local and international levels. Science councils, particularly the CSIR, have significantly higher patenting rates than higher-education institutions. This is consistent with findings in Europe where it was established that public research organizations have a relatively higher numbers of patents than universities (Montobbio, 2009:7).

A recent study of the patenting activity at the USPTO by the five most innovative South African universities concludes that their performance is well below that of other countries (Lubango and Pouris, 2007:791).

Sibanda (2008:1) found that there appears to be a correlation between patenting activity and the existence of institutional IP policies and arrangements for the management and commercialization of intellectual property, with institutions having arrangements and policies in place, recording higher proportions of Patent Cooperation Treaty (PCT) patent applications, European Patent Office (EPO) and US Patent and Trademark Office (USPTO) patents. This finding was consistent with the findings in Garduno (2004:3) on South African institutions, as well as with the review carried out by Nicola (2006:4) that a supportive environment inside a university is important to stimulate patenting and licensing activities.

Some scholars argue that increased university patenting and licensing could potentially weaken academic researchers' commitments to "open science" leading to publication delays, secrecy and withholding of data and materials (Dasgupta and David, 1994:489). However, Mowery and Sampat (2001a:338) argue that there is little evidence of substantial shifts since the establishment of Bayh-Dole in the context of academic research in the US.

Sibanda (2007:1) was of the opinion that technology transfer offices at the institutions are under-resourced, thus explaining not only the low disclosure rates which result in the low patenting rates, but also the low conversions of patents to commercial products and/or licenses. One of the challenges faced by technology transfer offices, particularly at higher-education institutions, is the increasing pressure to generate "third stream" income in the wake of reduced government subsidies. He believes that this may adversely impact on the focus of the technology transfer offices. Instead of focusing on getting institutional intellectual property out into the market place, these offices may increasingly find themselves under pressure to generate income, with the result that the

relationship with industry may be affected as the institutions may adopt more aggressive approaches to negotiating licenses and technology transfer.

Kaplan's (2009:18) study reveals that, by international standards, South African higher-education institutions generally have very low patenting activity, which appears to mirror a stagnant research output from these institutions as indicated in publications from available data on scientific publications. Sibanda (2007:1) stated that the extent of patenting appeared to be dependent on the type of research being undertaken by each institution, which was often influenced by the mandate of the funding agency.

A review of patenting activity of research institutions by the Companies and Intellectual Property Commission (CIPC) revealed a concentration of patents in classes that may be linked to the life sciences, biotechnology and ICT. This is consistent with the findings of Geuna and Nesta (2006) that "broadly defined, the research area of biotechnology and pharmaceuticals tends to be an area of extremely high university patenting activity across countries". This, as pointed out by Montobbio (2009:9), could be due to growing opportunities in the biomedical and ICT sectors or to the fact that the results of university research in the area of pharmaceuticals, communications and electronics are conducive to R&D projects which require clearly defined intellectual property (Montobbio, 2009:9). In addition, the other reason for a relatively high patenting rate in the life sciences and biotechnology sector could be attributed to significant funding by the government pursuant to the formulation of the biotechnology strategy (DST, 2001) which allocated a total amount of 450 million rand over a three-year period for establishment and funding of biotechnology regional innovation centres.

The national system of innovation encourages university participation in advancing technology transfer (Mowery, Nelson, Sampat and Ziedonis, 2001:103; Nelson, 2001:16). However studies have expressed differing conclusions about whether universities should engage in the commercialization of research through patenting. Some inventors argue that intellectual property enables academic scientists and universities to support knowledge flow and benefits to the public (Mowery, Nelson,

Sampat and Ziedonis, 2001:105; Nelson, 2001:19), while other university academics argue that intellectual property limits access and allows one party to dictate the direction of that invention, which is antithetical to the academic culture and scientific inquiry.

Sibanda (2009:168) explains that the lack of harmonized IP policies with clear benefit-sharing arrangements for inventors, may have contributed to the low rate of patenting by institutions.

Affordability may be the one implication that keeps intellectual property registration activity low at universities. Patent activities incur new, additional costs for higher education and the public (de Larena, 2007:1384). Literature reports that technology transfer, as measured through patents and licensing, occurs at a loss (Powers, 2006:18; Thursby and Thursby, 2003:208). Universities cannot afford to patent every invention. A university patent office must assess the potential value of the invention in light of its expected costs. Patenting and licensing activities represent significant expenses in the process (Sun and Baez, 2009:82). When the government pays for research, the argument for public access strengthens, because the public already paid for the research through taxes. Everyone should have access to the work and patents only prevent access. Any additional costs to use the invention create economic “rents” paid to the holder of the patent (Heller and Eisenberg, 1998:699). Simply put, costs associated with patenting serve as additional barriers to the goals of communal science.

From the literature reviewed above, the main contributory challenges universities are faced with, which are common to most, such as lack of support mechanisms, lack of funds and commercialization problems, are the common obstacles that are experienced by the five most innovative universities in South Africa. These factors confirm their performance and provide possible reasons why their intellectual property registration is lower than that of universities abroad.

2.14.4 REASONS IN SUPPORT OF UNIVERSITY PATENTING OF INVENTIONS

The literature reviewed presents four reasons to support university patenting of inventions: acknowledgement of the inventors, control of the invention quality, ensuring accessibility to the invention and a mission and goals aligned with the public interest.

- **Recognition of Inventors:** Patents provide attribution of those significantly engaged in the invention's conception and development (Bagley, 2006:221; Patel, 1996:493). This process recognizes listed inventors through a national recording process that appears in a public record. Although financial rewards may be negligible, attribution serves as a symbolic reward to the inventor, which in turn meets the intended policy purpose of creating incentives for creators and discoverers of academic inventions (Bagley, 2006:219; Patel, 1996:487).

- **Control of invention's quality**: University patents enable universities to control the invention's quality (Apple, 1989:376; Metlay, 2006:587; Mowery and Sampat, 2001a:340). Metlay (2006:591) illustrated an example in which a Wisconsin inventor who was Steenbock's mentor, Stephen Babcock, did not patent his invention. The lack of control resulted in the distribution of poor-quality products. Besides the problems faced by retail consumers, the quality control problem could jeopardize the reputation of the university and the inventor. Thus, university patents permit some degree of control for the inventor.

- **Greater access to inventions**: University patents typically allow for greater access to these inventions (Campbell, Powers, Blumenthal and Biles, 2004:68; Kesselheim and Avorn, 2005:853; Pressman et al., 2006:32). Under a university patent, the academic community is less likely to operate in a manner that monopolizes the invention and strictly controls the licensing practices of others to drive price controls and other unethical practices (Apple 1996:386; Metlay 2006:573).

- **Research for public good:** In furtherance of research for the public good, university engagement in patent activities fits its mission and roles better than other organizations, even other public services entities such as the government (Kesselheim and Avorn, 2005:856; Pressman et al., 2006:36).

The above section discussed the forces that moved higher education towards greater patent activities and explored the arguments and interests related to university engagement in patent protection. The core business in higher education includes publishing of research conducted by post-graduate students and staff at institutions. The next section will investigate how patenting impacts on publishing at higher education institution.

2.14.5 PATENTING VERSUS PUBLISHING AT HIGHER EDUCATION INSTITUTIONS

The following section will examine the effects that publishing has on patenting and the possible solution for higher education institutions to consider intellectual property registration prior to publishing.

The evidence put forward mostly in the US (Thursby et al., 2007:63; Agrawal and Henderson, 2002:49) but also in the EU (Breschi et al., 2005:7; Geuna and Nesta, 2006:801) indicated that, at least for the top academics, there is no evidence of substitution effect between the two activities. Top researchers succeed to publish and patent simultaneously, a high patent output does not seem to negatively affect the publication output of the most prolific researchers (Crespi et al., 2008:3).

Sibanda (2008:134) reported his findings as the number of publications per higher-education institution is greater than the patent applications filed and/or granted. He explains one possible reason for this misalignment is the fact that the publications, as opposed to patents, form the core of subsidy determinations and promotion to higher positions at higher-education institutions by the Department of Education. Another of

Sibanda's findings were disclosed in an interview with an inventor who indicated that the adverse effect that patenting has on publication is in respect of publication delays necessitated by a need to comply with novelty requirements of patentability.

As inventors' status follows a priority system, that is, the first inventor to give notice through a patent or publication, holds the property rights. Academic scientists therefore have an interest to restrict, delay, or block scientific knowledge through such mechanisms as patenting (Campbell et al 2004:71)

The advantage that the IP system provides is that it encourages scientists to publish their findings in the form of patents, which permit and facilitate technological improvement, while ensuring protection of commercial spin-offs. This is a much better alternative than protecting research results as trade secrets, thereby preventing and inhibiting new knowledge creation (Dickinson 2007:4).

Consistent with those findings, Thursby and Thursby (2007:627) also concluded that industry agreements contributed to delays in publishing. According to some authors, "some scientists are reluctant to share their research results with commercially active investigators for fear that the shared data will be used for commercial rather than academic purposes" (Campbell et al 2004:310).

Sibanda (2008:135) explained that in terms of his understanding of the patenting time-lines, he was of the view that the perceived delays to publication caused by patenting could either be avoided or at least minimized. A study of patenting by academics (Lubango and Pouris, 2007:789) found that those with prior industry experience had a higher propensity to patent and suggests that it is possible to successfully manage the tension between patenting and publication in such a way that both objectives are attained.

From the preceding discussion, it does appear that the decision whether to prioritize publication or patenting is dependent on many factors, including the type of research

being undertaken, and also the area of technology, with more commercial or market-focused research being more prone to patenting, depending on whether the research results are more suitable for publication.

Researchers at universities are faced with various conflicting points to consider when deciding to publish or register a patent prior to publishing. Some of the main points highlighted within the literature reviewed above prove that there is no evidence of substitution effect between the two activities of publishing and patenting. The core subsidy determinations from publications which lead to promotions to higher positions within higher education institutions could be a deciding factor for researchers. Some researchers see patenting as an obstacle. Other researchers fear that shared research results could be used for commercial rather academic purposes as explained (Campbell et al 2004:310).

2.15 MANAGING INTELLECTUAL PROPERTY ASSETS AT UNIVERSITIES

In reviewing literature on the successful management of intellectual property at universities, the possible reasons for the perceived low patenting rate are explored in this section.

Effective IP management creates market leaders (Khota and Stern 2005:5). Effective management of IP rights must be recognized as an essential foundation for creating core competence and South African businesses need to develop competencies in this regard to promote business development through effective technology exploitation and knowledge transfer (Lamprecht 2004a:8).

According to Bull (2006:331), South African universities and research institutions are enjoying the benefits of increased investment in scientific research and development. He states that the principal source of this funding is the South African government, which is making funds available through a range of investment schemes and grants. Some of these funds are industry focused. For example, a substantial investment is

being made in the field of biotechnology, while others are general funds for early-stage technologies and fundamental research.

IP management typically encompasses teamwork between the legal team driving IP protection and the engineering team responsible for innovation because managing the stakeholder involvement and ownership of IP requires a specific technology/IP strategy that is integrated with the company's technology strategy and which seeks to encompass the technology management life-cycle (Lamprecht 2004b:9). The management of IP involves considerable resources and time to ensure its effectiveness (Spoor & Fisher, 2009:3).

Bull (2006:332) reports that the additional investment in scientific research and development has created challenges for university administrators. The areas in which the greatest challenges are being faced are:

- Improving the management of intellectual property, with a particular focus on commercializing patented technology;
- Overcoming the funding gap between government grant money and venture capital investors in an environment where venture capital funding is in short supply; and
- Managing the commercialization of technology against the introduction of Bayh-Dole style legislation.

In compliance with the IP Act 51 of 2008, a number of universities in South Africa have sought to establish intellectual property and commercialization departments that are responsible for generating revenue from research. A balance has to be struck between meeting challenges and not allowing universities to detract from the focus of being a centre for education, skills development and research.

Bull (2006:333) further states the one area where there is a lack of consistency in the policies adopted by universities in South Africa relates to the ownership of intellectual property developed by academic and research staff.

Khota and Stern (2005:12) advise that, in seeking to identify management best practice in this ever changing context of increasing competitiveness and complexity, research to date indicates that management attention across the life cycle of a product must focus on exploiting IP as a strategic lever for creating competitive advantage. They state further that such focus encompasses the following:

- Resource management: management must seek to ensure the synchronization of technical innovations with knowledge protection initiative across the product development life-cycle; and

- IP strategy: management must define a tactic for the exploitation of its evolving IP optimal commercial benefit.

Facets of IP, encompassing trademarks, copyright, design and patent law, as essential strategic levers for management and products or services demands that organizations identify and implement company-wide IP-based strategic activities that extend the organization's competitive advantages in product development by encouraging and defining measures for organizational IP evolution and exploitation (Khota and Stern 2005:19).

Cloete, Nel and Theron (2006:558), as cited by Sibanda (2008:31), are of the view that one of the reasons for the low patenting activity by South African scientists is that "research has not been carried out with commercialization in mind and has, therefore, lacked market focus." From the literature reviewed thus far, the extent of patenting activities by higher-education institutions appears to be dependent on the type of

research being undertaken by each institution, which is often influenced by the mandate of the funding agencies.

2.16 BACKGROUND TO THE DURBAN UNIVERSITY OF TECHNOLOGY (DUT)

Education Minister Kader Asmal's plan to merge many of South African's tertiary institutions had given impetus to the merger of two of the country's oldest technikons, namely, Technikon Natal and ML Sultan, both located in the city of Durban, which culminated in the birth of Durban Institute of Technology(DIT) and now the Durban University of Technology.

The DUT had been a functioning technikon with technikon policies, procedures, processes, staff qualifications and academic workload right up to the end of 2007. In moving to a UoT, this meant setting up the structure and framework of a university of technology (Du Pre 2009:3).

2.16.1 Becoming a University of Technology (UoT)

A University of Technology differs from the traditional university not because of the use of technology within a university, but rather the interwovenness, focus and interrelation between technology and the nature of a university which constitutes a technological university. In essence, universities of technology "make knowledge useful" and "identify the needs and problems of society and find solutions to these" (Du Pre 2009:2).

Du Pre (2010:9) explains that "technology" means the human arrangement of nature with the help of tools for human purposes. Technology refers to the effective and efficient application of the accumulated know-how, knowledge, skills and expertise that, when applied, will result in the output of value-added products, processes and services. In essence, it is the know-how to fabricate things, which includes creating and developing new technologies.

As a university of technology, the DUT is characterized by being research-informed rather that research-driven, with a focus on strategic and applied research that can translate into professional practice. Research output may be commercialized thus providing a source of income for the institution. DUT's emphasis has been on becoming a preferred-choice University of Technology that values innovation and the transfer of knowledge, and a leader among universities of technology. The DUT strives to develop an applied research profile that enhances knowledge creation for the benefit of the university and broader society (Du Pre 2009:3)

The refocusing of DUT from a technikon to a university of technology is based on the five pillars of a University of Technology: teaching and learning; research and development; developing leadership in technology; technological innovation and technology transfer and partnerships. Underpinning these pillars are: quality as foundation and platform; an innovative and entrepreneurial culture; responsive to communities and knowledge transfer and exchange. In preparing the DUT for a UoT, the Technology Transfer and Innovation division was established to drive the DUT as a university of technology in line with the identified pillars of a university of technology. This was meant to increase/encourage patents and artifacts; drive innovation and entrepreneurship; and to take forward the commercialization of research.

During the merger period, the South African Research and Development Strategy (R&D Strategy) identified disparate practices in respect of ownership, management and commercialization of intellectual property emanating from publicly financed research institutions, DST (2002). The R&D Strategy proposed a need for harmonization of practices and establishment of dedicated funds to finance the securing of IP from publicly financed research (Sibanda, 2008:4).

Since 2008, the DUT proceeded to develop and implement an IP policy aimed at ensuring certainty in respect of ownership, commercialization and technology transfer of IP developed at the university, as a requirement of Act 51 of 2008.

2.17 CONCLUSION

Innovation is a key driver for present-day and future economic growth, and IP Rights are the tools that make such growth tangible.

Generally, countries worldwide, including South Africa, are striving to stimulate innovation as a fundamental source of competitiveness and are building on locally generated intellectual property.

HESA survey 2007 findings signaled that technology transfer and diffusion activities are taking root in South Africa's public HEIs. Sibanda's (2008:7) study indicated that technology transfer offices in South Africa are relatively young.

One aspect of innovation systems is the important role played by HEIs. However, it should be noted that the success of technology transfer in a country is highly dependent on national investment in research. It is not possible for technology transfer to make any significant contribution to economic development without a well-funded high quality research system. South Africa looked for ways to promote and strengthen technology transfer at its HEIs.

The South African Government had expressed concern with regard to the low intellectual property registration activity at higher education institutions in the country. This has resulted in the government having to revise the old intellectual property rights policy and implement new policies, which resulted in the IP Act 51 of 2008.

South Africa has yet to meet international standards regarding intellectual property registrations and the management thereof. Low patenting registration is evident from the literature reviewed, which confirms that it is stagnant and comparatively low compared with international standards. Also from this literature it is evident that there is high publication output and negligible patenting activity generally at all HEIs in the country. Cloete, Nel and Theron (2006:561), as cited by Sibanda (2008:5), are of the view that one of the reason for the low patenting activity by South African scientists is that "research has not been carried out with commercialization in mind and has, therefore, lacked market focus".

Higher Education institutions play a critical role in assisting government to realize its goal by producing knowledge and innovation through skilled labour, bearing in mind the social needs of the country.

The review of the related literature highlighted various valid reasons for the low IP registration which varied from one higher education institute to another.

The next chapter outlines the methodology for the study.

Chapter 3

RESEARCH METHODOLOGY

3.1 Introduction

This Chapter focuses on the issues involved in designing the study and developing a strategy to guide the research process. It presents an account of the techniques employed and how the planned research will be carried out. The steps that will be utilized, the data collection techniques, the instrument used to gather data, and the procedures followed in the administration and co-ordination of the research are outlined. The data collected was mainly qualitative and quantitative to some extent. Therefore, the research design of this study was dependent on both qualitative and quantitative research techniques.

Information on the survey questionnaire as the primary data gathering tool employed in this study is presented. A description of the construction and design of the questionnaire, validity testing and the techniques involved in data analysis is presented.

3.2 Problem Statement

Intellectual Property management and protection at the Durban University of Technology will be investigated.

3.2.1 Objective of Study

The purpose of this study is to investigate the reason for the low rate of registration of IP rights such as patents, trademark and design rights at the DUT through a survey conducted amongst the academic staff at the institution.

The sub-objectives of the study are to:

- determine why university research does not generally result in IP registration;

- determine the perceptions of supervisors/researchers as to whether they can identify the potential of intellectual property that can arise from students' or their own research;

- determine the level of awareness among staff and their perceptions regarding intellectual property legislation and the university's IP Policy; and

- determine the nature of problems experienced by staff relating to IP registrations.

Hence, the research questions answered by the study include:

- What are the levels of awareness among researchers relating to the IP legislation and DUT's IP policy?

- Are researchers able to identify potential IP that can arise from research?

- What are the reasons for research not resulting in IP registration?

- What is the nature of problems experienced by researchers relating to IP registrations?

3.3 Research Design

This research will adopt a case study approach in examining IP registrations at the DUT in detail. Appropriate decisions on the study design will be based on the problem definition and research objectives. Research design is the plan for the collection, measurement and analysis of data.

According to Welman and Kruger (2007:78) the purpose of quantitative research is to evaluate objective data consisting of numbers, while qualitative research deals with subjective data that is produced by the minds of respondents. They add that qualitative data is presented in language instead of numbers as qualitative research is often undertaken to explain the findings obtained from quantitative research. For the purpose of this study, a combination of both qualitative and quantitative methods will be utilized in order to obtain the best results.

The research design includes the main objective of the study, the types of research questions that are addressed to examine the underlying problems, the techniques to be used in collecting the data, approaches to selecting the population; and how the data will be analyzed (Gray 2009:131).

3.4 Methods and Instruments of Data Collection

In conducting this research, both primary and secondary sources of data will be included to achieve the study objectives. Primary data, according to Saunders et al. (2003:3), is usually collected through observation, interviews and questionnaires.

This study uses both qualitative and quantitative methodology. The study will entail a survey through the use of questionnaires on specific aspects of IP management and protection at the DUT. The sample population will include all full-time academic staff from selected departments at the DUT.

3.4.1 Questionnaires

Measurement, in short, is not an end in itself. Its scientific worth can be appreciated only in an instrumentalist perspective, in which we ask what ends measurement is intended to serve; what role it is called upon to play in the scientific situation; and what functions it performs in inquiry (Kaplan 1964:171)

Questionnaires were administered to all full-time academic staff in selected departments. When the completed questionnaires were received, the study identified

the possible researchers with a research track record and those researchers with a possible requirement for IP registration and protection. Oppenheim (2005:25) explains that when data is collected at the same time, the research design is such that it does not allow for change over time. Nevertheless, the immediate nature of cross-sectional designs, as well as the relative ease of data collection, makes these types of design the most common choice for social scientists.

3.5 Case Study

Yin (2009:18) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. The case study enables the researcher to analyze the uniqueness of the situation and the individuals involved. A brief reflection on the case study and a description of the findings in relation to the relevant theoretical and empirical literature, are discussed. The discussion addresses the primary research questions of this part of the study.

Yin (2009:35) observed that, in comparison with research methods, case studies require an inquiring mind during data collection. The key is the ability to pose and ask good questions.

This design approach allows one to embrace different orientations that the evidence may address through “different research questions” as the case study proceeds (Yin 2009:52). The case study approach was utilized for the purpose of this study. A case study is a documented history of noteworthy events that have taken place in a given institution. Case studies involve an in-depth contextual analysis of similar situations in other organizations, where the nature and definition of the problem happen to be the same as experienced at the DUT.

3.6 Target Population

Widd and Diggines (2009: 195-196) explain that the aggregate of units of the analysis forms the population.

The sample population for this study will include all full-time academic staff members from selected departments at the DUT.

3.6.1 Sampling Design

Sampling design decisions are important aspects of research design and include both the sampling plan used and the sample size. For this study, the non-probability sampling method, called purposive sampling (Sekaran 2003:6), was used to obtain information from specific sample groups which comprised of full-time academic staff within specific faculties and departments of the DUT.

The basic idea of sampling is that, by selecting some of the elements in a population, a researcher may draw conclusions about the entire population. The ultimate test of a sample design in the study is how well it represents the characteristics of the population it purported to represent (Cooper and Schindler 2001:9).

Given that there are clearly identified academic staff who will provide the necessary information, this technique allows the researcher to deliberately obtain the sample that will be regarded as representative of the relevant population, taking into account their involvement in research and supervision, as well as the possibility of registering IP.

3.6.2 Sample Size

DePoy and Gitlin (2005:154) are of the view that determining the number of participants or the size of the sample in the study is a critical issue that often causes difficulty for new investigators. A common suggestion is to obtain as many subjects as the researcher can afford. A large sample size is not always the best method and is often

unnecessary. Therefore the sample size needs to be carefully thought out so that external validity can be maximized.

The sample size was determined by the level of precision and confidence desired in estimating the population, as well as the variability in the population itself (Sekaran 2003:24). The sample must reflect the characteristics of the population and be a suitable representation (Goddard and Melville 2001:35).

A purposive (judgmental) sample comprising of 136 academic full-time staff from selected departments at the DUT was selected.

The sample included all full-time academic staff from selected departments as listed below:

- 2 departments in the Faculty of Health Sciences, namely Dental Science (12 academic staff) and Emergency Medical Care and Rescue (10 academic staff);

- 1 department under the Faculty of Applied Science, namely Biotechnology and Food Technology (13 academic staff); and

- All 9 departments (101 academic staff) will be targeted under the Faculty of Engineering and the Built Environment.

The above faculties and chosen departments were selected as a representational cross-section of the DUT's departments involved in innovation type research.

3.7 Validity and Reliability

As explained by Sekaran (2003: 23), validity refers to the evidence that the instrument, technique or process used to measure a concept does indeed measure the intended concept.

According to Sekaran (2003:31) reliability attests to the consistency and stability of the measuring instrument. Sekaran (2003:36) further states that reliability is the degree to which data collection method(s) yield consistent findings, and similar observations would be made or conclusions reached by the researchers if there is transparency in how sense was made from the raw data. The researcher conducted a pre-test using a questionnaire as a measuring tool to test or identify any problems that respondents might have encountered when answering the questionnaire. This ensured that the responses from participating respondents were all consistent.

3.8 Ethical Considerations

Ethical behaviour pervades each step of the research process: data collection, data analysis, and reporting and dissemination of information on the internet. It also relates to how the subjects are treated and how confidential information is safeguarded (Sekaran 2003: 45).

In this study, the researcher ensured that ethical considerations were strictly complied with. The study was designed in a manner that did not subject the research population to embarrassment or any other material disadvantage.

3.9 Data Analysis and Interpretation

Welman et al. (2007:241-242) state that, after the research is conducted according to the planned design, the obtained results must be interpreted. The design of the study also concerns the statistical analysis and interpretation of the appropriate data. Qualitative data analysis often involves analyzing content analysis. Quantitative data analysis involves a statistical analysis of the obtained data.

An interpretative approach to analyzing the qualitative data will be adopted. In respect of the semi-structured interviews, the sessions will be recorded and notes will be taken. From the notes and recorded interviews, one would be able to identify possible themes

and be able to categorize the responses. With this information from the responses, a narrative will be drawn up based on recurrent patterns and comments made in terms of the themes.

The quantitative data gathered through the survey instrument was analyzed using the Predictive Analytic Software (PASW) Statistics version 18.0.

3.10 Summary

This chapter dealt with the research approach to the study. Given the two methods of data gathering instruments, the study on IP registrations will be examined through a descriptive and interpretative case study, with the DUT registration as the case. Hence, the research design lends itself to both qualitative as well as quantitative approaches. In respect of the case study, data will be gathered from a primary source. The primary source will include the structured questionnaires.

Much of the information will be gathered from the DUT's community of researchers with the purpose of eliciting the perceptions of staff in respect of their experiences relating to IP registrations.

The next chapter deals with the presentation and analysis of data.

Chapter 4

ANALYSIS AND DISCUSSION

4.1 Introduction

Chapter three outlined the methodology for this research. This chapter discusses the information gathered from the questionnaire. The questionnaire was designed with due consideration given to the objectives of the study as highlighted in Chapter three.

The data collected from the responses will be analyzed with the Predictive Analytic Software (PASW) Statistics version 18.0. The results will be presented in the form of graphs, cross tabulations and other figures.

The questions posed were aligned with specific themes which further related the findings of the study to the objectives set out. The themes of this study are listed below:

The first part gathers biographical information on the respondents: **Theme One**: Levels of awareness of IP Legislation and DUT's IP Policy; **Theme Two**: Researchers ability to identify potential IP that could arise from research; **Theme Three**: Reasons for research not resulting in IP registration; **Theme Four**: The Nature of problems experienced by staff relating to IP registration.

For the purpose of this study, questionnaires were chosen as the instrument for data collection. The questionnaire was designed to obtain information from respondents regarding their perceptions of the new IP Act, their understanding of the Act, gather information on why their research work was not resulting in IP registration; and their experiences relating to IP registration at the DUT.

The total sample size was 136. A total of 136 questionnaires were administered to full-time academic staff in selected departments at the DUT.

The analysis covered both a quantitative and qualitative study. Themes were used to analyze the qualitative data. The questionnaires completed by the relevant respondents were analyzed using the above mentioned and are presented in this chapter as follows:

4.2 Presentation and discussion of results:

4.2.1 Biographical details of respondents

4.2.1.1 Question One: Faculty affiliation

This section presents the descriptive statistics based on the demographic information of the study. The information is described using methods that include graphical representations and cross tabulations.

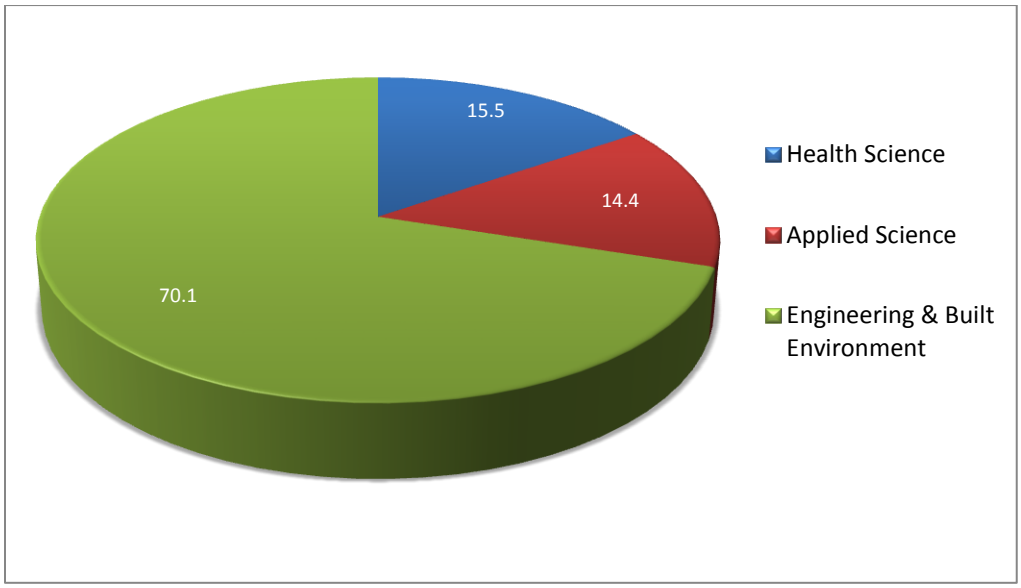

Figure 5. Faculty distribution of the respondents.

The majority of the respondents (70.1%) were from the Faculty of Engineering and the Built Environment. The remaining respondents were almost evenly split between the faculties of Applied Science (14.4%) and Health Science (15.5%).It can therefore be noted that a majority of the respondents were from the Engineering and Built Environment Faculty.

4.2.1.2 Question Two: Whether respondents supervised post-graduate students

The respondents were asked to indicate whether they supervise or have supervised post-graduate students.

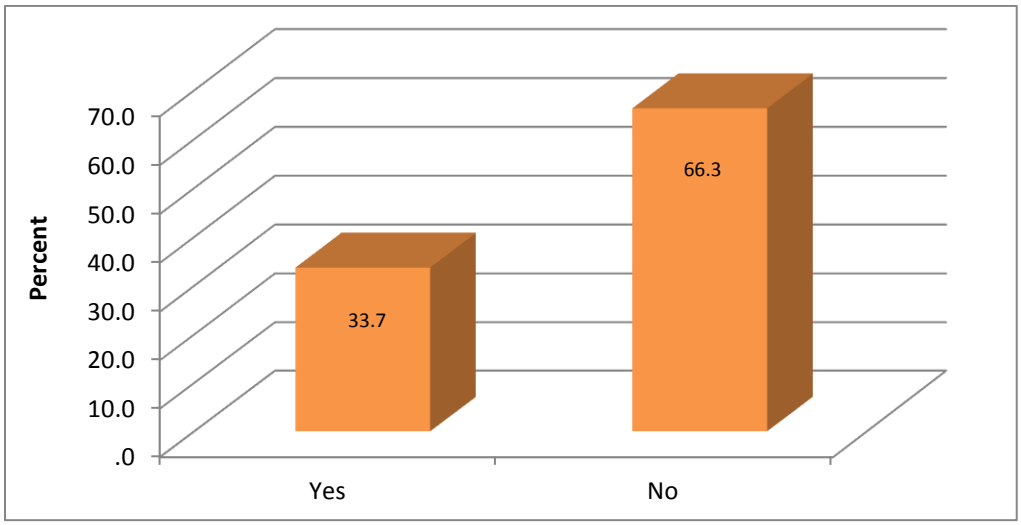

Figure 6. Whether respondents supervised post-graduate students.

Approximately one-third of the respondents (33.7%) indicated that they did supervise Masters and Doctoral students and two thirds (66.3%) did not engage in this activity.

4.2.1.3 Question Three: Qualifications of respondents

Question 3 requested the respondents to indicate their highest qualification.

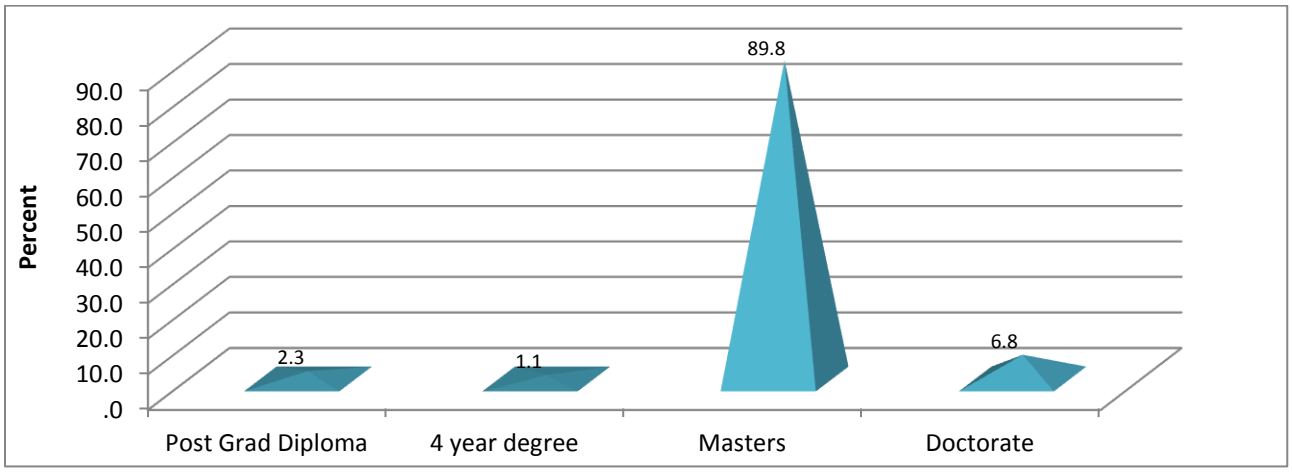

Figure 7: Qualifications of respondents

Eighty nine point eight percent of the respondents were in possession of a Master's degree, with a further 6.8% having a Doctoral degree. 2.3% have post-graduate diplomas and 1.1% are in possession of a 4-year degree. It can therefore be noted that the majority of the respondents' highest qualification is a master's degree.

4.2.1.4 Question Four: Year in which the highest qualification was obtained

The respondents were asked to indicate the year in which their highest qualification was obtained.

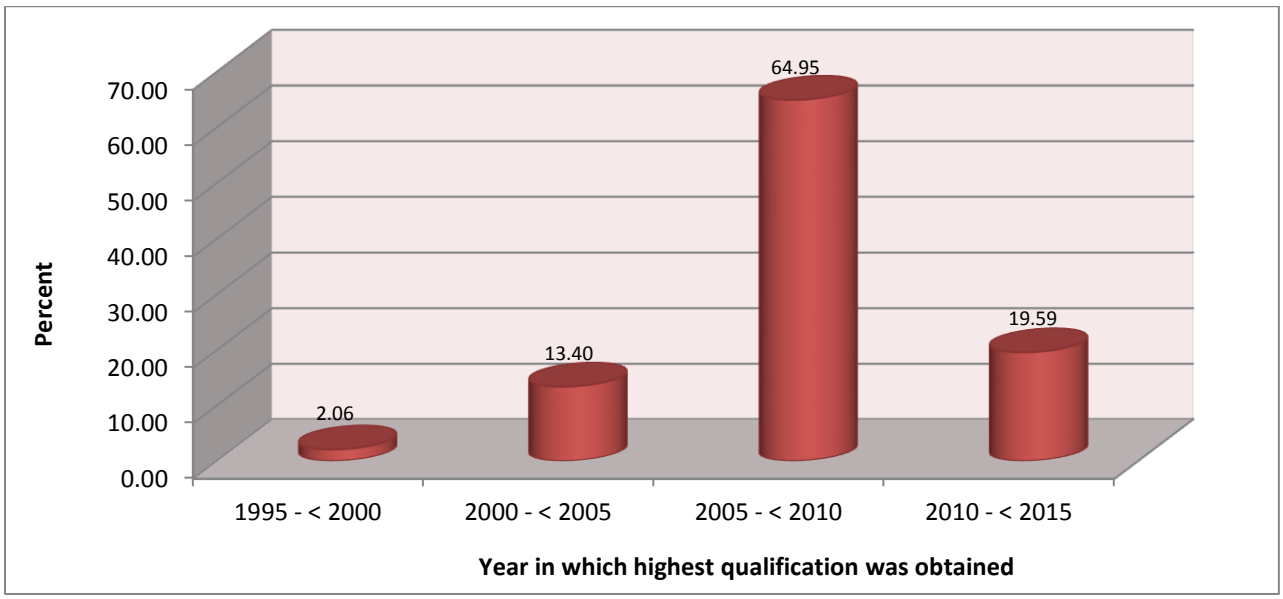

Figure 8: Years in which highest qualifications were obtained

The results show that nearly two-thirds (64.95%) of the respondents received their highest qualification between the years 2005 and 2010. Between the years 1995 and 2000, 2.06% respondents obtained their highest qualifications. Between the years 2000 and 2005, 13.40% obtained their highest qualifications, and the remaining 19.59% received their qualifications between the years 2010 and 2011.

4.2.1.5 Question Five: Number of years that respondents were involved in research

Question 5 enquired about the number of years the respondents were engaged in research.

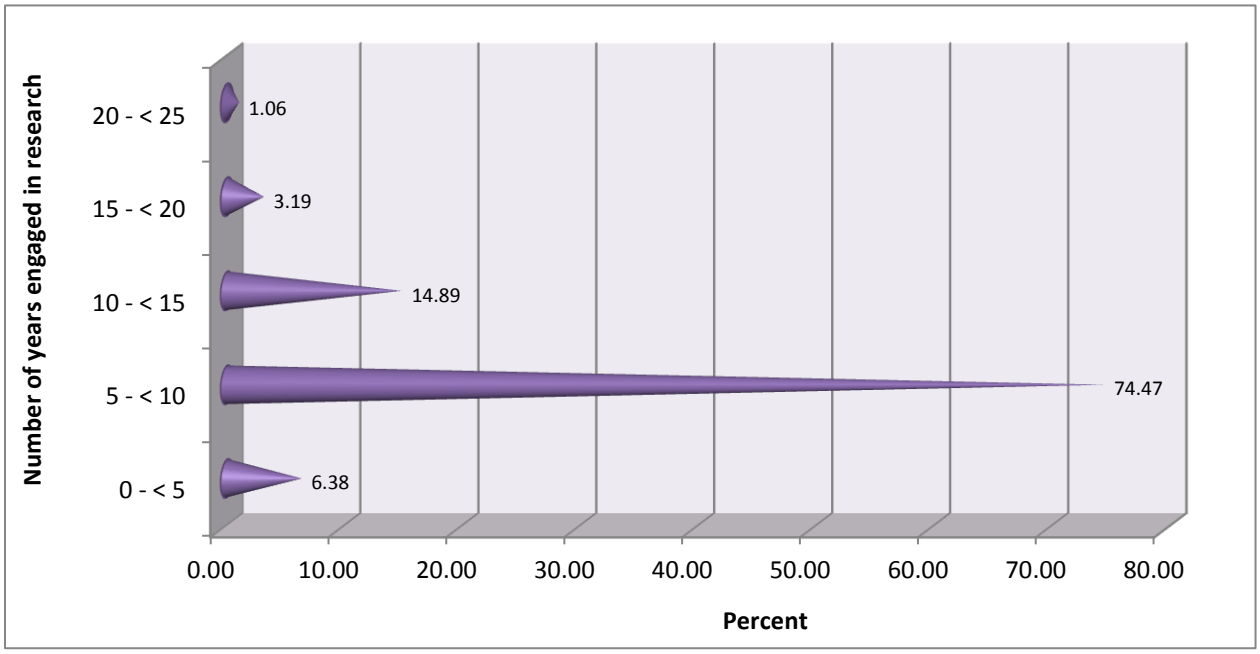

Figure 9. Length of time respondents have been involved in research

Respondents were asked to indicate the length of time that they have been involved in research. In terms of the findings, 74.47 % of the respondents have been involved in research for between 5 and 10 years, while 14.89% have been involved for between 10 and 15 years.

4.2.1.6 Question Six: Number of years respondents involved in supervising students

The respondents were asked about the number of years they had been involved in supervising students.

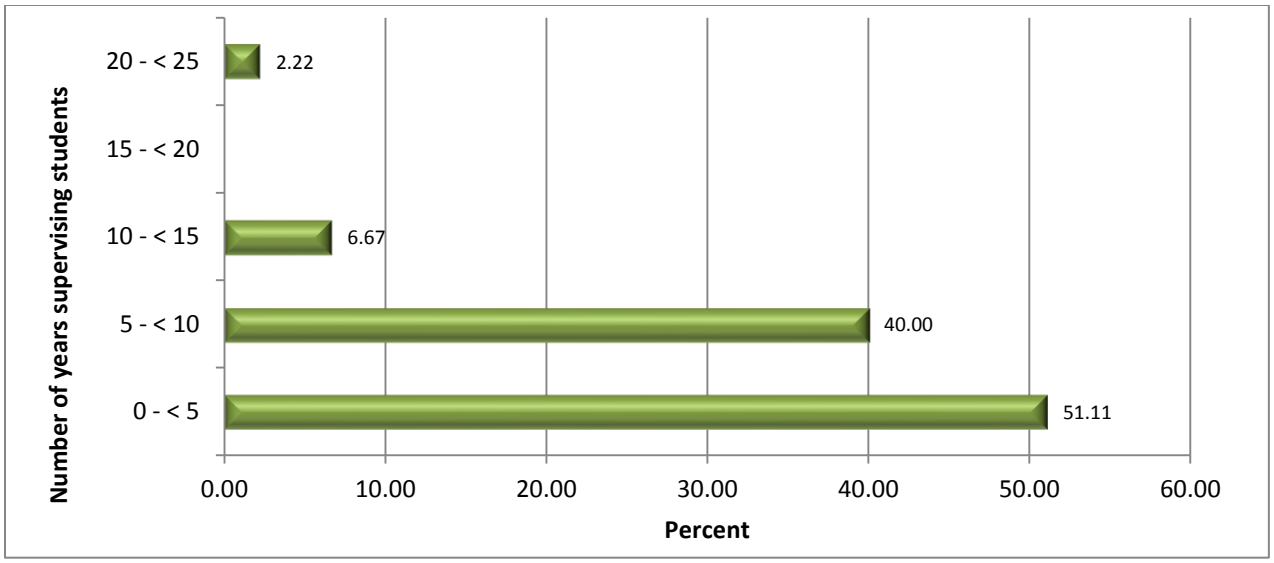

Figure 10. Number of years that respondents have been involved in the supervision of students

In response to the question on the length of time that respondents were involved in the supervision of post-graduate students, 51.11% of the respondents indicated that they had been supervising Masters and Doctoral students for less than 5 years, while 40% of them indicated that they have been involved in supervision for between 5 to 10 years. Only 2.22% had been supervising for more than 20 years and the remaining 6.67% had been supervising for a period between 10 – 15 years.

4.2.2 AWARENESS OF IP LEGISLATION AND DUT's IP POLICY

This section investigates the levels of awareness of respondents with regards to the new IP legislation.

The graphs below indicate the percentages for each statement for each component.

4.2.2.1 Question Seven: Whether respondents have a full understanding of the ownership provisions of the IP Act as indicated in questionnaire

Question 7 enquired about the levels of understanding of the ownership provisions of the IP Act.

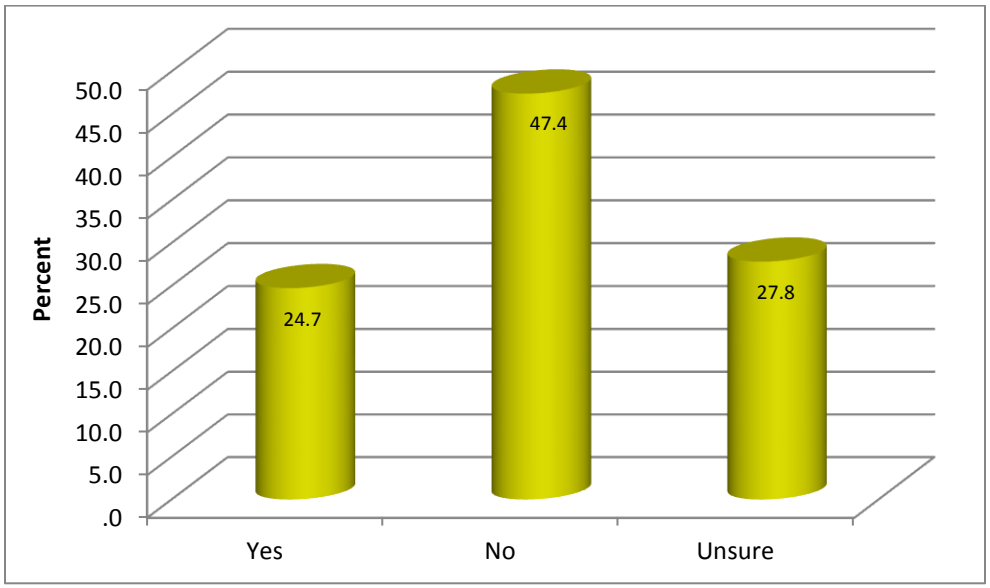

Figure 11. Respondents understanding of ownership provisions of the IP Act

The respondents were asked to indicate whether they had a full understanding of the ownership provisions of the IP Act. 47.4% indicated that they did not fully understand the IP legislation. Approximately a quarter (24.7%) indicated that they understand the ownership provisions and the other 27.8% were unsure. Support for this question is strengthened from the responses to Questions 29 and 30.

4.2.3 OWNERSHIP PROVISIONS OF IP FROM PUBLICLY FUNDED RESEARCH

Questions 8, 9 & 10 related to the ownership provisions of IP from publicly funded research.

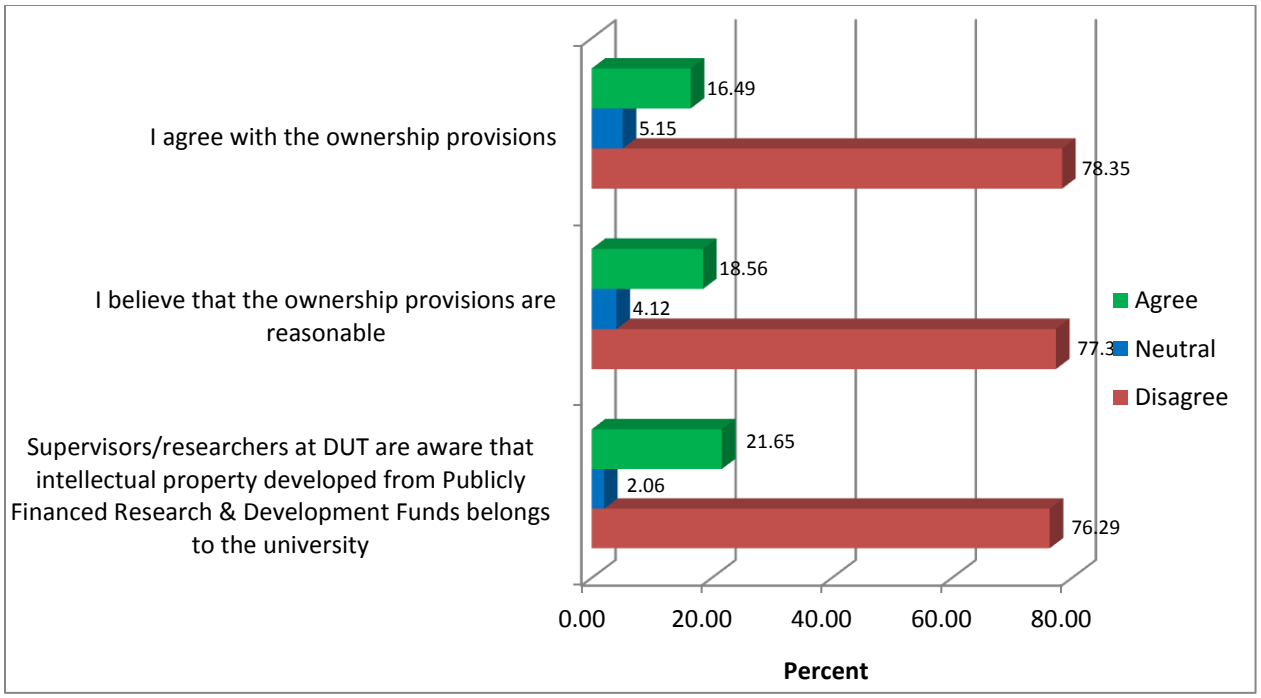

Figure 12. Results on ownership provisions of the Act

4.2.3.1 Question Eight: Whether respondents agreed with ownership provisions

Question 8 required the respondents to indicate whether they agree with ownership provisions of the act. A total of 78.35% of the respondents did not agree with the ownership provision of the IP legislation, while 16.49% agreed with it. The results indicate that a large percentage of respondents do not agree with the ownership provisions of the Act.

4.2.3.2 Question Nine: Whether respondents believed that the ownership provisions were reasonable

The respondents were asked whether they believed the ownership provisions to be reasonable. A total of 77.32% disagreed that the ownership provisions were reasonable and only 18.56% agreed that the provision was reasonable. The remaining 4.12% were neutral to the ownership provisions.

Although financial rewards may be negligible, attribution through patents serves as a symbolic reward to the inventor, which in turn meets the intended policy purpose of

creating incentives for creators and discoverers of academic inventions (Bagley, 2006:219; Patel, 1996:487).

Results from Questions 8 & 9 differ with respect to the following:

University patents typically allow for greater access to these inventions (Campbell, Powers, Blumenthal and Biles, 2004:68; Kesselheim and Avorn, 2005:853; Pressman et al., 2006:32). Under a university patent, the academic community is less likely to operate in a manner that monopolizes the invention and strictly controls the licensing practices of others to drive price controls and other unethical practices (Apple, 1996:386; Metlay, 2006:573).

4.2.3.3 Question Ten: Whether respondents were aware that IP developed from publicly financed research and development funds belonged to the university

Question 10 required the respondents to indicate whether they were aware that IP developed from publicly financed research and development funds belonged to the university. A total of 76.29 % of respondents indicated that they were not aware that IP developed from publicly financed research & development fund belong to the university and only 21.65% acknowledged that they were aware of this ownership. The remaining 2.06% were neutral on this point.

The results of question 8, 9 and 10 above clearly indicate that the respondents disagree with the ownership provisions of the Act. Gray (2009:2) highlighted that the central provision of the Act is that universities carrying out research from public funds have to assess and report on all research carried out at the university that might have the potential for IPR protection and commercialization. According to Act 51 of 2008, such research would be owned by the university.

4.2.3.4 Question Eleven: DUT compelled to register all IP from public funds

The respondents were asked, if they were aware that the DUT was compelled to register all IP that resulted from publicly funded research.

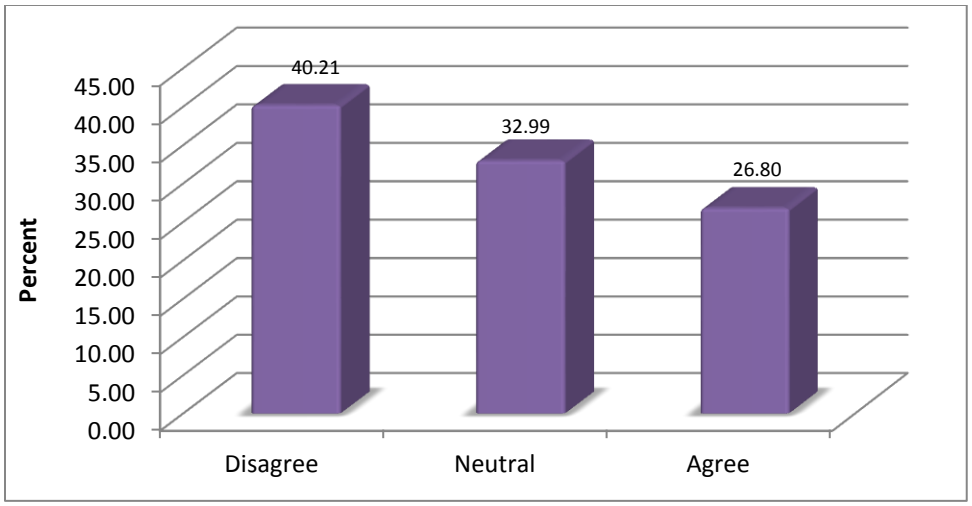

Figure 13. Awareness that the DUT was compelled to register all IP that resulted from publicly funded research.

Only 26.8% of respondents were aware that DUT was compelled to register all IP that resulted from publicly funded research. The majority of the respondents (40.21%) were not aware, while the remaining 32.99% elected to be neutral on this point. The results of questions 7 and 11 reveal consistency and this confirms a lack of understanding of the IP Act. Despite the fact that 40.21 % were not aware that DUT was compelled to register all IP that resulted from publicly funded research, the findings from the literature review were clear on this. Gray (2009:2), for instance, explained that the Act was designed to ensure that all publicly funded research gets intellectual property protection for the purpose of commercialization.

4.2.4 RESEARCHERS' ABILITY TO IDENTIFY POTENTIAL IP THAT CAN ARISE FROM RESEARCH

4.2.4.1 Question Twelve: Researchers knowing that their work could result in IP

Question 12 enquired if researchers knew that their work could result in IP.

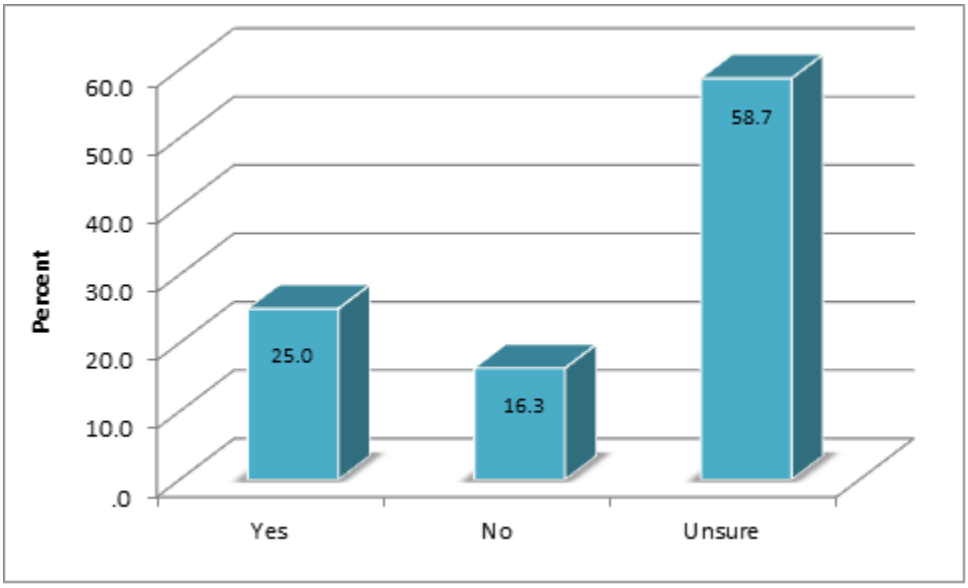

Figure 14. Respondents' awareness of whether their work could result in IP

A majority of the respondents (58.7%) were uncertain regarding the fact that their research work could result in IP. Only a quarter (25%) of the respondents believed that their research work could lead to IP registration, and 16.3% thought that their work could not result in IP.

4.2.4.2 Question Thirteen: Should the task of identifying and promoting IP registration be the task of the FRC/related structure as this could be complex to identify

The respondents were asked if the task of identifying and promoting IP registration should be the task of the FRC/related structure as this could be complex to identify.

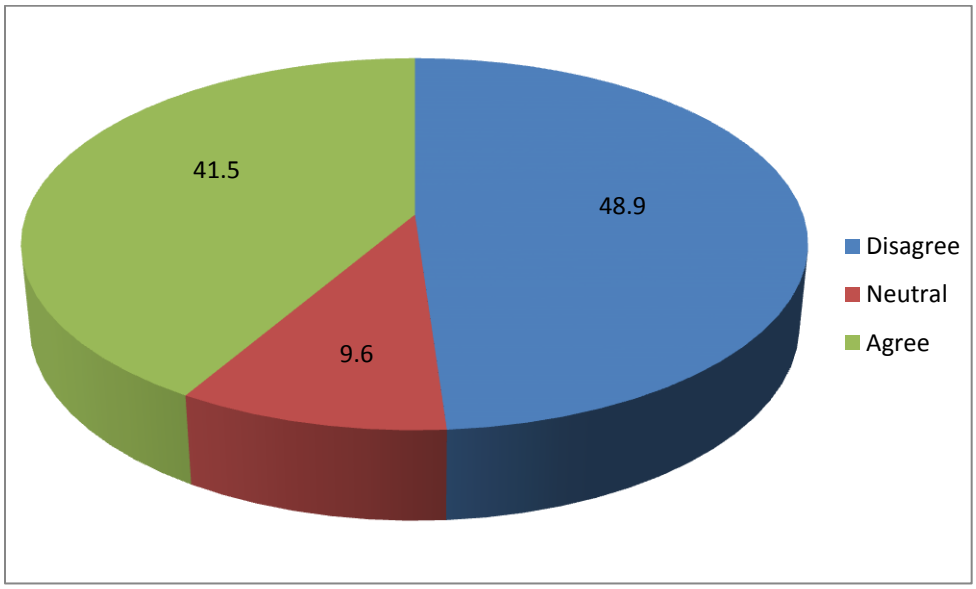

Figure 15. Whether the identification and promotion of IP registration should be the task of FRC/related structure

Almost half (48.9%) of the respondents disagreed that identifying and promoting research that could lead to IP registration should be the task of the FRC/related structure, as this could be complex to identify. 41.5% agreed that this should be their task, while 9.6% remained neutral in their response.

4.2.5 REASONS FOR RESEARCH NOT RESULTING IN IP REGISTRATION

Questions 14, 15, 16 and 17 enquired about possible reasons for research that was conducted at the university not resulting in IP registration.

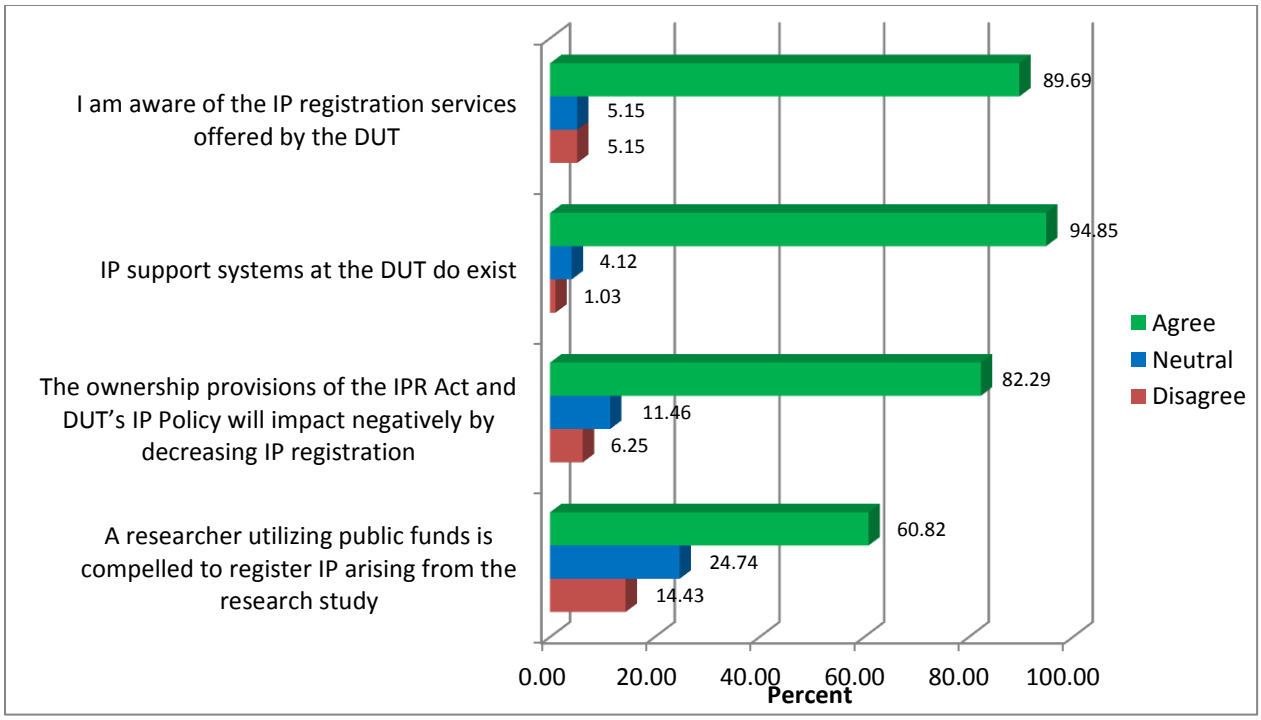

Figure 16. Research work not resulting in IP registration

4.2.5.1 Question Fourteen: Awareness of IP registration services

Respondents were asked if they were aware of IP registration services offered by the DUT. A total of 89.69% were aware of the service. Equal percentages of 5.15% disagreed and or were neutral.

4.2.5.2 Question Fifteen: Existence of IP support

Question 15 enquired from respondents about the existence of IP support systems at the DUT. A result of 94.85% of respondents agreed about the existence of an IP support system, while 1.03% disagreed and 4.12% were neutral.

4.2.5.3 Question Sixteen: Impact of the IP Act and DUT's IP Policy on registration

Respondents were asked whether they agreed that the provisions of the IP Act and the DUT's IP Policy will have a negative impact on IP registrations. A majority of 82.29% agreed that the Act and the DUT's IP Policy will have a negative impact and will decrease IP registration, while 11.46% elected to remain neutral and 6.25% disagreed. This result is contradictory to the findings of other studies reported in the literature

review, which found that university patent activity increased significantly after the Bayh-Dole Act was passed (Dai, Popp and Bretschneider 2005:19).

4.2.5.4 Question Seventeen: Whether researchers are compelled to register IP from research

Question 17 enquired about whether researchers using public funds are compelled to register IP arising from the research work. A total of 60.82% agreed with this statement, while 24.74% remained neutral on this statement and 14.43 disagreed with the statement.

According to Sun and Baez (2009:81), the Act advanced its purpose of commercializing research and spurring on technological innovation through patent and licensing activities at American universities.

4.2.5.5 Question Eighteen: Preference to file/register IP with: DUT; in collaboration with industry; or privately to retain ownership.

Respondents were asked their preference when filing/registering IP. Would they select registering with DUT, understanding that ownership would reside with DUT; in collaboration with industry understanding that the IP would have shared ownership; or privately to retain ownership?

	Frequency	Percent
DUT	38	40.9
In collaboration with industry	25	26.9
On my own; privately	30	32.2
Total	93	100.0

Table 1. Inventor's preference to register/file IP

Bearing in mind that only 93 of the respondents answered question 18, the filing preference in favour of the DUT was a total of 40.9%. A total of 26.9% indicated that they would register in collaboration with industry and 32.2% indicated that they would prefer to file privately. The 32.2% that indicated they would prefer to file privately would

confirm the findings from the responses to questions 8, 9 and 10 on the high level of disagreement with the ownership provisions of the Act.

4.2.5.6 Question Nineteen: Description of IP Portfolio

Respondents were asked to describe their IP portfolio, stating how many patents, trademarks and/or design rights, etc. they were in possession of.

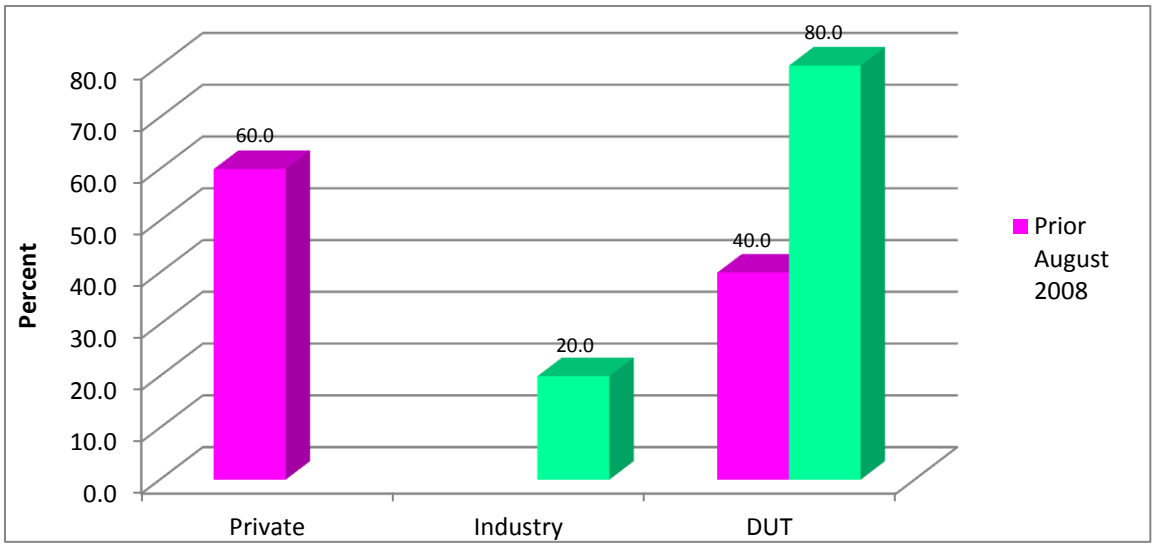

Figure 17. Respondents' IP Portfolio Description

The results of question 19 suggest that prior to August 2008, 60% of IP registrations were handled privately, was revealed while 40% registered with the DUT with no indication of filing in collaboration with industry. Post August 2008, 20% elected to register with industry and 80% elected to register with the DUT, with no private registration indication.

4.2.5.7 Question Twenty: Whether IP registration would increase if ownership of IP belonged to the researcher

Respondents were asked if IP registration would increase should the IP resulting from research work belong to the researcher.

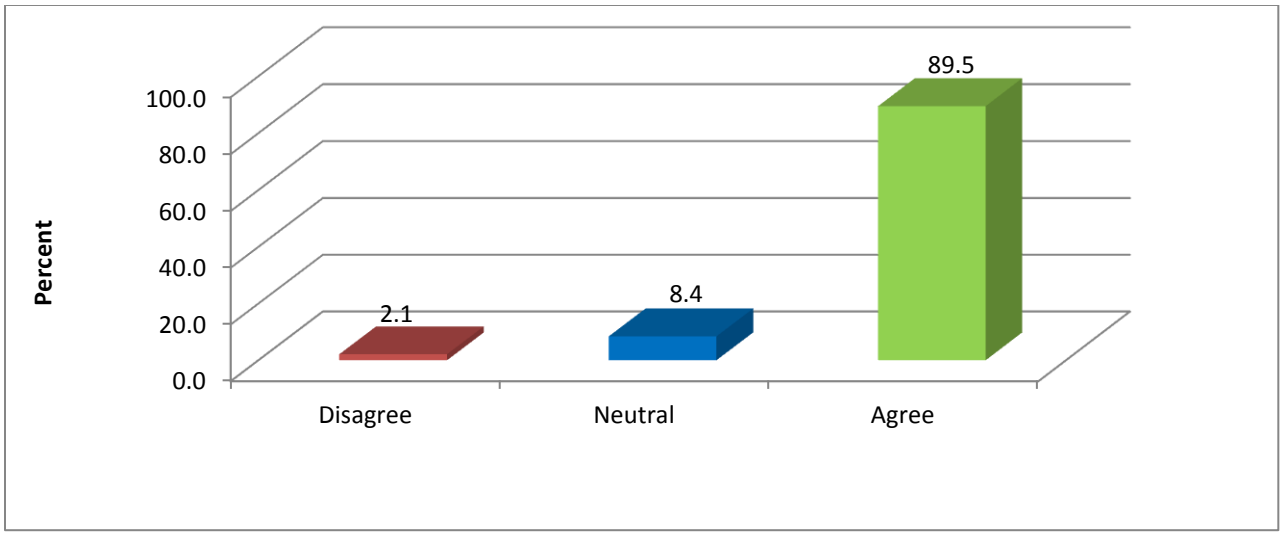

Figure 18. Ownership of IP

The results for Question 20 indicate that 89.47% of respondents agreed that if ownership of IP belonged to the researcher, IP registration would increase significantly. 8.42% remained neutral on this point and 2.11% were in disagreement with this statement.

This section enquired about IP registration and commercialization.

Question 21 & 22 enquired if IP registration and exploitation/commercialization was a goal of research.

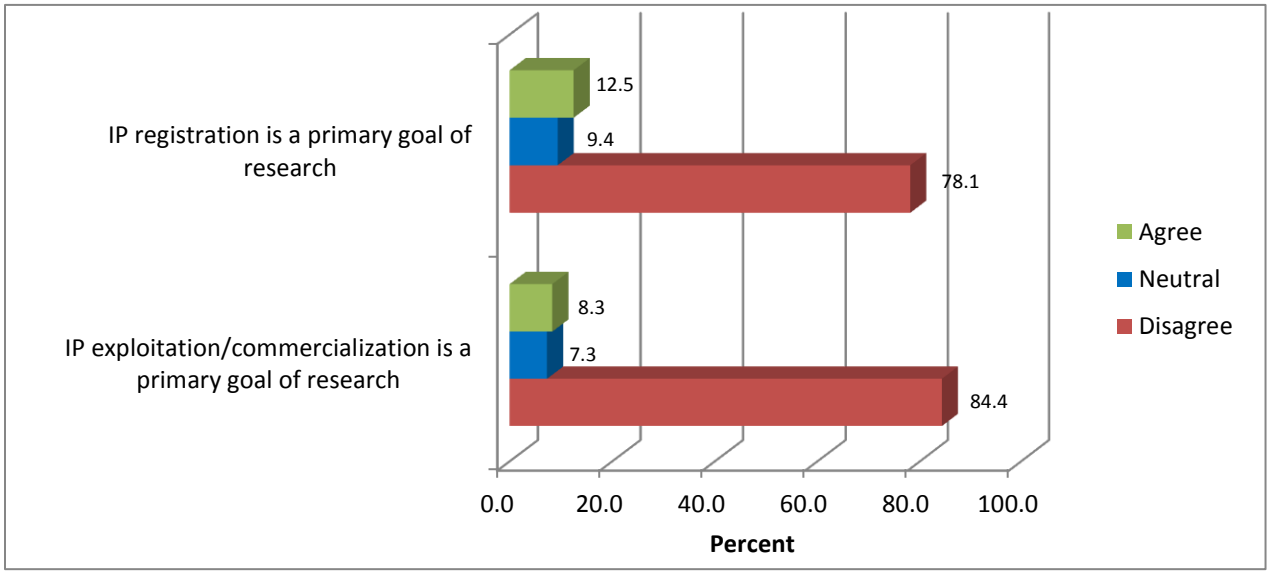

Figure 19. Exploitation/commercialization

4.2.5.8 Question Twenty One: Enquired on whether IP registration was a goal.

Respondents were asked whether IP registration was a primary goal of research. The results showed that 78.1% disagreed that IP registration was a primary goal of research, while 12.5% agreed and 9.4% were neutral to this question. Dai et al (2005:581) mentioned that their research results proved that the Bayh-Dole Act spurred university patenting and fostered technology transfer which appears to contradict the negative results indicated for questions 21 and 22 below.

4.2.5.9 Question Twenty Two: IP exploitation/commercialization

Respondents were asked whether IP exploitation/commercialization was a primary goal of research. 84.4% of respondents disagreed, 8.3% agreed and 7.3% chose to remain neutral on this question.

A total of 78.13% and 84.38% respectively agreed that IP registration and exploitation/commercialization was not a primary goal of research. These results are consistent with Cloete, Nel and Theron (2006:560) findings, as cited by Sibanda (2008:29), that one of the reasons for the low patenting activity by South African scientists is that “research has not been carried out with commercialization in mind and has, therefore, lacked market focus”

Sibanda (2009:134) reports his findings that the number of publications per higher-education institution is greater than the patent applications filed and/or granted. He explains that one possible reason for this misalignment is the fact that publications, as opposed to patents, form the core of subsidy determinations and promotion to higher positions at higher-education institutions by the Department of Education. Another of Sibanda’s findings were disclosed in an interview with an inventor who indicated that the adverse effect that patenting has on publication is in respect of publication delays necessitated by a need to comply with novelty requirements of patentability.

The results of question 21 and 22 could also be a reason why research work at DUT does not result in IP registration and low patent registration at DUT.

4.2.5.10 Question Twenty Three: Consideration of IP registration prior to publishing/conference presentation.

Researchers were asked if one should consider IP registration prior to publishing/conference presentation.

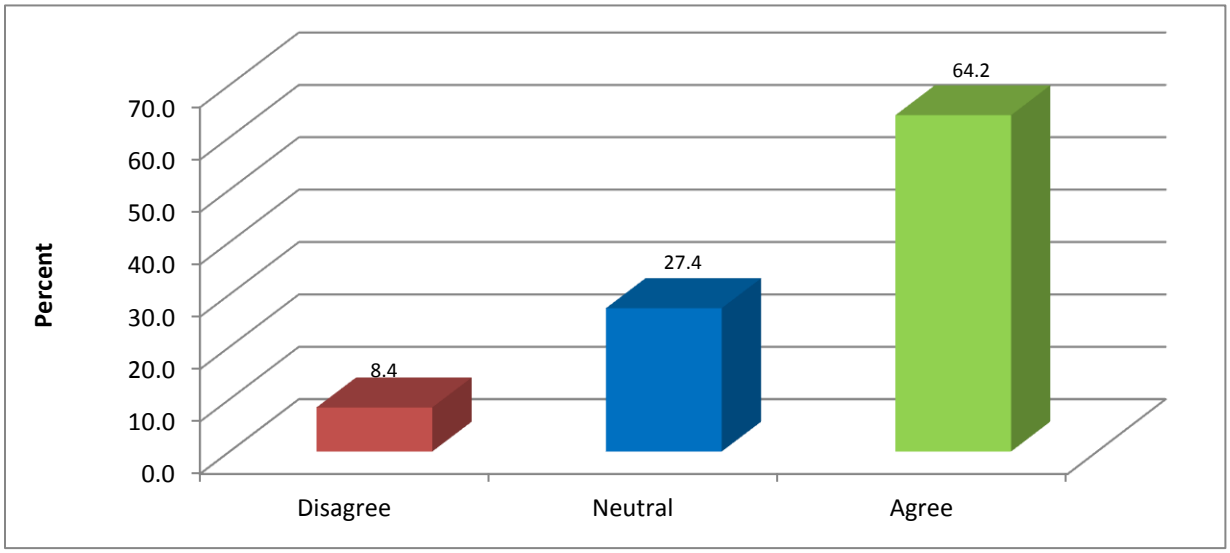

Figure 20. Whether patents should be registered prior to publishing/conference presentation.

Question 23 revealed that there was a total of 64.2% of respondents who were aware that IP registration should be considered prior to publishing/conference presentation to be able to qualify for IP registration, 27.37% remained neutral and 8.42% disagreed with this statement. These results are consistent with views expressed in the literature review (Crespi et al 2008:3) that top researchers succeed to publish and patent simultaneously, and that a high patent output does not seem to negatively affect the publication output of the most prolific researchers.

4.2.5.11 Question Twenty Four: Identification of potential IP from research work

Researchers were asked whether supervisors at the DUT were capable of identifying potential IP from research work.

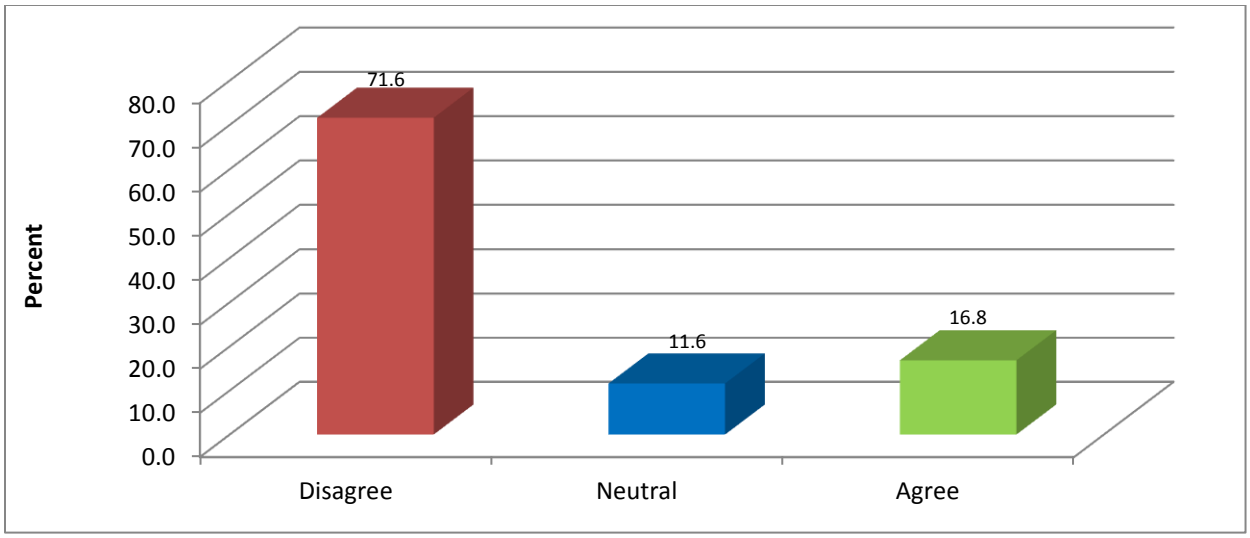

Figure 21. Potential IP identified from research work

Question 24 revealed that 71.58% of respondents disagreed that supervisors at the DUT identified potential IP that required registration from research work. 16.84% agreed and 11.58% elected to remain neutral. A lack of understanding of the IP Act and general awareness of IP knowledge are contributing factors to a supervisor's potential to identify IP registration.

4.2.6 NATURE OF PROBLEMS EXPERIENCED BY RESEARCH STAFF RELATING TO IP REGISTRATION

Questions 25, 26, 27 and 28 relate to researcher opinion, understanding of the DUT's process and procedures, and the availability of funds for IP registration.

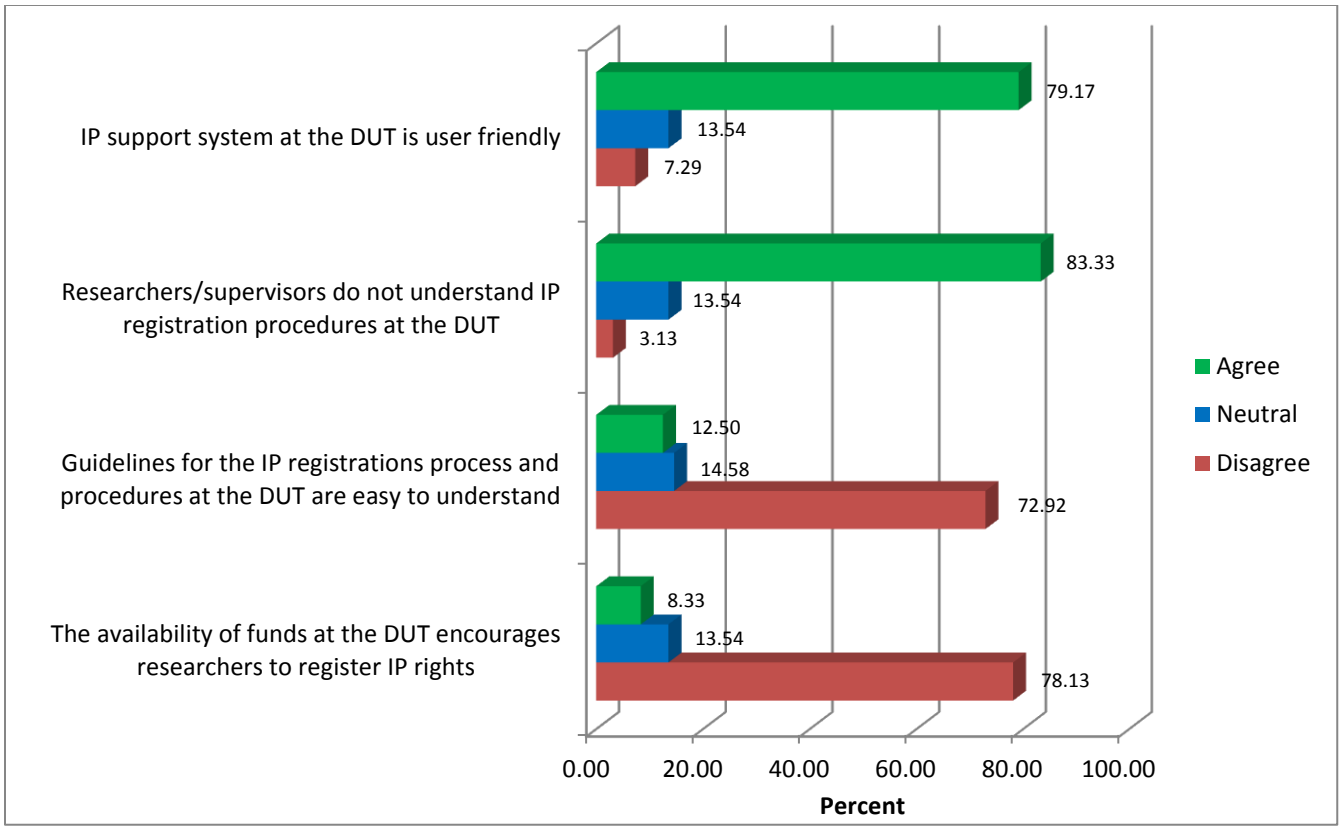

Figure 22. Process, Procedure and availability of funds

4.2.6.1 Question Twenty Five: IP support system at DUT

The respondents were asked to comment on whether the IP support system at DUT is user-friendly. 79.17% agreed that the IP support system at the DUT is user-friendly. 13.54 % remained neutral (possibly as a result of not having had the opportunity to engage with the IP support system at the DUT as yet, for reason that they do not have IP to register). 7.29% found the IP support system was not user-friendly.

4.2.6.2 Question Twenty Six: Whether the IP registration procedure at the DUT was understood

The respondents were asked to comment on whether the IP registration procedure at the DUT was understood. 83.33% agreed that they did not understand the procedure, while 3.13 % disagreed with this statement. The remaining 13.54% elected to remain neutral.

4.2.6.3 Question Twenty Seven: Whether IP registration processes and procedures at the DUT were easy to understand

Question 27 enquired if the guidelines for the IP registration process and procedures at the DUT were easy to understand. The results proved to be consistent with question 26. A total of 72.92% disagreed that the process and procedures were easy to understand, while 12.50% found it easy to understand and 14.58% were neutral.

4.2.6.4 Question Twenty Eight: Whether the availability of funds at the DUT encouraged researchers to register IP rights

The respondents were asked to comment on whether the availability of funds at the DUT encourages researchers to register IP rights. The results indicated that 78.13% disagreed that the availability of funds encouraged registration of IP rights. The remaining 8.33% agreed with the statement and 13.54% remained neutral.

Bull (2005:332) reports that the additional investment in scientific research and development has created challenges for university administrators. Overcoming the funding gap between government grant money and venture capital investors in an environment where venture capital funding is in short supply remains a challenge for universities.

4.2.6.5 Question Twenty Nine: Experiences/problems encountered when registering IP at the DUT

Question 29 enquired about experiences or problems that respondents may have encountered when attempting to register IP at DUT's IP Office, relating to service and assistance.

Only 17 of the 98 respondents offered an answer to questions 29 and 30. The following responses were received relating to experiences or problems encountered:

- Nine respondents indicated difficulty in understanding the IP Act and IP process and procedures at the DUT;

- Understanding of IP registration is not always simple;

- IP Regulations are flawed and worrisome on so many levels:
  Management taking decisions on research work have little or no specialist knowledge of disciplinary fields. Suggestions from respondents were that experts from appropriate fields be brought in to viability group meetings to take informed decisions.

- Lack of clear direction on the process and procedure from senior management;

- IP Act is difficult to understand;

- I do not entirely understand IP. Therefore, when I was unsure the IP office staff always assisted;

- "Red Tape" bureaucratic rules;

- Frustrations were often the result of the ineffective DUT structures and lack of support to enable the IP office to perform their functions effectively; and

- Lack of understanding of the IP registration process. Hence, assistance will always be required from the IP office.

4.2.6.6 Question Thirty: Comments on the subject of IP registration.

Respondents were invited to give additional comments on the subject of IP registration.

As for the previous question, only 17 of the 98 respondents offered additional comments. The following responses were received:

- Eleven respondents indicated difficulty in the understanding of IP-related matters;

- Nine respondents indicated that the issue of ownership of IP should be re-visited;

- Seven respondents indicated disagreement with ownership;
- One respondent mentioned that the financial structure at DUT should be reviewed;
- Five respondents indicated that IP issues needed to be work shopped on a regular basis;
- 2 respondents indicated that, ultimately, the inventor should be the owner (or even shared between the institution and inventor);
- 2 respondents mentioned that IP ownership should be shared between DUT and the inventor (70% and 30% split or similar);
- The IP office should assist in the PCT application for a SA registered patent;
- Ultimately the inventor should be the owner;
- Invention formulated by the inventor without funding from DUT will not produce any output. Similarly, funding without the idea (inventor) will not produce an output;
- It seems that DUT capitalizes on the fact that inventors do not have funds to process IP registration and therefore come to the fore to assist in taking the ownership of invention;
- DUT seems to allow for registration on profit-splitting, etc. This can pose many problems in the future;
- Regulations that cover revenue-sharing leave very little money for researchers and inventors;

- Senior managers of the IP office need to consider a sales and marketing office in order to positively influence future researchers and staff to become involved with IP. This is a huge barrier for the university and I believe that it is one of the main reasons why researchers and staff are disinterested in IP and tend to contravene the IP Act;

- IP registration is a good way to bring research to industry;

- IP registration should never compromise/discourage research initiatives especially at an institution that is making an effort to establish a culture of research;

- Policies and procedures need to be clear, transparent and mutually beneficial;

- "Big Talk" no action from management;

- Closed door management style;

- Lack of funding;

- No support from management for technology transfer to industry; and

- Difficulty for market penetration – no support from management.

4.3 SUMMARY

From the literature review and the results of the questionnaire distributed at the DUT, there is a correlation in the low rate of applications for IP registration. In this chapter, the data collected through self-administered questionnaires, was analyzed and presented using graphs and tabular presentations. This was done to understand the reasons for the low IP registration rate.

The results indicated that 33.7% of respondents supervised post-graduate students: 89.8% obtained their Master's degree mostly between the years 2005 and 2010. Furthermore, a majority of the respondents (74.47%) had been involved in research over a period of 5 to 10 years.

The results for **Theme One** indicate that a larger number of respondents did not understand or agree with the ownership provisions of the IP Act and found the act to be unreasonable. **From the results for Theme Two**, it is clear that a majority of the respondents were either unsure or unaware that their research could result in IP. They also disagreed that the identification and promotion of IP registration should be the task of FRC or related structure.

The results for Theme Three showed that there was a strong positive response on the awareness of IP registration services offered at the DUT and of the support systems that do exist. There was a general agreement that the IP Act, together with the DUT's IP Policy, impacts negatively by decreasing IP registration. There were mixed responses on preference to file or register IP with the DUT, with industry or privately. On the issue of ownership of IP belonging to the researcher, an overwhelming majority of the respondents (89.47%) agreed that this will increase IP registration. This was the general consensus that was found in the literature review as well. The finding that also emerged was that IP registration and commercialization/exploitation is not the goal of research. This finding is consistent with literature (Sibanda, 2008:29).

In terms of the results for **Theme Four,** respondents indicated that the IP support system at DUT was user-friendly but commented that the IP registration procedure and process was difficult to understand.

Additional comments from respondents gave an indication of the problems experienced with IP registration, ranging from the lack of management direction in IP-related matters to the lack of IP Act understanding. Respondents also found IP procedures and processes difficult to understand and called for more IP-related workshops.

The next Chapter sets out the conclusions and recommendations from the study.

Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter four analyzed and interpreted the data from the questionnaires. In this chapter the researcher presents a summary of the study, the conclusions that were drawn from the study and recommendations for possible further study.

As the information age emphasizes knowledge, intellectual property escalates as an issue of concern, especially for higher education institutions. Higher education serves the society of the information age through preparation of the labour force, but equally critically, higher education participates in the commercial world of intellectual property. Higher education produces, maintains, controls and trades intellectual property, which requires it to construct intellectual property policies and practices balancing several considerations (Sun and Baez, 2009:115).

An important consideration is whether patenting is undertaken with the view to commercialization at some stage. 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 time directing efforts towards commercialization of the patent portfolios (Sibanda 2007:31).Patenting for the sake of patenting is not adequate.

According to Sibanda (2007:31) 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 commercialized.

The aim of this study was to explore reasons for the low rate of registration of intellectual property rights such as patents, trademarks and design rights, at the DUT with a view to increasing the number of registered Intellectual Property rights. This research project investigated the low rate of IP activities as well as the problems associated with IP compliance, through the use of questionnaires.

The sub-objectives of the study were to:

- Determine why university research does not generally result in IP registration;

- Determine perceptions of supervisors/researchers as to whether they can identify the potential intellectual property rights that can arise from students' or their own research;

- Determine the level of awareness among staff and their perceptions regarding intellectual property legislation, particularly the IP Rights Act 51 of 2008, and university's IP Policy; and

- Determine the nature of problems experienced by staff relating to IP registrations.

The study was conducted with a view to achieving these objectives and the conclusions are discussed under four broad themes represented in the objectives, namely, awareness of IP Legislation and the DUT's IP Policy; the researcher's ability to identify potential IP that could arise from research; reasons for research not resulting in IP registration; and the nature of problems experienced by staff relating to IP registration.

5.2 CONCLUSION FROM LITERATURE REVIEW

The literature review sets out a broad theoretical framework in relation to Intellectual Property Management practices globally and nationally. The literature also included a review of South Africa's national and institutional framework as it looks for ways to promote and strengthen Intellectual Property management. It was also found that HEI's with established IP policies and structures performed better in terms of patenting activity, which were findings by Garduno (2004:47) and Sibanda (2008:30).

The South African Government has expressed concern over the low intellectual property registration activity at higher education institutions in the country. This has resulted in the government having to revise the old intellectual property rights policy and implement new policies, which resulted in the IP Act 51 of 2008.

From the literature reviewed, the reasons for low IP registration include:

- The lack of funding opportunities;
- The introduction of the ownership provisions as regulated by legislation;
- South Africa being “small” in terms of research and invention capacity, finds difficulty in competing with international standards;
- The government implementing strategies to sustain research and development with the aim of building capacity and improving research output with special emphasis on publishing in accredited publications rather than on producing IP;
- The fact that the IP Act 51 of 2008 seems to be easily misinterpreted and misunderstood; and
- Many have found sections of the legislation to be unclear, or not simple enough for interpretation.

5.3 CONCLUSIONS FROM THE EMPIRICAL STUDY

The empirical study comprised a survey through self-administered questionnaires to researchers in the selected faculties. From the findings of the empirical study, the following conclusions can be drawn in respect of each of the objectives indicated:

Why university research does not generally result in IP registration

The reasons why university research does not generally result in IP registration include:

- Unfavorable ownership provisions of the IP Act and the DUT's IP Policy. Gray (2009:1) highlighted the point that the Act is clear that where universities carried out research from public funds, such research would be owned by the university;

- IP registration and exploitation/commercialization was not viewed as a primary goal of research. These results are consistent with Cloete, Nel and Theron (2006:22), as cited by Sibanda (2008:17), who indicated that one of the reasons for the low patenting activity by South African scientists is that "research has not been carried out with commercialization in mind and has, therefore, lacked market focus";

- Novelty destroyed by publication. This is consistent with Sibanda's (2009:1) view that 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, information is in the public domain, and IP registration thereafter is therefore not possible. This is in fact a contributing factor to low IP registration; and

- Respondents are uncertain as to whether their or their student's work could lead to IP registration.

Whether supervisors/researchers can identify the potential intellectual property rights arising from students' or their own research

- Uncertainty as to whether research work could result in intellectual property registration. This is a further contributing factor to the problem of low IP registration at the institution;

- Disagreement that the task of identifying and promoting research that could lead to IP registration should be the task of the supervisors/Faculty Research Committee;

- Low perception that supervisors/researcher had the ability to identify potential intellectual property that can arise from research work. The majority felt that this task should be the task of a specialized group of people, experts in the identified field of study.

Level of Awareness relating to IP legislation and the DUT's IP Policy

- Difficulty in understanding of IP Act. Gray (2009:1) stated that the regulations were flawed with grey areas;

- Dissatisfaction with ownership provisions of the Act and suggestions that the regulations be re-visited;

- Unfair revenue-sharing left very little money for inventors;

- Ownership should reside with the inventors. As highlighted by Gray (2009:3), although this was in accordance with Act 51 of 2008, such research would be owned by the university;

- Disagreement, and unsure or neutral that DUT was compelled to register all IP that resulted from publicly funded research. The literature reviews were clear. Gray (2009:3) highlighted that the Act was designed to ensure that all publicly funded research was entitled to intellectual property protection for the purpose of commercialization.

Nature of problems experienced by staff relating to IP registrations

The experiences of the respondents revealed the following problems relating to service at DUT relating to IP matters:

- The procedures for IP registration are not always simple;
- There is a lack of clear direction on the process and procedures from senior management on IP matters;
- There is a lack of understanding of the provisions of the IP Act;
- The existence of “red tape” and bureaucratic rules;
- Ineffective DUT structures and lack of support to enable the IP office to perform their functions effectively; and
- Lack of understating of the IP registration process.

A majority of respondents replied that they found that they did not understand the process and procedure for IP registration at the DUT. Most felt that the IP Act was difficult to interpret. A large number of respondents reported that the lack of funding was a reason for disinterest in IP registration, which was also revealed in the literature that was reviewed. Bull (2005:332) reported that overcoming the funding gap between government grant money and venture capital investors in an environment where venture capital funding is in short supply, was a major stumbling block to overcome. Other

comments made by the respondents were a lack of clear direction from senior management and bureaucratic rules were some of the problem experienced. Aside from the IP registration process not being simple to follow, it was felt that the “red tape” management style was not acceptable.

Figure 23: Diagrammatic representation of conclusion from study.

5.4 RECOMMENDATIONS

Strong, successful IP management is an important requirement for successful commercialization and transfer of technology. Such activities require decisions makers with a sound background of technical, science and business entrepreneurial skills.

Invention viability meetings and the creation of an advisory board with the involvement of members of the university research committee, and experts from industry specifically would provide valued advice to the leadership and management of the DUT's IP and Technology Transfer Unit.

This study also recommends that DUT should encourage and adopt an IP and commercialization culture that increases intellectual property registration. New ideas and inventions should be respected and rewarded for the potential economic and societal benefit to the community. This outcome is expected of the IP Act 51 of 2008. The South African government expects returns from publicly financed funding invested in higher education institutions. The expected return may not necessarily be in the form of financial returns, but in terms of new inventions and technological creations that benefits society. The outcome of this study encourages the DUT to make strong efforts towards creating a positive support structure for IP registration and commercialization activity, in line with the IP Act. Based on the outcome of this investigation, the following suggestions to assist in increasing IP registration are made:

- Activities such as IP awareness campaigns should be held regularly to encourage an active culture of IP registration;
- Clarity on IP Legislation and DUT's IP Policy explained;
- The importance of stressing invention disclosure to be submitted within 90 days of identification, as regulated by the IP Act;
- The establishment of an audit committee to identify inventions;

- Due attention and respect must be afforded to all invention disclosures;
- Evaluation of invention assessment should not be based on revenue generation, social benefit must be considered as expected by government regulation; and
- Commercialization activities can be complex functions that require diverse skills from outsourced specialists in the field of commercialization.

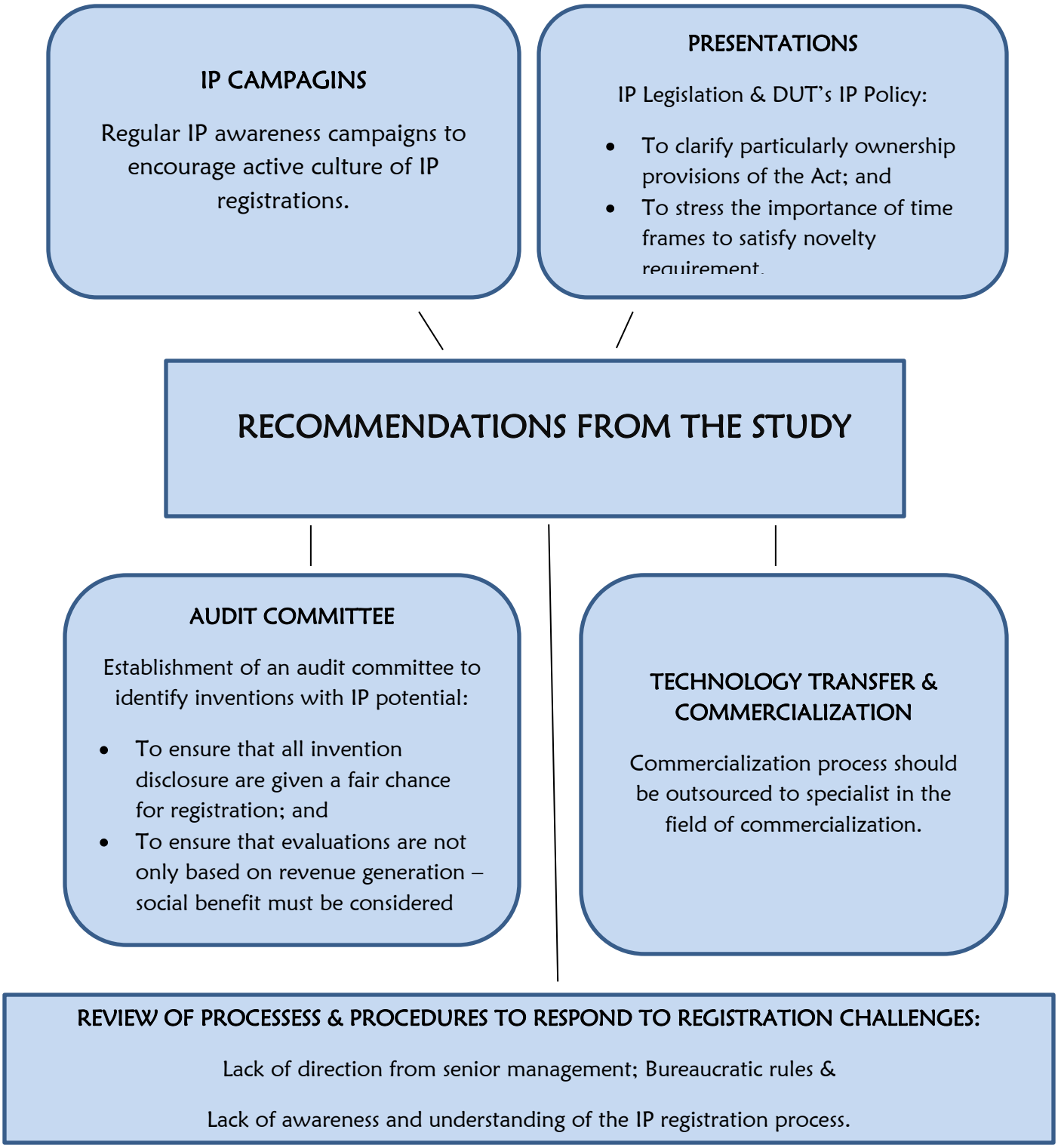

Figure 24: Diagrammatic representation of recommendations from the study

5.5 FUTURE RESEARCH

The field of intellectual property management possesses a large scope for conducting extensive research. Based on the results obtained from the investigation conducted on the reasons for low IP registration at universities, the following aspects may be explored for future research studies:

- Is the IP Act 51 of 2008 a bridge or a barrier to IP registration and commercialization in South Africa?

- To investigate the state of the patenting landscape in South Africa since the implementation of the IP Act; and

- To investigate the success rate of IP registration for commercialization and technology transfer to industry.

5.6 CONCLUSION

This study has established that there are many and varied challenges that the DUT is faced with relating to IP registration and commercialization activities. These challenges include low IP registration due to a lack of awareness ; a lack of management support; lack of potential funding for registration; a lack of understanding the provisions of the IP Act and the DUT's IP policy; and a lack of support in obtaining funding for product development and commercialization.

This study recommends that DUT should implement strategies adopted from Manley (2004) to develop in-depth knowledge on what research is being done and to also assess the commercial potential prior to decisions being taken to patent, as well as to educate researchers on how to protect their ideas, build trust and comfort with the idea of commercialization.

At DUT, a place where there has not been an active culture of patenting, strong efforts need to be directed towards developing such a culture, with similar attention towards

commercialization of the patent portfolios. Patent counts, weighted by citations, are regarded in South Africa as good indicators for measuring and assessing the value of innovation.

The issue of change is inevitable and some framework is needed to address these matters. This study presented the current state of IP as derived from the law and literature. It noted the changes in the law and HEIs practices and policies, yet, in years to come, this discussion will be foreign to IP practitioners. Frameworks will continue to reflect the economic, political and social forces, which sets the stage for the factors of legal matters, technological advancement and competing interest that shape IP Policies and practices at HEIs. This accounts for future changes of IP in the more advanced information age.

Intellectual Property Law establishes ownership and control over the works. Competing interest from various individuals and groups contribute to the crafting of intellectual property policies and practices at HEI (Sun and Baez as cited by Bobbitt, 1998:7). As competing interest came to light, HEIs responded with intellectual property policies and practices.

In order to harmonize conflicting interest of researchers and to achieve the objective of increasing IP registration, intellectual property needs to be managed according to the institution's core values, mission, business strategy and innovation practices. The review of literature suggests that a well-constructed system for IP is fundamental to extract full value and to create intangible asset portfolio to extract value (Jain and Sharma 2006:331).

No IP strategy can be applied across all institutions as there is no "one size fits all" approach to IP management. The DUT needs to look at their IP Policy in relation to their business models. The strategy should optimize the benefits that can be gained from the use of IP, enhance knowledge transfer for the benefit of society and to becoming a self-sustaining UoT.

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7 December 2011

Dear Respondent/Colleague

I am currently studying for a Master's Degree in Business Administration and am undertaking a research project that investigates "***Intellectual Property Management and Protection at the Durban University of Technology".***

The purpose of this questionnaire is to gather information from staff engaged in research/supervision, on Intellectual Property registrations at the DUT. Your completing this questionnaire in its entirety will be of assistance to the researcher. It should take approximately 10-15 minutes. Results will be kept confidential and used for academic purposes only. You as a respondent will remain anonymous

Subject matter covered in this study includes the objective of the **Intellectual Property Rights from Publicly Financed Research and Development Act No. 51 of 2008.**

The primary focus of the Act is:

> " to make provision that intellectual property emanating from **publicly financed research and development fund is owned by the receiving institution -** is **identified**, **protected**, **utilised**, and **commercialized** for the **benefit** of the people of the Republic, whether it be for social, economic, military or other benefit "

Supervisor: Prof K. Reddy
Department of Applied Law

Thank you for your willingness to participate in this study and for your time in completing the questionnaire.

Sincerely

Ramika Bansi

Faculty of Management Sciences
Durban University of Technology

DURBAN UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ENTREPRENEURIAL STUDIES & MANAGEMENT

FACULTY OF MANAGEMENT SCIENCES

INTELLECTUAL PROPERTY REGISTRATIONS QUESTIONNAIRE

A. BIOGRAPHICAL INFORMATION

1. Faculty attached to at the DUT?

Health Science	Applied Science	Engineering & Built Environment

2. Do you supervise Masters/Doctorial research studies?

Yes ☐ No ☐

3. Highest completed qualification?

Post Grad Diploma	4 year degree	Honours	Masters	Doctorate

4. Year in which highest qualification was obtained? ☐

5. How many years have you been engaged in research (personal)? ☐

6. How many years have you been engaged in supervising research students? ☐

B. AWARENESS OF IP LEGISLATION AND DUT's IP POLICY

The focus of the **Intellectual Property Rights Act** is as follows:
If a researcher has conducted research with publicly financed funding, the ownership of the intellectual property produced from such research resides with the HE institution.

7. I fully understand the ownership provisions of the IP legislation as indicated above.

   Yes ☐ No ☐ not sure ☐

8. I agree with the ownership provisions as described above.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. I believe that the ownership provisions are reasonable.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. Supervisors/researchers at DUT are aware that intellectual property developed from Publicly Financed Research & Development Funds belongs to the university

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11. I am aware that legislation requires the DUT to register all IP that results from publicly funded research.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

C. RESEARCHERS ABILITY TO IDENTIFY POTENTIAL IP THAT CAN ARISE FROM RESEARCH

12. My research work could lead to IP registration?

Yes ☐ No ☐ Unsure ☐

13. Identifying and promoting research that could lead to IP registration, should be the task of the FRC/related structure, as this could be complex to identify

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

D. REASONS FOR RESEARCH NOT RESULTING IN IP REGISTRATION

14. I am aware of the IP registration services offered by the DUT.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

15. IP support systems at the DUT do exist

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

16. The ownership provisions of the IPR Act and DUT's IP Policy will impact negatively by decreasing IP registration

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. A researcher utilizing public funds is compelled to register IP arising from the research study

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

18. I prefer to file/register IP with: (Please tick one)

- The DUT ☐
- In collaboration with industry ☐
- On my own privately ☐

19. Describe your IP Portfolio

No. of IP Registrations	Private	Industry	DUT
Prior August 2008			
Post August 2008			

20. If ownership of intellectual property rights belonged to the researcher, it would encourage registration of IP rights arising from research.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

21. IP registration is a primary goal of research

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

22. IP exploitation/commercialization is a primary goal of research

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

23. I am aware that researchers/inventors should consider patent registration before publishing/conference presentation in order to qualify for registration

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

24. Generally supervisors at DUT identify potential IP that requires registration from students/own research

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

E. NATURE OF PROBLEMS EXPERIENCED BY STAFF RELATING TO IP REGISTRATION

25. IP support system at the DUT is user friendly

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

26. Researchers/supervisors do not understand IP registration procedures at the DUT

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

27. Guidelines for the IP registrations process and procedures at the DUT are easy to understand

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

28. The availability of funds at the DUT encourages researchers to register IP rights

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

29. Describe the problems you have experienced (if any) when registering IP, relating to service and assistance from the IP Office?

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30. Additional comments on the subject of IP registration

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Thank you for your most valued participation.