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An investigation of the role played by the Botswana Technology Centre (BOTEC) Library in supporting the engineer's information requirements

by

Oonayang Ntsite Phyllis Dilebanye/ DLBOON001

A minor dissertation submitted in partial fulfillment of the requirements for the award of:

Master of Library and Information Science Degree

Faculty of Humanities

University of Cape Town

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Signed by candidate Date: 31st January 2006

This work is dedicated

To

My children Stella, Bololo, Tibelo, granddaughter Osi, the rest of the Dilebanye family and to the loving memories of my late father Dilebanye M. Dilebanye (DMD) and brother Caleb.

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Life is a struggle and therefore calls for endurance. It is through endurance and encouragement that this research project was realised.

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ABSTRACT

Although it is generally accepted that libraries are for all, many are oriented towards serving people within specialised areas such as the engineering research field. This dissertation is a result of a survey of the engineers (user group) who are members of the Botswana Technology Centre (BOTEC) Library. The engineers used the library for varied reasons, hence the study was necessary to establish if the library positively or negatively responded to their information needs by investigating the role it played in supporting these engineer's information requirements.

The research project was based on two main approaches, the first being a conceptual review of the literature in the library and information field. The purpose of the literature review was to give an overview of the information need, information use, information seeking concepts related to the problem and its setting in order to arrive at a framework for determining the role played by the library in providing information to its users.

The second approach involved an empirical study that collected and analysed both qualitative and quantitative data. The study was carried out by means of a survey and the data was collected by means of questionnaires which contained open and closed-ended questions. These were distributed by hand or sent out electronically to the engineers registered as members of the Botswana Technology Centre Library. The engineers who participated in the study worked at Research and Development institutions, the University of Botswana and some Private companies in Gaborone and surrounding areas.

The data was analysed using Microsoft EXCEL software and the significance of the effect of the independent on the dependent variables was tested using the STATISTICA statistical package.

This dissertation provides background information on the BOTEC library and presents the engineers responses to the questions regarding the library's service and use, the engineers' information requirements, as well as their suggestions for service

improvement. The responses are discussed in the context of the engineer's profiles (independent variables) and the effect of these on the concepts explored in this study (dependent variables).

This research project has confirmed that the BOTEC library is adequately satisfying the basic information requirements of its users. It further indicates that there is, however, a need for the library to more vigorously adopt newer technologies and respond to other environmental changes in order for the library to fully fulfill its role in supporting the engineers' information requirements. The dissertation concludes with recommendations and strategies that the researcher suggests the BOTEC library could adopt to ensure a more user-centric and improved service.

CHAPTER 1

BACKGROUND TO THE RESEARCH PROJECT

1.1 Introduction

Information plays a major role in many aspects of life, ranging from a person's professional role in life to non-professional levels. It is used by individuals and organisations in decision making, communication, problem solving and prompts individuals to take action, such as in the case of research and development. However, the successful use of information is dependent on how it is interpreted and applied to fulfil information needs in a given situation.

Information is defined as "an assemblage of data in a comprehensive form capable of communication" (Prytherch, 1995:666). Many writers in the field of library and information science observe that information is a broad term that covers many inter-related activities, and now knowledge management has become the latest manifestation of the extent of the value and power of information and its related concept, knowledge.

Different individuals and organisations have varied information requirements and thus utilise information differently. Focus for this research is placed on engineers who use the Botswana Technology Centre library. These practising engineers are from varied sub-disciplines of engineering and by virtue of their respective work domain, these engineers need information to advance the objectives of the organisations they work for.

Generally information is used to achieve results, such as in research and development where the emphasis is on services and product development or improvement. It is therefore imperative that librarians and other information providers should study and understand user requirements, preferences and behavioural patterns displayed during the information seeking process in order to provide effective services. Studies however show

that for a long time information providers did not focus on the cognitive aspects of the human element but placed emphasis on the physical aspects of information provision.

The provision of information is a two-way process, thus there is a need to know how the services provided can influence the behaviour of those at the receiving end. This study proposes to seek the basis by means of which the Botswana Technology Centre (BOTEC) library can conduct continuous research relating to its services, users and means whereby the librarians can become more proactive and attuned to user requirements.

The experience gained serving the interest of engineers in a research environment while working at BOTEC, the insight gained from courses in library and information science, as well as the general literature on library and information science, particularly on special libraries and their users, have prompted the researcher to consider the role the BOTEC library plays in support of the information requirements of its users, the engineers.

This chapter therefore aims to provide a conceptual framework for the investigation of the role played by the BOTEC library in support of the engineers' information requirements. It does so by giving background information on BOTEC and the library, discussing the problem and its setting as well as concepts and terms related to the phenomenon being investigated.

1.2 The BOTEC Library

The Botswana Technology Centre (BOTEC) was established in 1979 to promote science and technology through research and development, technology transfer and co-ordination of technology endeavours that may have actual or potential impact on development in various sectors. These efforts are aimed at improving the quality of life of the citizens of Botswana and supporting the country's economy (Milne, 2000:38). To carry out its socio-economic obligation, BOTEC relies on information.

The BOTEC library is a specialised information service with an orientation towards science and technology. It is extensively used by researchers in the general discipline of

the applied sciences, and these are mainly the engineers in the employ of BOTEC, but also include engineers from other sectors and organisations.

The library was established to serve as a national focal point for technical information and it is the only one of its kind in Botswana. There is thus a need to ensure that it fully caters for the information requirements of its users, and also that the library provides a modern information facility encompassing the latest technologies for information access and retrieval. The current era, which is information and knowledge driven, greatly impacts on the operations of libraries and information services in general, and therefore information providers are challenged to reconsider, re-engineer and restructure information services in order to be able to meet the expectations and requirements of users.

In considering the current library situation, there are issues pertaining to the library's effectiveness in relation to the overall objectives of the parent organisation and these must be established and addressed. To achieve this, the users' needs should be empirically investigated taking into consideration the ever increasing and changing information requirements of the user community.

This study will be the first important initiative for BOTEC in this direction as the BOTEC library has never been seriously studied. The library has been serving the engineers over the years without obtaining any formal feedback on how the information found by means of the library has been utilised and whether the information has indeed satisfied users' needs, nor has it been established whether the library contributes in a positive way towards organisational objectives.

The researcher would like to suggest that because fairly comprehensive and varied information resources are made available in the library, the users usually take it for granted that the library is poised to meet their requirements. The library resources at the BOTEC library comprise research reports, journals and other literature on applied technology. However, the BOTEC library users need to be probed in order to make them

fully aware of the value of information use. The library in turn needs to establish the extent of the users' information requirements and whether these are being met, how the library is being used and the nature of the benefits being attained.

The research project was therefore carried out as the means for assessing the link between the library service and its users as well as to highlight the underlying factors which may in one way or another influence the success or failure of the service.

1.3 The research problem, its setting and the research questions

Since its inception, BOTEC library has provided science and technology information to engineers and other library members, as well as the general public. The extent of its impact, however, has not been extensively probed.

The study seeks to investigate BOTEC library's contribution towards the organisation's research and development activity as well as its general role in providing access to applied science information in Botswana. Thus, the researcher will investigate the Botswana Technology Centre Library's role in supporting the information requirements of the engineers it purports to serve. It will address the current library's situation in the light of what users require and its future role taking into consideration BOTEC's involvement in the formulation of the Science and Technology Policy for Botswana.

The Botswana government embarked on the formulation of a Science and Technology (S&T) Policy by considering strategies involving basic and applied sciences and ways in which knowledge can be shared and used. The objective of the policy in relation to information has been defined as,

> "To promote and strengthen the development of information, the technology used and data communication infrastructure by promotion science and technology information through libraries and modern technology systems" (Botswana. Ministry of Finance and Development Planning, 1998:30-31).

The above objective presents a challenge for librarians and other information providers, especially those involved with the provision of science and technology information to

assess their services in view of the policy statement and thus establish strategies for the implementation of change. The main focus of the policy is on the rationalisation of science and technology institutions in the country. The achievement of the S&T objective therefore brings up the issue of information management where libraries within the S&T institutions will have to consider strengthening their links and cooperation, particularly with reference to collection building and resource sharing.

To address the research objective outlined above and provide a framework for the investigation, the researcher derived the following research questions

1. **What are the information requirements of the engineers?**
2. **Does the BOTEC library adequately address and meet these requirements?**
3. **What strategies are necessary to better attune the library service towards the achievement of organisational goals?**

Given the current library situation, the researcher is of the opinion that this research project will help in determining the library's actual and potential role to fully support engineers with relevant information. It is important to find out how well the library has penetrated the user segment it is supposed to serve and establish strategies that will ensure management of the library service. The researcher is further convinced that this research project is being initiated at an opportune time as the scope of work at BOTEC is increasing because of recent expansion into new research areas such as that conducted by the mechanical engineering. This means that effective measures are needed to ensure that the library plays a significant role in increasing the information edge of its users and enhancing the advancement of organisational goals, and thereby increasing the information edge of the organisation. According to Griffiths and King (1993:21),

" information edge refers to the relative gain that can be achieved through effective use of information by individuals, their organisations and the country."

This study should address the question of whether the nature of the engineers' requirements in a research environment and the specific situation they operate in are being met by the library and whether there is a need for it to be re-engineered to enhance

the information process.

The questions therefore draw attention to the value of information, the role that the library should play in meeting engineers' requirements and identify areas for service improvement.

It is anticipated that the proposed research will not only uncover factors relating to the role played by the BOTEC library in meeting the demands of the engineers, but also that it will benefit other research libraries. Given the current science and technology research initiative for Botswana, the outcomes of this research will set parameters by means of which the library could strengthen services to meet users' information needs and thus contribute to the country's science and technology information effort.

To fully understand the conceptual context of the topic being studied, there was a need to define the main concepts that relate to the BOTEC library's role in meeting the engineers' information requirements.

1.4 Key Terms and Definitions

The major concepts that underpin this research project will thus be defined as follows:

1. **Engineer:** According to Parker (1994:681) an engineer is person who is skilled and specialises in one of the engineering disciplines; examples of these are, electronic and civil engineers.

2. **Engineering:** "It is the practical application of scientific knowledge by which properties of matter and sources of power in nature are made useful to humans by means of structures, machines and products" (Parker,1994:681).

3. **Information:** According to Smith, Dervin's opinion on this phenomenon is that it has no absolute existence outside human perception and interpretation and it is not an inanimate, concrete object or a thing (Smith, 1994:2). Within the concept of user studies,

information is used to denote factual data, advice or opinion and when gathered, assimilated and understood becomes knowledge.

4. **Information Requirements or Needs**: According to Keenan (2000:135) the term refers to the general expressions that cover any situation where information is being sought to satisfy a need, want or demand. Processes for meeting information requirements needs to be focused on how users gather, handle and use information as well as how they assimilate and construct sense and apply information in a particular situation

5. **Research and Development** (R&D) Keenan (2000:212) defines R&D as an activity that includes basic and applied research that is directed to the design, development and improvement of services and products

6. **Science:** It is the "study of the structure and behaviour of material through observation, experiment and measurement in which new knowledge is pursued". (Parker,1994:1765)

7. **Technology**: It has been defined as the "application of science through practical utilisation in the development of products and services which can create wealth and improve the quality of life," (Botswana. Ministry of Finance and Development Planning, 1998:2).

8. **User Groups**: The concept refers to individuals that usually come from diverse backgrounds and who have a common interest in using a library service. A user group uses the library to satisfy their research needs through information. (Keenan, 2000:248)

9. **User Satisfaction**: According to Prytherch (1995:666), the term refers to a measure of performance based on user perception of the adequate delivery of the service, or of a required item or the degree to which a system or service meets the needs of users.

10. **User Studies**: This concept refers to the processes for studying the use of libraries and information by various users. These studies are undertaken to determine what users want from a service and to an understanding of the interaction between individuals, systems and services. in a given situation as means for determining an element of effectiveness in achieving set goals.(Prytherch,1995:666)

1.5. Outline of the dissertation

The dissertation is presented in five chapters,

Chapter 1 of this research report sets the framework for the study and provides an introduction. Chapter 2 reviews the literature review in the field and it highlights the main conceptual issues and factors that relate to the research project. The review is centred around users' information requirements, and needs, and the value of information. Specific reference is made to the information seeking behaviour of engineers. Chapter 3 discusses the methodology used to conduct the investigation. Chapter 4 analyses the responses to the survey; Chapter 5 discusses the findings and includes a conclusion and recommendations.

1.6. Assumptions

In most cases assumptions are made regarding the use of libraries and the general belief that users utilise the library because it satisfies their specific information requirements and that users are aware of the services provided. Within the framework for this study, it is assumed that engineers are familiar with the library and thus would honestly respond to the survey questions.

Given the fact that the library has recently moved to the new headquarters building, it is assumed that this study will stimulate engineers in becoming more instrumental in shaping the library into an effective information facility and that they will openly express their views or perception regarding the service rendered to them.

CHAPTER 2
THE REVIEW OF THE LITERATURE

2.1 Introduction

A literature review is an important aspect of any research project as it provides means for the researcher to gain greater understanding of the phenomenon being studied. The researcher therefore needs to examine the key conceptual issues pertaining to the topic of the research project and form a theoretical framework on which the project should be based. During this process, information sources, both printed and electronic formats, are explored and critically examined in order for the researcher to build on ideas and apply these to the research project.

The review of the literature for this research project pertains to information and its use, the manner in which the information requirements or needs of users are met or satisfied, and how their information needs influence their information seeking behaviour. This research project focused specifically on the information transfer process and the information requirements of engineers within a recognizable context. The discussion thus includes the key conceptual issues that revolve around information and the strategies that can work for engineers in their search for technical solutions for innovation and problem solving.

As mentioned, this chapter thus forms the theoretical framework that was applied to investigate the communication patterns, and manner in which information is sought pertaining to the research work of applied scientists (engineers). It further provides an overview of the Botswana Technology Centre (BOTEC), its aims and the Botswana Science and Technology Policy as further contextual setting for this research project

2.2. An Overview of the Botswana Technology Centre (BOTEC)

BOTEC is focused on the development of technology, co-ordination of technology efforts within Botswana and the dissemination of information on technology. It provides advice to the Botswana Government on technological matters, as well as to non-governmental organisations and the private sector.

In the context of the Botswana's Science and Technology Policy, BOTEC has played a major role in the co-ordination of activities for the establishment of the policy paper and its presentation to the Botswana Parliament and it will continue to play a part in the implementation of the policy. The Science and Technology Policy for Botswana was adopted and approved by the Botswana National Assembly (Parliament) in 1998 and the Government of Botswana uses it as a guiding instrument for the development of research to assist in diversifying the economy and improving productivity. The Policy was implemented and, as recognition of BOTEC's contribution to the establishment of the Policy, the Technology Development Department Director was seconded to the Ministry of Finance and Development Planning to assist in the implementation process. The Science and Technology Policy was implemented as part of the Eighth National Development Plan (NDP8), which has as its theme sustainable economic diversification for the period 1997/98 to 2002/03. (Milne, et al. 2000:23).

The implementation process of the Science and Technology Policy was put to Parliament in 1998 and it was then moved that a National Commission for Science and Technology be established as a supreme advisory body to government to assist with the implementation of the policy. The body will act as a Science and Technology Investment agency with a primary function of co-ordinating all funding and investment for science and technology research and development. The agency will therefore be responsible for the development of research strategies for joint venture and partnerships among research providers. An important outcome of the establishment of the national body is that it will provide the basis for linking of all the Science and Technology Research Institutes in the country. This will further result in the co-operation among and networking of libraries

serving these institutes in order to strengthen the existing science and technology information infrastructure.

BOTEC is registered as a company limited by guarantee, of BOTEC's Board of directors, with the secretary for Economic Affairs as the Board chairperson. Most of the funding to support Centre's capital expenditure and the recurrent budget originally came from the Ministry of Finance and Development Planning and the Minister for this ministry was responsible for the centre. The Botswana Government has since established a Ministry for Communication and Science and Technology, thus BOTEC and other research and development organisation report to the new Ministry and the appointment of the boards is the responsibility of the new Minister of Communications and Science and Technology.

The core strengths of BOTEC are vested in the development of renewable energy, electronics, architectural, civil and mechanical engineering technologies which in turn rely on the access of scientific and technological information. BOTEC's operations are therefore guided by a mission statement that outlines the centre's strategic objectives; the mission statement thus reads, "To provide solutions for industrial and business development through innovative research and application of science and technology," and this towards realising the vision for BOTEC which is, "We lead in harnessing innovative science and technology for the transformation of Botswana into a globally competitive nation". BOTEC thus plays an important role in the coordination of activities towards promotion of economic growth and industrial development, expansion of research and development activities, collaboration of strategic partners in science and technology and industrial development, and improvement of information services in the field of Science and Technology (Botswana Technology Centre, 1997: 6)

The main areas of activity for BOTEC relate to research and development that produces products in science and technology. Thus, BOTEC carries out its activities through two main departments, the Technology Development Department (TDD) and the Technology Information Department (TID) and one Unit, the Technology Assessment and Economics

Unit (TAEU). The TDD is concerned with the development, evaluation and testing of technology innovations. The TID in turn deals with the dissemination of technical information; while the Technology Assessment and Economics Unit (TAEU) conducts environmental impact assessments and financial analysis of technological choices or economic viability of projects. (Botswana. Ministry of Finance and Development Planning, 1998:3). The overall management of the Botswana Technology Centre is the responsibility the Managing Director and Departmental heads, while certain specific administration functions such as operations, personnel and finance are the responsibility of the Finance and Administration Department (FAD). This department plays an important role to the proper functioning of the TDD, TID and the TAE Unit.

BOTEC has over the years further increased its involvement in research and development in the fields of architecture, civil engineering, renewable energy, computing, electronics and information. As mentioned, a proposed new field of development is mechanical engineering as well as closer co-operation with the private sector, especially the manufacturing services.

2.2.1. Technology Development Department (TDD)

BOTEC maintains its objective of research and development through five main units within the Technology Development Department; the department is made up of Architecture, Civil, Electronics, Mechanical and Renewable Energy Units. Staff members in these units are engineers and technicians who are involved in research and the development of prototype technologies and therefore require timely and relevant information for projects.

Each unit is involved with the promotion and development of technologies through research and design. The main aim of the department is to provide technological solutions for individuals and companies as well as national bodies in the country. Since Botswana's industry sector is not highly developed, TDD's work is centred on developing and expanding the industrial base of the country through innovation, adaptation and the transfer of appropriate technology. It thus plays an important role and contributes towards

Botswana's socio-economic development.

2.2.2. Technology Information Department (TID)

This department plays an important role by disseminating technical and other of information to both BOTEC employees and the nation at large by means of its Communications, Information and Computer Units. These three units are the life-blood of the organization because of the role they play in the dissemination of information. TID provides not only internally generated information, but also information on technologies from other leading research and development organisations. It serves as a clearing house of resources and these are collected based on the information requirements of the researchers.

The BOTEC library is an integral part of the TID and serves as a gateway to science and technology information. Its objective is to provide researchers with the information they require and to link the general customers and experts in various technologies through referrals for technical advice. The library is thus charged with the responsibility to provide the researchers (engineers) with relevant information to support their information requirements to enable these engineers to reach technological solutions.

2.2.3. Technology Assessment and Economic Unit (TAEU)

The unit is responsible for the assessment and effective transfer of technology to industries where it is applied. It also appraises projects for development budgeting, it markets BOTEC products and services, and assists technology-oriented enterprises by providing a business consultancy. A further function of the TAEU is to provide economic and financial analysis of technological choices and proposals at both national and industrial level.

The TAEU comprises the following sections: industrial development, planning and statistics, marketing, consultancies and technology assessment. The unit, through its planning and statistics section, designs and implements programmes for the preparation and collation of technology to cope with sand. This unit enables BOTEC to ascertain the

necessity of technology projects, and also to assess the impact of its technologies on the nation's industry and business community.

2.3. Information and Information Use

2.3.1 The Concept of Information

The discipline of Information Science revolves around information, and this concept is further also fundamental in society. The concept of information has been defined differently and with its varied meanings people have embraced specific meanings to satisfy their socio-economic and political needs. Generally, communities are aware of the value of information, hence the statement, "information is power". Although much has been written on what constitutes information, the literature on this concept has underpinned related studies such as those relating to information need and use and most of these studies cover investigative strategies on the use of information. In her paper on the role of government and libraries in development Cilliers (1994) states that information is a strategic resource that should contribute to socio-economic progress, also that information must be provided for the specific needs of users and must assist them in the execution of their particular duties and tasks.

The provision of accurate and timely information is therefore a determining factor in the success or failure in all sectors of life. Moyo (1993) notes the critical importance of information in the fields of medicine, political endeavour and economic management, amongst others. Hence, the managers of an information service should accept the responsibility to probe the unique needs or requirements of their specific users in order to tailor services towards the satisfaction of their needs and to be able to evaluate the outcome of the processes in place.

The value of information is clearly shown by both Cilliers and Moyo. As a core part of the information society, the information field is generally challenged to be more practical and realistic in ensuring excellence in the delivery of information to users in order to meet their needs. The quest for knowledge forms the most important aspect of life, and the dependence on information has greatly influenced the information gathering,

management and dissemination processes in libraries and information services. The significant developments that have taken place over the last few decades in the way information is gathered and accessed, makes it inevitable for librarians and information personnel to re-consider their information tasks with more emphasis on value-added and user oriented services.

Thus, the information revolution has resulted in the establishment of diverse information environments and there has been a shift from the "warehouse model" of how libraries function towards user-based models. The realization of the value of information has thus become a characteristic that library and information services have embraced in order to meet the socio-economic and cultural needs of the societies they serve (Zipperer, 1998:27-30).

Allen (1996:3) defines information as "the process in which an informant's cognitive structures are encoded and transmitted to an information seeker who perceives the coded messages, interprets them and learns from them." This definition thus sums up the diversity of approaches to the semantic analysis of information that relates to structure, its relation to knowledge, the mode for transmission, its value and its effects on those at the receiving end and the processes for user interfaces.

Even though information has always been an elusive and problematic concept, there is still need to review it in the light of a different framework. This is because there is increased understanding of human involvement as well as the diversity of approaches to the semantic analysis of information that relates to the changing structure of recipients. Hence proper utilization of information is crucial for the development of an individual and the community. Information is therefore regarded as "any stimulus that reduces uncertainty" (Krikelas, 1983:6).

There are different notions regarding what information is: some see it as a commodity, a thing, process, knowledge but the essence of all the definitions is that they all relate to its significance to individuals and society at large as well as its utilisation. Therefore, the

significance of information to individuals is attained through its access, exchange and sharing between individuals as well as organisations. It is inevitable that librarians gain more insight on individuals' interaction with specific types of information.

In the context of this study information is vital to BOTEC's research and development activity and consideration of the BOTEC engineers' information seeking behaviour and their information requirements is a core aspect of Botswana's investment in innovation. Generally library users expect to get the right information at the right time and place. The convergence of information and technology has raised users' expectations and they thus expect the library or an information service to add value in the process of information provision. (Sweeney,1997:32).

According to Sistla and Todd "information is a wonderful thing and using the right information tools can spell the difference between success or failure" (1998:19). Librarians and other information personnel should be able to apply value and personal judgment as to what resources to provide and how these can work best in a given situation. This is a challenge for librarians especially during the current information era and the resultant information overload. This points to management having to create effective information strategies for information delivery while still maintaining a balance between the advantages of technology, innovation and the irrefutable role of human interaction. Sistla and Todd (1998:22) further observe that, "a synergy between people and resources and process has a tremendous effect on the transformation of information into knowledge, though common sense guidelines can be applied to ensure an information strategy that works"; such a strategy should direct an organisation's information use towards the achievement of its goals.

2.3.2. Information Use and the User

The research on the role of the BOTEC library in supporting the information requirements of engineers should therefore subordinate the information processes or techniques to the needs of its users. This should provide the means to achieve the organisation's objectives and to prioritise the dissemination of information.

The library would be far better placed to meet the complex information requirements of the users and in this way assist in achieving BOTEC's research and development initiative if it had a better understanding of these needs.

According to Gustitus, the current form in which information is delivered "represents . . . a convenient means of receiving important information the user may not otherwise know exists." (1998:21). Hence, there is a need for the development of new competencies, both personal and professional, such as the development of the research skills of library personnel which should result in the conduct of more effective user studies and the delivery of quality information services (Piggott, 1995).

Studies on information use show that for many years library services were influenced by assumptions made by librarians as to what users information needs are and what was best for users without ascertaining the true needs through research (de Jager, 1993:3-5). Over the last few decades there has however been a shift in focus towards the user of information rather than the information service and this has made information providers more aware of the significance of studying patterns of use. Kuhlthau (1993:333-353) observes that some of the interesting research is converging around investigation into user perspectives of information seeking and use." This is shown by the increase in the number of studies which are more user-oriented and which cover topics that seek to establish who the users of library services are and how services respond to their varied information requirements.

These studies are adding an important dimension to library and information science research wherein both the role of libraries and librarians should be explored and it is suggested that this should be done on continual basis for example, the International Federation of Library Association's (IFLA) theme for the 67th conference which was held in Boston-USA in 2001 was "Libraries and Librarians: Making a Difference in the Knowledge Age". More and more journal articles that link information and knowledge to users are also being written, such as the article by Parker which is titled "Knowledge is like light -Information is like water," in which the 1993 World Bank President Lewis

Preston was quoted as saying,

> "Knowledge and ideas are critical to development. We need reliable data to inform us about how we are doing and analysis to determine which policies succeed.... we constantly need to replenish and sharpen our knowledge base" (Parker, 2000: 233)

The extensive literature on library use and users lends itself to further scrutiny because it covers concepts of user satisfaction, user perceptions, and establishes a link to the conceptual process of seeking and using information. Further to this, there are varied methods for collecting data about these phenomena and attempts are being made to generate models of the information seeking process and patterns of individual users or the user groups in these investigations. These models, according to Ellis and Haugan, are based on the three realms of human experience which include, feelings, thoughts and action or the cognitive, affective, and physical needs of information users (1997: 384-385).

Paisley (1980:113-166) was of the opinion that information use and its value are related to the various inherent attributes of the individuals and the environment in which information is handled and utilised, and this further emphasises the need for libraries to understand their user's needs. According to Nitecki (1993:255-277), the premise that users can most appropriately judge the effectiveness of the system or organisation with which they interact with is an important aspect that needs to be considered for managers of library and information services. This has in recent years been evidenced by a number of user studies carried out with a more holistic perspective towards information use from both a conceptualised and research design perspective (Baker & Lancaster, 1991:369). It is clear from the above that the scope of studies on use and users of information is extensive.

2.4. Information Requirements / Need

The concept of information need is embedded in studies of users and use. These according to Rhode (1986:49) form the most extensive and amorphous area of research in library and information science; as has been mentioned the emphasis in the past was more

on the perspective of the information providers than the use of information. With more research being carried out over the years, many researchers have sought to understand user behaviour by have applying theories on the cognitive ability of users. Thus, attention shifted from measuring information service performance to the impact of information on changing attitudes of users and problem solving. Hence this observation that, "Information service as an activity comprises the interpretation of information in terms of user needs" (Van Houten, 1982:72). Westbrook (1997:316) equates a need for information to "what individuals do to fill a gap in the knowledge they posses on a given issue, and this includes, thoughts, motivation and experiences." An information need may be on a specific area of research with a requirement for a particular piece of information or exhaustive information on a particular topic.

The understanding of individuals' information requirements or needs is usually taken at face value, hence there is still confusion on the use of such words as needs, wants and demands. These words are often used interchangeably irrespective of their exact meaning. However, researchers in information seeking behaviour and needs assessment studies have tried to highlight the difference between them. A need for information is therefore ascribed to what information an individual may demand to fill a gap created by lack of knowledge for accomplishment of educational, recreational or research pursuits. As an example, a researcher in most cases requires or needs information that would further his/her research activity or stimulate new ideas for a particular area of research.

The most important aspect of the information need is the actual experience of an individual and the consequences that result from the retrieval, assimilation and utilization of information in a given situation. The encounter with information is therefore largely dependent on the individual's responses to stimuli. An individual with an information need may be conscious of what he needs, but this may at some point be exaggerated or there may be a problem regarding the expression of the particular need.

Thus an individual who requires information will always have some expectations to have his/her need for information satisfied despite the manner in which the need is expressed.

Wilson's conceptualisation of the information need experience (Smith, 1994:14) sums this up as "the totality of experiences centred upon the individual as an information user." This however takes into account the users' "life" and the influencing factors on the information need and these may include, the environment, personal attitude and attributes as well as, the information system used for accessing information.

Due to the shift towards user-oriented service, libraries need to attune their services to fully appeal to the information requirements or needs of users, irrespective of whether these are expressed or not (Hernon & McClure, 1990:1-10). This draws attention to Dervin and Nilan (1986) who, in their review of information need and use, refer to a number of more user oriented approaches that can be adopted to ensure the design of effective service/user interfaces and service delivery.

The process of ascertaining the information requirements of users is complex because a number of variables come into play when trying to determine users' perceptions of a service, their use of the service and information, as well as service performance. Library management is thus faced with not only the delivery of information but with interpreting the users' actions throughout the information search process and coming up with measures that will ensure user satisfaction. The advent of newer technologies for global information transfer, and access to remote information resources has further had a great influence on the need for information. More library users are aware of the value of resources such as the Internet. However, these users still need to identify and match their information requirements to the information available as well as learn how to exploit these sources to the full extent to be able to attain optimum benefit and to fill the knowledge gaps they experience within their work environment.

2.4.1 Factors that Determine Information Need

Information services are designed to provide information to a wide spectrum of society and thus they have a social obligation towards the communities they serve. To realise this, there has to be an understanding of the overall environment they operate within, especially the way individuals interact with the systems. However, like in any many other

individual related activities, there are bound to be some constraints that may impede the effective transfer of information.

There are a number of issues inherent in the sociological, economic and political situations that may influence individuals' need for information. The most important aspects for consideration are however cognitive factors where for example, the recipient needs to have sufficient expertise to understand information which leads to a change in a person's knowledge base. Riley (1998:145) discusses the new era of information as "the age of mind." Further to this notion, he highlights the potential change in the ways that information can be produced, used and exchanged, which he refers to as "conveyance of information viz., conveyance of mechanisms with the process of thought."

The increasing complexity and interdependence of social activities mean that information needed by any individual may grow in diversity and the needs of an individual or a social group changes from time to time. Piggott observes that there are some fundamental realities that shape the information management process and the actual impact of information on an individual's as well as general societal need. These include socio-cultural, political and physical environments which may all play a major role in the satisfaction or dissatisfaction of an individuals' need for information (1995:11-20). An individual requiring information may experience such a need as an individual or part of a group and this may impact on the manner in which the need is met.

The work environment is one of the most important factors that affect the need for information and information seeking patterns of an individual or a group of people within an organisational framework. Smith refers to Wilson's statements that the information needs of individuals working in bureaucracies tend to be constrained because of organisational policies and structures. These often impede the information transfer process and inhibit the smooth flow of information because of the divisions created by roles and lines of authority (Smith, 1994:3). A point to note in considering the library's role in relation to the information requirements of engineers is that information transfer in an organisation takes place within a structured context where within a group there may be individuals who communicate more than others and this often results in the forming of

informal networks. Also individuals seek out those who may be able to assist them with their work outside the formal structure.

Apart from the work environment and its "climate", the socio-cultural and political environment as well as the physical environment will have an impact in various ways. For instance, the economic climate and the different stratification of resources will define some work environments as "information poor" and others as "information rich," Also, the political system may define certain types of information as forbidden to particular groups and, consequently, the non-availability of this information may affect performance in specific work roles. (Wilson,1981:9).

The importance of information is shown by the way people make transactions, control the supply and movement of goods and services and this is usually carried out through the interaction between individuals and societies from diverse cultural backgrounds. Societies have to determine ways in which to address the ever-increasing generation of information and its use. Above all the transformation of culture and society is very much dependent on individuals and their competence to conduct their work roles in a way that is inline with the culture and expectations of the organisation they work for.

2.5. Engineers and Information Seeking

Nitecki (1993:257) defines information seeking as "a process that is dependent on the information problem, where a gap in the knowledge is identified, defined and addressed through a search for a particular piece of information". The search for information is therefore a result of uncertainty which is usually felt during the early stages of an information inquiry where an individual may experience confusion and have vague ideas or thoughts about the subject of inquiry and his/her actual need (Kuhlthau, 1993:347). This according to Kuhlthau is usually due to an individual's cognitive state and it is a common cause for the affective symptoms of anxiety and lack of confidence (1998:355-367).

Pinelli and others are of the opinion that the literature on information seeking of applied

scientists is fragmented. The researcher is however of the opinion that this literature survey on the general topic of information requirements or need has shown that researchers in this field realise the need to study different user groups in relation to information gathering, handling and use and especially study its impact on the processes within a particular situation (1993:168). For example, Pinelli, Poland and Steinke have all discussed the information seeking and communication patterns of scientists and engineers. Steinke (1991:13) observed that applied scientist's interaction with information is minimal. This he states is due to the fact that they do not read and use the literature and the libraries if they are not directly oriented to them. It has further been observed that applied scientists use different channels of communication from pure scientists. For example the former are more inclined to use handbooks, data books and standard specifications than pure scientists who again make greater use of textbooks, journals and scholarly publications. of interest (Smith, 1981:124).

The rising interest in industrial development and competitiveness in Botswana has signified a greater awareness of the need to focus on investment in innovation through research and development. This challenges research libraries to re-engineer services and to apply a need-based approach in the design and operation of services.

The literature studied for this research project has given the researcher the impression and strong conviction that, despite the number of studies carried out on information need, the library and information field is still faced with a responsibility to further explore factors that may influence information seeking behaviour of users in order to successfully ascertain their needs. Furthermore, the paradigm shift in information processes has impacted on the nature of the discourse: the conceptual phenomenon that underpins this research project is based on information access and delivery, and the interfaces with the users' information need and use. According to Palmer (1999:1139-1140), such an understanding should influence librarians and information personnel to develop models that represent the dimension on which the user and his specific use of information in a particular information environment can be constructed.

Engineers are generally faced with demands on production processes that need to operate at optimum levels of quality and performance to ensure competitive advantage. Engineers thus need to be constantly aware of new and different ways of producing competitive products. The research and development component part of an engineers' work thus underpins all activities related to product identification, design, testing as well as technology transfer and eventually implementation. To do all this effectively engineers thus need access to appropriate information and the onus is therefore on the information personnel to advise engineers on where and how to get the information they need for their projects. As engineers' information needs become more complex and information overload is experienced in all professional spheres, it is apparent that new approaches should be found to ensure that information is managed successfully and strategies are developed to respond to their various information needs.

Filer (1996:1-2) observes that, "engineering has always been an information rich activity and a source of creation of real wealth." Engineers, following Palmer's categorization can be seen to be "information pragmatists" because of the nature of their information seeking patterns which tend to be occasional and sporadic and usually in response to a direct and immediate need (Palmer, 1991:123). An engineer's search for information is often based on a need to solve a specific problem rather than a general search for information. Usually these occur during specific projects and their information seeking is thus oriented to project development and completion. This approach is referred to as research and development portfolio models and these according to Ellis and Haugan (1997:392) are, "incremental, radical and fundamental to the achievement of set goals for projects".

A general observation on engineers' interaction with information is that their information requirements in most cases arise with the inception of project ideas and extend throughout the phases of the development of the project. Project stages include its initiation, the research as well as implementation and testing stages. Thus engineers may need current information from journals and at the same time use reports as well as engineering data books and specifications. The course of their work requires that they

carry out specific searches for a particular piece of information, and most of their time as mentioned is spent on finding solutions for engineering problems. (Pinelli and others,1993:170).

Poland (1994:173) has suggested that informal networks play an important role in the engineers' information seeking behaviour. Such "informal networks are the expression of hypothetical thinking" and are "relatively free from filtering and thus the researcher is in control of the information flow." Engineers thus not only have a need for formal sources of information (e.g. technical reports), but also their knowledge on the subject being researched or a product being developed by their colleagues. There is thus further need for information that engineering experts (gatekeepers), both within the organisation and from the external environment, can contribute to solve their problems.

The above features of engineers' information need and seeking that have been highlighted clearly indicate that information personnel need to pay closer attention to how engineers utilize the library resources. Another issue that needs to be addressed is the varied information environment that engineers encounter during the information seeking process and their responses to environments such as digital information services where information is shared, accessed and stored electronically. The nature of engineers work would suggest that they should be constantly aware of new information environments and that they should be conversant with all relevant information resources, whether these are electronic or not.

2.6. Conclusion

In summary, the proliferation of information and new information technologies challenges librarians and information personnel not only to determine what users' information requirements are, but how to assist them to get the best results from the information system in place as well as a how to measure the impact of such a system on users' needs and information seeking behaviour. There is a real possibility according to Sridhar (1988:75) that the user-system interface may be designed without much thought being given to the users' expectations and satisfaction, i.e. the system may be designed

based on an "exhaustive approach", where for an example, instead of providing specific information to solve a problem the information personnel may provide exhaustive bibliographies that are of no use to the engineers.

Another aspect that needs attention is that in assessing the match between users and information services, researchers may focus on the cognitive approach of the user and overlook that of the information personnel. This can then result in a mismatch between users' needs and the services provided. Library and information managers therefore need to investigate all aspects that relate to information and user interfaces to determine influencing factors that affect the information need and use.

The research carried out in information science identifies the interdependency of the interaction between information providers and users of library and information services. The responsibility is usually placed on the users to correctly state what they need and if the user of the information service has a passive approach, it will be difficult for the information providers to satisfy their needs. Engineers need to be encouraged to be actively involved in the processes for information delivery, access and retrieval. Information providers in turn need to take a more proactive stance in ascertaining the requirements of engineers. As the role of librarians broadens to include roles such as knowledge manager in a global information environment, value should be added to the information dissemination and delivery processes (Gustitus, 1998:21-24). A further aspect that should be considered is that the forms in which information is delivered to users should not only represent what the user needs, but what the user may not know exists. What has become more apparent from the survey of the available literature on the topic of information requirements is the fact that information is very much inter-linked with the communication and use of information. Through communication the user attains information which is then used toward meeting a need. However, this is usually the end result of the information seeking process and the results may or may not necessarily satisfy the information need depending on the impact of the information attained and how it is utilised.

Engineers depend on information for successful completion of their projects and information workers should thus support the engineers in their work situation and assist them to find relevant information. The engineer's need for information is an important factor and determinant for industrial development and this in turn plays an important part in economic stability. The importance of information for economic sustainability is stressed at national and international levels. Worldwide, this is evidenced by the World Bank's mission of poverty alleviation and sustainable economic development that places emphasis on the access of information and communication through the integration of information infrastructures and networks. This is a direct call for information services to re-think their strategies towards supporting their users with the information they require.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Research in library and information science has generally been influenced by trends and developments in the area of information and the social realm. The greater picture in this respect is that libraries and information services play a pivotal role in supporting the actions of other professions by providing these with the information they require from time to time. Hence these services are socially obliged towards the communities they serve. Library and information research being undertaken thus reflects the social responsibility these services are charged with. These services thus require some form of measurement or investigation to determine their viability or their strengths and weaknesses and this sets parameters for improvement or more effective services.

The research carried out by this project is, like many others, about social behaviour. Thus this research is "a study of human interaction interrelations and their conditions and consequences" (Mann 1985:1). A number of research approaches can be adopted as a means for investigation and measurement and the approach will be determined by the specific situation of the research population and environment.

The approach adopted for this research project was meant to establish events, processes and experiences that are associated with the engineers' search for and use of information as a way of measuring the effectiveness of the library-user interface. According to Babbie (1998:104) research in the social dimension should attempt to connect meaning and structure to the social world of individuals by probing their perceptions, assumptions, judgement and suppositions, and this served as the guidelines for the research approach adopted for this study.

This research project was based on empirical study and was predominantly in the domain of social research. Descriptive studies are usually of an exploratory nature, they clarify a given situation with regard to peoples' experiences and they are often undertaken to identify and establish basic contexts on which future studies could focus and further investigate relationships among variables and establish links wherever possible (Smith, 1981:135-136).

A variable refers to the attributes of the phenomenon being studied or researched. The two main categories of variable are generally referred to as the "independent" or casual variable and the dependent variable. Independent variables cause change or variation in the attributes of the dependent variables. Busha and Harter further refer to a variable as "an element of entity or a factor which may be qualitative or quantitative" (1980: 61).

The conceptual enquiry for this research project explored the relevant concepts surrounding the phenomenon that formed the basis of the topic for this research project, i.e. the extent to which the library supports the information requirements of engineers who are members of the BOTEC library.

In the following sections the research methodology adopted for the empirical research will be discussed.

3.2 Survey Research

The survey research method is one of the traditional methods that has been used and is still the main method used in library and information science research. According to Leedy (1993:183) the word survey means, "to look or see beyond". This method is thus used to collect contemporary information that can be used to explain and explore relationships or significant factors surrounding a phenomenon being investigated. According to Powell (1991:54) survey research is appropriate for studying personal factors and for exploratory analysis of relationships. Surveys, according to Babbie (1998:257) are a particularly effective method to use to explore characteristics, behaviour

and opinions of the population being researched more specifically; library and information science research has extensively relied on survey method to determine characteristics of users of an information system, to understand behaviour and measure opinion of users on the various aspects of the service and their information use (Rhode, 1986:49). The researcher decided to utilise the survey approach as the main method for this study. The BOTEC library users' opinions were solicited to indicate their information needs and the level at which the library satisfies their information requirements.

As with most research methods, there is tendency for bias. Bias may affect the validity of the responses; thus, the survey questions need to be designed with thoughtfulness and careful consideration of the factors that may influence engineer's responses to be biased towards the researcher's opinion of the library service. Generally responses may be influenced by pre-conceived notions about the service or assumptions by respondents on the researcher's intent in conducting the particular research. Also, unwillingness to give information on the part of respondents or ignorance may impact on the researcher's inferences.

3.3. The Population

According to Babbie (1998:194), "A study population refers to study elements about which information or data is collected and this population thus provides the basis for the actual selection of the sample and the analysis of data". Powell (1991:61) in turn defines the study population as "the total of all cases that conform to a prescribed criterion on which the results of the research can be generalised". During the planning and design stages of the research project to be undertaken, the researcher needs to clearly define and specify what population is to be studied. This requires that the researcher distinguishes the targeted population from the actual elements of the population to be probed. For this research, the researcher targeted the registered members of the BOTEC library who worked within a 200kms radius from the library and who were engineers. The 100 engineers who constituted the study population included employees of BOTEC, the Rural Industries Promotion Company (RIPCO), University of Botswana (UB) and private

companies.

3.3.1 Sampling

It is not often that an entire population is surveyed and sampling is usually applied. The process of sampling implies a representation of a larger number of elements by only a few (small number). It thus allows for an intense analysis of the elements. Sampling is a determinant on how the researcher can draw on the elements of the population that can provide the needed data (Powell, (1991:61).

The focus of this study is on engineers and aspiring engineers who are registered members of the library. A list of engineers and aspiring ones with contact details and organisations was drawn from the general library members records and when it was found that this constituted only 100 members it was decided that there was no need for the researcher to sample as it was feasible to survey all the targeted library members who were engineers.

3.4. The Collection of the Data

Data collection is one of the basic steps of survey research. Having determined the methodology to apply for this research project, the researcher made a choice of the necessary data collection techniques to use. For this research project data was collected from both the primary and secondary sources of data to support or refute the research questions under investigation.

The primary sources used for this investigation included a survey questionnaire in which engineers were probed on library use and the impact of the service on their information requirements and needs. The secondary source for data collection was carried out by the study of the literature on the broad subject of information need, engineers' requirements and their information seeking behaviour. The general sources on library and information use and engineers' communication patterns were also reviewed. The Botswana Science and Technology Policy document and the Botswana Technology Centre Strategic Plan

documents were consulted as a way of contextualising this research project.

The data collected for research purposes are usually characterized by some attributes (variable), which may change or vary from one observation to another. Two distinctive categories of data, discrete or continuous, may be collected. Discrete relate to quantitative measures and continuous to the measurement of possibilities. The success of any research project is dependent on clearly organised data, where a pattern is maintained in order that responses can be compared and any abnormalities or inferences can be explained (Smith, 1994).

3.4.1. Data collection by Questioning

Questioning data collection procedures are generally regarded as the most effective techniques to use in order to establish information requirements or needs. Hence they have become dominant in the area of library and information science research. According to Smith (1994), questioning techniques may be used to obtain both "Objective and subjective information and ascertain a subject's opinions or attitude on a given matter". The technique can be used in the form of questionnaires or interviews. However for this research project the researcher opted to use a questionnaire.

3.4.2. Questionnaire

The literature on survey questionnaire design offers several guidelines on how to plan, design and use questionnaires for those contemplating to undertake research and using this instrument. According to Berdie (1986:1), "A questionnaire is a series of predetermined questions that can be either self administered, administered by mail or asked by interviewers". A questionnaire should be designed in such a way that the required information can easily be elicited from the respondents. A well-designed questionnaire further needs to be clear and brief to allow easy completion and to prompt accurate responses from the respondents. (Asantewa 1992:13).

The researcher endeavoured to follow the guidelines outlined above and sequenced the questions as logically and effectively as possible. The questionnaire was therefore

divided into four sections, and an explanation of the intent of the research was included as part of the heading.

The question format for this research project included both closed and open questions in order to explore measures through which the BOTEC library supports the information requirements of engineers. To address this, the questions prompted the respondents to reflect on their use of the library service and disclose their satisfaction or dissatisfaction with the library. The questions also probed the respondents to provide suggestions on how best the library could provide them with the kind of information they require.

Incorporating both closed and open questions gave the respondents the freedom to provide their own answer to questions as well as offering them a choice of alternatives. In addition, the respondents were asked to rate their responses for some of the questions. The mixed structure format helped to break the monotony of similarly-formatted questions and the variation gave the respondents greater latitude for expressing their feelings and perception about the library service.

3.4.3. Questionnaire Administration

Survey questionnaires can be administered through the mail or be handed to respondents to complete either in the presence or absence of the researcher. Depending on the researcher's views regarding the sample's location, it may be appropriate to have the respondents come together in one place and complete the questionnaire at the same time. The questionnaires for this study were administered to all the registered members of the library who could be reached. The researcher established contact with all the engineers by telephone and explained the purpose of the study and asked for their cooperation. The researcher distributed the questionnaires to the engineers coming to the library or personally gave it to them in their offices either at BOTEC or the other institutions, and finally sent it to some electronically. A strict time schedule was adhered to for the distribution. The BOTEC library staff although not directly involved played a role in this research by following up the questionnaires and receiving those being returned.

The main problem that the researcher encountered during the data collection process was in reaching some of the engineers. Not all the engineers were reached as they had either left the organisations they worked for or were out of Gaborone on business. Thus out of the 100 engineers on the list, only 50 completed the questionnaire or responded. A major factor contributing to the low response rate was that the membership record had not been updated with new contact details.

3.5. Data Analysis

To ensure that the data can be analysed to provide the necessary evidence on the research, the data needs to be categorised and coded to represent the responses. Fowler (1993:125) states "a code is a set of rules that translates answers into numbers". To make the process of data organisation less cumbersome computers that can apply statistical packages are utilised.

Therefore, for this research project, the researcher used a computer for data entry. The Microsoft Excel Software was used both for data entry and analysis. The results of this research project were analysed and then presented in tabular form. The effect of the independent variables on the dependent variables was tested for significance using STATISTICA statistical package

3.6. Pilot study

Every aspect of social research activity needs to be planned in such a way that a trial is conducted of the instrument to be used for the collection of data (primary), especially in the case where a survey questionnaire is used. A trial or pre-test is carried out on a small-scale to measure or determine whether the design of the instrument is in line with the problem being investigated. Thus, the survey questionnaire had to be created, scrutinized and adapted before it could be presented to the population to be studied. According to Fowler (1993:102), a self administered questionnaire needs to be pre-tested so that the researcher is able to ascertain the questionnaire's strengths and weakness. Thus, during the pre-testing exercise the researcher gets an opportunity to identify questions that are not too clear, and repetitive, etc. and refines them accordingly.

The pre-testing exercise for this study involved a small section of BOTEC staff and took place before the actual survey began. The responses to the pilot study enabled the researcher to clarify some issues pertaining to the use of information sources, staff assistance, electronic sources and the use of other information services. The researcher was also able to observe the length of time it took the actual respondents to complete the questionnaire.

CHAPTER 4

DATA ANALYSIS AND PRESENTATION OF THE RESULTS

4.1 Introduction

In this chapter the data collected from the questionnaires that were distributed during the survey (Chapter 3) are analysed and discussed.

According to Babbie (1998:2), social science research is primarily concerned with the measurement and interpretation of information. Interpretation or analysis of data refers to a systematic process in which the data is examined through the use of statistics and logic to establish whether meaningful patterns can be identified and inferences be made about the relationships among the phenomenon being investigated. Usually patterns that are derived by means of such a process can be simple descriptions of the phenomenon researched in terms of dependent and independent variables and their relationships with each other. Such data analysis therefore transforms raw survey responses into meaningful patterns that enable the researcher to interpret the data and draw results from an empirical study.

There are generally two main approaches to data analysis, the deductive and inductive, and these enable the researcher to work either from specific results and arrive at theories or deconstruct from the general to the specific. Both approaches aim at identifying general principles of the phenomenon being studied and whether the data collected refute or validate the theory or assumptions regarding the phenomenon being investigated. These approaches form the basis for the analysis of both quantitative and qualitative results obtained in this research project.

4.2. Data Analysis for this Study

The response rate for this survey was 50% as 50 respondents returned completed questionnaires out of the 100 that were handed out. This is generally regarded to be an

"adequate" response rate for statistical purposes (Rubin & Babbie, 1993: 340). The responses to the survey were captured and analysed using the Microsoft Excel software package. A record structure was created to accommodate the responses to each of the four parts in the questionnaire (cf. Appendix A). The analysis first considered the profile of the respondents in terms of their organisational affiliation, position, qualifications, and area of specialisation (Part A of the questionnaire). This was followed by an analysis of the responses that related to the engineers' use of the BOTEC library and their perception of service provision (Part B of the questionnaire), their information needs and information seeking behaviour (Part C of the questionnaire), and finally their use of newer technologies and suggestions for new technology implementation (Part D of the questionnaire).

Basic statistics were initially performed using Excel to analyse the data and this resulted in the calculation of percentages and the presentation of the results in both Tables and Charts. The demographic data was then further applied as independent variables in cross tabulations to establish whether they had any effect on the survey data collected in Parts B, C and D of the questionnaire (the dependent variables). The STATISTICA software package was used to calculate chi-squared statistics for the cross tabulations to establish which of these had produced statistically significant results. Only results that were significant at a significance (p-level) of <0.05 were accepted and reported on in this chapter.

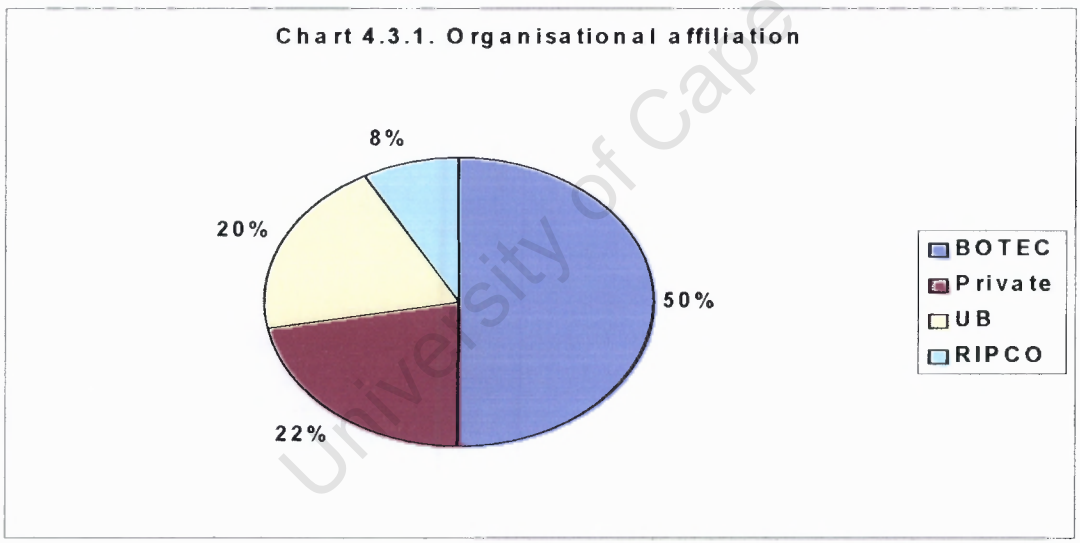
4.3. Demographic Profile

Part A of the questionnaire (questions 1-4, Appendix A) related to the engineer's demographic details, established their profiles and identified the independent variables for the study. This included the organizational affiliations of the respondents, their positions in the organization, qualifications, and areas of specialisation. The BOTEC library's clientele is made up of researchers at BOTEC (primary clientele) and researchers from other research organizations and engineering firms or companies in Botswana.

The demographic variables for this study are important to help assess information use and information seeking behaviour and the BOTEC library's ability to meet information need in terms of the various categories of engineers. As mentioned only results that showed significant chi-square results at a significance level of <0.05 are discussed in this chapter.

4.3.1 Organisational affiliation

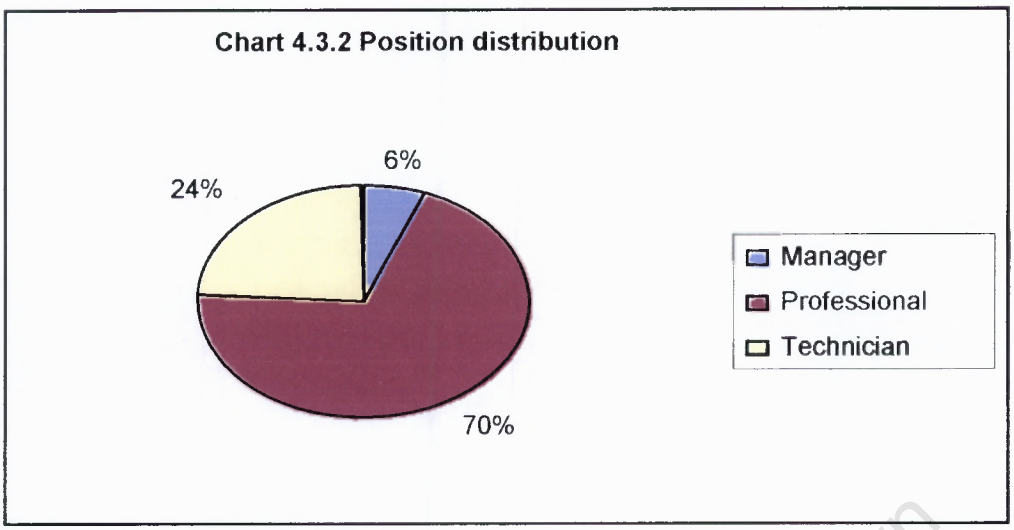
It was found that the respondents were affiliated to the following organisations: The Botswana Technology Centre (BOTEC), University of Botswana (UB), Rural Industries Promotion Company (RIPCO) and private organisations. It is clear from Chart 4.3.1 that half of the respondents (50%) were affiliated to the Botswana Technology Centre (BOTEC). The other respondents were distributed as follows: 22% from various private companies such as Solar World, 20%, from the University of Botswana (UB) and the remaining 8% worked for the Rural Industries Promotion Company (RIPCO).



4.3.2 Position Distribution

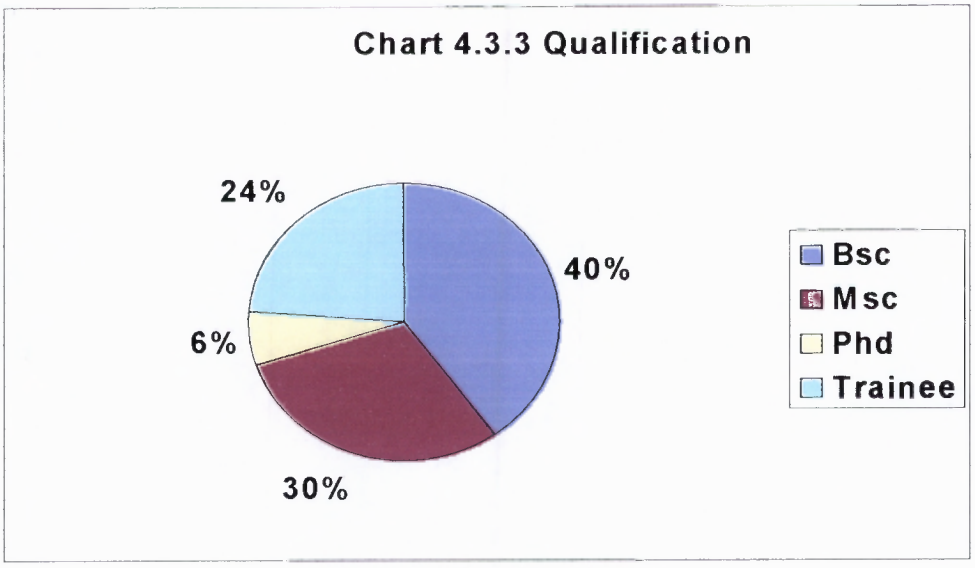
The positions held included the managerial category (i.e. manager's level); a professional category that covered all those with formal engineering qualifications who worked as engineers, and finally technicians. The latter category covered paraprofessionals or aspiring engineers who were still studying to obtain professional qualifications. The positions of the respondents for this study are shown graphically in chart 4.3.2 and ranged

from the largest proportion of engineers (70%) who were at the professional level to 24% who were at the technician level, and only 6% who were at the managerial level.



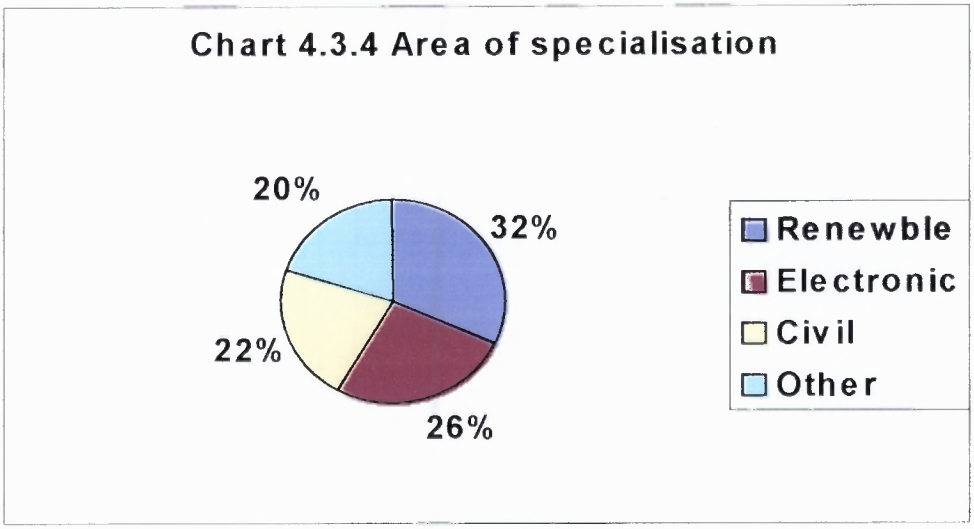
4.3.3 Qualifications

The qualifications of the respondents for this study included those who had attained a Bachelor degree (BSc), Masters degree (MSc), and a Doctorate (PhD). Additionally those with trainee status (i.e. all those without a formal engineering qualification but who were training to become engineers) were included. It is clear from Chart 4.3.3 that the largest proportion of the respondents held a Bachelor of Science (BSc) degree (40%), while those with a Masters degree (MSc) represented 30% of the sample, and Doctorate degree (PhD) holders constituted only 6%. Respondents still in training in one way or another made up 24% of the sample.



4.3.4. Area of Specialisation

The area of specialisation variable indicates the specific fields of engineering that the respondents are involved in and these subject areas are depicted in chart 4.3.4. It can be seen from this chart that the engineers mostly worked in three distinct areas of engineering specialisation and these are: Civil Engineering (22%), Electronic (26%) and Renewable Energy Engineering(32%). The remaining respondents (20%) covered "other" areas of engineering such as Chemical Engineering, Food Technology, etc.



4.4. Library Service and Use

The engineers were probed on their use of the library service as well as on their views of the effectiveness of service delivery by means of questions 5-12 (Part B of the questionnaire, Appendix A)

4.4.1. Reasons for using the BOTEC Library (Question 5)

The BOTEC library is used by engineers who are the employees of the Botswana Technology Centre and those within other research organisations, such as RIPCO, tertiary institutions (UB), and private engineering companies (consultants). These engineers use the library for a variety of purposes and it was decided to establish what the main reasons for use were by means of question 5. The results are depicted in table 4.4.1 below.

The most highly rated use was for reference purposes (58%), followed by the use of the library for study purposes (46%), to conduct literature searches (38%), and to browse (24%). No responses were obtained for the "other" category. It is thus clear that engineers mostly used the library to specifically refer to and utilise the resources to get the information they require for research projects and other work-related needs.

Table 4.4.1: Reasons for Library Use

Q5: Library Use							
%		%		%		%	
Study	*Total*	*Reference*	*Total*	*Literature Search*	*Total*	*Browse*	*Total*
No	54%	No	42%	No	62%	No	76%
Yes	46%	Yes	58%	Yes	38%	Yes	24%
Grand Total	100%		100%		100%		100%

The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p level ≤ 0.05 are reported).

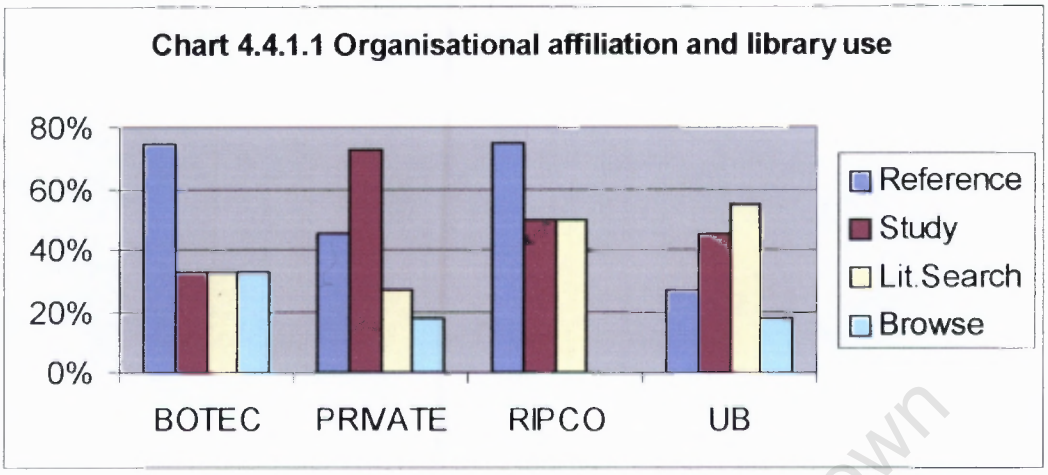
i) Organisational affiliation and reasons for Library use

The difference in response between the engineers from different organisations was examined to assess whether organisational affiliation had an effect on the reason for using the library.

The reference use of the library was the strongest among the BOTEC and RIPCO engineers (both categories gave a 75% rating), while the engineers from private companies gave this use a 45% rating and the UB engineers only gave it a 27% rating. The use of the library for study purposes attracted the most responses from the engineers from private companies (73%), followed by 56% of the UB engineers, 50% of the RIPCO engineers, while only 33% of the BOTEC engineers used it for this purpose.

The engineers who were the most positive about using the library for literature search purposes were those from UB (55%) and RIPCO (50%). The other engineers rated this use far lower at 33% for the BOTEC and 27% for the private company engineers. The use of the library for browsing purposes was the strongest among the BOTEC engineers

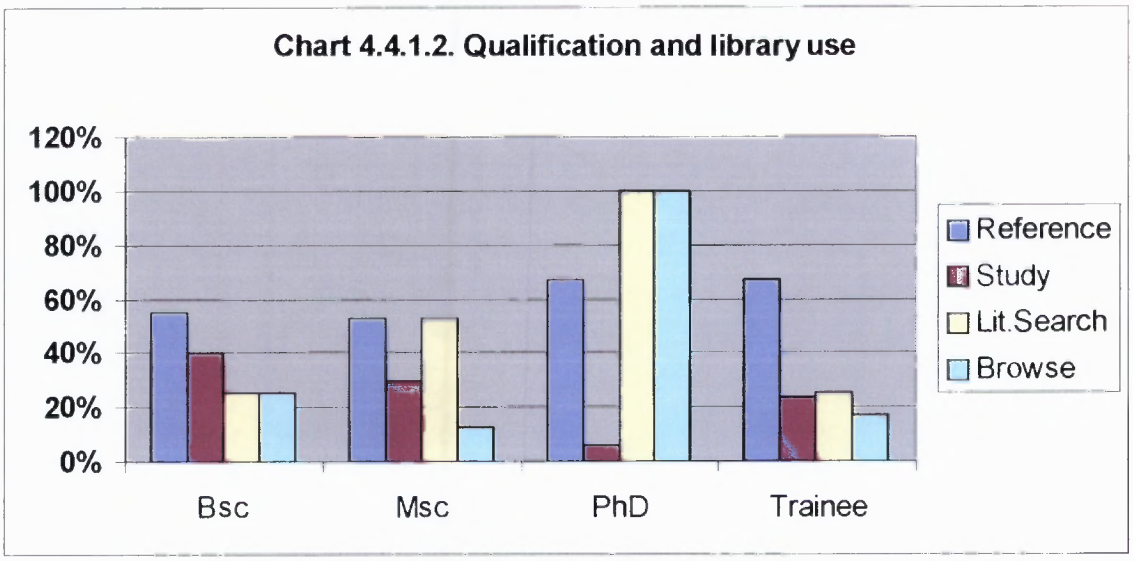
(33%), while the engineers from private companies and UB rated this use lower at 18% each and the RIPCO engineers did not use the library for this purpose at all. The results obtained are depicted by Chart 4.4.1.1 below.



ii) Qualification and Library use

The variation on the engineer's responses was assessed with regard to their educational background and reasons for using the library. The responses showed that the PhD's and the trainees used the library more for reference use (a 67% rating each) than the BSc and MSc engineers at 56% each. When examining the use of the library for study purposes it was found that the BSc engineers made the most use at 40% while the use rate declined as can be expected with higher qualifications and the MSc's and PhD's indicating a mere 6% use for this purpose. The trainees indicated a surprisingly low rating at 22%.

All of the engineers (100%) with the highest qualification (PhD) indicated that they used the library for literature search purposes, followed by 53% of the MSc engineers. The engineers with a BSc and the trainees rated this use far lower at 25%. The results further revealed that while all of the PhD engineers (100%) used the library for browsing purposes, the MSc, BSc, and the trainees rated this use far lower at 13%, 25%, and 17% respectively.



4.4.2. Library Sources (Question 6)

Question 6 probed the engineers on the sources of information they mainly used in the library and the relative usage was calculated and the result depicted in Table 4.4.2 1 below.

It is clear that books and journals were the sources that were mostly used in the library with 80% and 72% respective rates. The use of reference works followed with a 62% rating, while the research reports had a 52% use rate, then newspapers at a 40% response rate and business information sources were with a low 28% rating.

Table 4.4.2 Library Sources Consulted

Library Sources Consulted	%
Journals	72%
Business Information	28%
Research Reports	52%
Books	80%
Reference Works	62%
Newspapers	40%

The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p level ≤ 0.05 are reported).

i) Position and Journals

Journals, the most main source of current information were heavily used by the Professionals (83%), followed by the technicians with a 50% rating , while the Managers only gave a moderate rating of 33%.

Chart 4.4.2.1 Position and Journals

Journals Consulted	Position Manager	Professional	Technician
	33%	83%	50%

ii) Qualification and Business Information sources

In terms of the use of the business information sources by the engineers, the results clearly show that the engineers with a PhD (99%) consulted these sources more than the other qualification categories, while those with a BSc gave a 50% use rating and the Trainees and those with an MSc degree gave 25% and 14% use rate respectively.

Table 4.4.2.2 Qualification and Business Information Sources

Business Info sources	Qualification			
Consulted	BSc	MSc	PhD	Trainee
%	50%	14%	99%	25%

iii) Organisational affiliation and Research Reports

When the organisational affiliation and the research reports variables were cross-tabulated, it was clear that the engineers from RIPCO were by far the greatest users of research reports (100%) more than any of the respondents from other organisations. The UB engineers had a 54% response rate, followed by BOTEC engineers with a 50% rating

then those from private companies with a moderate 36% rating.

Table 4.4.2.3 Organisational Affiliation and Research Reports

Research Reports Consulted	Organisation BOTEC	Private	RIPCO	UB
%	50%	36%	100%	54%

iv) Organisational Affiliation and Reference Sources

When the organisational affiliation and the reference sources variables were cross-tabulated, it was clear that the engineers from RIPCO consulted this source more (100%) than respondents from other organisations. They were followed by the engineers from UB with 82% rating, private companies with a 63% rating, and surprisingly the BOTEC engineers only gave a moderate rating of 46%.

Table 4.4.2.4 Organisational Affiliation and Reference Sources

Reference Sources Consulted	Organisation BOTEC	Private	RIPCO	UB
%	46%	63%	100%	82%

v) Area of Specialisation and Reference Sources

The results of the cross tabulation for the engineer's area of specialisation and reference resources variables indicated that the majority of the engineers who consulted these sources were from the Renewable energy category (73%). They were followed by the engineers from the "Other" category (65% response rate), while the civil engineers gave a 54% rating and the electronic engineers category had moderate response rate of 45%.

Table 4.4.2.5 Area of Specialisation and Reference Sources

Reference. Sources		Civil	Electronics	Re-Energy	Other
Consulted	%	54%	45%	73%	65%

vi) Qualification and Newspapers

The cross-tabulation for qualification and the newspaper variables indicated that the engineers who mostly consulted newspapers were the trainees (66%), followed by the PhD engineers with a 33% and rating, while the BSc and MSc only gave 30% and 23% respective ratings for this source.

Table 4.4.2.6 Qualification and Newspapers

Newspapers Consulted	Qualifications BSc	MSc	PhD	Trainee
%	30%	23%	33%	66%

4.4.3. Problems with Finding Information (Question 7)

This question was intended to discover if the respondents encountered any problems finding information when they used the library. The results indicate that 80% of the engineers sometimes encountered problems while 18% never encountered problems and only 2% always encountered problems (cf. Table 4.4.3 below).

Table 4.4.3 Problems with Finding Information

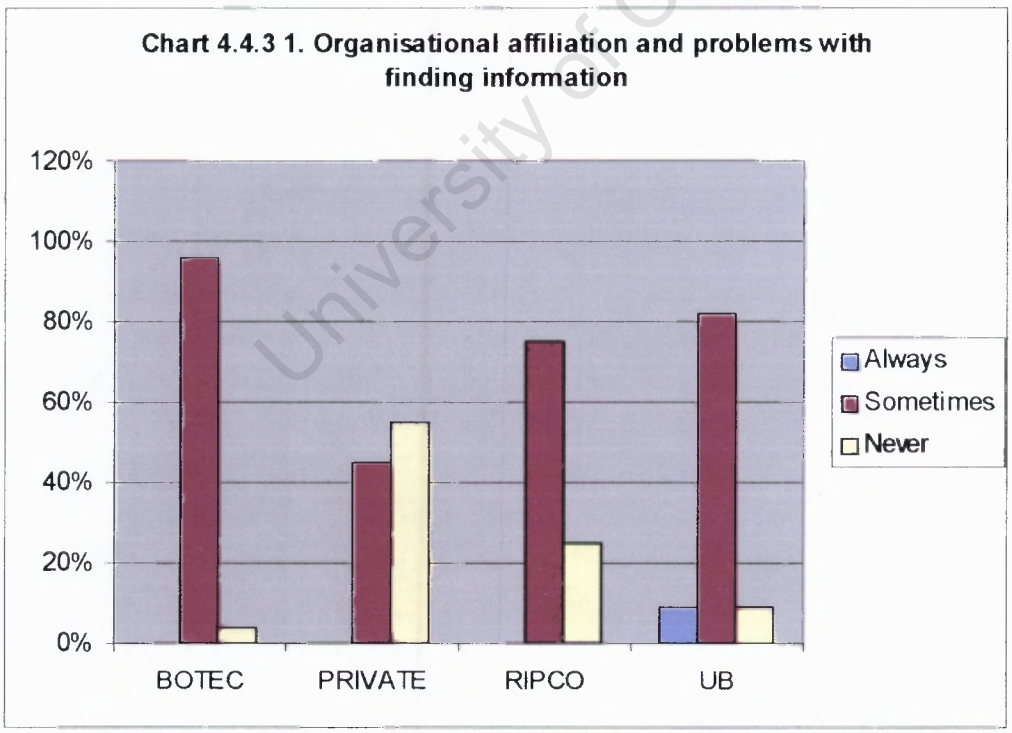
%		%		%	
Always	Total	Sometimes	Total	Never	Total
No	98%	No	20%	No	82%
Yes	2%	Yes	80%	Yes	18%
Grand Total	100%		100%		100%

When the results were further analysed and cross tabulated with the respondents' organisational affiliation, position, qualification and specialisation area the following statistically significant results were found (significant at a p level ≤ 0.05).

i) Organisational Affiliation and Problems with Finding Information

When the organisational affiliation and finding information variables were cross-tabulated, the results indicated that all the categories of engineers sometimes experienced problems, albeit in varying degrees of intensity. The BOTEC engineers surprisingly were those who had the highest rating for sometimes encountering problems (96%). The engineers who indicated the highest rating for never experiencing problems were from private companies (55%), and they also gave a 45% for sometimes encountering problems. The UB and the RIPCO engineers gave a 9% and 25% respective rating for never encountering problems, while the UB engineers were the only category who returned a small 9% response for always having problems finding information.

Chart 4.4.3 1. Organisational affiliation and problems with finding information



4.4.4. Engineers' Search Preferences (Question 8)

In question 8 the engineers were probed to establish whether they preferred to search for information on their own or to have a librarian assist them with their search. It can be seen from Table 4.4.4 below that there was an overwhelming preference to do their own searching when using the library (84%), and only 28% preferred to be assisted.

Table 4.4.4 Engineer's Preferences

% Self Search	Total	% Assisted search	Total
No	16%	No	72%
Yes	84%	Yes	28%
Grand Total	100%		100%

When the results were further analysed by the independent variables no significant results emerged.

4.4 5. Handling of Information Requests (Question 9)

The engineers were asked to indicate the manner in which the library handled their requests for information, i.e. whether the requests were handled effectively or otherwise. Table 4.4.5 below reveals that most of the engineers found the library "very effective" in handling their information requests with a rating of 73%, while 21% found the library to be "effective" and a mere 7% of the engineers found the library ineffective.

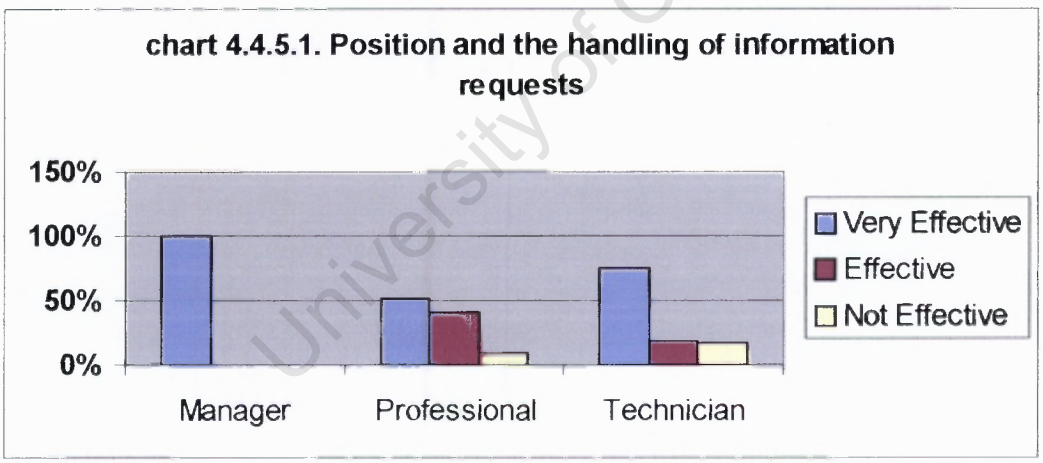
Table 4.4.5. Handling of Information Requests

% Very Effective	Total	% Effective	Total	% Not Effective	Total
No	7%	No	79%	No	93%
Yes	73%	Yes	21%	Yes	7%
Grand Total	100%		100%		100%

The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p level ≤0.05 are reported).

i) Position and handling of Information Requests

The cross-tabulation of position and satisfaction with the library's handling of information requests indicate that the engineers at managerial level were the most satisfied with a 100% "very effective" rating, while those at a professional and technician level gave respectively a 37% and 8% "very effective" rating. The responses with regard to the "effective" handling of requests showed that 40% of the engineers at the professional level and only 18% of the technicians found the service to be "effective". Finally those who had the highest rating for non effective handling of information requests were the technicians at 17% and the professionals at 9%. It is clear that the more senior the respondents, the more satisfied they were with the service.



4.4.6. The Library Collection (Question 10)

The engineers were probed on the quality and quantity of the library collection as a means to determine whether the collection was balanced in terms of scope, size and age. Table 4.4.6 indicates that the engineers were generally satisfied with the currency of the collection (70%) and just over half (54%) thought that the scope was adequate. The size

of the collection was however generally not thought to be sufficient with only a 28% sufficiency rating

Table 4.4.6.. Library collection

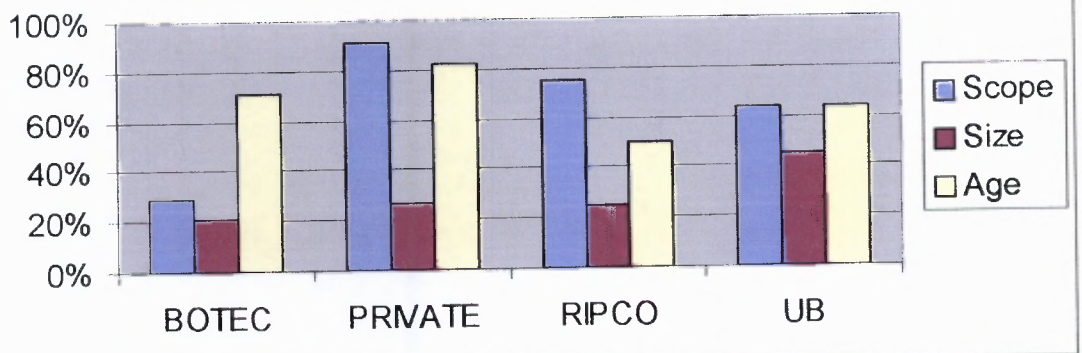
% Scope	Total	% Size	Total	% Age	Total
Adequate	54%	Sufficient	28%	Current	70%
Inadequate	46%	Insufficient	72%	Outdated	30%
Total	100%		100%		100%

The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p level ≤0.05 are reported).

i) Organisational affiliation and the Library Collection

In terms of the organisational affiliation and the library collection, the highest rating for the scope of the library collection came from the engineers affiliated to private companies (91%) followed by those from RIPCO (75%) and UB (64%). Only 29% of the BOTEC engineers were satisfied with the scope. The assessment of the collection on the basis of its age or currency shows that 85% of the engineers affiliated to private companies found the library collection current, while 71% of the BOTEC engineers, 64% of those affiliated to UB and 50% of the RIPCO engineers rated it sufficiently up-to-date. The results reveal that all the engineers were mostly not very satisfied with the size of the collection and ratings ranged from the 45% sufficiency rating given by the UB engineers to the 27% from those at private companies, to 25% from the RIPCO engineers and 21% from the BOTEC engineers.

Chart 4.4.6 Organisational affiliation and the library collection - Adequacy



4.4.7 Assessment of Library Service and Features (Question 11)

Question 11 probed the engineers to establish whether they found the library service to be adequate with regard to the access of library material, ease of use of the catalogue, physical layout of the library and staff attitude. A "relative satisfaction" rating was calculated for each category and the results are outlined in Table 4.4.7, below.

It is clear that the engineers were very satisfied with the attitude of the staff (76% "good" rating). The majority were also satisfied with the physical layout of library and the access provided to materials (54% "good" rating for each). They were however far less satisfied with ease of use of the catalogue (30% "good" rating).

Table 4.4.7. Assessment of Library Service Features

Assessment	Access to Materials	Catalogue Ease of Use	Physical Layout	Staff Attitude
Average	46%	44%	42%	24%
Good	54%	30%	54%	74%
Poor	0%	26%	4%	2%

The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p level ≤ 0.05 are reported).

i) Organisational Affiliation and Physical Layout

The responses relating to the physical layout according to organisational affiliation showed that the engineers from the private companies were the most positive with a 91% "good" rating followed by those from BOTEC with a 63% "good" rating, while the RIPCO and UB engineers were far less satisfied and only respectively gave a 25% and 9% "good" rating cf. Table 4.4.7.1. below

Table 4.4.7.1 Organisational Affiliation and Physical Layout

Layout	Organisation			
	BOTEC	Private	RIPCO	UB
Average	29%	9%	75%	91%
Good	63%	91%	25%	9%
Poor	8%	0%	0%	0%
Grand Total	100%	100%	100%	100%

4.5. The Engineer's Information Need

This section deals with questions 11-20 (Part C of the questionnaire, Appendix A) that pertain to information-seeking behaviour, information need and the satisfaction thereof in relation to the research activities of the engineers.

4.5.1. Research Activity (Question 12)

Question 12 probed the engineers on the main category of research activity they were involved in during the 6 months prior to the administration of the questionnaire. The responses (cf. table 4.5.1 below) indicated that conducting research that was related to specific projects (60%) was the activity they were mostly engaged in, followed by research to provide technical advice (40%), and then general work related research (36%). Only 14% conducted research related to their personal studies. .

Table 4.5.1 Research activity

%	%		%		%		
General Research	***Total***	***Project***	***Total***	***Study Program***	***Total***	***Technical Advice***	**Total**
No	64%	No	40%	No	86%	No	60%
Yes	36%	Yes	60%	Yes	14%	Yes	40%
Grand Total	100%		100%		100%		100%

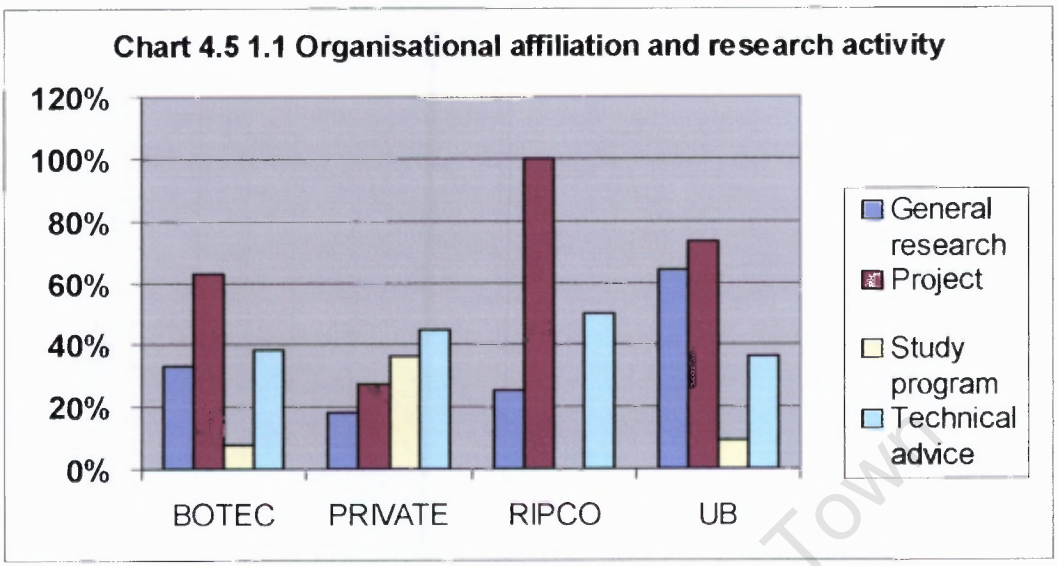
The data were further analysed according to the independent variables and chi-square statistics calculated. The following significant results were obtained (only results with a p-level ≤ 0.05 are reported).

i) Organisational affiliation and Research Activity

When the results of the research activities that the engineers were involved in were analysed with reference to the organisations they are affiliated to, it was found that all the RIPCO engineers (100%) were involved in project research, as were 73% of the engineers at UB and 63% of the BOTEC engineers. However, only 26% of the engineers from private companies were involved in project research. It further emerged that 64% of the engineers from UB were involved in general research, while only 33% of the BOTEC, 25% of the RIPCO and 18% of the private company engineers were involved in this kind of research.

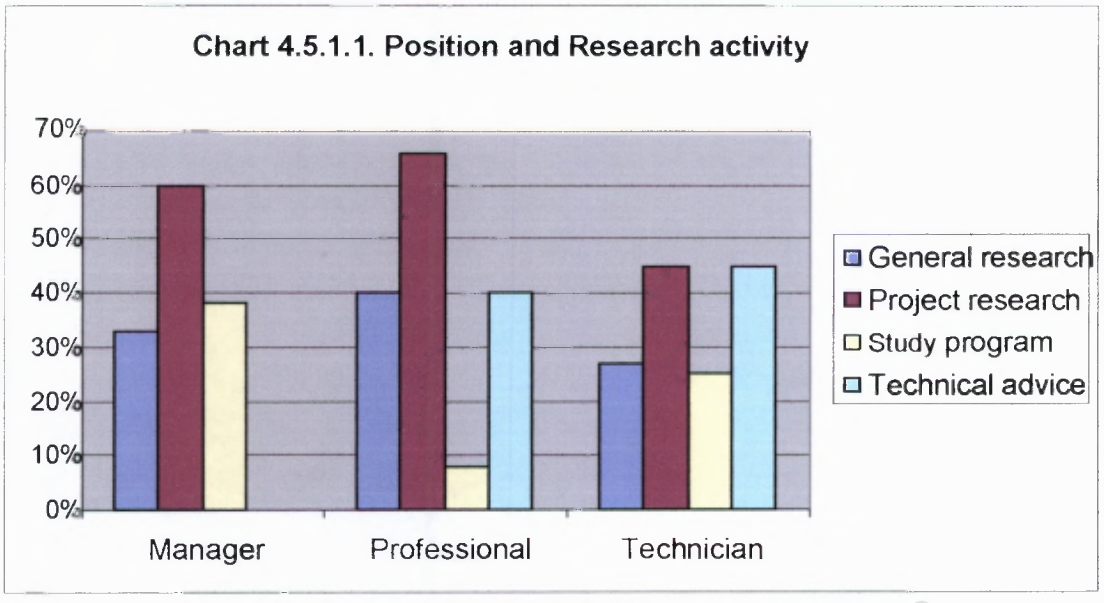
Most of the engineers who were involved in research that related to their technical advice activities were from RIPCO (50%), followed by 45% who were with private companies, 38% who were from BOTEC and the 36% from UB. Although only a small percentage of the engineers were engaged in research for their own study programmes it was found that most of those who were so involved were attached to private companies (36%) and only

18% and 9% were respectively from BOTEC and UB. None of the RIPCO engineers were involved in research to support their own study program.



ii) Position and Research Activity

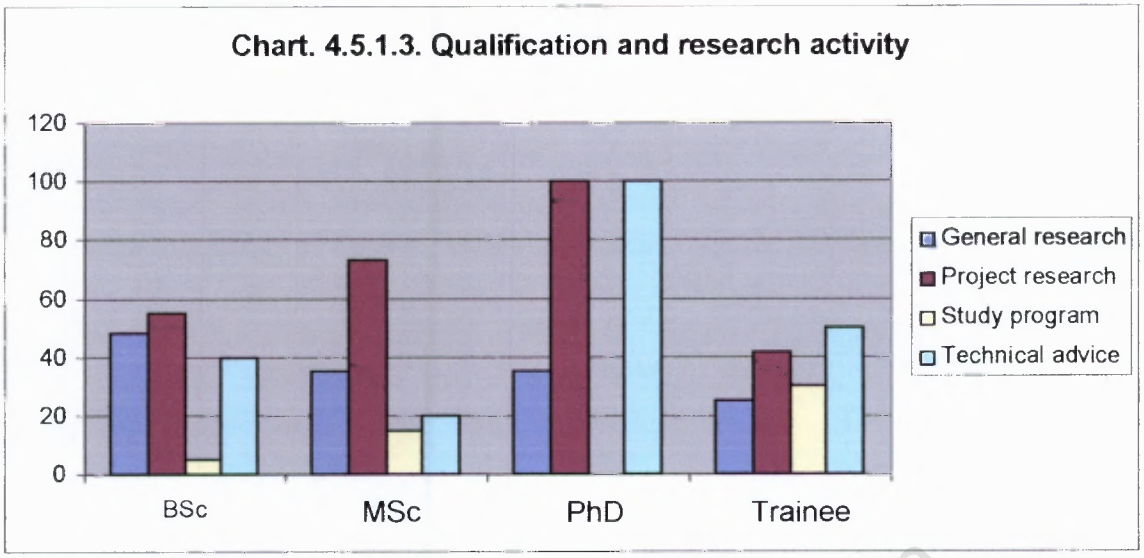
It can be seen that in terms of the position the engineers held and their research activity that the engineers who were mostly involved in research for projects were those at the professional level (66%) followed closely by the managerial level at (60%), while only 45% of those at the technician level indicated activity in this field. The engineers at the professional level were also more involved in general research (40%) than both those at managerial (33%) and the technician (27%) levels. The results for research towards their own study programme show that the managerial and technician levels rated this activity higher at 38% and 25% respectively than the professional level with only an 8% rating. The only engineers who were involved in research for technical advice were those at the technical level (45%) followed by those at a professional level (40%), while the managerial level was not involved in research for technical advice at all.



iii) Qualification and Research Activity

The cross tabulations between the engineer's qualifications and their research activity indicated that the engineers with a PhD were very heavily involved in research projects (100%), followed by those with an MSc qualification (73%). The engineers with a BSc qualification gave a 55% rating and trainees a 42% for this aspect. The engineers who were the most involved in general research were those with a BSc qualification (48%), followed by those with PhD and MSc qualifications with equal ratings of 35%, and the trainees at 25%.

The results further reveal that of the engineers who were involved in research to support their own study program, the trainees gave the highest response rate (30%) followed by those with an MSc (15%) and BSc (5%). Those with the highest qualification (PhD) gave a zero rating for research for this purpose. Research was also carried out to enable the engineers to give technical advice and those with the highest qualification (PhD) gave a 100% rating for this purpose followed by the trainees with a rating of (50%), while those with a BSc gave a rating of 40% and those with an MSc qualification a rating of 20%.



4.5.2 Research Results or Output (Question 13)

Question 13 probed the engineers to elicit the outcome of their research activity, i.e. whether the research they were involved in resulted in them writing papers, producing reports, attaining a qualification, completing projects or other outputs. Table .4.5.2 below shows that the end product of the respondent's research was mostly either to complete projects (44%) or to write reports (40%). Only 18% wrote papers as a result of their research and a mere 6% attained qualifications and no other output was given.

Table 4.5.2.1 Research Results

				%		%	
Paper	Total	***Report***	Total	***Studies***	Total	***Project***	Total
No	82%	No	60%	No	94%	No	56%
Yes	18%	Yes	40%	Yes	6%	Yes	44%
Grand Total	100%		100%		100%		100%

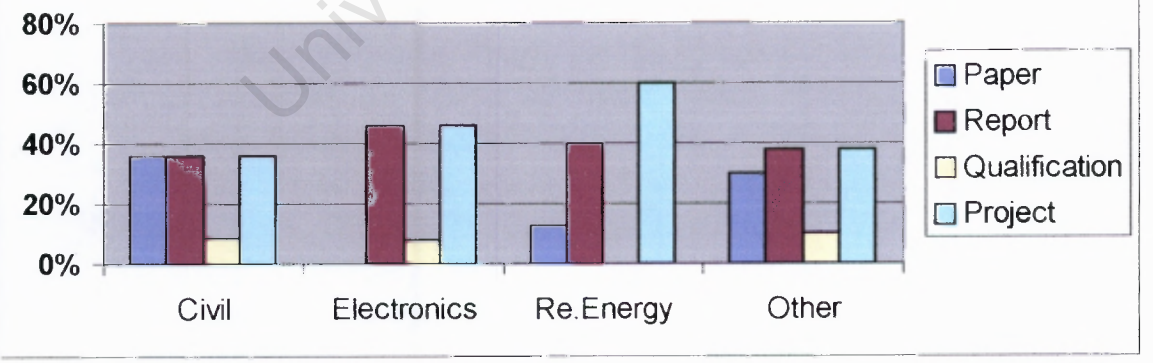
The results for research results were further analysed and the following statistically

significant cross tabulations emerged, (≤0.05 level of significance).

i) Area of Specialisation and Research Results

When the research area and research results were cross-tabulated, the following responses emerged. The engineers who gave the highest rating for the completion of projects were from the "Other" subject category (60%) followed by the electronics category (46%), then the renewable energy (38%), and civil engineering category (36%). The engineers also produced reports as a result of their research activity and all the subject categories were fairly similar with the electronics category giving a 46% rating, the "Other" category 40%, the renewable energy 38% and the civil engineering category 36%. The results further show that the civil engineering category were those with the highest rating (36%) for the production of papers followed by the "Other" category 30%, then the renewable energy category 13%, while the electronics category did not write papers at all. The engineers who attained a qualification as result of research were very few with only 10% of the "Other" category, 9% of the civil engineering, 8% of the electronics category and the renewable energy category giving a zero rating.

Chart 4.5.2.1 Area of specialisation and research results



4.5.3. Timeframe (Question 14)

The engineers were probed on the currency of their need for information for this particular research activity. It is clear from Table cf.4.5.3 below that the highest rating

(70%) was for the engineers who needed information over a month before they completed the questionnaire. Only 16% of the engineers needed information the week of the survey and 14% needed it 2 weeks before the survey.

Table 4.5.3. Timeframe

Timeframe	%
2weeks	14%
This week	16%
1month	70%
Grand Total	100%

The results for the timeframe of the engineers need for information was further analysed and no statistically significant results emerged.

4.5.4. Subject of Information Required (Question 15)

The engineers were probed on the subject they required information on and the results obtained were found to relate to the main disciplinary areas of civil, renewable, mechanical electronic or computer engineering. It can be seen from Table (cf.4.5.4.1 below that the topics of enquiry were fairly equally distributed among computer applications 28%, civil engineering 26% and renewable engineering 26%, followed by mechanical engineering 12% and electronics engineering 8%.

Table 4.5.4. Subject of Information Required

Research Topic	%
Electronics	8%
Mechanical engineering	12%
Civil engineering	26%
Renewable engineering	26%
Computer applications	28%
Grand Total	100%

Further analysis of the data by the independent variables did not produce statistically significant results at the ≤ 0.05 level.

4.5.5. Information Search Strategy (Question 16)

In question 16, the engineers were asked to indicate the strategy they used to obtain the information they needed for their research. It is clear from the results that the largest proportion of engineers obtained information through browsing (46%), followed closely by those who conducted literature searches (40%). It is clear that far fewer engineers obtained their information by means of informal conversation (22%) or from asking experts (14%).

Table 4.5.5. Information Search Strategy

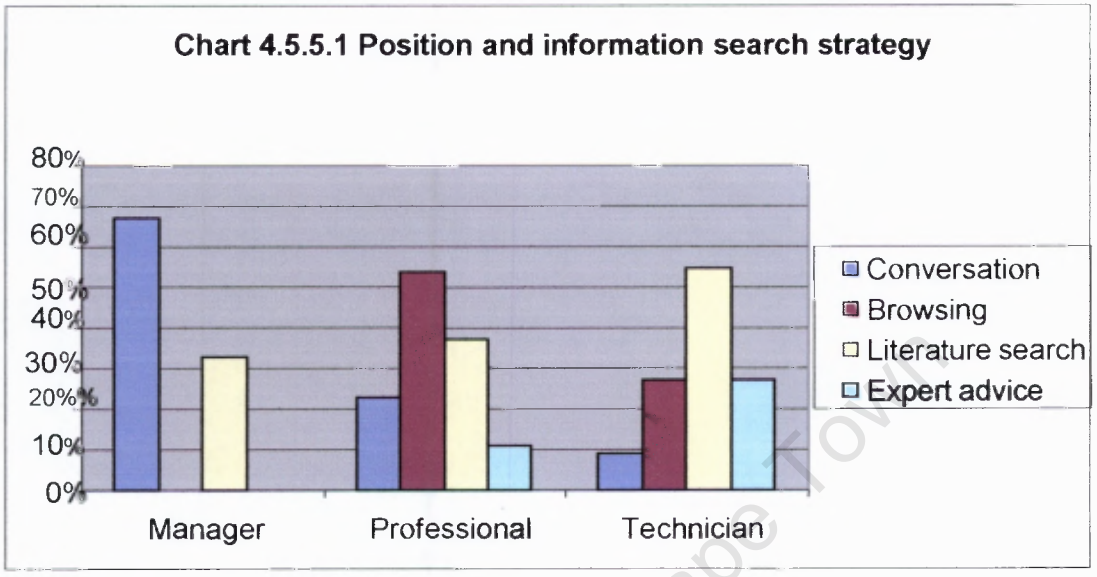
	%		%		%		%
Conversation	Total	***Browsing***	Total	***Literature Search***	Total	***Expert Advice***	***Total***
No	78%	No	54%	No	60%	No	86%
Yes	22%	Yes	46%	Yes	40%	Yes	14%
Grand Total	100%		100%		100%		100%

The results were further analysed according to the engineers' organisational affiliation, position, qualification and the engineers' areas of specialisation and the statistically significant results at the ≤0.05 level are reported below.

i) Position and Information Search Strategy

When the engineers' positions and their information search strategies were cross tabulated it emerged that the managerial level rated informal conversation very highly (67%) while the professional category rated it far lower at 23%, and the technician level gave a it mere 9% rating. Literature searching as a strategy was rated higher by the technician level (55%) than the professional level at 37% and the managerial level at 33%. The professional level gave the highest rating (54%) for finding information through browsing while the technician level only gave a 27% rating and the managerial

level did not browse to find information. Obtaining information from experts was only supported by the technical level (27%), and the professional level (11%), while the managerial level gave this method a zero rating.



4.5.6 Library Staff Mediation (Question 17)

Question17 probed the respondents on whether there had been staff intervention or mediation during the search process. The results indicate that 58% of the engineers did not require staff mediation or assistance when they searched for information, while 42% stated they required assistance or staff mediation as shown by the Table . 4.5.6 below.

Table 4.5.6. Library Staff Mediation

Information Search	*%*
Assisted	*Total*
Non mediated	58%
Mediated	42%
Grand Total	100%

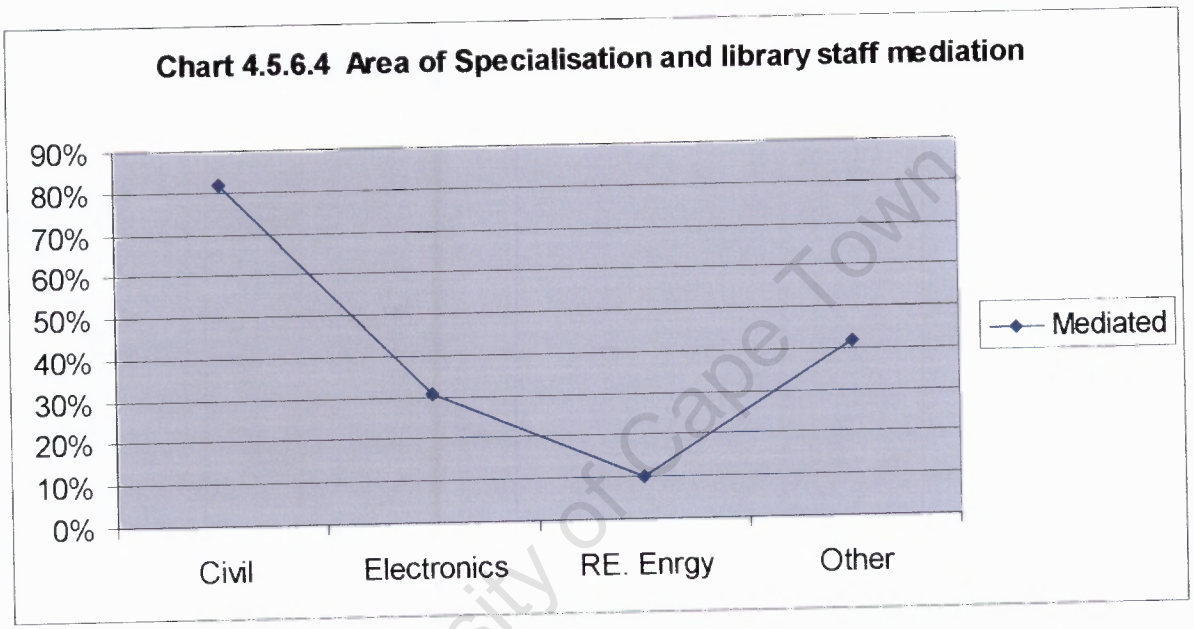
The results for library staff mediation were further analysed and the following

statistically relevant results emerged at the 0.01 significance level.

i) Area of Specialisation and Library Staff Mediation

The results from the cross-tabulation between the engineer's areas of specialization and whether they received staff mediation indicated that far more of the civil engineering respondents (82%) required mediation during the search, than the "Other" category (42%), the electronics (31%) and the renewable energy category (10%).

Chart 4.5.6.4 Area of Specialisation and library staff mediation



4.5.7. Information Value (Question 18)

The engineers were probed on the value of the information they found for their research. There is strong indication that the information the engineers found was of great value as 76% of the engineers were positive and only 24% found the information to be of no value, as shown by Table .4.5.7. below.

Table 4.5.7. Information Value

	%
Value	*Total*
No	24%
Yes	76%
Grand Total	100%

The results were further analysed and no statistically significant results were found.

4.5.8. Resources Used (Question 19)

Question (19) asked the engineers to state from which resources they mostly obtained their information. Half of the respondents (50%) indicated that they had obtained the information from the BOTEC library. Of the remainder, 26% found the information in other resources. Upon examining what they specified as other, it was found to be electronic sources. Other libraries and document delivery services constituted the remaining responses (respectively 20% and 4%).

Table 4.5.7 Resources Used

Resources Used	%
DOCDEL	4%
Other Library	20%
E-Sources	26%
BOTEC	50%
Grand Total	100%

The data was analysed further by means of cross-tabulation with independent variables, but no significant results were obtained.

4.5.9. Additional Information Received (Question 20)

The question on additional information or subsequent updates was intended to find out if the respondents had a need for further information on the topic and, if yes, whether they received the information. The results show that 46% of the engineers required, but did not

receive, the updates relating to their research activity, and 28% received the updates they required. The remaining 26% did not have any need for updates.

Table 4.5.8. Additional Information Received

Additional Information Received	%
No Need	26%
Received	28%
Not received	46%
Grand Total	100%

The data was further cross-tabulated with the independent variables, but no statistically significant results were obtained.

4.6. Strategy for Development

This section deals with questions 21-23 (Part D) of the questionnaire, Appendix A), that pertaining to engineers suggestions towards the improvement of the BOTEC library service.

4.6.1. Use of newer technologies (Question 21)

The respondents were asked to indicate if they had ever used any of the newer technologies such as CD-ROM, on-line databases or the Internet to find information. The responses (see the Table 4.6.1 below) show that the overwhelming majority (88%) had never used any of these technologies

Table 4.6.1. Use of Newer Technologies

Used New Technologies	%
No	88%
Yes	12%
Grand Total	100%

The data was further analysed by means of cross-tabulation with the independent variables. The following statistically significant result was obtained at the ≤0.05 level

i) Area of Specialisation and Use of new technologies

If the use of new technologies is cross tabulated with the engineers' area of specialization, it can be seen that the engineers from the civil engineering category had made the most use of the new technologies (36%). A small proportion of the renewable energy category (13%) had also used these technologies for information retrieval purposes. The other engineering categories (the electronics and the "Other") had never used the newer technologies

Table 4.6.1.2 Used Newer Technologies and Area of Specialisation

Used New Technologies	Area of Specialisation Civil	% Electronics	% Other	% Re-energy
No	64%	100%	100%	88%
Yes	36%	0%	0%	13%
Grand Total	100%	100%	100%	100%

4.6.2. The Library and Technology (Question 22)

Question 22 solicited the respondent's opinions regarding the extent to which the library has embraced the use of newer technologies such as the Internet for information access and retrieval. The majority of engineers indicated that the library had adequately embraced the technologies (56% response rate), followed by 24% who indicated that the library had embraced the technologies well, while only 20% indicated that the library had embraced the technologies rather poorly

Table 4.6.2. The Library and Technology

The Library and Technology	%
Poorly	20%
Well	24%
Adequately	56%
Grand Total	100%

The results of how well for the library had embraced the use of technology for access and

retrieval of information were further analysed, but no significant cross-tabulations emerged.

4.6.3. Areas for Development for the Library (Question 23)

Question (23) solicited the respondents to provide suggestions for improving and developing library services. The largest proportion of the respondents indicated that the library needs to be part of a science and technology information network (62%), while 56% indicated the need for improved access to online databases, and 44% suggested that the library should introduce an internet café as a new service as well as a means for cost recovery.

Table 4.6.3.1. Areas for Development for the Library

% S&T Info. Network	Total	% Internet Café	Total	% On-line info.	Total
No	38%	No	56%	No	44%
Yes	62%	Yes	44%	Yes	56%
Grand Total	100%		100%		100%

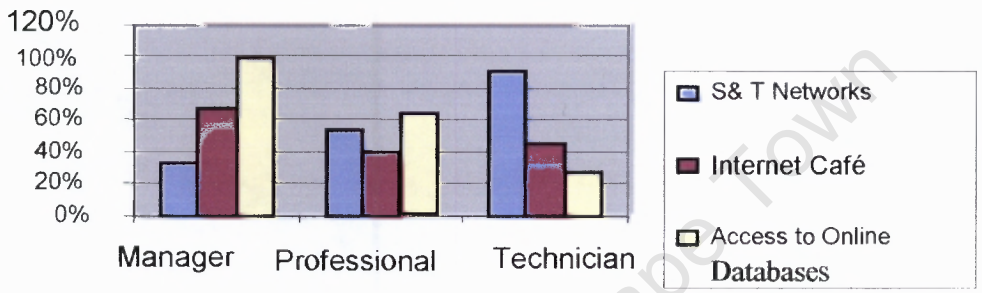
The results were further analysed and the following cross-tabulation were statistically significant ($p \leq 0.05$)

i) Position and Areas for Development for the library.

The cross-tabulation for the engineers position and the areas for development variables indicated that the technician level were those who favoured the establishment or improvement of science and technology networks the most (91%) followed by the professional level (54%), and the managers 33% rating. The development of an internet café was rated the highest by the managerial level with a 67% rating, followed by the

technicians with a 45% rating and the professionals with a 40% rating. The results further reveal that the managerial level fully supported (100%) the use of online databases at BOTEC library, while the professional level gave a 63% rating for such a development, and the technician level rated this development at 27%.

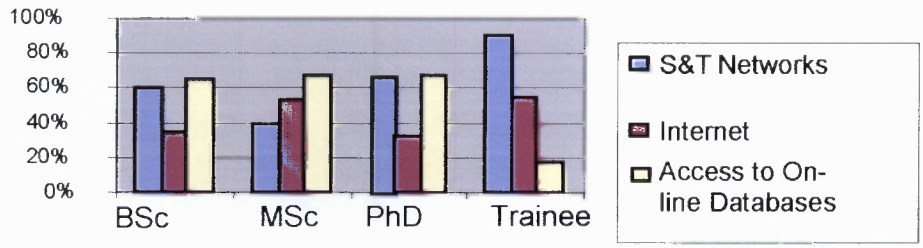
Chart 4.6.3.1 Position and area of development for the library



ii) Qualification and Area of development for the Library

In terms of qualification and the area of development for the library variables, it is clear that the trainees were the most positive towards seeing the library develop science and technology networks (91%), while those with a PhD qualification gave a 67% rating, followed by those with BSc (60%) and MSc (40%). Further results show that those who felt that the library should have an internet café were mostly the engineers with an MSc (53%), followed the trainees (45%), and those with a BSc (35%) and PhD (33%). Access to online databases was equally rated (67% each) by those with a MSc and PhD qualifications, while those with BSc rated it 65% and the trainees only gave a 18% rating for this aspect of development as shown by the chart below.

Chart 5.6.3.2 Qualification and areas of Development for the Library



CHAPTER 5
DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter discusses the findings derived from the pertinent issues that arose from the survey results which are reported in chapter 4 (Analysis of the data) as well as relevant links to the concepts discussed in chapter 2 (The review of the literature). In order to bring out the issues for discussion in this chapter, the approach used in chapter 4 is generally followed, thus, the discussions are based on the main issues that encompass the BOTEC library service and use, the engineers' information need, and strategy for improvement. The researcher has also provided input from her experience and observation as librarian at BOTEC over the last 10 years. The chapter further discusses the impact of the independent variables that produced statistically significant cross-tabulations and finally the discussion is concluded by relating the main findings to the research questions for this research project. The research questions centred around the engineers information requirements and the role that the BOTEC library plays in meeting these requirements and what it needs to do in order to fully support the organisation's research endeavour.

5.2. Demographic Profile

The engineers' demographic details related to the organisations they were affiliated to, the levels at which they operated within their respective organisations, their qualifications and their areas of specialisation (research areas) and these served as the independent variables for the study (cf.4.3). The survey results were cross tabulated with these independent variables and the significance level of the effect tested by means of chi square statistics and only the results with a significance level of $p \leq 0.05$ are reported and discussed.

5.2.1. Organisational Affiliation

The survey results (cf.4.3.1) indicate that half of the respondents were from BOTEC (50%), a not unusual outcome as they are supposed to be the primary clientele for the BOTEC library, while the rest of the respondents fall within the secondary clientele category. Although the BOTEC library's role since its inception was to make technical information available to those who needed it (a national focal point for technical information), its main function is to support the BOTEC engineers with the information they need for projects, as well as to make the information generated by these engineers accessible to other researchers and members of the public. Thus, the BOTEC engineers are expected to benefit the most from the service.

It was also observed that the engineers from the private companies were the 2nd largest category that was surveyed (22%). The private companies in most cases do not have corporate libraries and thus rely on libraries such as the BOTEC library, the University library and to some extent the public library for their technical information. The engineers affiliated to the other two organisations, the University of Botswana (UB), and the Rural Industries Promotion Company (RIPCO) do have institutional libraries that they can use, but nonetheless used the BOTEC library as it is highly specialised in terms of its engineering collection and fills the information gap within their organisational libraries.

5.2.2 Position

In terms of position, the respondents were from three distinct levels which included the managerial, professional and technician levels. The majority of the respondents were in the professional level category (70%) and the least represented was the managerial level. The professional level included practicing engineers, while the managerial level included those who operated at managing director's level (Chief Executive Officers, or CEOs) in the research and development organisations and engineering companies, and the technician level included those aspiring to be engineers. The engineers at professional level are in most cases directly involved in research for their respective organisations. The managers in turn oversee the work of the professionals and technicians and their heavy work

involvement often precluded them from actively utilising the library. The technicians are mostly working and at the same time pursuing a course of study.

5.2.3. Qualification

The survey results have shown that the engineers with a Bachelor of Science Degree (BSc) constituted the largest proportion of the sample for the study (40%). These engineers are mostly involved in research for specific projects. Those with higher degrees are involved in research for projects as well as academic presentations and conferences etc. and often managerial duties. The trainees were more interested in advancing themselves career-wise or for continuing their professional development.

5.2.4 Area of Specialisation

The greatest proportion of the respondents was engaged in some form of renewable energy research (32%). Renewable energy research is an important research area for BOTEC, the main reason being that there is a considerable drive to find alternative sources of energy in Botswana, such as solar energy, particularly for rural communities.

5.3 Discussions of the Engineers' Responses

The discussion of the engineers' responses are grouped into the three broad areas followed in chapter 4 and relate to their (i) use of the library service and its resources, (ii) information needs and their behavioural patterns during the information search process, and finally (iii) their perceptions regarding the use of the newer technologies and their opinions on the strategy that is suitable for service improvement.

5.3.1 The Discussion Relating to BOTEC Library Service and Use

This section covers the engineers' perceptions of the library service, and their use of the service and the resources provided. The purpose of these series of questions was to find out if the engineers derived maximum benefit from using the library. They were thus asked to state their reasons for using the service, what sources of information they consulted, whether they experienced problems accessing the library and its resources, if they preferred

to be assisted while using the library as well as their perception regarding the adequacy of the collection and the library service provided. It was also considered worthwhile to find out how well the library had handled the engineers' information requests.

The library was established at the time of BOTEC's inception to provide technical information as part of the general drive towards industrialisation of Botswana. Thus, BOTEC started as a project to stimulate the nation's awareness of socio-economic and industrial development. The first library collection for BOTEC was relocated from the Botswana Development Corporation where the project was initiated. The original material that was collected for the library was thus oriented towards industrial development and was mainly based on research reports relating to industrial development and other cognate fields. After the relocation of the collection to BOTEC books and journals were gradually added to the collection, as well as research reports for projects carried out by BOTEC, international research organisations and various government sectors, e.g. the Department of Energy Affairs. The current library collection thus includes all technical reports/papers and other publications relevant to BOTEC's research endeavour.

Over the ensuing years the library has expanded its role to serve the general public or any other researcher requiring technical / engineering information and the questions on use were thus meant to determine the extent to which the library was used and the range of purposes for which it was used. Although the library has been open for use by all researchers and the members of the public in Botswana, the study has shown that its users were mainly BOTEC researchers and other researchers attached to different research organisations. This correlates to some extent with Paisley's (1980:113) assertion that information use and its value are related to inherent attributes and the environment in which the information is handled and utilised.

It was clearly indicated in 4.4.1 that the library was extensively used as a research reference library (58%) and to a slightly lesser extent for study purposes (46%). It was not particularly heavily used to conduct literature searches (38%) or for browsing purposes (24%). The significant cross tabulation with organisational affiliation shows that while the

BOTEC and RIPCO engineers mainly used the library for reference purposes, the private company engineers used it mainly for their studies and the UB engineers to conduct literature searches. The reason for this could be that both the BOTEC and RIPCO engineers mostly conducted applied research that has as its main outcome product and process designs. The UB engineers are more engaged with basic research and thus have greater need to search for information in the primary literature.

Although the significant cross tabulation between library use and qualification indicated very different use patterns among the four categories, it did also show that the use of the library for reference purposes was almost equally high among all the categories. The greatest variation occurred for its use for browsing and literature search purposes, where the PhD's used these facilities by far the most extensively (the MSc's also made good use of the literature search facility). The categories that used the library for study purposes, (and even then it was not very extensive) were the BSc, MSc and trainee respondents.

The responses to the question on what resources the engineers consulted (cf.4.4.2) show that the engineers most extensively used the general book (80%) and journal collections (72%), followed by the reference sources (62%) and report literature (52%). Their use of newspapers (40%) and the business collection (28%) was far less substantive. It is thus clear that the use of the type of library material correlates well with the reasons for using the library.

It was imperative to establish whether the engineers experienced any problems in finding information and material to satisfy their needs (cf.4.4.3). It appears that finding information in the library was not a major problem with the bulk of respondents (80%) reporting that they only occasionally or never (18%) had problems, and only 2% stating that they frequently encountered problems.

The researcher was surprised by the outcome to the question that probed the engineer's search preferences (cf.4.4.4). An overwhelming number of respondents indicated that they preferred to search for information on their own (84%) rather than ask for assistance from

the librarians. This result raises some concerns as in the researcher's view, many of the library users are not really conversant with the finer details of the search process and should therefore seek staff intervention.

Information provision is an important aspect of any library service, and thus knowing how well users' requests for information are handled is vital to the information delivery process, both in terms of availability of relevant information and the reaction of the library staff to any information query. A very positive outcome for the library was the vast majority of the engineers (73%) who found the library very effective in handling their information requests (cf.4.4.5). The significant cross tabulation with the respondent's position categories showed that those at managerial level were far more satisfied with information service provision than the other two levels. This can be attributed to the nature of the requests put by those at the managerial level, as in most cases they require quick and not detailed responses, while the information requests put by the professionals and technicians generally need extensive and detailed information searches to be conducted.

The perception of the quality, quantity and the currency of the library's collection is largely dependent on the demand for information which, in turn, is generally linked to the type of projects the engineers are involved in and to some extent the information requirements of the organisation at large. While the vast majority of the respondents (70%) found the library collection to be current, and just over half (54%) thought that its scope was adequate, only 28% were satisfied with the size of the collection (cf.4.4.6). The latter aspect should be a matter of concern for the library and should be addressed by the collection development policy.

The significant cross tabulation between collection adequacy and organisation showed the RIPCO and UB engineers were slightly less satisfied with the currency of the collection than their counterparts at BOTEC and in private companies; the BOTEC engineers were predominantly dissatisfied with the scope (the other organisations were happy), and although all the engineers thought the collection size was inadequate the BOTEC respondents were the least satisfied.

Another aspect that the engineers were asked to give their opinion on was library services and features and, according to the responses (cf.4.4.7), while a large majority of the users were satisfied with the attitude of the staff (74%) and more than half were also satisfied with the physical layout and access to materials (54%), only 26% thought that the catalogue was easy to use. This result would appear to indicate that the BOTEC library should pay attention to making its catalogue more user-friendly. Other than that, it would appear that the library is generally satisfying its users and is making progress towards "attuning their services to fully appeal to users' requirements" (Hernon & McClure,1990:1), an approach that is fundamental to the establishment of an effective user-services interface. Such a user-centred approach thus empowers users to play an integral part in the information seeking process. The library should, however not be complacent with the positive attitude the engineers have towards the library service. Nitecki (1993:255) has warned that the premise that users can most appropriately judge the effectiveness of the system they interact with can be queried and this is an aspect that should be probed.

5.3.2. The Discussion Relating to the Engineers' Information Need

This section attempted to ascertain the engineer's information needs and to discuss the extent to which the library satisfied their need, particularly pertaining to their research activities. To contextualise these questions, the engineers were probed on the particular research activity and topic they were involved in at the time the data was collected for this research project. The outcome of any research activity brings meaning to the research effort, and hence the engineers were further also probed on the outcome of their research activity. It was also necessary to establish whether the engineers could recall how far back they needed the information and the strategy they used to get the information, whether the information they received was of any value, as well as whether the library provided additional information after the initial request was made and what resources were used to satisfy their need.

According to the results for the questions from Part C (12 to 20), it is apparent that the engineers' information needs were very closely linked to the nature of their work and their

research endeavours. Westbrook (1997:316) refers to the fact that information is in most cases needed to fill a gap in the knowledge an individual possesses on a given issue. From 4.5.1 it would appear that the predominant reasons why the engineers had recently been conducting research was related to the specific projects they were involved in (60%). Smaller proportions were involved in research related to technical advice they had to provide (40%), or general research (36%) and only a very small proportion carried out research to support their studies (14%). The significant cross tabulation of these results with organisational affiliation showed that the engineers affiliated with RIPCO, BOTEC and UB carried out project research far more extensively than those at private companies, a not surprising outcome as these institutions are heavily involved with projects and also play an important role in the implementation of science and technology policy and promoting public understanding of science and technology issues in Botswana. It was also not surprising that the University of Botswana (UB) had the largest majority of engineers who were involved in general research (64%), while most of the engineers' involved in research for personal study and to provide technical advice were the RIPCO engineers. These engineers are largely involved in imparting knowledge on the various technologies to rural communities or giving technical advice on the technologies they develop.

The significant cross tabulation between the reasons for conducting research and the position categories showed that the managerial and the professional levels were far more involved with project work than the technicians. This is understandable as both the managerial and professional levels are responsible for ensuring effective management of projects and the technicians usually work with project managers. The cross tabulations further showed that while the professionals were moderately involved in general research, the managerial and technician levels were not particularly involved with this aspect. Once again this is an understandable result as technicians are not usually involved in basic research and the managers would be more involved in managing projects.

The qualification level of the engineers also showed variation with research activity. The engineers with a PhD qualification most extensively carried out research for projects and for technical advice purposes (100% rating for each). This would follow as the engineers

with a PhD would generally play a leading role in imparting knowledge to their colleagues with lower qualifications. The engineers with a BSc were more heavily involved in general research than the other qualification categories. The application of research for study purposes very logically correlated strongly with qualification level, ranging from no involvement by those with a PhD to 50% for those who were still trainees and studying for a first qualification.

It is clear and not unexpected, that the major research output was firstly the completion of a project (44%), followed by the writing of reports (40%) and far less so journal articles (18%), while only 6% had as their outcome the completion of their studies (cf.4.5.2). The significant cross tabulations between the main research results or output and area of specialisation showed that far more of the "Other" category (60%) rated the completion of projects as the main outcome than the other three categories (civil, electronics and renewable energy engineering). All the categories were almost equally involved in producing reports, while only the civil engineers and the "Other" category indicated a significant contribution to writing papers.

The engineers were probed on the time interval since they last needed information for the research they were conducting (cf.4.5.3). It is clear from the responses that most of them had not recently required information, as 70% indicated a need for information approximately a month prior to the survey. This outcome can be generally explained by the workflow that relates to project work. The engineers' need to plan ahead for projects and usually the projects that they undertake are fairly substantial and take a lot of time before completion. The engineers who were not involved in big projects were generally the ones who indicated a need for information that ranged from 2 weeks (14%) to a week prior to the survey being administered (16%). Thus, the timeframe for the engineers' research and information need was dictated by the type of work they were involved in. Ellis and Haugan (1997:392) is of the opinion that research and development portfolio models are based on human experience and physical needs, which would suggest that engineers will usually need information more at the time they are actively working on projects.

The engineers were further asked to indicate the topic or subject of their inquiry (cf.4.5.4) and from the responses it is clear that the engineers were almost equally involved with computer applications (28%), renewable energy and civil engineering (26% for each), while mechanical and electronics engineering had lower ratings of 12% and 8% respectively. It is clear that computer applications played an important role in their research and their subsequent need for information.

The engineers were also asked to indicate what strategy they preferred to follow to get the information they needed (cf.4.5.5). It is clear that the engineers mostly (and in almost equal proportions) obtained information through browsing (46%), or literature searches (40%). Obtaining information through informal contacts with colleagues or by approaching experts was utilised far less (22% and 14% respectively). This outcome is in contrast with Polands' (1994:173) assertion that engineers utilise informal networks extensively to get the information they needed. The significant cross tabulation of the variables indicated that the engineers at the managerial level (67%) were those who mostly obtained information through colleagues. This is understandable as the more senior engineers would have as they progressed over the years in their profession created a network of contacts over the years. It is further easy for these engineers to interact with their colleagues during meetings, both formally and informally, as they often are members of the same board, e.g. the RIPCO CEO and the Dean of the UB Faculty of Engineering both sit on the BOTEC board. The technicians were the position category who made the greatest use of expert advice and this can be attributed to the fact that they, being the most junior and least qualified, of the engineers, had the greatest need to approach so called exerts for advice. The professional level was the category that made the most intensive use of browsing (54%) as a search strategy.

Just over half of the engineers indicated they did not require assistance or intervention when searching for the information they needed, while 42% did need it (cf.4.4.4). The researcher would like once again to suggest that the library should try and establish the reason why so many engineers did not avail themselves of assistance when searching for information and would like to support Steinke's (1991:113) observation that applied

scientists (engineers) have minimal interaction with information, and hence library staff need to pay more attention to how engineers go about searching for information and they should be more actively involved in the information search process. The user-service interface needs to be stressed through communication, and the engineers would also benefit more from the service if they are informed on how the library could assist them to address their information needs. For example, by using Sridhar's "exhaustive approach" (1988:75), they would more effectively be acquiring appropriate information for their research endeavour.

The engineers who mostly made use of staff mediation when searching for information were from the civil engineering category (82%), while the renewable energy respondents made the least use of staff assistance (10%). The researcher has no definite explanation for the large variation between areas of specialisation and the need for staff mediation other than that this might relate to inherent subject oriented information seeking behavioural patterns.

Most of the engineers (76%) stated the information they had retrieved was valuable for their research (cf.4.5.7). As indicated by the study of the literature in chapter 2, the relation between information retrieval and use in a given situation is an important aspect of the information seeking process which Smith (1994:14) conceptualises as the information need experience. The engineers were conscious of their need for information and were thus stimulated to embark on a search and assess the impact of the information they found on the work situation.

On being asked where they had found the information they needed, it was established that most of the engineers had retrieved the information from the BOTEC library resources (50%), while only 26% found information in electronic resources, 20% found it in another library and a mere 4% found the document delivery service to be of any use (the electronic resources were the resources listed by respondents under the "Other" category). The proliferation of information technologies (ICT) has greatly influenced the manner in which information is managed. This paradigm shift challenges information providers to be more

proactive as competencies are changing and librarians need to become well conversant with the ever changing information formats.

The engineers were further probed on whether they had, subsequent to the initial search, received further information on the search topic from the BOTEC library (cf.4.5.8). The results show that only 28% did receive updates and 26% indicated they had no need for them. The delivery of updates when the initial search exercise has been carried out should be an essential part of a service and is a positive indication that the library is prepared to go a step further in ensuring that the topic was well researched. If the librarians were to interpret and pay more attention to the searchers' behavioural patterns during the search process they would be able to identify areas which might not have been covered and thus fill important information gaps. The library therefore should maintain a file of all the information requests received and a copy of the results which can later be checked against new requests.

5.3.3. The Discussion of Strategies for service improvement

The BOTEC library is currently facing a challenge to re-engineer its services and come up with a strategy to ensure that the library service is aligned to current trends in information delivery using modern information technology (ICT). The library users (engineers) were brought on board by soliciting their opinions, hence the last part of the survey focused on the engineers' views regarding their use of the new technologies at the BOTEC library, their opinion on the extent to which the library has embraced technology and the service areas they would like to see the library improve or develop. The effects of the current information environment has necessitated an increase in the use of modern technologies for information access, and libraries thus need to keep abreast of new developments for the management of information. The researcher would therefore like to see the BOTEC library embrace the shift towards electronic information resources and thus try and improve library service provision.

The vast majority of the engineers (cf.4.6.1) have not actually used the newer technologies at the BOTEC library as only 12% of these engineers indicated having used these

technologies. This is mainly due to the fact that the library had only recently introduced Internet for public access and at the time of the study there were only a few computers available that could be accessed by the library users to conduct searches (CD-ROM and Internet). There were only three computers for public access and even these were obsolete with regard to age and speed. The cross tabulated responses showed significant results for the engineers' research area (area of specialisation) and it is clear that the civil engineering category had used the newer technologies considerably more (36%) than the other three research areas categories.

Although it was clear from the responses (cf.4.6.2) that the majority of the engineers were of the opinion that the library has adequately embraced the newer technologies to provide access and retrieval of information, some still feel there is room for improvement. It is further also concerning that so few of the engineers had not, or were not able, to use these newer facilities. These factors should challenge the library management to focus on and improve processes for electronic information delivery. A framework should thus be established for the exploitation of electronic information as well as widening the scope of end-user searching and providing easy access to in-house and external electronic databases, e.g.. the Internet.

On being presented with a number of possible improvement strategies that the library could adopt (cf.4.6.3) the respondents showed the most support for the development of a science and technology network for resource sharing purposes (62%), followed by improved access to online information (56%) and the introduction of an Internet café (44%). A number of authors have referred to the fact that the advent of the electronic information environment is gradually changing the face of libraries to become information systems where the access to information is expanded beyond the library to provide electronic access to global information (Ghosh and Wesley, 2002:145; Simon, 1997:3).

The significant cross tabulation between the (new strategy) results and position indicated that among the position levels, the management level was probably driven by cost recovery motives to be the most supportive of all categories for the idea of an Internet café. This

category was also the most supportive of all categories for the idea that access to online information should be improved. The category that was the most supportive of establishing science and technology networks was the professional category. The engineers' responses based on their qualification showed that the engineers who most supported the establishment of science and technology networks were from the trainee category (91%).

Libraries have entered the electronic age and are no longer limited to resources they house but have become facilities that provide access to global information resource. According to Ghosh and Wesley (2002:145), James Michael has suggested a blue print that libraries should implement to ensure such a shift. The main points he covered relate to;

- Interconnectivity: ensuring network uniformity of data storage and location
- Interoperability: ensuring that several computers can talk to each other
- Integration: creating a single user- interface to access internal and external resources.
- Intermediation: providing, guided research assistance, reference services and instruction
- Interdependency: ensuring resource sharing and information exchange because one library can not have all the information that is required

It is clear from these discussions that though the BOTEC library is moving towards a "hybrid" information system which integrates traditional and electronic library resources it still needs to expand its electronic collection and access facilities considerably.

5.4. Summary of the Discussions of the Engineers' Responses

The discussions in this chapter regarding library service and use indicate that the BOTEC library has generally been fairly successful in providing its users (engineers) with the information they required or needed for research purposes. Although Filer (1996:1) has suggested that engineering is an information-rich activity and that engineers use a wide range of information sources (information pragmatists), Palmer (1991:123) has observed that engineers' information seeking patterns are rather sporadic and are based on direct need, and Steinke (1991:13) has in turn stated that they have minimal interaction with

information because they infrequently read and use literature and only use information services that are directly oriented to them. These contradicting observations show that the field of engineers' information need and their interaction with information has not been fully researched and thus underscores the need for studies such as this one. It was further also clear that the library was not only used by engineers from BOTEC, but that it was extensively used by engineers from other cognate organizations. The fact that engineers from both RIPCO and UB, as well as some private companies, use their institutional libraries as well as the BOTEC library suggests that the BOTEC library plays an important role in meeting the information needs of the engineering community in Botswana, irrespective of their operational situations.

The responses to the section on the engineers' information need clearly indicate that these needs are oriented towards projects that they are involved in and also with problem solving. Such information needs Ellis and Haugan (1997:392) have described as incremental, radical and fundamental, and are core elements for the survival of projects. This approach is vital for the achievement of set goals for projects in terms of research and development portfolio models. The engineer's information seeking patterns are further also oriented towards innovative ideas and turning such ideas into viable products, hence information is an important aspect for the development of innovation. This is evidenced by the development of products by both the RIPCO and BOTEC engineers.

The consideration of BOTEC library's involvement with the electronic information environment was important as the new information era places emphasis on libraries without walls or virtual libraries (digitization). Thus, the nature of information services is becoming increasingly more hybrid with the emphasis gradually shifting from basically being paper-based to encompassing electronic resources. This paradigm shift makes it important for libraries to assess their situation regarding the use of technology. Most of the engineers in this study stated that they have not used the newer information technology and electronic resources at the BOTEC library, but this could be attributed to the recency of the introduction of the technologies as well as the shortage of adequate computers to access the electronic resources.

In contradiction to this, it was found that most of the respondents felt that the library has embraced the technology adequately and they mostly also felt that the library needs to move with the times and align itself with the new electronic information era. Such a shift would suggest that the library should consider cooperating with other information services (networks), and increase subscriptions to online databases, electronic journals and electronic books. This could only be achieved through networking and the establishment of consortiums. Generally libraries are experiencing budget cuts and the BOTEC library has also suffered in this way and may have to consider moving from a public entity to a fee-based service.

5.4.1. The Significant Cross Tabulations

An examination of the significant cross tabulations have shown that various factors have impacted on the engineers' interaction with the library and their information need. From the previous discussions it would appear that the engineers' organisational affiliation and position frequently led to marked differences in how they perceived the library's role in satisfying their information needs. Variations in qualification and area of specialization appear to have had a lesser effect. In this section a brief overview will be provided of the main responses derived from the significant cross tabulations for the independent variables.

5.4.1.1 Organisational affiliation

It was seen that while the BOTEC and RIPCO engineers mainly used the library for reference purposes, their counterparts in private companies mainly used it for study purposes, and the UB engineers used it predominantly to conduct literature searches. The only significant differentiation in use of information sources among the engineers at the four organisations related to their use of the research reports and reference sources housed by the BOTEC library. The RIPCO engineers were by far the greatest users of both these categories (100% use in each case) followed by the UB engineers (54% and 85% use for research reports and reference sources).

The responses relating to the problems the respondents encountered when looking for information in the library have shown that the engineers from the private companies and from RIPCO encountered the least problems while those from BOTEC and UB returned a higher percentage of "sometimes" having difficulties.

Variation in responses from the respondents from the different organisations regarding the adequacy of the library's collections has shown that the BOTEC engineers were not at all satisfied with the scope of the collections while the other engineers were satisfied, the private company ones even more so than the others. The UB engineers were the only category that was moderately satisfied with the size of the collection, while all the other engineers felt that the size was inadequate. Although all the engineers were satisfied with the age of the collection, the private companies were more so than the others.

The responses regarding the physical layout of the library showed that while almost all the respondents from the private companies and a good majority of the BOTEC engineers thought that this library service feature was good, most of the RIPCO and almost all the UB engineers rated it "average".

With regard to the kind of research activity the engineers were engaged in, it was found that while all the RIPCO engineers and over half the UB and BOTEC engineers were involved in research relating to projects, only a small percentage of the private company engineers were so engaged. The only engineers who were substantively involved with general research were the UB engineers, and the private company engineers were again the only category with a substantial number engaged in research for private study purposes. Although all the categories showed almost equal involvement in research to support their technical advice activities, the RIPCO engineers indicated a slightly higher, and the UB engineers a slightly lower, involvement.

The researcher would like to suggest that the variation in the responses of the engineers from the four different organisations is mainly due to the fact that both the engineers at BOTEC and RIPCO conduct applied oriented research that has as its main outcomes

product and process design. The UB engineers are mostly engaged with basic research with the main outcomes that of imparting their knowledge to students and publication and those at private companies are more involved with consultancies. The first three organisations also played an important role in the formulation of the science and technology policy for Botswana and were instrumental in the promotion of public understanding of science and technology.

5.4.1.2 Position

The results that were found to be significant for this variable related to the sources used (and more specifically the use of journals), the handling of information requests, the engineers research activity, the strategies they employed to get information and the topic of the information search. It can be seen that the position category that made the greatest use of journals was the professional level. Only a third of the managerial level and half of the technicians indicated that they used this source. This could be attributed to the fact that the managers are very involved with administrative issues and don't have time to read journals while the professionals, and to a lesser extent the technicians, are more involved with direct research and are concerned with staying abreast with new research areas and findings which are published in current journals.

The three position categories showed significant variation in their view as to how effectively the library handled information requests. All of the managerial, almost 80% of the technician, and only half of the professional level respondents were satisfied with how the library handled their information requests. This could be because the managers' requests are usually precisely phrased and not as time-consuming and detailed as compared to those received from the professional and technician levels.

It is clear that the main research activity of the managers and the professionals is related to the projects they were involved in (the professional slightly more so than the managers). This is understandable as both the managerial and professional level are responsible for ensuring effective management of projects. It was further shown that while the professional level was moderately involved in general research, the managerial and technician level was

not particularly involved with this aspect. This is an understandable result as technicians are not usually involved in basic research and the managerial level is more inclined to coordinating projects. The technicians' reasons for conducting research was more evenly distributed among general research, project research, own study programs and technical advice.

The three position categories indicated that they follow very different strategies when looking for information. The managerial level mostly obtained information from colleagues. It is further evident that the more senior engineers have built up contacts and networks over the years and it is also easy for them to interact with their colleagues during meetings, both formal and informal. The professional category mostly found the information they need through browsing and the technicians by seeking expert advice. The latter aspect is probably because as the most junior category they would naturally turn to more experienced and senior "experts" for information and assistance. It is interesting that all three position categories utilised fairly informal, unstructured, methods to find information and that the more systematic literature search approach was not that popular. This supports Poland's assertion that the engineers she investigated extensively utilised information networks to get the information they needed (1994:173).

In their response to what areas of development are necessary for the BOTEC library, all the managers indicated support for improved online access to electronic databases and a substantive majority also recommended the introduction of an Internet café in the library. The professional levels distributed their support more equally among science and technology (S & T) networks, an Internet café and improved access to online databases. The technicians again were the most enthusiastic about the establishment of S & T networks. Simon (1997:181-194) has observed that the advent of the electronic information environment is gradually changing the face of libraries to that of information systems where access to information is not to be limited only to what they house, but to provision of electronic access to global information.

5.4.1.3 Qualification

The reasons for using the BOTEC library according to the various qualification categories showed that the engineers with a PhD qualification mainly used it for browsing and literature search purposes and to a slightly lesser extent for reference purposes. The MSc respondents mostly used it for reference and literature search purpose, while the engineers with a BSc used it for reference and study purposes. The trainees, in turn, mostly used the library for reference purposes.

The responses relating to what sources the engineers used showed significant variation for the use of business information sources and newspapers when cross tabulated with the qualification categories. While almost all the engineers with a PhD qualification and half of those with an MSc indicated that they used the business information resources, the other two qualifications categories hardly used this resource. This section of the library collection is mainly intended for those engineers who run or intend to start their own business and one can only surmise that many of the engineers with a PhD have or are contemplating venturing into business (this would apply to a lesser extent to those with a BSc). The trainees were the only position category that made substantial use of the newspaper collection in the library.

If the engineers' research activity is considered in terms of their qualifications it can be seen that while all categories conducted project-related research, this purpose featured the most prominently among those with a PhD qualification. All the engineers with a PhD were also engaged with research to support their technical advice activities. Those who were engaged in general research were almost equally distributed among all the qualification categories, and research for personal study purposes was the most prominent among the trainees.

5.4.1.4 Area of Specialisation

The significant results for the engineers' area of specialisation in relation to the sources the engineers consulted show that the reference sources were the most heavily used by the engineers specialising in renewable energy and slightly less so by the engineers in "other"

fields. The researchers' personal observation tends to confirm that these engineers are the most active in conducting research and are in constant contact with other researchers within their field, locally and regionally.

If the engineers' responses regarding their research results or outputs are examined with regard to their area of specialisation (i.e. the significant cross tabulations) it can be seen that although all categories indicated that it mainly resulted in the completion of a project and the writing of a report, the renewable energy engineers returned the highest rating for the completion of projects. A low percentage of the engineers indicated the writing of papers as an outcome, and even fewer listed the completion of a qualification.

Another significant result for area of specialisation was for the responses to whether the engineers required staff mediation during the search process. While most of the civil engineering category indicated that they required staff intervention during the research process very low percentages of the other specialisation categories indicated this need. The researcher has no definite explanation for the large variance between areas of specialisation and the need for staff mediation other than that this might relate to inherent subject-oriented information seeking behavioural patterns.

With reference to the use of the new technologies at the BOTEC library, it is evident that very few of the engineers had used the newer technologies available at the BOTEC library. Only a few engineers in the fields of civil and renewable energy engineering had used these technologies.

5.4.1.5 Cross Tabulation Conclusion

This discussion of the cross tabulations have so far given a clear indication of the areas that the BOTEC library needs to emphasize and develop to ensure quality information delivery to all sectors of its client base and there is clearly a need for greater interaction with all the members of the applied science research community. The BOTEC research staff showed less enthusiasm than the engineers from other institutions for the library which was specifically established to assist them in their work and it is a direct challenge for the library

to re-engineer the library to align its services more closely to the needs of its primary user group.

5.5. General Conclusion

The goal for any research project or study is to refute, deduce, test, or confirm the research questions and concepts around the phenomenon being researched or studied. This particular research project was therefore carried out to find answers to the three questions raised in connection with the BOTEC library's ability or inability to support the engineers' information requirements. The study has attempted to present viewpoints discussed in the literature regarding concepts on information need, use and the information seeking behaviour of the engineers and has also recognised that access to information is vital to the engineering field and thus it has economic value and can contribute to national wealth.

The researcher would like to point out that the pattern established throughout the discussion of the results indicates that the engineers found the BOTEC library to be a good resource of the information they required and thus it contributes to the mission, vision and objectives of the Botswana Technology Centre. Cilliers (1994:16) advocates information as a strategic resource by asserting that it should contribute to social-economic progress, also that it must provide for the specific needs of users and should assist them in the execution of their particular duties and tasks.

This study required the engineers to examine the BOTEC library service, their library use patterns, evaluate whether the information was of value and make recommendations for a library service that would best appeal to their needs. It is common knowledge that "information is power"; also that it is a commodity of immense value, and this aspect surfaced very clearly in the study, from the first question on the engineers' reasons for using the library to the last one on service improvement.

The BOTEC library was used for a number of reasons but the most common use was as a reference library in support of the engineers' research and other work activities, and this need appeared to be adequately satisfied by the type of resources provided. Access to the

library and its resources was satisfactory as most of the engineers only sometimes encountered problems in using the library and most of the engineers also preferred to do independent information searches rather than be assisted by the librarians. It was further established that the library resources were relevant and that these resources met the expectations of the engineers and that the engineers' requests for information were met satisfactorily and handled effectively. The engineers were generally satisfied with the collection, though its size was of some concern.

Regarding the engineer's information need, it is evident that the engineers have diverse information needs which are generally dictated by the type of work they are involved in which in most cases revolved around involvement with projects. The BOTEC library is the only one of its kind that specialises in collecting and disseminating information on the engineering sciences in Botswana and its particular strength is its collection of reports that relate to project work.

An important outcome of the introduction of a science and technology policy by the Botswana Government in 2003 was the establishment of a Ministry of Communication Science and Technology (MCST). One of the main roles of this ministry is to oversee the overall science and technology initiative for Botswana and it thus works closely with all the research and development institutions in the country, and the Botswana Technology Centre plays an active role by acting as the secretariat for the National Council for Science and Technology. The BOTEC library is thus further challenged to align its services to the needs of the science and technology research community and to arrive at an effective strategy for information provision in the new electronic information era.

In conclusion the researcher would like to refer back to the research questions that served as the framework for this project (cf.1.3) and establish to what extent they have been answered, viz.:

i) What are the information requirements of the engineers?

ii) Does the library adequately address and meet these requirements?

iii) What strategies are necessary to attune the library service towards the achievement of

organisational goals?

With reference to the first question, it was seen that the engineers who use the BOTEC library and who were sampled for this study had a need for information for their varied research activities that were mainly related to project work and problem solving. There was also a lesser need to support general research, the writing of papers and reports, and personal study programs. The information they required for these endeavours was obtained by applying various information retrieval strategies.

The BOTEC library is a specialised library geared towards science and technology information provision, and is thus well oriented towards providing appropriate resources and services. It has a collection which is adequate in terms of its scope, and currency, it handles information requests efficiently, maintains an environment conducive to research and development activities, and it generally appears to have satisfactorily addressed the information requirements of the engineers. The engineers mostly appeared to have used the resources within the BOTEC library and only occasionally used other libraries and other resources to satisfy their information needs.

In the light of the current situation at BOTEC library, it is apparent that the library faces a challenge to become a state-of-the-art library. Although it was shown that the library supports the engineers' information requirements, the advent of newer technologies makes it imperative that the library should develop strategies that will enable it to implement and use such technologies. It is further also clear that it should attune its services towards the greater achievement of organisational strategic goals and also more closely align the library service to the engineers' more specific information requirements, both expressed and unexpressed.

From the foregoing sections it is apparent that the BOTEC library generally supports the engineers' information requirements. The discussions have clearly shown that the library is a research reference library which provides information for the applied sciences sector and specifically the engineering sector. It is generally effective in meeting the engineers' need and for the specific information they require in their work situation. These aspects together

with the recognition shown by the engineers for the services the library provides suggests that the library is assisting its clients to effectively use the right information resources and as Sistla and Todd have stated, this can spell the difference between success and failure (1998: 28).

5.6. Future Research and Recommendations

This investigation on the role played by the BOTEC library in supporting the engineers' information requirements has answered some questions but also opened avenues for new or future research. Based on the discussions it is evident that the library management should regularly conduct more user studies to ensure that its service provision is always adequately aligned to information need.

5.6.1. Future Research

The current research project only targeted the engineers who are registered members of the BOTEC library and yet there are many other engineers in the country and their information needs should in future also be researched. The library needs to assess its national role and the impact it should make throughout the country and ascertain the needs of the entire engineering community in Botswana.

Based on the results for this study there is indication that the library can further improve its service delivery and thus more research is needed to map out the direction for such improvement. Future research should therefore be directed to all the areas of the service, resources and the users, and their information seeking patterns. Such research should focus on the need to enhance the library service to respond to the ever- increasing user demands, how to align library services to enterprise strategy, establishing what new service offerings are required, identifying new user groups, ways to increase skills, and how the value of information through enhanced desk-top solutions can be to maximized.

The main thrust of this study is embedded in the concepts regarding the engineers' use of information resources and their interaction with these resources, and it will thus be a worthwhile exercise to find out if the engineers are equipped with sufficient skills to exploit

the information resources at their disposal. A further important aspect to research in future would be to establish why some engineers sometimes experience problems, what these experienced problems are, whether these were associated with their information seeking behaviour, the search strategy used or the resources available.

Furthermore, the transformation of any culture is dependent on individuals and their competencies to carry out their work to the expectations of the organisations they are part of, and therefore it would also be vital to find out whether the information provided meets the overall organisational requirements. Management can be questioned on how the library can champion, drive or leverage overall organizational information and knowledge to the best benefit of organizational objectives.

5.6.2. Recommendations

These recommendations are based on the outcome of the study as well as the researcher's observations on the overall library situation. It is proposed that the BOTEC library should develop and evolve into a state-of-the-art engineering information resource and, to realize this, the library needs to set the following goals,

- To preserve, optimise and improve information resources provided to users, especially the engineering community
- To utilize existing and emerging technologies to provide timely and relevant information
- To develop and provide new value-added services to meet information needs of the library clientele
- To provide and maintain a homepage as a gateway to information about the library and its services
- To continue to support corporate objectives

The above points provide a compelling argument that the library should be transformed and that relevant principles of change management should be adopted to assist in transforming

the library into a modern information centre. It is important that the library should clearly identify its client base and align its services to the organisation's strategic goals.

The researcher therefore recommends that;

1. The BOTEC library needs to be used mainly as a reference source for external researchers and not as a reading room for personal study by external users. There is thus a need to establish who really should be using the library other than the employees of the Botswana Technology Centre. This library should be given the status of a corporate library with responsibility to provide information to researchers who research within BOTEC's research areas.

2. There is a need to examine the existing information infrastructure and find ways how best the library can serve the overall engineering research community. The library management should explore possible alternative avenues by which information can be provided to the researchers, such as digitization of resources, electronic journals and document delivery services.

3. The engineers' information needs are stimulated by the type of work they do and often this is based on a profit making model such as in the case of organisations like the private companies and RIPCO. It is therefore worth introducing fee-based services or a business information unit and the latter could result in increasing credibility among the engineering community as well as generating income to supplement BOTEC's resources which, as a non-profit making organisation, is solely derived from government subsidies.

4. For the BOTEC library to implement change it needs to learn from the experiences of other libraries that have introduced changes to align themselves with developments in the current information environment (paradigm shift). This could be made possible through establishment of links or collaboration projects, staff exchange or twinning exercises at regional and international level.

5. BOTEC library needs to introduce an outcome-based library education programme in which researchers will be given information literacy induction courses to improve the library-user interface and assist users to get the best out of the service.

6. It is vital for the library staff to enhance their information skills by undergoing on-going training related to current developments such as the application and use of electronic information resources and appropriate information and knowledge management techniques. Competencies for librarians have changed and thus librarians need to build successful relationships with information technology specialists without losing their identity as librarians.

7. While the above were considered in relation to the service, there is however also a concern that the library is structured as a section within the Technology Information Department instead of being a unit or even a department. This has been detrimental to the growth and development of the library and this has a bearing on information flow between the Head of the library and the Director for the department. There is further a need to increase the number of professional staff in the library to effect the changes suggested and improve service delivery.

6. Selected bibliography and references

Allen, B. L. 1996. *Information tasks: towards a user-centred approach to information systems*. London: Academic Press.

Asantewa, D. 1992. *Strategic planning basics for special librarians*. Washington, DC: Special Libraries Association.

Babbie, E. R. 1998. *Survey research methods*. 2nd ed. Belmont, CA: Wadsworth.

Baker, S. L. & Lancaster, F. W. 1991. *The measurement and evaluation of library services*. 2nd ed. Arlington, VA: Information Resources.

Berdie, D.R. 1986. *Questionnaire design and use*. New Jersey: The Scarecrow Press.

Botswana. Ministry of Finance & Development Planning. 1998. *Science and technology policy for Botswana.* Gaborone: Government Printer.

Botswana Technology Centre. 1997. *Strategic plan 2003/2007*: Gaborone: The Centre.

Busha, C. & Harter, S. P. 1980. *Research methods in librarianship*. New York: Academic Press.

Cilliers, I. 1994. The unique role of the public library as an information provider. *Cape librarian* 38(5):16-21.

De Jager, K. 1995. What is library use?: a search for appropriate measures with which to evaluate the functions of an academic library in South Africa in the 1990's, PhD Thesis Department of Library and Information Science, University of Cape Town.

De Jager, K. 1991. The researcher as a library user: the study of library support for successful research activities in Art and Science. *South African journal of library and information science.* 60(4):201-213.

De Jager, K. 1991. Whom do we serve. *South African journal of library and information science,* 59(4):267-281.

Dervin, B. & Nilan, M. 1986. Information needs and uses. *Annual review of information science and technology.* 21:3-33

Ellis, D. & Haugan, M. 1997. Modeling the information seeking patterns of engineers and research scientists. *Journal of documentation* 53(4):384-403.

Filer, D. E. 1996. Information and the engineer. In: *Information sources in engineering* 3rd ed. Edited by K.W. Mildren & P.J. Hicks. London: Bowker-Saur. 1-2.

Fowler, F. J. 1993. *Survey research methods.* 2nd ed. London: Sage Publications.

Ghosh, S. & Wesley, G. Y. 2002. A special library for development research -- the role of ISS in managing information requirements for research. *INSPEL* 36 (2):135-145.

Griffiths, J.M & King, D.W. 1993. *Special libraries: increasing the information edge.* Washington DC: Special Libraries Association.

Gustitus, C. 1998. The push is on: what push technology means to the special librarian. *Information outlook* 2(1):21-24.

Hernon, P. & McClure, C. R. 1990. *Evaluation and library decision making.* Norwood: Ablex.

International Federation of Library Associations and Institutions. 2001. *Conference information for the 67th Council and General Conference "Libraries and librarians: making a difference in the Knowledge Age"*, August 16th - 25th 2001, Boston, USA. http://www.ifla/iv/ifla67/conf-e.htm [site visited 23 January 2006].

Itoga, M. 1992. Seeking understanding beneath the unspecifiable: an alternative framework for mapping information needs in communication. *Libri* 42(4):330-344.

Keenan, S. 2000. *Concise dictionary of library and information science 2nd ed.*. London: Bowker-Saur.

Krikelas, J. 1983. Information seeking behaviour: patterns and concepts. *Drexel library quarterly* 19(2):5-20.

Kuhlthau, C. C. 1993. A principle of uncertainty for information seeking. *Journal of documentation*, 49(4): 339-355.

Kuhlthau, C. C. 1998. An uncertainty principle for information seeking: a qualitative approach. In *Encyclopedia of library and information science*, vol. 61. edited by A.Kent and C. M. Hall. New York: Marcel Dekker, 355-368.

Leedy, P. D. 1993. *Practical research: planning and design.* 5th ed. New York: Macmillan.

Mann, P. H. 1985. *Methods of social investigation. 2nd ed.* Oxford: Blackwell.

Milne, D, Palmer, C. & Yeatsley, J. 2000. *Focusing investment innovation on the coordination and rationalisation of science and technology and research and development in Botswana: report to the Ministry of Finance and Development Planning.* Wellington, New Zealand: Science and Technology Consortium.

Moyo, L. 1993. Traditional information services and networking for agricultural sciences. *Information strategies for scientists in Southern Africa.* edited by J. R. Strachan. London: Commonwealth Science Council, 61-73.

Nitecki, D. A. 1993. Conceptual models of libraries held by faculty administrators and librarians:an exploration of communication in the 'Chronicle of Higher Learning'. *Journal of documentation*, 49(3):255-277.

Paisley, W. J. 1980. Information and work. In *Progress in communication sciences* 2. edited by B. Dervin & M. Voigt. Norwood, NJ: Ablex. 113-166.

Palmer, C. L. 1999. Aligning studies of information seeking and use with domain analysis. *Journal of the American Society for Information Science*, 50(12):1139-1140.

Palmer, J. 1991. Scientists and information: using cluster analysis to identify information style *Journal of documentation* 47 (2), 105-129.

Parker, S. P (ed.) 1994. *McGraw-Hill dictionary of scientific and technical terms*. 5th ed. New York: McGraw-Hill.

Parker, S. P. 2000. Knowledge is like light -- information is like water. *Information development* 16(4): 233-236.

Piggot, S. E. P 1995. Why corporate librarians must re-engineer the library for the technology age. *Special libraries*, 86(1):11-20.

Pinelli, T., Bishop, A., Barclay, R., & Kennedy, J. 1993. The information-seeking behavior of engineers. *Encyclopedia of library and information science*, vol. 52. edited by A. Kent & C. M. Hall. New York: Marcel Dekker. 167-201.

Poland, J. A. 1994. Informal communication among scientists and engineers. *Encyclopedia of library and information science.* vol. 53. edited by A. Kent & C. M Hall. New York: Marcel Dekker. 171-181.

Powell, R. R. 1991. *Basic research methods for librarians*. 2nd ed. Norwood, N.J: Ablex.

Prytherch, R. J. 1995. *Harrods librarians' glossary: 9000 terms used in information management, library science, publishing, the book trades and archive management*. 8th ed. Aldershot: Gower.

Rhode, N. F. 1986. Information need assessment. *Advances in librarianship* vol.14. edited by I. Godden. New York, Academic Press. 49-73.

Riley, B. 1998. You are now entering the Age of Mind: thoughts on the knowledge society. *Australian library journal* 47 (2): 145-156.

Rubin, A. & Babbie, E. 1993. *Research methods for social work.* 2nd ed. Pacific Groves, CA: Brooks/Cole.

Simon, E. 1997. Business libraries: means and forms of international cooperation. *INSPEL* 31(4): 181-194.

Sistla, M. & Todd, J. 1998. Warning: a killer mistake in business: don't let technology drive your requirements. *Information outlook* 2 (6): 19-22, 24.

Smith, J. G. 1981. Information requirements of natural scientists and engineers at academic institutions with specific reference to the University of Cape Town. MA Thesis. University of Cape Town.

Smith, J. G. 1994. *Information needs assessment: lecture notes* (unpublished). University of Cape Town.

Sridhar, M. S. 1988. Organisation of information systems: an introspection of present premises, presumptions and practices. *IASLIC bulletin*, 33(2/3):71-79.

Steinke, C. A. (ed.) 1991. *Information seeking and communication behavior of scientists and engineers*. New York: Haworth Press.

Sweeney, R. 1997. Leadership skills in the re-engineered library: empowerment and value-added trend implications for library leaders. *Library administration and management*. 11(1):30-41.

Van Houten, R. 1982. The requirements for specialized information in an innovative process: research and technological applications. In *Information and innovation: proceedings of a seminar of ICSU-AB (International Council of Scientific Unions Abstracting Board) on the role of information in the innovative process*, Amsterdam, 24-25 May 1982. edited by B. T. Stern. Amsterdam: North-Holland. 63-85.

Westbrook, L. 1997. User needs. In *Encyclopedia of library and information science* vol.59. edited by A. Kent and C. Hall. New York. Marcel Dekker. 316-347.

Wilson, T. D. 1981. On user studies and information needs. *Journal of documentation*, 37(1):3-15.

Zipperer, L. 1998. Librarians in evolving corporate roles. *Information outlook* 2(6): 27-30.

APPENDIX A

Questionnaire

QUESTIONNAIRE ON THE ROLE THAT THE BOTSWANA TECHNOLOGY CENTRE LIBRARY PLAYS TO SUPPORT THE INFORMATION REQUIREMENTS OF THE ENGINEERS IT SERVES

Dear Respondent,

The questionnaire is intended to obtain your feedback on the services rendered to you by the Botswana Technology Centre Library (BOTEC). It forms part of research being done towards an M BIBL dissertation at the University of Cape Town. Your response data will be treated with strict anonymity, and confidentiality will also be maintained.

Thank you

PART A

1. Give the name of the organisation you work for_____

2. What position do you hold_____

3. What are your qualifications_____

4. Indicate your specific area of specialisation under one of the following broad subject categories (circle)

    4.1 Civil
    4.2 Electronics/Electrical
    4.3 Mechanical
    4.4 Renewable Energy
    4.5 Computer
    4.6 Other _____

PART B

5. What do you mainly use the BOTEC library for? (circle)

    5.1 Reference
    5.2 Study
    5.3 Literature search
    5.4 Browsing
    5.5. Other (specify)_____

6. Which of the following sources do you usually consult when you use the BOTEC library

6.1 Periodicals/Journals
6.2. Business information sources
6.3. Research reports
6.4 Books
6.5 Articles
6.6. Newspapers
6.7. Reference works
Other (specify)_____

7. Do you have problems finding material in the library? (circle)

7.1 Always
7..2 Sometimes
7.3 Never

8.. When using the library you prefer (circle)

8.1. Assisted Search
8.2. Self Search

9. How did the library handle your information request? (circle)

8.1 Very Effectively
8.2 Effectively
8.3 Not effectively

10. Please indicate appropriate category that applies to the library collection (circle)

LIBRARY COLLECTION	**CONDITION**	
Scope	Adequate YES Inadequate NO	
Size	Sufficient NO Insufficient YES	
Age	Current YES Outdated NO	

11. Indicate how you find the library service and features

	Good	Fair	Poor
11.1. Ease of access to material			
11.2. Easy use of the catalogue			
11.3. Physical layout			
11.4. Staff attitude towards users			
11.5. Other (specify)			

PART C

12.. Please indicate a specific research activity you were involved in during the last six months (circle)

12.1 General work related research
12.2. Specific Project work
12.3 Own studies
12.4 Technical advice
12.5. Other_____

13.. What was the result (output) of your research activity (circle)

13.1. Paper
13.2. Report
13.3 Qualification
13.4. Product
13.5. Other_____

14.. When was the last time you needed substantial information relating to this research?

14.1. 2weeks
14.2. This week
14.3. 1month

15. What was the subject/topic of your enquiry?

_____

16.. What strategy did you use to get the information you needed ?. (circle)

16.1 Conversation with colleagues/ friend
16.2 Reading
16.3 Specific literature search
16.4 Expert Enquiry

17.. Did you need library staff mediation during your search for information?
(circle)

17.1 Yes
17.2 No

18. Was the information you obtained valuable to you (circle)

18.1 Yes
18.2. No

19. Where was the information obtained from? (circle)

19.1 BOTEC resources
19.2 Another Library
19.3 Document Delivery
19.4. Other (specify)_____

20. Have you subsequently received more information on your research topic from the library (please circle)

20.1. Yes
20.2 No
20.3. No need

Part D

21. Have you ever used used any og the new technologies such as the DD-Rom and the

21.1 Yes
21.2. No

22. In your opinion you would say the library has embraced the use of technology for information access and retrieval

22.1 Well
22.2.Adequately
22.3. Poorly

23. Which of the following areas would you like to see the library develop more fully?

23.1 S&T networks
23.2. Internet
23.3 On-line database access

23.4. Other (specify)_____

ABSTRACT

Although it is generally accepted that libraries are for all, many are oriented towards serving people within specialised areas such as the engineering research field. This dissertation is a result of a survey of the engineers (user group) who are members of the Botswana Technology Centre (BOTEC) Library. The engineers used the library for varied reasons, hence the study was necessary to establish if the library positively or negatively responded to their information needs by investigating the role it played in supporting these engineer's information requirements.

The research project was based on two main approaches, the first being a conceptual review of the literature in the library and information field. The purpose of the literature review was to give an overview of the information need, information use, information seeking concepts related to the problem and its setting in order to arrive at a framework for determining the role played by the library in providing information to its users.

The second approach involved an empirical study that collected and analysed both qualitative and quantitative data. The study was carried out by

means of a survey and the data was collected by means of questionnaires which contained open and closed-ended questions. These were distributed by hand or sent out electronically to the engineers registered as members of the Botswana Technology Centre Library. The engineers who participated in the study worked at Research and Development institutions, the University of Botswana and some Private companies in Gaborone and surrounding areas.

The data was analysed using Microsoft EXCEL software and the significance of the effect of the independent on the dependent variables was tested using the STATISTICA statistical package.

This dissertation provides background information on the BOTEC library and presents the engineers responses to the questions regarding the library's service and use, the engineers' information requirements, as well as their suggestions for service improvement. The responses are discussed in the context of the engineer's profiles (independent variables) and the effect of these on the concepts explored in this study (dependent variables).