Information needs and information seeking behaviour of researchers in an Industrial Research Institute in Nigeria

by

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submitted in accordance with the requirements

for the degree of

DOCTOR OF PHILOSOPHY

in the subject

INFORMATION SCIENCE

at the

UNIVERSITY OF SOUTH AFRICA

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MARCH 2018

DECLARATION

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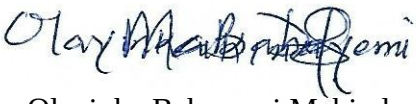
I, Olayinka Babayemi 'Makinde', wish to declare that this study, Information needs and information seeking behaviour of researchers in an Industrial Research Institute in Nigeria, is my own work and that all the sources that I have consulted have been indicated and acknowledged by means of complete references.



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Co-supervisor (Dr. T. Mugwisi) Date

DEDICATION

To the Almighty God – the omnipotent, omnipresent and omniscient, and my late father, Mr Julius Olaniran Makinde, who left us twenty-two years ago with a solid foundation laid for my academic pursuit.

My father, thank you for the sure foundation you laid for my academics. You believed in me so much that you clearly saw a bright future for your dear son and you began to equip me with the requisite quality of education before the cold hands of death took you away. You taught me the lesson of hardwork, dedication and the GOD factor. You are not here to rejoice with me, but I know you are glad that your loving son at last bagged a PhD and has made you proud.

ACKNOWLEDGEMENTS

Joy unspeakable, full of glory, is all I can say at this point. I cannot thank God enough for the immeasurable joy he has given to me today. If all the hair on my head were to be made of tongues, they are not enough to appreciate the Almighty God for his provision, guidance, wisdom, direction and good health. Gracious God, I thank you.

It is with much pleasure that I wish to acknowledge the huge and painstaking academic contributions of my promoters and academic mentors, Prof. G. V. Jiyane and Dr. Tinashe Mugwisi. Prof. Jiyane, thank you very much for being an outstanding academic and motivator. You will live forever in my heart.

I am eternally grateful to Mrs Christianah Ebun Makinde (my priceless mother), Mrs Esther Oluwakemi Makinde (my wife and inestimable jewel), my two sons (Abraham Oluwamakinde Makinde and Isreal Iseoluwa Makinde), my uncles (Mr Ambrose Makinde (late) and Mr Sunday Omole) and, of course, my siblings. Especially, I want to thank my wife and two children for their patience, love, great understanding and support during my academic pursuit.

In addition, this research would not have been possible without the support and understanding of the following persons: Prof. (Mrs) Gloria Elemo (Director-General of FIIRO), Mr Raji (Director HR Department of FIIRO), Dr (Mrs) Oyedoyin (Acting Director, PTTIM Department of FIIRO), Dr Oyeku, Dr (Mrs) Kayode, Dr Ilori, Mr Tunji Ogunjimi, The Aribisalas, Mr Kehinde Osho, Mr Ojo, Mr Gbenga Adenuga, Mr Edun, Mr Fatoba and Mr Shada. I also want to appreciate my patient analyst, Mrs Dayo Akinbode who had to work extra time because of the work pressure I put her through. Thank you all.

ABSTRACT

The entire world needs and seeks information to survive and thrive in the 21st century as a result of information acquisition, with doctors, lawyers, teachers, students and even the elderly all desiring information for their everyday activities. Researchers of different disciplines working at the various federal institutes in Nigeria are no exceptions to the craving for requisite information that will enable them successfully carry out their numerous research projects undertaken towards achieving sustainable national development.

The aim of the study was to investigate the information needs and information-seeking behaviour of researchers at the Federal Institute of Industrial Research Oshodi, Nigeria. This study applied both quantitative and qualitative research approaches for the purpose of triangulation. The quantitative approach had a strong dominance over the qualitative approach in this study. This study adopted the positivist paradigm.

The questionnaire, interview and observation data collection tools were the chosen tools used to collect data from researchers from the six departments of the Federal Institute of Industrial Research Oshodi and five professional librarians of the institute's library. Out of 165 questionnaires that were administered to researchers, a total of 121 were returned (resulting in a response rate of 73%). Inaccuracies were identified in seven copies of the questionnaires which were discarded and not analysed. Therefore, usable returns totalled 114 (67%).

Wilson's 1999 model of information behaviour was used as the theoretical framework. This study revealed that both formal and informal sources were consulted by the researchers. It was important to note that the internet was the information source most commonly used by the researchers to obtain information. The institute's library was poorly used because it contained outdated library materials and was not equipped with an

internet facility. The researchers opted for the use of mobile phone/iPad, personally owned or sourced internet access and business centres (supplying internet services outside the institute) to access information sources for information.

The study ascertained that there was undoubtedly an instituted library officially established within the institute to provide information to researchers. But due to socio-economic and political problems faced by the country Nigeria, predominantly with respect to the outlook of poor funding of sustainable library development concerns and the government's lack of interest in research, outdated library collections and poor information provision services have become the given at the institute's library. This ultimately brought about pessimistic reactions from the researchers.

Among its recommendations, the study suggested that funding the institute's library in order to update and replace outdated library collections is a priority. An information audit should be carried out to ascertain the current state of ICTs within the institute and the institute's library should be equipped with an internet facility promptly. Adopting these recommendations would enable researchers to have limitless access to items of information they need for research as they seek for information.

KEY TERMS

Information Needs, Information Seeking Behaviour, Information Sources, Industrial Researchers, Research Libraries, Federal Institute of Industrial Research Oshodi, Pragmatism, Wilson's 1999 Model, Information Access, Information Services.

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ABBREVIATIONS AND ACRONYMS

BD	Biotechnology Department
CFET	Chemical, Fibre and Environmental Technology Department
CSIR-CRI	Council for Scientific and Industrial Research Crops Research Institute
FIIRO	Federal Institute of Industrial Research Oshodi
FT	Food Technology Department
HTML	Hypertext Markup Language
ICTs	Information and Communication Technologies
ISP	Internet Service Provider
LIS	Library and Information Science
MBA	Masters in Business Administration
MMR	Mixed Method Research
NUC	National Universities Commission of Nigeria
OA	Open Access
OPAC	Online Public Access Catalogue
PALM	Production, Analytical and Laboratory Management Department
PDD	Project Development and Design Department
PDF	Portable Document Format
PTTIM	Planning, Technology Transfer and Information Management Department
RDIs	Research and Development Institutions
R&D	Research and Development

RIN	Research Information Network
SPSS	Statistical Package for the Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organisation
Unisa	University of South Africa

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CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION AND BACKGROUND

Information as a concept is not new to the field of LIS and its existence is designed to solve problems when it is needed and sought by individuals on a day-to-day basis. According to Edewor, Emeka-Ukwu and Egreajena (2016:2), the whole world needs and seeks information to survive and thrive in the 21st century with professionals, teachers, students and even the elderly desiring information for their everyday activities. Researchers of different disciplines working at the various federal institutes in Nigeria are no exception to the popular craving for information for their numerous projects geared towards significantly contributing to sustainable national development.

Chowdhury (2004:194) and Ikoja-Odongo and Mostert (2006:147) set forth that an information need may arise when an individual recognises that his or her current state of knowledge is insufficient to cope with the task at hand, to resolve conflicts - or to fill a void in some area of knowledge. Similarly, Ingwersen and Järvelin (2005:20) and Nicholas (2000:20) point out that information needs have to do with an identified or recognised knowledge gap that is available to an actor/user or an anomaly which an actor/user wishes to resolve. Choo, Detlor and Turnbull (2000:3) maintain that information needs are frequently thought of in terms of a person's cognitive needs - gaps or anomalies in the state of knowledge or understanding that may be represented by questions or topics. These questions or topics will definitely lead to users of information seeking information.

In the same vein, Wilson (2006:665) opines that when we speak of users' information needs, "we should not have in mind a concept of a fundamental, innate, cognitive or emotional need for information, but a concept of information as a means towards an end of satisfying such fundamental needs". He stresses that as part of the search for the satisfaction of these needs, an individual may engage in information-seeking behaviour. He further states that it is advisable to remove the term "information needs" from our

professional vocabulary and rather speak about "information seeking towards the satisfaction of need".

Information seeking involves the act of reaching out for totality of information-related products and services that researchers may perceive to have a potential purpose in filling the gaps in their current knowledge regarding the research they are carrying out. Information-seeking behaviour can be regarded as a response to information needs which an information seeker performs as depicted by Wilson (2000:49) as a purposive-seeking action for information as a consequence of a need to satisfy some goals. According to Acheampong and Dzandu (2015:88), the need to be an informed and knowledgeable individual leads to the process of identifying information needs. This process does not stand alone without the individuals knowing the way they articulate, seek, evaluate, select and use the information, which is commonly referred to as "informating-seeking behaviour" being sought for. Information-seeking actions entail the actions that researchers are willing to take in the course of carrying out their research projects in order to fill research knowledge gaps.

Research is an endeavour undertaken by all professionals, irrespective of their field of study, and not just one engaged in by students and academics. Kumar (2011) posits that the word 'research' is composed of two syllables namely 're' and 'search' with 're' meaning 'again' or 'anew' while 'search' means 'to examine carefully, to test or to probe'. Kothari (2004:9) describes research to be "an inquiry into the nature of, the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur". Grinnell (1993:4) also reveals that research could be described as a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles. Grinnell further adds that "research is a structured enquiry that utilises acceptable scientific methodology to solve problems and creates new knowledge that is generally applicable". Furthermore, Burns (1997:2) terms research as "a systematic investigation to find answers to a problem". The process of research is expected to be systematic and methodological, involving investigations in order to discover, interpret or revise facts and theories with knowledge being discovered (Chikwe, Ogidi &

Nwachukwu 2015:44; Webb, Gannon-Leary & Bent 2007:35). More relevant to this study is the definition of Olayinka, Taiwo, Raji-Oyelade and Farai (2006:2) that describes research as a form of inquiry that involves the seeking of evidence to increase knowledge which entails a systematic process for recognising a need for information, acquiring and validating that information and deriving conclusions from it. This is what researchers do on a daily basis at the various federal research institutes in Nigeria as they conduct their research.

Kothari (2004:2-4) highlights five basic types of research which are as follows:

- Descriptive vs. Analytical: Descriptive research takes account of surveys and fact-finding enquiries of different kinds. On the other hand, analytical research has to do with when the researcher has to use facts or information already available - and analyse these to make a critical evaluation of the material.
- Applied vs. Fundamental: Research can be either applied (action) research or fundamental (basic or pure) research. The goal of applied research is finding a solution for an immediate problem which a society or an industrial/business organisation faces, while fundamental research is mostly concerned with generalisations and the formulation of a theory.
- Quantitative vs. Qualitative: Quantitative research is based on the measurement of quantity or amount and it is applicable to phenomena that can be expressed in terms of quantity. Conversely, qualitative research is connected to qualitative phenomena, that is, phenomena relating to or involving quality of kind. An example is when we are interested in investigating the reasons for human behaviour, that is, why people think or do certain things.
- Conceptual vs. Empirical: Conceptual research is related to some abstract idea(s) or theory and it is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. On the other hand, empirical research depends on experience or observation alone, usually without due regard to system and theory.
- Some other types of research: All other types of research are variations or modifications of one or more of the above approaches to research. This is based

on the purpose of the research with the time required to accomplish research, the environment in which the research is done or on the basis of some other similar factors. In terms of time, we have two types of research namely the one-time research (it is confined to a single-time period) and the longitudinal research (research performed over several time periods). Based on the environment in which the research is to be carried out, we have three types of research namely the field-setting research, the laboratory research or the simulation research and the exploratory or the formulated research. Exploratory research has its objective as the development of hypotheses rather than their testing, while formulation research has a substantial structure coupled with specific hypotheses to be tested.

The UNESCO Institute for Statistics (2010:7-10) stresses that research and experimental development (R&D), which researchers all over the world carry out, plays an indispensable role in innovation, which in recent years, has taken a focal position as one of the main drivers of economic growth and poverty alleviation. In turn, policy makers - can help spread the benefits of innovation through policies that encourage growth in the areas of science and technology. However, Bogoro (2014:9) is of the opinion that the environment of the third-world countries like Nigeria - makes research complicated; as a result, it is difficult to create research institutions but what is possible and available are public universities with teaching as their main focus. According to Odia and Omofonmwan (2013:258), the challenges besetting the research industry in Nigeria include leadership issues, administrative issues, quality funding problems, complete absence of a clear philosophy of national development (reflected in government policies and programmes), political instability, mentoring and the lackadaisical attitude of people towards research.

Kothari (2004:9) emphasises that the existence of research points to the fact that there is a researcher who is interested in more than particular results, repeatability of the results and in their extension to complicated and general situations. With the engagement of researchers in research, research continues to be a means to understand various burning issues. The Commission of European Communities (2003:6) describes ‘researchers’ as

"professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of projects concerned".

The knowledge that is created during research is invaluable to individuals and national development. Tress, Tres, Fry and Opdam (2005:13) state that the production of new knowledge (in the form of a new theory and method development) is a characteristic of research. Kaniki (2003:3) stresses that this knowledge creation brings about the use of such understanding to deal with problems and for a person (user) to provide the value of experience or knowledge to others. By and large with knowledge being the outcome of research, the principal function of research is to discover answers to meaningful questions aimed at remedying societal challenges (Odia & Omofonmwan 2013:258). Moreover, the production of new knowledge is worthless without its application. The essence of the apparatus of science and innovation system in any country, and globally, is for the system to provide an excellent basis for research such that the application of new knowledge produced from research can provide significant changes in our world and make human existence better (Allas 2014:12,20).

Probst, Raub and Romhardt (2000:24) describe knowledge as the whole body of cognitions and skills which individuals use to solve problems, and it entails both theoretical and practical everyday rules and instructions for action. They further explicate that knowledge is based on data and information, but unlike these two concepts, it is always bound in persons and constructed by individuals, and represents their beliefs and causal relationships. Kaniki (2003:4) states that knowledge is simply information combined with personal expertise. The concepts of data, information and knowledge will be dealt with comprehensively in Chapter Two.

Prasad (1992:5) underscores that there is no field of study or human activity in which information is not a component – be it research and development or business and industry. Prasad further points out that the effectiveness of performance in all these spheres of activity depends largely on the availability of information at the right time in the right quantity. Existing relevant, current and accurate information is what researchers as professionals depend on to identify research problem(s) (Acheampong & Dzandu 2015:89). Therefore, researchers crave for information as they proceed from one

stage to another in their research work – from the stage where the idea emerges to the stage where the idea takes shape (Idiegbeyan-Ose, Okoedion & Nwadioha 2014:144). In solving the problems that researchers have already identified or will identify, they will have to seek and obtain the applicable information they need. While conducting, applying and managing research, researchers have the need for information and this need must be satisfied in order for them and the science innovation system to function effectively (Kaniki 2004:82). In terms of research, we are living in a world where researchers need dependable and useful information about the actual object of research in order to arrive at a justifiable conclusion, which in turn will determine the pace of the growth and development of humanity (Odia & Omofonmwan 2013:257-258).

Yusuf (2012) highlights that for any meaningful information to be provided certain relevant information sources must be consulted and it is only through such sources that information researchers can obtain information that is ideal for meaningful decision-making which could lead to an increase in productivity. Idiegbeyan-Ose et al. (2014:148) reveal that the unavailability of relevant information sources is the major hindrance to research, and as a result, library/information centres should acquire relevant information sources to meet the information needs of researchers in order for them to contribute their quota to national development, since research contributes to national development. In addition, these information sources have to be easily accessible. Open access (OA) and repositories ensure ease of obtaining and publishing information via information sources for researchers. Raju, Adam, Johnson, Miller and Pietersen (2015:7) argue concerning open access that:

> The primary purpose of this service is to promote the distribution of scholarly literature for the growth and development of research and society, thus connecting researcher, society and development.

Raju et al. (2015) further stresses the fact that the researcher is both the user and the creator of information or knowledge, as access to current information is necessary for the production of new knowledge in a globally connected information society. Generally, information sources used by researchers include journals, books, bibliographies, abstracts and indexes, consulting library staff for new information, consulting colleagues for

information, consulting electronic or digital information-bearing entities in a variety of media and many more.

Even with a variety of information sources aimed at addressing the problems of information needs and information seeking, Kuruppu and Gruber (2006:609) maintain that "understanding information needs and information-seeking behaviour of researchers is challenging and it becomes more complicated as researchers play several roles (as educator, as planner, as administrator and as supervisor), their needs and interests change over time and they are "continuously" affected by technological advances". Chandel and Saikia (2012:148) submit that technological advancement can be seen in the form of information and communication technologies (ICTs), with this making an intense impact on the availability and accessibility of e-resources. They further maintain that ICTs also provide quick and comprehensive access to resources by using the best possible tools and techniques, which is the ultimate aim of every noble library.

Developments in ICTs have opened opportunities as well as challenges for users who need and use information and for libraries to meet the information needs of their users. ICTs have opened a window of opportunity for easing documentation, organisation and retrieval of information and have also brought about information explosion resulting in difficulties on the part of users to access information of their choice for their project (Dulle & Alphonce 2016:266). ICTs aid researchers in the access to a variety of information sources and, in turn, the seeking and use of information is achieved with ease and speed (Obioha 2005:312). According to Obioha (2005:311) and Salau and Saingbe (2008:7), some of the constraints to the utilisation of ICTs include inability to operate some ICT tools, financial problems, poor access to ICTs, lack of interest, irregular power supply, lack of alternative power supply, network failure of internet and telephone services, among others. Researchers need to be given adequate training in order to acquire the necessary skills to enable them to adopt and use computers and other ICT facilities and services in meeting their information needs (Dzandu & Dadzie 2012; Salau & Saingbe 2008:7).

By and large, the problems encountered when researchers engage in the act of information seeking to solve their information needs must be addressed sufficiently. This will ensure that their information needs are adequately taken care of. With the set goal of boosting industrial development in Nigeria by the different tiers of government in order for Nigeria to be the giant of Africa (economically and infrastructurally), the onus lies on researchers at various research institutions to be at the forefront and this can only be achieved if the information needed for research is supplied not just for support, but also for strategic purposes. Chen and Hernon (1982) argue that individuals, groups of individuals, organisations and governments frequently find themselves in situations where they must make timely decisions, solve problems, put forward questions and answer questions, uncover facts and/or understand something that might be somewhat complex. Connaway (2015: i-v) submits that situations as explained by Chen and Hernon (1982) create uncertainties that will certainly manifest in needs. For these needs to be minimised or eliminated, with uncertainties reduction resulting in the satisfaction of the needs of users, individuals personally or as members of a group or on behalf of an organisation must seek information for which provision must be made. Connaway (2015) further points out that information must be given and transferred by somebody or some source to another person or body through some channel and it must be received by the person requiring or seeking it.

1.2 CONTEXTUAL SETTING

Research is embarked on by public research institutions (controlled by either the state or federal government), private research institutions (controlled by individuals or non-government bodies), universities (both public and private universities) and international research institutions across Nigeria. Adeyinka (2014:54), Excellence and Education Network (2016) and Yusuf (2012:321) state that with respect to high-ranking research in Nigeria, there are research institutes conducting diverse research in a number of subject areas, alongside with the institutions of higher learning, the professional and specialised public research institutions. However, Adeyinka (2014:54) points out that the record of the National Planning Commission (NPC) shows that some research institutions are

involved in core research and development activities while others are engaged in training, data gathering and policy research.

According to Yusuf (2012:321), the main distinctive feature of research institutes in Nigeria is that they are professionally oriented to undertake specific or specialised research projects such as work revolving around industrial research, agricultural research, medical research, and so on. However, the majority of the public research institutions are into scientific and technological research. They aim to discover better ways of doing things, improving the knowledge base and raising standards in specific fields. The research institutes also have a mandate to make research findings, technology and knowledge adaptable and applicable to local Nigerian situations. The research findings, technology and knowledge that researchers generate constitute research output that can be adopted to bring about positive socio-economic changes in our society (Bornmann 2012:217).

1.2.1 Research output in Nigeria

Okafor (2011:2) defines research output as a means by which academics contribute their own knowledge to the existing body of knowledge, which can be in the form of journal articles, technical reports, books, chapters in a book, supervision of students, etc. Yusuf (2012:324) concurs with Okafor (2011) that research output is the quantitative and measurable means by which academics contribute new knowledge to the existing body of knowledge. Adeyinka (2014:57) is of the opinion that research output in Research and Development Institutions (RDIs) is a measure of the productivity at organisational level, which includes number of innovations, number of seminars and/or extension services, number of projects commenced and completed and number of patents. He explains that at the individual level, the number and type of publications continue to be the key measure of determining annual output of researchers in RDIs. According to Cetto [in Fadokun (2009:4-5)], an index that can measure research output is the number/quality of published works authored by Nigerians and co-authored academic work in international journals and by the world distribution of active serial titles emanating from the universities that contribute to the generation, dissemination and application of scientific knowledge for development in Nigeria and beyond.

Ani and Onyancha (2012:144-145) observe that there is a paucity of literature on productivity measures and the evaluation of research performance in Nigeria with the country not having any national bibliographic or citation database that can be used to evaluate research output in the country. More information is known about the research output of university faculties/departments, university lecturers and research institutions situated in universities than other known organised research institutions outside academic institutions in Nigeria.

1.2.1.1 Research output and scholarly communication in Nigeria's universities and non-academic research institutions

Judging from the fact that productivity can be measured from research generated, it is not surprising to know that scholars are beginning to examine the knowledge generated from public research organisations (Adeoti, Odekunle & Adeyinka 2010:26). Yusuf (2012:321) also stresses that given almost a century of continuous research in institutions of higher learning in Nigeria, the pertinent question in relation to what is the research output in these institutions in terms of both quantity and quality of research should be asked.

Yusuf (2012:321) emphasises that the policy documents by the National Policy on Education (NPE) (1977,1981,1990,1998,2004), National Policy on Science and Education (NPST) (1986, 1999, 2003) and subsequent related policy documents have recognised the significant contribution the higher education system and research institutes could make with respect to repositories of knowledge and research generation. Oyewale (2006:9&13) maintains that Nigeria universities and research institutes generate research that might be further developed, resulting in scholarly articles, inventions and eventually being patented. Adeyinka (2014:54) expresses that researchers have the most important occupation of embarking on research and development activities focused towards boosting knowledge generation and innovation capacity to ensure the realisation of development in the economy.

According to Bako (2005:12) and Fadokun (2009:13-15), the National Universities Commission of Nigeria (NUC) in its 2005 ranking (which originated from the Nigerian

universities research and development fair organised by the NUC between 22 and 26 November 2004) evaluated 65 universities (and also their research centres) based on the factor of the quality of their scholarly research output measured according to scholarly articles published in high-class international journals with noteworthy contributions to national and global development and published in journals with editorial offices in North Africa, Europe, Australia and Asia. Furthermore, their contents were abstracted in scholarly indexes and physically sighted by the NUC teams before they were considered fit for scoring. They showed the first 20 universities research output ranking in Nigeria. Obafemi Awolowo University, Ile-Ife, occupies the leading position (200), Federal University of Technology, Akure, occupies the second position (186), University of Ibadan, Ibadan occupies the third position (154) and University of Maiduguri, Maiduguri occupies the twentieth position (10). On the other hand, Ani and Onyancha (2012:147) report the productivity of the top 20 universities in Nigeria in terms of publication output as an indicator of research output. The research study indicated that the University of Ibadan was the most productive, with 2310 articles (17.1%) of the total number of publications produced in Nigeria. In the second place was Obafemi Awolowo University, publishing 1352 (10.0%) of the articles [that was ranked in the first position by the studies of Bako (2005) and Fadokun (2009)], followed closely by the University of Nigeria (1044 articles, 7.7%), Ahmadu Bello University (854, 6.3%) and the University of Lagos (813, 6.0%). In terms of the average number of articles per year, the University of Ibadan produced 210 articles, followed by the Obafemi Awolowo University (122.9), the University of Nigeria (94.9), Ahmadu Bello University (77.6) and the University of Lagos (73.9).

Knoema (2017a) identifies scientific and technical journal articles as the number of scientific and engineering articles published in the fields of research, namely physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. This standard as given by Knoema can be referred to as the research output or capacity of nations of the world in terms of research. Knoema (2017b) reported the value of Nigeria's research output to be 3654 from 2002 to 2013, which is its latest score. Nigeria's research output was highest in 2011 with the value of 4456 and lowest in 2002 with the value of 1030. There was a progressive

increase in the value of research output from 2002 to 2011 with Nigeria's research output value reduced considerably from 2012 to 2013 having the values of 3905 and 3654 respectively, compared to the research output value of 4456 in 2011.

Adeyinka (2014) examined 300 researchers in 24 research and development institutions that are involved in core research and development activities in Nigeria. The research output was measured in the study in terms of the number and type of research publications of researchers published between 2003 and 2007. From the research output study, there was an observed generally low pattern of research publications published by researchers, with at least 50% of the researchers showing that they had zero publications between 2003 and 2007 in all types of research publications. Besides, the far larger fraction of the volume of research publications published by researchers was discovered to be concentrated in local journals, seminars, conferences and workshop articles.

However, the study of Ani and Onyancha (2012) where the publications of researchers in Nigeria were counted using three databases on the Web of Science portal [the Science Citation Index (SCI), the Social Science Citation Index (SSCI) and the Arts and Humanities Citation Index (AHCI)] reveals that three researchers from the International Institute of Tropical Agriculture (IITA), an international research institution in Nigeria, were ranked third, fourth and sixth with 53 articles (0.39%), 49 articles (0.36%) and 48 articles (0.36%) respectively. This indicates that researchers in non-university-based research institutions do publish research articles, but at a lower level compared to university-based researchers with just the International Institute of Tropical Agriculture (the only non-university research institution) appearing among the first ten research institutions with the highest research output of published research publications in Nigeria. This will definitely affect the visibility of researchers and the availability of local research information for researchers in terms of meeting their information needs.

The research output of FIIRO will go a long way in solving the problems of information needs and information-seeking behaviour of the industrial researchers of the institute. FIIRO research that are publishable in peer-reviewed journals (both print and electronic), conference proceedings, books, and so on can be deposited in the FIIRO library and made available to other researchers both within and outside the institute. These research outputs

will augment FIIRO's collection outlook and utilisation of research materials, boost research visibility of FIIRO/FIIRO researchers and attract collaborative research towards addressing issues surrounding information needs and information-seeking behaviour of industrial researchers at large.

1.2.1.2 Constraints affecting research output in Nigeria

Yusuf (2012:321&325) puts forward constraints constituting serious limitations to the research output/capacity of research institutions (for both university-based and non-university based research institutions), which include poor motivation, poor/irregular funding, obsolete research infrastructure, lack of research skills in modern methods, inadequate qualified research personnel and poor linkage between researchers and the industrial sector. Yusuf (2012:324) stresses that it is difficult to appraise research capacity because available statistics on the research capacity of Nigerian research institutions are limited. Similarly, Okafor (2011:3) and Ani and Onyancha (2012:145) maintain the fact that there is no database in Nigeria to carry out research output studies. In addition, Okafor (2011:3) observes that researchers who have carried out studies on research output used questionnaires to study different professionals. These studies were not comprehensive enough.

In the present day, where all the above listed limiting factors hamper the visibility of the research output/capacity of research generated by Nigerian researchers, it is unlikely to see the information needs of researchers being met as they require information for the developmental projects they carry out. This will slow down socio-economic growth and development.

1.2.2 Federal Institute of Industrial Research Oshodi, Nigeria

Each and every time an organisation is investigated, context is an important element that is considered within the information behaviour literature and this is well exposed in the works of renowned researchers in the literature and information systems (LIS) field, specifically, Case (2002, 2006, 2007, 2012); Ingwersen and Järvelin (2005); Choo (2009); Savolainen (2007, 2009); Julien, Pecoskie and Reed (2011) and Stilwell (2010). Case (2008:26) observes that a noticeable viewpoint of human information behaviour is

the organisation in which the behaviour arises. This is also especially important in organisational settings because it is often the first step in organisational change efforts (Johnson 1996:3) and adaptation to new conditions that might arise (Choo 1998:3). Organisational settings tend to be volatile; therefore, information is crucial to decision-making and problem-solving (Choo 1998:24). Besides, information can be a form of social support that allows for coping with organisational life (Johnson 1996:3).

The Federal Institute of Industrial Research Oshodi (FIIRO), Nigeria, was established in 1956 (Adeboye 1988:5, Onilude & Apampa 2010:1). It is a parastatal organisation under the agency of the Federal Ministry of Science and Technology. The broad mandate of FIIRO is to assist in accelerating industrialisation process of Nigeria through finding utilisation of the country's raw materials and upgrading of indigenous production techniques (Adeboye 1988:6, Onilude & Apampa 2010:1). There are a total of 171 multidisciplinary researchers at FIIRO with professionals such as microbiologists, biochemists, agriculturists, food technologists, breeders, textile technologists and engineers (Adeboye 1988:6, Federal Institute of Industrial Research Oshodi. 2016. Letter, 19 May). All 171 researchers are located at FIIRO office in Lagos (Federal Institute of Industrial Research Oshodi. 2016. Letter, 19 May). The number of researchers is shown in Table 1.1

Table 1.1: Departments and number of researchers in FIIRO (FIIRO Documentation Department 2016:1)

Department	**Number of researchers**
Food Technology	45
Project Development & Design	31
Biotechnology	37
Chemical Fibre & Environmental Technology	35
Production, Analytical & Laboratory Management	19
Planning, Technology Transfer & Information Management	4
Total	**171**

FIIRO as a research institute stands out and its uniqueness informs this study emanating from its broad mandate to accelerate the industrialisation process in Nigeria and has over the years developed technologies that have promoted the ideals of industrial and national development. Such technologies have come from alternative raw materials sourced

locally (conserving foreign exchange), improvement of nutritional content of food intake through adequate food processing techniques and locally fabricated machines and equipment (all done by FIIRO researchers) with corporate organisations, governments, NGOs, international organisations, donor agencies, and the academia identifying and impressed with the unequalled strides of FIIRO R&D pursuits (FIIRO 2016b). This by inference means that FIIRO would have excellent researchers from which information on information needs and information-seeking behaviour of their industrial researchers can be obtained and consequently help in no small measure in addressing the gaps in researchers' information needs and information-seeking behaviour.

1.2.3 The Federal Institute of Industrial Research Oshodi Library

The Federal Institute of Industrial Research Oshodi Library is a special library established in 1957 out of the necessity to provide information support to research and development activities of the institute (FIIRO 2016a). Olaifa and Oyeniyi (2014:257) state that special libraries (research libraries) in Nigeria are found in research institutes with the number of research libraries being the same as the number of research institutes in Nigeria. Therefore, the FIIRO library is among the special libraries of many research institutes operating under the auspices of the Federal Ministry of Science and Technology in Nigeria. FIIRO was quick to realise that the accomplishment of its mandate would not be possible without effective and efficient information support even more so with technology and industry where availability of information determines the rate of industrialisation (FIIRO 2016a)

The FIIRO library is a section under the Library and Documentation Division directly reporting to the directorate of Planning, Technology Transfer and Information Management and it is saddled with the responsibilities of providing expertise information flow to her parent body (i.e. FIIRO), industries, and educational and government institutions (Onilude & Apampa 2010:1). In a bid to achieve the above, scientific, technical, economic and administrative information materials are acquired and processed to enhance accessibility and use (FIIRO 2016a). The resources in the FIIRO library include books, journals, abstracts, directories, standards, trade catalogues, photographs and video recordings, research reports, technical memoranda, seminar papers, industrial

profiles and other publications of her parent body with librarians that process these materials (FIIRO 2016a).

The FIIRO library has six full-time and two part-time employees of whom five are professional librarians and three are library assistants. Three FIIRO library employees have a tertiary education degree in library science with one out of the three possessing a master's degree in library science. Two staff members have a higher national diploma (HND) in library science, with the remaining three staff members having an ordinary national diploma (OND) in different disciplines. Three of the professional librarians (information specialists) are assigned to support the information needs of specific departments. Their departmental support services include collection development, creating subject portals, literature searches, alerting services, and providing support and advice on copyright (FIIRO 2016a).

The mission statement of the FIIRO library is to be an information dissemination gateway in support of research and development activities for technological advancement and the vision statement is to be a reputable centre in the management of scientific and technical information for public and private organisations towards the development of the national economy (FIIRO 2016a). However, this section comprises the following four units:

- Collection development unit: This unit performs a cluster of activities that together shapes the library holdings. These include selection of materials for acquisition, placing of order on management approval of selected materials, checking of arrivals against order list, stamping, accessioning, cataloguing and classification, preparation of catalogue cards.
- Circulation unit: This is the image-maker of the library. It is the first point of call to any user visiting the library. The unit coordinates the day-to-day activities targeted towards the library users. The activities include checking clientele in and out of the library, users registration, loan services, collating of daily statistics of library use, and promotion and sale of the institute's publications.
- Serial unit: This unit is in charge of all serial publications - journals, abstracts, newspapers, magazines, etc.

- Audio-visual unit: This unit is responsible for the recording of video and photograph taking of the institute's events. The responsibility for the final production of the video recorded or photograph taken also rests on the unit. It is also charged with the responsibility of operating projectors during divisional seminars and official events outside the institute. Storage and maintenance of all audio-visual materials is also the responsibility of this unit.

1.3 STATEMENT OF THE PROBLEM

Kumari, Kumari and Devi (2013:64) submit that information plays a critical role in different arenas of knowledge, decision-making, cultural growth, economic planning, development and research. Therefore, the continued existence of science and technology depends on research (Goldemberg 2003:1-2), which makes it essential to find out what the actual information needs of researchers are considering the role that science and technology play in the socio-economic life of developing nations like Nigeria (Idiegbeyan-ose et al. 2014:144). Idiegbeyan-Ose et al. (2014:144) further observe that, there has been widespread lamentation by several researchers that there is a need for empirical research into the information needs of scientists, technologists and researchers – and by inference, their information-seeking behaviour to this end. Chikwe et al. (2015:45) stresses that the facilities and materials (such as periodicals and books) needed for meaningful research and the provision of information to researchers are difficult to obtain in research libraries. These statements imply that researchers in Nigeria urgently need to know how their information needs and information-seeking endeavour will be adequately addressed in order for their research information needs to be qualitatively attended to in the course of their research undertaken.

Many of the investigations into information needs and information-seeking behaviour in the existing literature addressed researchers in an academic setting with few addressing researchers in an established federal research institution like FIIRO. Adigun, Kotso and Kolajo (2013:157) emphasise on the changing roles of academic and research institutions libraries on the scholarly information landscape using an academic setting as their case study, but research institutions librarians and their relationship with science and technology researchers in terms of the provision of these modern information sources in a

federal research institution setting were not covered in their research. Okonoko et al. (2015) provide insight into the challenges associated with information-seeking behaviour of researchers in Nigerian libraries such as information being scattered in too many sources, which is a pointer to the challenge of information explosion resulting from the 'adoption' or recent gigantic advancements in the field of ICTs. However, the study focused on a cross-sectional survey of researchers in Nigerian academic institutions libraries and not necessarily on the information-seeking behaviour of researchers in a federal institution. Ivwighreghweta and Onoriode (2012) focused on opportunities and challenges to Nigerian researchers with respect to open access resources and scholarly publishing. The study used an academic setting (a university) as case study pointing out the observable behaviour of the lecturers as users appreciating the usage of open resources and benefits being in need of guidance as to proper user usage. The study did not necessarily address the need to guide researchers in the usage of open access resources and publishing in a federal research institution setting.

Furthermore, Kadiri and Adetoro (2012:24) stress that the noticeable consequence of the challenge of information explosion has brought about the challenge of too much information everywhere in the industrial sector, economic sector, science and technology sector and education sector making the act of information seeking by researchers complicated. Consequently, there is an obvious challenge of improving the methodology of seeking information to address information needs. Although, Kadiri and Adetoro's study addressed the information explosion and the challenges of ICT utilisation in Nigerian libraries and information centres, it did not address the impact of ICTs vis-à-vis the challenge of information explosion on the information-seeking behaviour of industrial researchers in a federal research institution.

The researcher worked at FIIRO during his industrial training programme for his Masters in Information Science degree where he met researchers seeking information on various aspects of their research undertaking. Although several information sources and services are currently provided to researchers at the Federal Institute of Industrial Research Oshodi (FIIRO) Nigeria by the FIIRO library, it is not clear if they are meeting the information needs of researchers fully. While these information sources and services are

being provided, the question to be asked is whether these FIIRO researchers are reaping the benefits and finding adequate information for their research endeavours. Does the FIIRO library and librarians satisfy the researchers' information needs? This study is set to investigate this.

With many of the investigations into information needs and information-seeking behaviour in extant the literature addressing researchers in an academic setting and not industrial researchers in a reputable federal research institution in Nigeria like FIIRO, it means that researchers in such a federal institute of industrial research need to be studied sufficiently to know and address their research information needs to aid industrial development. More in-depth knowledge is needed by stakeholders to address the information needs of this information user group (FIIRO's' researchers) and it is necessary for the library management staff to know what exactly the information needs and information-seeking behaviour of FIIRO researchers are in order to make provisions for more effective and efficient support in this direction.

This current study seeks to provide a detailed investigation and analysis of the information needs of researchers at FIIRO as they seek information for research and suggests solutions for better provision of access to and utilisation of information. This study will provide the proper identification of the information needs and information-seeking behaviour exhibited by FIIRO's' researchers with a view to systematically a possible excellently effective information process in obtaining the right type of information for researchers in Nigeria. Furthermore, this study will determine how and to what extent the different research methods to be used in this study will be able to contribute to research and insight into the information needs and information-seeking behaviour of researchers in order to make recommendations for future research on this topic. Therefore, the study filled an important research gap in the field of user studies and the use of information for research by researchers towards significantly contributing to national development in Nigeria, which is one of the core subject areas in information science as a discipline.

1.4 AIM OF THE STUDY

The aim of the study was to investigate the information needs and information-seeking behaviour of researchers at FIIRO.

1.5 OBJECTIVES OF THE STUDY

In order to achieve the aim, the research objectives were as follows:

- To examine the information needs of FIIRO's researchers in Nigeria.
- To analyse the information sources used by FIIRO's researchers in Nigeria.
- To evaluate the accessibility of information by FIIRO's researchers in Nigeria.
- To assess the factors affecting information-seeking behaviour of FIIRO's researchers in Nigeria.
- To assess the level of the adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria.
- To determine the purposes of ICT resources and services to FIIRO's researchers in Nigeria.
- To examine the influence of recent technologies on the information needs and information-seeking behaviour of FIIRO's researchers.
- To make recommendations on how information services offered by the FIIRO library can be improved upon based on the understanding of FIIRO's researchers' experiences on information seeking.
- Develop a model for researchers' information behaviour towards building a theory to address their information needs.

1.6 RESEARCH QUESTIONS OF THE STUDY

From the stated objectives of the study, the study sought to answer the following research questions:

i. What are the information needs of FIIRO's researchers in Nigeria?
ii. What are the information sources that are used by FIIRO's researchers in Nigeria?
iii. How do FIIRO's researchers in Nigeria access information?

iv. What are the factors affecting the information-seeking behaviour of FIIRO's researchers in Nigeria?

v. What is the level of adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria?

vi. What is the purpose of ICT resources and services to FIIRO's researchers in Nigeria?

vii. What is the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers?

viii. How can information services offered by the FIIRO library to FIIRO's researchers be improved upon based on the outcome of this study?

Table 1.2: Illustration of relationships between objectives, research questions, population and possible sources of data

OBJECTIVES	RESEARCH QUESTIONS	POPULATION	SOURCES OF DATA
To examine the information needs of FIIRO's researchers in Nigeria	What are the information needs of FIIRO's researchers in Nigeria?	Researchers/Librarians	Questionnaires/ Interviews/Content analysis
To analyse the information sources used by FIIRO's researchers in Nigeria	What are the information sources that are used by FIIRO's researchers in Nigeria?	Researchers	Questionnaires/ Interviews/Content analysis
To evaluate the accessibility of information by FIIRO's researchers in Nigeria	How do FIIRO's researchers in Nigeria access information?	Researchers	Questionnaires/ Interviews/Content analysis
To assess the factors affecting information-seeking behaviour of FIIRO's researchers in Nigeria	What are the factors affecting the information-seeking behaviour of FIIRO's researchers in Nigeria?	Researchers	Questionnaires/ Interviews/Content analysis

To assess the level of availability and adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria	What is the level of availability and adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria?	Researchers	Questionnaires/ Interviews/Content analysis
To determine the purposes of ICT resources and services to FIIRO's researchers in Nigeria	What is the purpose of ICT resources and services to FIIRO's researchers in Nigeria?	Researchers	Questionnaires/ Interviews/Content analysis
To examine the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers	What is the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers?	Researchers	Questionnaires/ Interviews/Content analysis
To make recommendations on how information services offered by the FIIRO library can be improved upon based on the understanding of FIIRO's researchers' experiences on information seeking.	How can the information services offered by the FIIRO library to FIIRO's researchers be improved upon based on the outcome of this study?	Researchers/Librarians	Questionnaires/ Interviews/Content analysis/ Observation

1.7 SIGNIFICANCE OF THE STUDY

The importance of this study lies primarily in exploring the context in which it occurs, that is, the Federal Industrial Research Institute, and the research pressure that is placed on

researchers that drives them into the act of information seeking in order to have their research information needs satisfied. This study is significant because it describes and analyses the information needs and information-seeking behaviour of industrial researchers studying the Federal Institute of Industrial Research Oshodi in Nigeria (a foremost industrial research institute in Nigeria). A main reason for choosing this population is because these researchers have never been investigated before as a separate group of users in relation to their information needs and information-seeking behaviour. More importantly, however, these researchers were chosen because of their diversity in terms of research areas and sub-disciplines.

As stated earlier in section 1.3, there have been lamentations by different researchers that there is the need for empirical research into the information needs of scientists, technologists and researchers in Nigeria. At present, Nigeria is going through an industrial reform programme, which has thus far seen crucial changes in industrial research establishments with the primary aim of bringing about industrial growth and development. This has also resulted in industrial researchers seeking research information in a significantly increased fashion to facilitate the process of carrying out more research undertakings to record an equally significant level of increase in research output that contributes to national development. However, this cannot be achieved until the information needs of researchers are met appropriately and adequately.

The findings emanating from this study will assist in improving the services offered to researchers by research libraries and information centres. It would also enable decision makers to improve and update their research policies in order to aid the excellent undertaking of research. The findings also aimed at making research support available in science and technology and related fields.

The study aimed to contribute to the growing literature on information needs and information-seeking behaviour and to the researcher's knowledge in this area of study. The study is expected to provide useful research output that can be used widely within institutions of higher learning. It also seeks to add to pertinent information materials that can be offered to industrial researchers.

1.8 RESEARCH METHODOLOGY

Research methodology is the basic framework underlying and unifying any research project (Leedy & Ormrod 2010:6). It entails complete designs and frameworks utilised for a particular research (Lapan, Quartaroli & Riemer 2012:1). For this study, both quantitative and qualitative approaches were adopted because it sought to gain an in-depth undestanding of the phenomena of – information needs and information-seeking behaviour of researchers at FIIRO Nigeria. Quantitative and qualitative data were obtained and analysed in this study. The data were obtained using the questionnaire, interview, observation and content analysis research instruments as elaborated in Chapter Four. Quantitative data that were generated from the data collection instruments were analysed using the Statistical Package for the Social Sciences (SPSS).

The research design in this study was a case study. However, the complete research methodology is discussed under the research methodology chapter, Chapter Four of this research study.

1.9 ORIGINALITY OF THE STUDY

Although many studies have been done on the information needs and information-seeking behaviour of researchers, very few focused on multidisciplinary industrial researchers in a federal industrial research setting like FIIRO, Nigeria. Therefore, the study will provide invaluable insight into the information needs and information-seeking behaviour of industrial researchers. This might also hold value for research on the information behaviour of industrial researchers in general in the Nigerian research environment and African continent at large. The originality of this study also lies in the fact that it is a single-case study research with the positivist paradigm being adopted for the study. Therefore, this study will provide invaluable insight of this viewpoint. The research will also identify gaps in addressing the information needs of this particularly chosen single-case study user group to improve library services.

1.10 SCOPE AND LIMITATIONS OF THE STUDY

As stated by Mugenda and Mugenda (1999:41), the scope of a study represents the area, extent or latitude that a study covers. Likewise, Simon and Goes (2011) refer to the

scope of a study as the parameters under which the study will be operating. It makes as clear as possible what is to be studied and what factors are within the accepted range of the study. Mugenda and Mugenda (1999:41) also express that the limitations of a study deal with the restrictions that are imposed on the research. They further refer to limitations as matters and occurrences that arise in a study which are out of the researcher's control. Limitations limit the extent to which a study can go, and sometimes affect the end result and conclusions that can be drawn. Irrespective of how a study is conducted and constructed, it must have limitations.

Therefore, the study was conducted with the following guidelines:

- Subject coverage - this study described the research system in Nigeria and investigated the information needs and information-seeking behaviour of the researchers at the Federal Institute of Industrial Research Oshodi, Nigeria as they carry out their functions as supported by the institute's library and other information services. Information services include various information systems used to communicate and transmit information.
- Purpose limitations - the study investigated the information needs and information seeking-behaviour of researchers at FIIRO, a parastatal organisation under the jurisdiction of the Federal Ministry of Science and Technology. Included were the Departments of Food Technology, Project Design and Development and Chemical, Fibre and Environmental Technology. Others were Biotechnology, Production, Analytical and Laboratory Management and Planning, Technology Transfer and Information Management. Although this study acknowledged the existence of other research institutes and organisations dealing with science and technology and its related subjects, these research institutes and organisations were not the focus of this research. Researchers were chosen because of the important roles they play in generating new knowledge through painstaking research. Also, five profesional librarians of the institute's library were also interviewed to add credence to the information obtained from the researchers.

- Considering the actuality that the study was limited to the information needs and information-seeking behaviour within the library and information science

discipline, it did not emphasise on assessment from a psychological viewpoint but rather on the viewpoints of the researchers and their information needs/information-seeking behaviour from the library and information science standpoint.

- Political limitations - although Nigeria is divided into six geopolitical zones with the citizens belonging to different tribes, this bias is not reflected in my study. The study addressed the research questions as they appeared observably prevalent without any deliberate political bias towards any geopolitical zone or tribe.

1.11 LITERATURE REVIEW

A literature review was conducted of theoretical and empirical research findings on the information needs and information-seeking behaviour of researchers. These findings contributed to an understanding of the information needs and information-seeking behaviour of researchers in general. There is also the fact that information for research is not adequately provided to satisfy the research needs of researchers in addition to the fact that the information-seeking behaviour of researchers is poor. Research models that have been developed to explain information needs and information-seeking behaviour were studied in order to identify the research approach that could be used for this study. One of these models is used as a framework to systematise and interpret the empirical findings on the information needs and information-seeking behaviour of researchers at the Federal Institute of Industrial Research Oshodi in Nigeria. However, the complete literature review is clearly studied in Chapter Two of this study.

1.12 DISSEMINATION OF FINDINGS

According to Harmsworth and Turpin (2000), the term dissemination can best be described as the "delivering and receiving of a message", "the engagement of an individual in a process" and "the transfer of a process or product". It involves the dissemination of awareness, dissemination for understanding and dissemination for action. Ocholla (1999:141) further states that the possession of information without it being well disseminated is useless and research is incomplete until it is disseminated. The findings of this study will be disseminated as follows:

- Through the printed form of the thesis stored in the libraries of the University of South Africa and the Federal Institute of Industrial Research Oshodi, Nigeria.
- Publication of this thesis (online and having extracts published as research papers in reputable international printed research journals).
- Presentation of the findings at conferences, in seminars and workshops.

1.13 ETHICAL CONSIDERATIONS

Robson (1993:29) points out that ethics can be referred to as the rule of conduct and it has to conform characteristically to a code or set of principles. Leedy (1997:116) expounds that ethics principles stipulate that research should never be conducted under circumstances in which total disclosure of the aims and purposes of the research cannot be set forth or should any subject be enticed into cooperating in the research endeavour without knowing fully what participation in the study will entail and what demands may be made on him or her. The National Committee for Research Ethics in Norway (2006:5) define research ethics as a concept that refers to a complex set of values, standards and institutional schemes that help constitute and regulate scientific activity. Fouka and Mantzorou (2011:4) elucidate that research ethics involve requirements on daily work, the protection of dignity of objects and the publication of the information in the research. They argue that ethics is rooted in ancient Greek philosophical inquiry of moral life and that ethics is the branch of philosophy that deals with the dynamics of decision-making concerning what is wrong or right.

The National Committee for Research Ethics in Norway (2006:6) pinpoints that research must be regulated by ethical standards and values, irrespective of the fact that confusion and conflicts can arise given that research brings new insights and possibilities. The committee explains further that ethical standards have to do with ethical responsibilities related to the research process. These standards are broadly divided into three main categories, namely:

- Standard for freedom of research, good research practice associated with research's request for truth and independence, and the relationship between researchers.
- Standards that regulate relationships with individuals and groups directly affected by the research
- Standards regarding social relevance and users' interests and regard for cultural reproduction and rationality in the public debate.

The Unisa (2013:16) document on ethics of research underlines that researchers should uphold the ideals of privacy, anonymity, and confidentiality of information while collecting, creating, storing, accessing, transferring and disposing of personal records and data under their control, be it written, automated or recorded in any other medium, including in computer equipment, graphs, drawings, photographs, films or other devices in which visual images are represented.

Human beings are usually subjects of study in social science research and are referred to as participants. (Ani 2013:132) indicates that a good researcher should carry out his or her research project without harming the respondents and should also gain respondents' confidence at every stage of the work. Unisa (2013:11) stresses that participants should be seen as indispensable partners in research for the research to achieve its goal of being doable and able to contribute to the wealth of knowledge in a discipline. Every researcher should strive to protect the right to privacy and interests that the participants in a research work hold so dearly. Nachmias and Nachmias (2005:81) indicate that a consent form should be given to every participant in a research work, which must be duly signed and collected before the commencement of the research. Taylor (2000:7) supports this by saying that the subjects participating in a research study must be offered a choice to determine if they want to participate or not.

In adherence to strict ethical issues for the current study, a covering letter was attached to each data collection instrument in order to comprehensively explain the purpose of the study with the aim of seeking voluntary informed consent from respondents and obtaining their permission to be involved in the research (Fisher & Anushko 2008:99). The study gave respondents and participants the freedom to choose their right of

participation with their privacy held with the utmost discretion. With respect to confidentiality, the researcher did not include any section for the respondents to append their signatures or fill in their names, thereby gaining the confidence of the respondents. The researcher also obtained official permission from the management of FIIRO to carry out the research.

1.14 DEFINITIONS OF KEY TERMS

This section describes the key terms relevant to this study.

1.14.1 Information needs

An information need commences when a person identifies a problematic situation or what is otherwise called a knowledge gap, in which his or her knowledge and beliefs, and the representation of the environment fail to recommend a path towards the satisfaction of his or her goals (Case 2007:333). Ingwersen and Järvelin (2005:20) stress that such identification of information needs may lead to information seeking and formulation of requests for desired information.

1.14.2 Information-seeking behaviour

Information-seeking behaviour is the purposive seeking for desired information to satisfy information need(s) in order to achieve some goals (Wilson 2000:49). In this present study, information seeking encompasses the entirety of information-related products and services that researchers perceive to have a possible purpose to fill current knowledge gaps with respect to the research they are carrying out.

1.14.3 Industrial research

Research means the examination of inadequate and limited knowledge by assessing known information, defining “unanswered questions” and drawing up organised methods to answer them in meaningful ways. The focus of this study is that of scientific and technological research under the umbrella of industrial research carried out at FIIRO. InnoviSCOP (2016) says industrial research is “planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products,

processes or services or for bringing about a significant improvement in existing products, processes or services".

1.14.4 Industrial researcher

It is hard to define the term "researcher" in a single way. It should be noted that not all researchers are associated with or connected to research or academic institutes (Webb et al. 2007:36). In the present study, the term "researcher" refers to industrial researchers at a research institution. It will include all relevant researchers in research departments carrying out institutional research projects.

1.14.5 Professional librarians

Several terms have been used to describe librarians supporting the information needs of researchers. Such terms include, "subject librarian" (Pinfield 2001), "reference librarian" (Hart & Kleinveldt 2011) or "library and information professional" (Pantry & Griffiths 2009). In the present study, the term "professional librarian" is used for librarians supporting the information needs of researchers at a research institution.

1.15 STRUCTURE OF THE THESIS

The thesis is distinctly structured according to following six chapters:

Chapter One: Introduction and background to the study

This chapter provides the introduction and conceptual setting, contextual setting, motivation and statement of the problem, aim of the study, objectives of the study, scope and limitations of the study, significance of the study and the organisation of the study.

Chapter Two: Literature review

This chapter provides a review of the literature related to the study. It mainly includes all related studies previously done in relation to the information needs and information-seeking behaviour of researchers. It also reviews their information-seeking behaviour and sources used. The chapter discusses the adoption of ICTs by FIIRO's' researchers as they seek for information and it outlines the various information services used.

Chapter Three: Theoretical framework

This chapter discusses the theoretical framework of the study. It first covers the literature on information-seeking models and puts forward Wilson's 1999 model of information behaviour as the choice model used for the study. It explains the model and justifies the applicability of the model to the present study.

Chapter Four: Research methodology

This chapter describes the research design and methodology. It identifies the population and sampling techniques applied in the study. Among other issues, it discusses the approach adopted, the data collection procedures, the validity and reliability of the instruments used in the data collection process used to collect both qualitative and quantitative data. It also discusses the data analysis process, which includes SPSS.

Chapter Five: Analysis, interpretation and discussion of data

This chapter presents and analyses the data collected through data collection tools used for the purpose of the study. These include data from questionnaires, observation, content analysis instruments and data collected from interviews. Research data are presented in the form of tables. Frequencies and percentages facilitate the proper presentation and understanding of the collected research data for further discussion purposes.

The selected theoretical framework of the study, which is Wilson's 1999 model of information behaviour, created a framework for interpretation of the research data collected. In addition, the findings of previous related information-seeking behaviour studies reviewed in Chapter Two of this study were further compared to the findings of this study in order to gain insights into the information-seeking behaviour of researchers. This chapter also discusses the research findings as presented in the light of the literature review and the research questions underpinning this study. In this chapter, a holistic view of this study is provided, and problems and insights are highlighted.

Chapter Six: Summary of findings, conclusions and recommendations

This chapter includes the summary of findings, conclusion and recommendations of the study in line with the research questions underpinning the study and the results of the study as they are discussed and interpreted in Chapter Five. In this chapter, the conclusion is based on the summary of findings which leads to the formulation of relevant recommendations with suggestions for further studies.

1.16 SUMMARY

The chapter introduced and presented a conceptual and contextual background of the study and outlined the aim, statement of the problem, objectives, research questions, motivation, significance, and scope and limitations of the study. In this chapter, the importance of the study has been articulated and, consequently, the foundation of the study has been laid. The proposed structure of the thesis was also outlined.

The next chapter provides a review of the literature related to information needs and information-seeking behaviour as it relates to researchers.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the literature review for the study. Neuman (2011:111**)** states that literature review centres on the assumption that knowledge accumulates and that people learn from and build on what others have done. Similarly, Bowers and Stevens (2010:94) observe that the literature review creates a strong foundation to rely on when building the entire research project. Therefore, in literature review formation, the researcher should focus only on germane literature in order to answer the poised research questions satisfactorily (Blaikie 2010:18). In addition, the literature review largely plays an indispensable role in establishing theoretical roots of the research project, systematically identifying and explaining fundamental ideas, and empirically developing the research methodology (Kumar 2011:31).

A literature review aims to establish the project under study within current research works (Boote and Beile 2005:3). It recognises and fills gaps in the researcher's knowledge (Kumar 2011:31-32; Vithal & Jansen 2004:14) and reveals where the present study fits into the wider debates and, in this way substantiates the significance of the study (Pather 2004:72). For the intention of writing a thesis or dissertation of a project, the review of existing literature frequently occurs as a chapter itself (Blaikie 2010:17-18) as will be the case with this study. Stilwell (2000:173) emphasises the fact that the review of the literature needs to reveal the dissimilar views, agreements, disagreements and developments of thought on the topic of research which has to be precisely described and acknowledged in the text. Similarly, Babbie and Mouton (2009:566) also maintain that a review of the literature must bring to light the foremost trends, arguments and disagreements.

With the above in mind, the literature review for this study contributes to a better understanding of the main research components of the present study and yields a great deal of insight on the information needs and information-seeking behaviour of researchers. This involves identifying the patterns of information seeking and use, as well

as the sources available and how they are used. It also involves looking at potential sources of information that may not be known to the researchers and how their availability could help fill perceived gaps in adequately meeting their information needs. This would be done by identifying research on the subject and related topics of interest published in peer-reviewed journals, theses and dissertations, grey literature and electronic records.

Significant research has been conducted on information needs and information-seeking behaviour in Africa. For example, Adelani (2002), Akinola (2009), Nel (2015), Nnadozie and Nnadozie (2008) and Idiegbeyan-ose et al. (2014) focused on information needs and information-seeking behaviour, albeit in the academic setting; Mugwisi (2013) and Nwosu (2009) focused on information needs of agricultural researchers and Acheampong and Dzandu (2015) focused on information-seeking behaviour of crop researchers; Oguche (2013) focused on the information needs and information-seeking behaviour of researchers in the Nigerian Institute of Advanced Legal Studies; Okonoko, Njideka and Mazah (2015) focused on the information-seeking behaviour of researchers in Nigerian libraries from a librarian's perspective; Ingwersen and Järvelin (2005) and Beaulieu (2003) proposed a cognitive framework which considers the combination of information-seeking and retrieval research within the LIS field; Yusuf (2012) focused on information needs, sources and the information-seeking behaviour of artisans in Nigeria; Ikoja-Odongo and Mostert (2006) reviewed major studies that focused on the concepts of information behaviour, needs, seeking and use and also look at the context of information behaviour to be considered as the foundation for any research in this field; Acheampong and Dzandu (2012), Nwabueze, Anyira, Ivwighreghweta and Onoriode (2010), Raju, et al. (2015) and Ugah (2008) focused on the role of libraries and information centres; Kamba (2008) focused on the role of ICTs; Nwachukwu, Abdulsalami and Salami (2014) and Ugah (2007) focused on information accessibility to users and Akande (2014), Ansari (2013), Ayoku and Okafor (2015), Itsekor and Ugwunna (2014), Kamba (2011), Ojiegbe (2010) and Okoye (2013) focused on ICT skills and competencies of librarians towards providing quality information services to users.

The current study is distinct from the above mentioned studies in the information behaviour field in that it is a single-case study that focused on the information needs and information-seeking behaviour of industrial researchers of different disciplines working in a federal research institute (FIIRO) under the federal ministry of science and technology in Nigeria. This allowed for an in-depth study of the information needs and information-seeking behaviour of FIIRO's' researchers revealing how information services offered by the FIIRO library had helped or not helped in satisfying their research information needs from the African perspective. This would make the FIIRO library to be aware of their information needs and information-seeking behaviour and therefore, information services would be tailored to satisfy revealed information needs.

2.2 STUDIES OF INFORMATION NEEDS

In view of the fact that the concept of information needs ultimately differs from one group to another, this section mainly contextualises the information needs in relation to the present research. It then focuses on the existing literature concerning the information needs of researchers. It is vital to primarily understand the concept of 'information' and then progress to the discussion of information needs. The term 'information' will be explained along with the two other related concepts, data and knowledge as they will appropriately throw more light on information and information needs. The word 'information' was spelt out earlier in order to contextualise the implication for the appropriate use of the word in the study of the information needs and information-seeking behaviour of researchers.

2.2.1 Data, information and knowledge

Shannon and Weaver (1949) perceive data as informative to the extent to which they are intrinsically capable of reducing pre-existing uncertainty about the state of nature. Cong and Pandya (2003:26) describe data as "raw facts". Ikoja-Odongo and Mostert (2006:146) maintain that data refers to "measurements and representations of the world around us". Tiamiyu (2005:11) is of the opinion that the communication chain model begins by identifying data as the primitive symbols for communicating ideas. Tiamiyu stresses that data could be textual, numerical, graphical, pictorial, or even sound.

Giannetto and Wheeler (2000:3) reveal that through a process of change, data become systematically arranged and processed data denote information. Similarly, Gamble and Blackwell (2001:143) maintain that information is a result of processed data but in a meaningful form. Case (2002:62) further argues that information can be described as "data that has been gathered, processed and analysed to provide a useful result called information". Feather and Sturges (2003:244) agree with other researchers that were mentioned earlier. They maintain that data develops into information by the time it has been organised, analysed and given appropriate value in a meaningful and relevant manner for present or future use.

McCreadie and Rice (1999:46) present a very brief summary of the current concepts defining information. As stated by them, there are currently four major assumptions about information. They are as follows:

- Information as commodity/resource: in this case, information is considered as a physical commodity with market value which can be produced, purchased, replicated, distributed, manipulated, passed along, controlled, traded, and sold.
- Information as data in the environment: this perception considers information to entail readily available data from an individual's environment. There is the deliberate and accidental communication of this data for human processing and is achieved from objects, artefacts, sounds, visual and tangible phenomena, events or natural phenomena.
- Information as a representation of knowledge: information is considered to be a representation of, or a pointer to, knowledge. Documents in printed form such as books and journals are assumed to be the primary repositories of knowledge. However, recent technological advances in electronic media have provided alternative options as primary repositories of knowledge.
- Information as part of the communication process: this is when meanings are seen to be characteristic of people rather than of words or data, and factors that include timing and other social and personal factors influence the processing and interpretation of information.

Ikoja-Odongo and Mostert (2006:146) and Hayes (1993) reveal the "colloquial uses" and the variety of definitions of information across disciplines. They also observe the challenges that arise from the interchangeable use of the concepts of data, information and knowledge. Case (2012:50) further expresses that information suggests three main senses. He justifies the work of Buckland (1991:351) that identifies three principal users of the word 'information' and the stance of McCreadie and Rice (1999). These senses are:

- Information-as-process: This is when someone is informed and what s/he knows is changed information and, in this sense, this is referred to as the act of informing or communicating knowledge or 'news' of some fact.
- Information-as-knowledge: This is when information which is new to a recipient is useful for the reduction of uncertainty and improves existing knowledge. Information in this sense refers to the knowledge of the fact, subject or event, which, when assimilated, changes the recipients existing knowledge.
- Information-as-thing: This has to do with information being characteristically referred to as objects, such as data in documents because they are regarded as being informative, or having the quality of communicating information or imparting knowledge.

Wilson (2006:659) recognises the challenges with defining information, revealing that various definitions have been devised that seek to distinguish the concepts of data, information and knowledge, and, recently, efforts have been made to delineate the unique definition of the concept of information as it is particularly used in the field of information science. This Wilson blames on the failure to suitably use definitions to the level and purpose of investigations. In the context of user studies as seen in information science, Wilson (2006:659) proposes that the word 'information' is used to denote a physical entity or phenomenon (such as questions relating to the number of books read in a period of time, the number of journals subscribed to, etc.); the channel of communication through which messages are transmitted (such as when the occurrence of oral versus written information is mentioned); or the factual data that are empirically determined and presented in a document or transmitted orally.

Case (2012:8-9) remarks on ten common assumptions or norms related to the term 'information' (since the late 1970s) from the perspective of communication and information-seeking studies. These comprise the following:

- Only 'objective' information is valuable. It is assumed that users of information have the ability to make rational decisions based on the information received from the environment. Conversely, the reality is that users frequently rely on the first optional solution, instead of uncovering the best possible solution.
- More information is always better. It is practical to consider that having a large quantity of information does not necessarily guarantee that the holder of information is a well-informed person. Although, the possession of sufficient information empowers decision makers with various alternatives, too much of information often leads to information overload, which creates confusion.
- Objective information can be transmitted out of context. Information users may sometimes experience complicated situations when trying to adjust to the surrounding environment or the world they find themselves in as the environment is always dynamic and ever changing.
- Information can only be acquired through formal sources. It is commonly accepted that people are not merely limited to formal sources. The reality is that even in a research environment people (researchers) tend to use both formal and informal sources.
- There is relevant information for every need. This assumption may not apply to everybody or each situation because needs vary from one individual to another and need is situational and not static.
- Every need situation has a solution. Information professionals are skilled to understand customer or user satisfaction and they require a high level of skill to understand the user's needs and expectations. However, in a situation where the information users fail to express their needs, this may lead to a misunderstanding between the information providers and users translating into a misrepresentation of information provided which results in a failure of providing solution to every need situation.

- It is always possible to make information available or accessible. Formal information systems are designed by experts in a way that they can only meet specific information requests or limited needs. Regrettably, information needs are different from place to place and change from time to time.
- Functional units of information, such as books or television programmes, always fit the needs of individuals. Information service providers provide information to people without first finding out from clients as to the kind of information users will need. Consequently, the outcome is that of poor information service which often leads to non-satisfaction from the point of view of the user.
- Time and space concerning individual situations can be ignored in addressing information-seeking and use. This can result in a challenge that borders on communication and information-seeking viewpoints, as it is commonly accepted that needs differ from one individual to another and from one case to another.
- People make easy and conflict-free connections. This perception has the effect of concentrating only to understanding things that are happening around us, instead of identifying the reasons for which people do things differently or act in different ways.

It is imperative to mention that the above ten assumptions reveal everyday information needs and not such needs in the context of the specific needs of people (users) especially industrial researchers being studied in this research. Wilson (2006:659) opines that the actuality that information as a concept does not have one specific definition has regrettably led to researchers frequently failing to use a definition appropriate for the purpose of their investigation. Ikoja-Odongo and Mostert (2006) and Turner (2010) stress that with the diverse definitions of information, there is still the display of a convergence of similar terms like data, information and knowledge and it is important in making vital decisions, judgments and articulating problems or challenges. Case (2012:51) reveals that the different criticisms and distinctions of the concept of information that the different scholars propose should not create confusion, but rather assist in understanding the meaning of the concept called information.

Tiamiyu (2005:11) describes knowledge as the accumulation of information that has been assimilated over time by, and into, a human mind and is thereby deemed unique to the individual. Case (2012:73) observes that information becomes knowledge once a human being forms justified and true beliefs about the world. Nitecki (1985:390) asserts that knowledge as a concept is an abstract, open-ended and ever-changing entity, with the concept shifting as new understanding of the interactions between different aspects of reality emerges. Sallis and Jones (2002:6) underscore that formal knowledge essentially appears in a broader range of formats with official policy documents and correspondence files, for instance while informal knowledge is highly intangible. Ackerman, Piper and Wulf (2003:33) stipulate that there are three basic classifications of knowledge. They are:

- Tacit knowledge: This is expressed through action-based skills and cannot be reduced to rules and recipes.
- Explicit knowledge: This can easily be expressed and communicated and it may be object based or rule based (Henczel 2000:4)
- Cultural knowledge: Ackerman, Piper and Wulf (2003:33) reveal that cultural knowledge is based on the application and acceptance of the values and norms of the organisation.

From the standpoint of culture, Holmes (2004:295) maintains that knowledge is often produced through a process of questioning of and assessment of beliefs.

With respect to the relationship between data, information and knowledge, Choo, Dettor and Turnbull (2000:29) signify that "information depends on a collection of data and knowledge based on the accumulation of experience". According to Miller (2002:4), Sveiby distinguished between information and knowledge as shown in Table 2.1.

Table 2.1: Differences between information and knowledge

Information	**Knowledge**
Static	Dynamic
Independent of the Individual	Dependent on individuals
Explicit	Tacit
Digital	Analogue
Easy to duplicate	Must be re-created
Easy to broadcast	Face-to-face mainly
No intrinsic meaning	Meaning has to be personal assigned

Miller 2002

2.2.2 General view on information needs

A ‘need’ is described as the lack of something, which one cannot well do without or a necessity (Chamber 2007, sv ‘need’). A necessity constitutes a basic need without which a problem arises. According to Green [in Case (2007:69)], there are four general conclusions about the concept of needs. These are:

- Needs are always instrumental, that is, they involve reaching desired goals.
- Needs are usually contestable. This makes them differ from wants.
- Needs are related to the concept of necessity. This is to make a distinction between primary and secondary needs in terms of moral weight justification.
- Needs are not necessarily a state of mind and it is possible to be unaware of one’s true needs.

In their review of post-1978 literature on information, Dervin and Nilan (1986:10-12) observed that most studies left the terms ‘information needs’ and ‘information use’ undefined, somewhat suggesting that by knowing how users use or might use systems, one knows what their needs are or might be. By focusing on what the studies seemed to suggest being the evidence of a need, Dervin and Nilan in 1986 came up with the concept of ‘information needs assessment’.

2.2.2.1 Information needs assessment

Dervin and Nilan (1986) suggest six possible different approaches to ‘information needs assessment’, and these are:

i. The demand or system/resource approach: This approach measures the extent to which different kinds of sources, media, systems, documents, materials or channels are used.
ii. The awareness approach: This approach constitutes the set of measurements that focuses on determining respondent’s awareness of current services. The existence of a need is implied when areas of awareness are deemed lower than they ought to be.

iii. The likes-dislikes approach: This approach constitutes the set of measurements that focuses on determining the degree to which people are satisfied or dissatisfied with different aspects of a service. Those aspects that satisfy are seen to indicate a need for more service, while those that do not satisfy are usually seen to indicate a need for a system improvement.

iv. The priorities approach: In the approach that constitutes a set of these measurements, respondents are asked to indicate what they would like the information to be like. Activities or characteristics that are highly prioritised point to the need for the development of the service.

v. The community profile approach: In the approach that constitutes a set of these measurements, demographic and environmental profiles of a community are developed. These profiles are then used to suggest programme development needs.

vi. The interests, activities and group membership approach: In these measurements, respondents are asked to state their interests, activities and group membership. Extrapolations are then made from the data to suggest programme development needs.

Dervin and Nilan (1986:11) argue that most of the approaches mentioned above are inhibited by system definitions of what needs are, and they are limited to examining behaviour primarily within the context of user interactions with systems. Devadason and Lingham (1996) also argue that the effectiveness of an information system depends on the extent to which the system's characteristics are in accordance with the outlook of the the user's environment and situation and on the potential of the system to make use of the services provided in the information system. Likewise, the studies of Dervin and Nilan (1986) and Devadason and Lingham (1996) call for the careful identification, analysis and classification of the 'real' information needs of users (including all potential users and non-users) as an essential basis for the planning, implementation and operation of information systems. They identify some of the challenges of information needs identification as follows:

- The same information is perceived differently by different users as the answer to their information needs.

- Researchers require original documents, whereas planners need digests of points of view or opinions.
- Information is put to different uses by different groups of people.
- A need is satisfied by having access to the identified information in a particular package, form, and at a suitable time.
- The flow of information through channels of communication is complex and adds to the complexity of identifying information needs.
- Individual preferences and behavioural aspects add a further dimension to information needs identification.

Chatman (2000:10) opines that individuals will not search for information for their works if there is no need to do so. Belkin, Oddy and Brooks (1982:64) suggest that the need for information to some extent signifies "a statement of what the user does not know". Kuhlthau (1993) emphasises that the need for information developed from the consciousness that something is missing, which demands the seeking of information as a method to be adopted in solving problems. For example, Vickery and Vickery (1992:17) discuss a broad view for the need of information as a citizen may have need of on a daily basis and from time to time in the form of having to obtain information on availability, quality and cost of so many things (these include consumer goods and services, health and welfare services, education and training facilities). They further reveal that the individual with these valuable needs would require different types of general information to satisfy his or her intellectual curiosity with the desire for information ranging from information on current affairs, social and political events, legal matters to financial matters. Vickery and Vickery (1992) and Choo et al. (2000) say that for these needs to be met, information sources have to be consulted (such as newspapers, magazines, television, radio etc.) depending on the needs in question.

Ikoja-Odonga and Mostert (2006:146) stress that information needs have varying definitions because different scholars with differing areas of expertise define the concept differently. Derr (1983:273) describes an information need to be a condition in which a

certain piece of information plays a vital part in the achievement of a genuine or legitimate information purpose. Derr goes further to stress that an information need is a relationship that exists between information and information purposes. In addition, Ikoja-Odongo and Mostert (2006:147) state that "an information need is a requirement that drives people into information seeking". Consequently, an information need is more often than not considered as a cause of information seeking (Kadli & Kumber 2011:1). An information need may begin as an unclear sort of discontent with a particular thing which is characterised by confusion and a perplexing reaction to an indistinct new idea (Kuhlthau 2004:26). The need to get clarity and be knowledgeable about the fuzzy ideal leads to the process of identifying information needs (Zawawi & Majid 2001:25). From the standpoint of information retrievals, Chowdhury (2004:194) pinpoints the characteristics of information need(s) as follows:

- An information need is a relative concept that depends on numerous factors and does not remain constant but changes over a period of time.
- Information needs vary from person to person, job to job, subject to subject, organisation to organisation etc.
- Information needs largely depend on the environment, for instance the information needs of those in the academic environment may differ from those in business or industry.
- Information needs often remain unexpressed or are poorly expressed.
- Information needs often change upon the receipt of some information.

Hjorland (1997:159) and Kaniki (2003:6) point out that certain factors influence the information needs of a user. They include economic status, geographical location, education, recreation, research, availability of information systems and services, awareness of the availability of information systems and services, personal role in social life and culture, among others. They also argue that users' information needs may be professionally oriented or it may be more or less acknowledged. This study investigates factors that influence the information needs of FIIRO's' researchers such as research, finding solution to personal needs, consultation (attending to clients), education, general awareness and so on. This was achieved considering their hierarchy in terms of the way

researchers rank their need for information as provoked by these factors. These factors compel them to require information to solve their problems.

Taylor (1968:182) explains a cognitive approach to information needs which states that an information need develops in a relatively independent manner inside the head of the information user and evolves continuously going through four levels or phases of question formation namely:

- Visceral need: This is the actual but unexpressed need for information. This may be a simple, vague sort of dissatisfaction, which changes in quality and distinctiveness as information is added.
- Conscious need or conscious awareness of an ill-defined area or indecision: It has to do with the mental depiction of the need.
- Formulated need: It is the formal statement of the need. With this, an individual can develop a logical and suitable statement of his question.
- Compromised need: This is a description of the inquirer's need within the limitations of a system and its files.

Case (2012:81-86) discusses information needs on the basis of Taylor's four typologies that were derived from the four levels or phases that were put as seeking answers, reducing uncertainty and making sense, as well as the spectrum of motivations. The first typology of information needs relate to seeking answers as it brings awareness to the origins of information needs (Taylor 1968:182). From the point that a problem evolves, it is insufficient to seek an answer or a solution without taking into account the ways in which and the reason people look for information (Thani & Hashim 2011:137). On this subject, Case (2012:82) uses Taylor's typology of information needs in order to clarify why people seeking help from information professionals, especially from librarians, tend to be more general in expressing their information needs rather than doing so in a specific way. Case (2012:82) takes note that Taylor's typology includes the visceral need which denotes the unexpressed need for information, the conscious need which imitates conscious mental description, the formally used need which refers to the rational statement of need, and the compromised need which points toward an in-depth understanding between information service provider and a requester. The second

typology of the information needs has to do with reducing uncertainty. Information is described as the recognition of the existence of uncertainty in the personal or work-related life of an individual (Ikoja-Odongo & Mostert 2006:149). Consequently, individuals may try to deal with their uncertainties by way of requesting for information (Idiegbeyan-Ose & Akpoghome 2009:22). Ingwersen (1992:27) observes that an action that is essential for gaining knowledge guides the information seeker to the cognition of a stage of uncertainty in the requester's mind.

The third typology of information needs involves sense-making. Sense-making was successfully employed for the first time in the early 1980s through Dervin's work-related communication research and it has also played a fundamental role in the development of relevant studies across different disciplines including information needs, seeking and users' studies (Dervin 1983:3). Savolainen (2010a:1783) reveals that the sense-making theory has inspired some important empirical studies, which include Julien (1999) study that focuses on adolescents' information seeking for career decision making and the study Pettigrew, Durrance and Unruh (2002) that focuses on the ways people use public, library-community network system. Savolainen (1993:16) further shows that the basic activities involved throughout the sense-making approach entail information-seeking, processing, creating and efficient use of information. Dervin (1999:739) observes that sense-making involves the use of information that is available for the purpose of bridging the existing knowledge gap. Likewise, Schamber (2000:734) maintains that the sense-making approach comprises of the ways in which people perceive and bridge cognitive knowledge gaps with the goal of making sense of the world they find themselves in. From these perspectives, Case (2012:85) declares that the approaches engaged in sense-making are shaped by the theory that the searcher forms (both the gap and the bridge), and by the answers, ideas, and resources obtained along the way. Consequently, for the intent of this study, it is observed that the information needs of industrial researchers could be affected by the characteristics of their different research disciplines that are fused within the wider fields of science and technology. The fourth typology of information needs has to do with spectrum of motivations. Case (2012:86) limited this typology to two important viewpoints which he refers to as the objective pole and subjective pole. The objective pole considers information needs to be understood as

relatively fixed which reflects the traditional information pattern where information must be objective in order to be considered valuable (Morris 1994:21). In contrast, the subjective pole is based on the fact that information needs are often dynamic and human needs are influenced by this concept of dynamism (Bates 2006:1033).

2.2.3 Information needs of researchers

In the course of carrying out research, researchers that engage in undertaking research projects ending up with laudable results and innovations experience information needs (Kaniki 2003:6). Idiegbeyan-Ose et al. (2004:148) affirm that researchers need and utilise information for their research works. Pareek and Rana (2013:1) observe that academics, researchers and students all need relevant and up-to-date information for their research works. Consequently, it is of great significance to identify the information needs and information-seeking behaviour of industrial researchers at FIIRO.

Rosenfeld and Morville (2002:28) state that information needs can vary widely, and each type of information need causes users to exhibit specific information-seeking behaviour. The knowledge about the information needs of researchers will play a vital role in meeting their information needs successfully and research libraries can also employ this knowledge in re-jigging the outlook of their collections and facilities to meet the specific research needs of researchers (Acheampong & Dzandu 2012:4).

2.2.3.1 Information needs attachment to discipline

Research Libraries UK (2012:13) states that in terms of researchers' information needs, researchers differ in particular in relation to their discipline and/or subject and its culture and praxis, and the stage of their career. Similarly, Nel (2015:9) maintains that it has been argued for many decades that researchers from different disciplines have different information needs and they take different approaches to satisfy these information needs. Therefore, it is convenient to say that the cause for debate is that the understanding of information needs of researchers is challenging and often gets more complicated (Kuruppu & Gruber 2006:609) given the fact, as pointed out in the literature that researchers are not a homogeneous group (Research Libraries UK 2012:13).

Connaway and Dickey (2010) review evidence from research works funded by the Joint Information Systems Committee (JISC) in the UK and they identify examples of ways in which researchers in different disciplines behave differently and have needs. Connaway and Dickey (2010:11-14) discover that mathematicians and computer scientists are more predisposed to archive their own materials, whereas science researchers are more likely to use digital repositories and Virtual Research Environments (VREs) and are more likely to use Twitter. Classicists like to disseminate their research output themselves and social scientists are more reluctant to use technologies. In Zimbabwe, Mugwisi, Ocholla and Mostert (2014:89) observe that the information needs of agricultural researchers varied in terms of the type of information required but with no specific disposition to a specific agricultural discipline. For the type of information needed, the researchers relate highly to the information on tobacco culture, agricultural engineering, dairy farming, animal health and poultry. The less important types of information needed include information on climate change, soil fertility and advisory information. Generally, the information needs of the researchers are numerous within the agricultural discipline and cover the major areas of animal science, crop science, agricultural engineering and advisory and policy development.

2.2.3.2 Information needs common to researchers

Notwithstanding Davies and Harrison (2007:79) stance revealing that "need" varies among the population and is not homogenous, Kaniki (2004:83) indicates that researchers have needs that are common to them. The common needs of researchers are explicated below:

i. **Library support** - Researchers need the support of the library in order to seek for information needed for their research works (Kumar 2010:66). Traditionally, libraries are physical structures where one can find a collection of books, manuscripts, journals and other sources of recorded information. However, in the last five decades libraries have progressively advanced into information resources and service providers for researchers that do not require a building (Ogunsola 2011:1). Nwabueze et al. (2010:1) note that "research and the library are

interrelated and are not mutually exclusive". Therefore, researchers and libraries are interconnected.

The report commissioned by Researcher Information Network and the Consortium of Research Libraries (2007) stresses that for centuries libraries have played indispensable role in all research subjects and disciplines in various locations and establishments where they are found. It further argues that there has been a significant change in the relationship between researchers and libraries in the last decade, which is brought about by technological developments and the availability of information resources online. Ogunsola (2011:1) explicates that this is made clear in the terms 'digital library' or 'virtual library' (used to refer to vast collections of information that people gain access to remotely).

ii. **Information technology support** - Information technology support as a need of researchers includes digital products and electronic information resources such as websites, blogs and wikis. It also includes communication on social networks, such as Facebooks, Twitter, Instagram, and so on. Educause Center for Applied Research (ECAR) (2006) stresses that "each of the rare moments of transformation in the nature of how we learn and think has been intertwined with the development of a new information technology". It further maintains that "research methods, research subjects, the composition of research teams, and collaborative practices have all been affected in ways that are important to those who manage research and information technology. Infact, ECAR asserts that when the mission of research is critical, responding to researchers' evolving information technology needs is key to acquiring funding and serving local, national, and global communities.

iii. **Administrative services** - Researchers need research administrative services. This brings about the concept of research administrators in addressing the needs of researchers. Deem (2010:41) lists the four key areas in which research administrators work and are thus defined by these areas. They are:

- Aspect dealing with direct assistance with or intelligence related to bidding for research funds and work on funding contracts after receipt.
- Aspect of working on research strategies and policy.
- Aspect dealing with working or collecting and collating data on research activity.
- Aspect dealing with working on assisting exchange and transfer.

iv. **Publication channels -** Research Information Network (2010:4) indicates that researchers need publication channels where they can disseminate and publish their research in many different ways. Publication channels can be through formal publication in books and learned/professional journals, conferences proceedings, and through a variety of less formal means (now including web-based tools for social networking).

Researchers need more help to effectively undertake their work, be published and succeed in their careers in the observable hyper-competition riddled environment they find themselves (Inchcoombe 2016:2). Research Information Network (2010:14) further maintains that decisions on where and how to publish are driven primarily by disciplinary norms and by a desire to maximise credit by securing publication in a high-status journal with such decisions having a major influence on individual researchers' careers.

v. **Central support -** Research Information Network (2010:12) describes the need of researchers for central support - this is critically important for researchers in dealing with staff appointments and other human resources issues. Other human resources issues include legal and regulatory issues (such as health and safety), purchasing equipment, monitoring progress and providing reports to research funders where necessary.

vi. **Data management support -** Research Information Network (2010:13) asserts that there is much talk at present about the need to support researchers in managing the data they gather and create in the course of their research. It also

maintains that "relatively few researchers have the knowledge or skills to manage their data effectively". Consequently, they need data management support.

vii. **Financial support -** Researchers need financial support or adequate funding. Odia and Omofonmwan (2013:258) emphasise that quality funding should be offered to researchers to drive development initiatives through research. Bello (2012:37) maintains that researchers are motivated to carry out research in science and technology when adequately provided with financial support. Research Information Network (2010:10) also argues that researchers need funding opportunities and strategies to achieve their research goals.

viii **Collaboration** – Researchers need scientific collaboration in order for their research efforts to come to fruition. Yusuf (2012:322) stresses the fact that researchers need to work in partnership with other researchers both on the domestic and international scene in order to come up with viable and up-to-date research. He further states that, unfortunately, the facilities for such collaborative research are lacking in a country like Nigeria.

Similarly, Kaniki (2003:10-11) maintains that researchers need information to get them aware of current research in their different fields of study, keeping abreast of new knowledge and developments in their fields, networking with colleagues, sourcing for research funding and collaborative possibilities within their country and abroad.

The present study does not just seek to find the different information needs of the different multi-disciplinary researchers at FIIRO and their corresponding information-seeking behaviour as seen in other studies but it also seeks to find out the shared information needs and information-seeking behaviour that connect the industrial researchers together.

2.2.3.3 Studies on information needs

Fourie (2010:28) considers a dormant information need situation which is that identified by information professionals on behalf of the user, with Budd (2005:44) asserting the fact that information professionals can only determine users' needs when they interact with

information seekers in a friendly manner. In this case, researchers' needs can be determined by information professionals based on the cordial relation that is developed. Grefsheim and Rankin (2007:431) underscore that if information needs of researchers are adequately satisfied it will have a positive impact on research productivity.

With respect to their study of biomedical researchers, Gresheim and Rankin (2007) observe that the information needs of researchers is deeply rooted in electronic resources and services since they save time and allow researchers to be more productive. Biomedical researchers are intensive, self-sufficient users of information and no matter their age they want the journals they read to be within their reach. Conversely, the study done by Haines, Light, O'Mailey and Delwiche (2010) of basic science researchers reveals that basic science researchers rely on a small network of individuals in their institution and at other institutions to satisfy their information needs.

In South Africa, Nel (2015) studies the information needs of veterinary researchers from the information specialists' perceptions. Nel (2015:135) shows that information needs of researchers were grouped into four categories. The first category is information searching (discovery) which entails knowledge about tools to search for information and database/literature searches. The second category is information use which entails access to resources (local collections, e-collections, interlibrary loans and document delivery) and knowledge about resources (to know which sources to access to obtain the latest or relevant information). The third category is information on research and methodology which entails information on research methods, guidelines for presenting and communicating research (help with referencing; proposal or article writing), information on where to publish (accredited journals, impact factor, open access) and assistance in writing grant-seeking proposals or applications for funding. The fourth category encompasses the library as a place to study or research and the knowledge on how to use computer programs and research support software (such as statistical software).

Searching through extant literature, few studies have been conducted on the information needs and information-seeking behaviour of industrial researchers in Nigeria. For instance, Idiegbeyan-Ose et al. (2014:148) reveal that science and technology researchers in Nigeria have complex information needs because of their varying areas of

specialisation. They mostly need information on research works and publications, current issues, general knowledge and academic issues. However, the science and technology researchers in their study are academics in three universities in Nigeria. This reveals a gap that has to be filled by investigating information needs of non-academic science and technology researchers in research institutes (as industrial researchers) such as FIIRO.

2.3 INFORMATION SOURCES USED BY RESEARCHERS

This section identifies the different sources of information used by researchers in a research environment. Agarwal (2011:48) describes an information source as a 'carrier of information' which involves both traditional sources such as books and people, and modern sources including predominantly digital libraries and search engines (such as Google, Yahoo, etc.) involving the use of electronic resources. Likewise, Ingwersen and Järverlin (2005:387) describe information sources as physical (or in digital format) entities in a variety of media providing potential information. Similarly, Tiamiyu (2003:17) describes information sources as entities that facilitate communication over time and space in a society with these entities conveying information about what they represent. Medical Library Africa (n.d) describes information sources to be the various means by which information is recorded for use by an individual or an organisation or the means by which a person is informed about something or knowledge is availed to someone, a group of people or an organisation. Yusuf (2012) emphasises that for any meaningful information to be provided, certain relevant information sources must be consulted and it is only through such sources that information seekers can obtain information that is ideal for meaningful decision making. This section also determines and explains more specifically the preferred sources of information used by researchers.

2.3.1 Available sources of information in a research environment

The identification of available information sources may positively assist researchers to effectively and accurately find the relevant information during their information-seeking behaviour process. According to the study by Rulke et al. (2000), information sources can be categorised as (i) interpersonal or relational or human (colleagues, friends, supervisor, internal and external experts, etc.) and (ii) impersonal or non-relational or non-human

(documents, manual, journals, books, libraries, electronic repositories, digital libraries, Google search, etc.). A study by Zimmer, Henry and Butler (2008) also classifies sources as relational (interpersonal) and non-relational (impersonal). Past studies have consistently shown that people (following the least effort principle which is explained in section 2.4.2) prefer interpersonal sources over impersonal sources (Choo 1994; Hertzum & Pejtersen 2000; Byström 2002; Yitzhaki & Hammershlag 2004). The tendency to use interpersonal information sources and networks within the organisation can be ascribed to the many new ideas that are obtained by talking to people who do similar work within the organisation (Jain & Triandis 1990:29). Du Preez (2008:25) expresses that information sources can be characterised as external and internal sources, human and documentary sources or formal and informal sources of information. Naresh (2009:115) states that information sources can reside within an organisation (internal) or outside its boundaries (external). Du Preez (2008:109) explicates that external information sources may include information sources that are acquired from personal subscriptions, journals or personally owned textbooks. However, Du Preez (2008:109) argues that personally owned journals and textbooks could be classified as internal sources although they have been produced outside the user's organisation, since they are part of the user's personal collection of reference sources. In this sense, the classification of sources as internal refers to the proximity and immediate availability of an information source (Vakkari 1998:369). The use of internal communication could reflect areas of specialised expertise (Anderson et al. 2010:13). Medical Library Africa (n.d) explains that information sources could be observations, people, speeches, documents, pictures, organisations or information sources that are obtainable in two major formats which are, print and non-print and these include published and unpublished sources. They are explained as follows:

- Print materials (published sources): Information could be in print format and these consist of all printed books, periodicals, maps, bibliographies, indexes and abstracts, government documents, technical reports, etc. Books are the most common type of printed materials. Books are classified into two categories, namely - fiction and non-fiction. Fiction contains ítems of information that are not true and all the scenes and characters are made up by the author. Non-fiction books deal with information that is true, about real things, people, events and

places. Different types of paper-based publications fulfil different information needs. Du Preez (2008:117) opines that trade and news journals, for example, provide fairly general, but newly created information, while scholarly or professional journals are more likely to provide specific information.

- Non-print materials: Besides printed materials, information is also produced in other formats (non-print) including audio, audio-visual, multimedia, microform and electronic books, electronic journals, images, and texts/records from the internet.
- Unpublished sources (indigenous knowledge (IK)) - In local communities in Africa, there is a rich body of information or knowledge which has been handed down by word of mouth from generation to generation. This is known as indigenous knowledge. It is neither written nor published but provides people in the community with strategies for survival. Abah, Mashebe and Denuga (2015:668) expound that indigenous knowledge is the sum total of knowledge and skills which people in a particular geographical area possess that enables them to get the most out of their natural environment in terms of education, science, technology, agriculture, medicine, engineering and other activities.

Evans and Saponaro (2005:21) maintain that people usually look for information from both formal and informal sources/systems. Case (2012:12) argues that one vital distinction that is made in the literature on information seeking is between formal and informal sources of information. Formal sources mostly involve books and reference materials whereas informal sources involve family, friends and colleagues. Marouf and Anwar (2010:536-538) describe the main information sources which are formal and informal sources as they are used by academics in the social sciences and the purpose for which they are utilised. Nevertheless, some of these information sources as mentioned by them might arguably serve researchers. The major information sources are the following: journals, books, papers presented at conferences, theses/dissertations, abstracts and indexes. Marouf and Anwar (2010:537) list the purposes of using these sources which include: personal development, keeping up-to-date, research activities and consultation work. Leckie, Pettigrew and Sylvain (1996:183-187) discuss the sources used by professionals including the library. McGarry (2003:371) considers the library as the best

sources of well-arranged resources that are efficiently used by users, including researchers. Pareek and Rana (2013:1) affirm that the library is the most widely-used source of information available to literate societies. Kadebe (2002:14) maintains that libraries and other information centres have historically used print-based information sources for a long time as the principal medium for storage and communication of recorded information content. All these formats are aimed and engineered towards addressing the information needs of different categories of information seekers.

2.3.2 Determinants of information sources

Studies show that the discipline of researchers is connected with the use of the literature and libraries in the traditional way (Garvey 1979) as well as in electronic format (Abels, Liebscher & Denman 1996; Eason, Richardson & Yu 2000; Tenopir, 2003). Fry and Talja (2007) study reveals some of the differences that various discipline brings, for instance, there is a greater preference for electronic sources among researchers in the sciences disciplines. In addition, keyword searching is also more important for this group of researchers in the sciences disciplines than for their colleagues in the humanities, who give preference to browsing and chaining search strategies.

In his principle of least effort, Zipf (1949) said that each individual will adopt a course of action that will involve the expenditure of the probable least average (least effort) of his work. Allen (1997) study of nineteen research and development engineers found that accessibility (least effort) played a more important role in the selection of information sources, rather in the quality of information. Similar patterns were observed by Rosenberg (1967) study of industrial personnel and Orr (1970) study of scientists. Different studies in information needs and information seeking have consistently shown that people prefer personal/people sources (which are most readily available and accessible sources) over the more authoritative print sources (Gerstenberger & Allen 1968; Chen & Hernon 1982; Hardy 1982; Chakrabarti, Feineman & Fuentevilla 1983; Choo 1994; Hertzum & Pejtersen 2000; Byström 2002; Yitzhaki & Hammershlag 2004).

Hardy's 1982 study reveals that people select information sources on the basis of their expected benefits (from obtaining the most complete and accurate information) weighed

against the likely costs. Case (2002) explains that while the cost-benefit principle emphasises a careful calculation of benefits versus costs, the least effort principle predicts that seekers will choose to minimise effort even if it means accepting a lower quality and quantity of information from an information source. Hardy (1982) study of 968 US forest service professionals indicates that they are oversensitive to the costs involved in acquiring information from information sources and under-sensitive to issues of information quality. However, conflicting findings have been found with regard to the importance of the cost (source accessibility) of the seeker's use of one or more information sources. Those advocating the least-effort principle include Culnan (1983), Anderson et al. (2001) and Yitzhaki and Hammershlag (2004). Other studies have reported source quality as more important, for example, Vancouver and Morrison (1985) and Morrison and Vancouver (2000). Harris and Dewdney (1994:27) observe that "people tend to seek information that is easily accessible, preferably from interpersonal sources such as friends, relatives or co-workers rather than from institutions or organisations". Henefer and Fulton (2005:226) affirm the role of interpersonal communication as a popular source of information. Similarly, Wilson (1997:562) further notes that interpersonal sources of information often play a crucial role in reducing uncertainty for an information seeker since they provide immediate feedback and social support.

A study by Zimmer et al. (2008) looked at the factors underlying the selection of sources that require direct interpersonal contact (relational or [interpersonal] sources) versus those that do not (non-relational or [impersonal] sources). They discovered that source accessibility and quality significantly affect the usage of a source, but that this relationship was moderated by the type of source used [interpersonal or impersonal]. They further pointed forward that accessibility has less effect on the use of interpersonal sources. They averred that the use of each of these two types of sources was also affected by the perceived accessibility and quality of alternative types of sources. However, the study by Zimmer et al. (2008) has several limitations which include:

- With the listing of eight source types (Zimmer et al. 2008:307), they only classify them as interpersonal/personal, which is just one dimension in classifying source types.
- All their survey respondents are students enrolled in an MBA programme working full-time in the industry. Since all the respondents are enrolled in the MBA programme, the results can only be generalised to those seeking their future in business and management, as opposed to respondents across a wider cross-section.
- They did not take any other contextual variables into account apart from the effect of quality and accessibility. These two factors have been shown to play an important role in source selection, but they are certainly not the only factors that can be considered (Zimmer et al. 2008:325). A large number of variables make up the context, which can potentially impact the use of an information source.
- Zimmer et al. (2008) muddled the difference between source types and sources.

In terms of technology, Chowdhury and Chowdhury (2004:16) perceive that improvement in technology in our fast-moving world led to multiple accesses of sources for users. However, depending on the user's career or profession, human and paper sources may sometimes be considered as preferred sources over electronic/digital resources but this happens not because of choice but rather by necessity (Mehdi, Roghayeh, Farbod & Sajedi 2010:23). Perley, Gentry, Fleming and Sein (2007:178) observe that the choice of print or electronic resources mostly depends on convenient access to available resources, but it should be stressed that the level of knowledge and skills is also important to be able to negotiate existing information systems/sources. In addition, trusting the source is vital. Mutshewa and Rao (2000:315) argue that in the current technological era, it is no longer necessary for users to physically come to the library buildings. Anderson (2010:42) says that online sources reliably assist libraries to decrease physical printing and distribution challenges. Fidel and Green (2004:572) pinpoint aspects relating to time-saving characteristics of the users through remote access during information seeking.

Tseng and Fogg (1999:41-42) and Hertzum (2002:2-3) highlight the following four types of trust (credibility) on which the trust in information sources can be based:

- First-hand experience or experienced credibility (a tendency to assess people's expertise and trustworthiness based on their personal interaction with people over time).
- Reputation or reputed credibility (asking someone for advice based on a colleague's recommendation).
- Simple inspection of surface attributes or surface credibility (judging people by the way they dress or the language they use).
- General assumptions and stereotypes or presumed credibility (trusting friends to tell the truth).

In agreement with these four types of trust, Van House, Butler and Schiff (1998:41) state that trust is rooted in communities of practice and that the physical distance between people (users of information) affects their readiness to trust each other. On the other hand, Rasmuson (2014) underscores accuracy, authority, objectivity, currency and coverage as the five evaluating measures that can be used to verify the trustworthiness and authenticity of all information sources utilised by the researchers. However, he argues that the five stated evaluating measures could be used by researchers to verify the trustworthiness and authenticity of all information sources. These evaluation measures enable researchers to a certain extent to rely on the information gathered from a particular website (Willis 2004:21). Savolainen (2010b:79) reinforces the five main criteria used in the designation of source preferences. These criteria include: availability and accessibility of the information source, content information, usability of information sources, user characteristics and situational factors of information seeking.

2.3.3 Preferred information sources used by researchers

The study of Pantry and Griffith in 2009 reveals that researchers obtain and use information from a large spectrum of information sources. A number of studies that investigates the use of different information sources have been published since the early 1940s (Case 2007:10). Although these studies indicate that their concentration is on

information needs and information seeking, Case (2007:6) points out that they indeed investigate the actual information sources used in research and how these are used. Reddy and Jansen (2008:257) state that the aim of identifying all possible information sources is to enable people (researchers) to find information effectively and efficiently.

Brown (1999) study on the information-seeking behaviour of scientists at the University of Oklahoma concludes that the ultimate preferred source for information is shown to be the printed journal article (Brown 1999:937). However, according to Tenopir et al. (2003), this applies only to the early evolving system phase, when electronic journal collections were expanding after their introduction to the academic community during the first part of the 1990s. Today, it is impossible to imagine research without access to online electronic sources as seen in the studies of Borrego and Urbano (2007), Mulligan and Mabe (2011), Niu, Hemminger, Lown, Adams, Level, McLure, Powers, Tennant and Cataldo (2010), Tenopir, Mays and Lei (2011) and Urquhart and Rowley (2007). The use of online information is also visible in other science disciplines. A study by Nicholas, Rowland, Huntington, Jamali and Hernandez Salazar (2010) gives insight into the use of electronic information sources by researchers from a large spectrum of disciplines (including physics, chemistry, economics, earth science and environmental science). They discover that researchers prefer the use of e-journals. Several other studies confirm that researchers in the science disciplines prefer electronic online information sources above traditional library services (such studies include Brown 2010; Case 2008, Hart & Kleinveldt 2011; Neal 2009). Mulligan and Mabe (2011:290) explain the means by which the migration from print to electronic environment for information sources has affected the motivations, attitudes and behaviours of researchers in research communication. By means of exploring both quantitative and qualitative research methodologies, they discovered that in spite of the impact of technology on the efficiency of research communication, the information behaviour of researchers basically stayed the same in the digital environment. Brown (2010:187) also affirms these findings, saying that "although the digital infrastructure facilitates new kinds of interaction, it has not altered the essential nature of scholarly communication".

Vilar, Južnič and Bartol (2012:12-13) identify the preferred information sources by researchers with respect to their research discipline. Natural scientists prefer research papers and dissertations and they do not acquire their resources by print journals or interlibrary loan. Social scientists prefer different information sources ranging from primary, secondary, tertiary to grey literature. Technical scientists prefer standards and patents. Humanistic scientists use research papers and dissertations but prefer printed sources (with them preferring print journal sources). Interdisciplinary researchers prefer e-archives. Medical researchers prefer websites and colleagues as their information sources. Biotechnology researchers use research papers and dissertations but prefer e-sources. In their study of biomedical researchers, Grefsheim and Rankin (2007:430) highlight that journals were the most important information resources for biomedical researchers and online journals were overwhelmingly preferred by all types of scientists (in the biomedical discipline) in all age groups. Databases (bibliographic and non-bibliographic) were the next most popular resources with policy documents, books, newsletters and regulations following in this order. The study by Haines et al. (2010) indicates that basic science researchers also prefer online sources to print sources. This is due to their convenience advantage and immediacy characteristics (Haines et al. 2010:78). Their information source activities also centre on the laboratory, the people they work with everyday, and colleagues working on closely related research in other institutions (Haines et al. 2010:79). Haines et al. (2010:79) also notably shows that researchers had limited awareness of library resources and stressed the need for improved communication.

Ellis (1997) in his study of sources of information used by research scientists in an industrial environment recalls that the use of formal channels decrease as research scientists progress in their research and person to person communication seems to be a more dominant factor (Ellis 1997:400). He further stresses that information seeking is most extensive in the initial phase of a project when both formal and informal sources are utilised. As mentioned by Ellis, in the final phase, however, both formal and informal sources are again utilised, but, indeed on a smaller scale, mainly in the form of a small literature search or through contacts with knowledgeable persons in the field to supplement the information already gathered. Acheampong and Dzandu (2015:88)

discover that crop research scientists prefer journal articles in an electronic format compared to print format. This might be due to occasional usage of information centres/libraries (Acheampong & Dzandu 2015:88). They also stress that crop research scientists used scientific meetings as part of their information sources.

Oguche (2013:53) discovers that the majority of the law researchers at the Nigerian Institute of Advanced Legal Studies prefer to consult the internet when seeking information among other sources such as law textbooks, journals, law reports, online databases, public lectures/seminars/roundtables, law teachers and professional colleagues. The least used information source is the law report. Meho and Tibbo (2003:578) point out that books, journals and newspapers were also indicated as important information sources apart from archival materials that were seen to be extremely important to social scientists. However, overall, it was found that the type of information that participants choose to identify, locate and use is based not only on the specific research topic, the discipline and the level of research required to satisfy the information need but also, and perhaps more importantly, on the identity (country of publication) accuracy, objectivity, and reliability of the information.

2.4 ACCESSIBILITY OF INFORMATION TO RESEARCHERS

The process of selecting an information source requires the information user to know the options available to him or her, and the most preferred sources will be those that are credible and accessible (Wilson 1997:561–566). Choo et al. (2000:12) and Culnan (1985:303) describe accessibility to be the ease with which professionals (for instance researchers) can gain access to or approach information sources, taking the social, economic and physical costs of use into consideration. Yusuf (2012) explains information accessibility as the availability of information that can be reached or the availability of information that can satisfy the needs of people. Nwachukwu et al. (2014:1) point out that accessibility simply means users being able to identify and use the resources that they need for their work. They believe learning materials might be available, that is, the library in its capacity has acquired them but they remain inaccessible for use to those who need them for whatever reason (be it uncatalogued, miscatalogued, misshelved, etc.). Hill (2013:138) describes accessibility as a term which incorporates accessible formats and

services, including both virtual and physical library environments. He expounds that accessing virtual environments concern the ability to access and utilise online resources, such as databases and websites while physical environment accessibility concerns all that is necessary for users to access and manoeuvre through the library's physical space. Ugah (2008:3) observes that the accessibility of information sources is commensurate with the rate at which users use such information sources; with users opting more for the use of information sources that costs less effort to access them. The act of choosing to seek for information is a function of its perceived accessibility (Kuhlthau 1991). Okello-Obura and Magara (2008:41) and McKnight, Stetson, Bakken, Curran and Cimino (2002:64) believe that information access can take on many forms, ranging from looking up information on a computer to checking textbooks, among others. Culnan (1985:304) suggests three dimensions of accessibility, namely:

- gaining physical access to the information sources.
- translating an information need or request into a language that is understood by the source (i.e. interface dimension).
- being able to retrieve the potentially relevant information physically (i.e. information dimension).

Choo et al. (2000:13) add a psychological fourth dimension to this list; for instance, the embarrassment of revealing one's ignorance or need for assistance.

Ugah (2008:3) emphasises that the accessibility of information sources is an important recurring subject in the literature. This shows the importance of the subject. Kim and Sin (2007:663) argue that a lack of accessibility to appropriate information resources might create limitations to the achievement of the task at hand which includes a research project that a researcher is working on. Research Information Network (2009:4) reports that researchers seek access to a wide range of research material, most evidently books and journals, but also artefacts, sound and image files, and data produced by other researchers, by commercial companies and by public bodies with them wanting access to these information in a variety of ways from their libraries, laboratories, office or home, on their desktops and in person.

There are many obstacles and challenges that make access to information difficult. Uhegbu (2002:62) identifies five such obstacles, which are economic, social, environmental, occupational and infrastructural challenges. Kamba (2008:1) argues that developing countries, particularly in Africa, have difficulty accessing materials from developed countries because of distance and financial limitations, among other reasons. Koller, Grutter, Peltenburg, Fischer and Steurer (2001:251) are of the opinion that access to information can be influenced by availability, physical distance, costs, convenience, skills and perceived relevance of the information. Ugah (2007) identifies ten obstacles that make accessibility of information difficult in developing countries. They are discussed as follows.

- **Lack of awareness** - Information seekers and users may not know about the availability of resources simply because the role of libraries has not always been made clear to information seekers, particularly in developing countries. Hart and Kleinveldt (2011:42) affirm that many researchers are unaware of the potential services and resources available to them and will only ask for what they already know about.
- **Inaccessibility** - A library's success depends upon the availability of information resources. It is not enough that they are available or even bibliographically accesible, they must also be physically accessible to those who need them. Aguolu and Aguolu [in Ugah (2007)] identify the following reasons for inaccessibility of information. These are: (i) users do not know precisely what they want and, if they do, they cannot articulate their needs accurately to the library staff; (ii) the bibliographic or intellectual access to the content of the library is inadequate owing to poor indexing system in the library catalogue or of the library collections; (iii) the circulation policy of the library is inefficient, shelving methods are unplanned, and guides to the library arrangement are lacking; and (iv) unnecessary physical and administrative barriers are imposed upon the use of library materials by the library management.
- **Information explosion** - The growth of knowledge is related to the growing number, size and diversity of information transfer packages. There are thousands of information packages being turned out by an ever-expanding publishing

industry, e.g. journals, books, magazines and newspapers. Various electronic media organisations also produce vast volumes of information. The impact is such that no researcher is able to lay hands on all materials published in his own field of study any longer. Even if that were possible, the volume would be massive.

- **Bibliographic obstacles** - Bibliographic obstacles take on various forms. In some cases, adequate bibliographic description is lacking, while, in other cases, the bibliographic description is incomplete or incorrect. In many cases, information retrieval devices themselves are lacking. A lack of information retrieval devices is more serious in developing countries like Nigeria, creating a serious obstacle to information access and use (Ugah 2007:1).
- **Environment** - This is possibly the main obstacle to information access and use. Such principal environmental obstacles include the polluted air in urban and industrialised cities of the world, wide ranges of temperature, pests and so on. Noise from traffic, other users' conversations, library staff and library equipment can also constitute a negative impediment. Uhegbu (2002:66) includes language and location of information as part of environmental obstacles to information access and use.
- **Declining budgets and rising costs** - Faced with declining budgets and increasing demands from users, libraries are finding it difficult to acquire both primary and secondary publications to meet information demands. Worldwide inflation and economic recession have drastically increased the cost of publications. All these reduce access to information.
- **Costs for users -** Many users cannot afford to travel from one place to another to obtain information. Information that is obtained in either rural areas or abroad is expensive to reach, and obtaining such may constitute an expensive logistics problem. This creates more obstacles to information access and use.
- **Library staff -** When professional librarians and other library employees fail to make adequate use of their knowledge and skills (provided they have adequate knowledge and skills), access to information is affected.
- **Crime -** Criminal activities are a formidable obstacle to information access and use. They include theft, mutilation of information sources and assault on staff.

- **Poor infrastructure -** Effective information access and use depends on the postal service, adequate supply of electricity as well as information communication facilities such as telephones, internet, telex, fax and computers, which are all embedded in information technology.

2.4.1 Information accessibility for researchers as seen in related studies

Some of the studies that discuss accessibility to information by researchers and closely related studies are hereby presented. Gardiner, McMenery and Chowdurry (2006:356-357) briefly outline key challenges influencing the accessibility and usability of electronic resources and these include:

- poor readability of electronic resources.
- accessibility and retrieval of information from online resources.
- information overload as there is too much information online than what should be necessary, it then becomes difficult for user to identify the relevant information.
- reliability and authenticity of web information.
- time required for accessing and evaluating useful information from thousands of available online resources.

The report of Research Information Network (RIN) in 2009 examines the barriers that researchers encounter in accessing the information required for their research, as well as the approaches researchers use to overcome them in the UK. RIN (2009:23) highlights the key reasons why researchers encounter access difficulties. They are the following:

- Content has not been digitised and made available online.
- Institutions have not purchased print copies or acquired a licence for online access to content that researchers need, and that they find through a wide range of discovery services.
- Discovery services themselves are often complex, and not well integrated with library systems.
- Licences for online content are seen as complex and sometimes restrictive of access for non-members of institutions.

- Institutions lack the technical or administrative capacity to make online licensed resources available to non-members.
- Restrictions on access are sometimes imposed by organisations on individuals outside the higher education sector who hold information resources that researchers wish to study in the course of their research.

In solving the access problems, RIN (2009:24) stipulates that:

> Open access content may become increasingly important as a means of overcoming researchers' current frustrations, but it is not available in sufficient volume yet, and licensed content will remain a key part of the landscape for the foreseeable future. In view of the evident importance of the various generic and specialist discovery services that most researchers use, a key aim should be to ensure that in all cases researchers can gain appropriate access to licensed content directly from such services. Similarly, libraries need to ensure that when they cannot provide access to content directly themselves, they have efficient, effective and user-friendly systems that allow researchers to gain access from other sources, via inter-library loan, document supply or other services.

RIN (2009:23) points out that the principal message from this report is that access to research information content issues must be addressed if the UK research community is to operate effectively and produce high-quality research that has a wider social and economic impact.

Acheampong and Dzandu (2012) study the access to and use of information centres among scientists at the Council for Scientific and Industrial Research Crops Research Institute (CSIR-CRI) in Kumasi city, Ghana. The study reveals that although scientists have unlimited access to use the CSIR-CRI information centre and others in and around Kumasi to obtain information for their research, their level of use was very low. CSRI-CRI scientists prefer to access most of the information they need for their research using their own computers from their offices such as accessing electronic journals. The reasons adduced for this are the poor state of the information centre which includes a lack of resources (current and relevant materials), lack of equipment and incompetence of library

staff. There were indications that researchers would use information centres more if it was well resourced with competent personnel, equipment and current and relevant materials. It was also evident that scientists themselves were part of the problem of lack of current materials at the information centre, since many of the scientists do not deposit their publications at the information centre despite being aware of the policy of publication submission at information centres.

Kamba (2008) study in Nigeria lists factors constraining accessibility to library resources which are: inadequate library collections, high cost of services which makes interlibrary loans and resource sharing almost impossible, high cost of international journals and books, poor funding, inadequate and poor information infrastructure, high level of poverty, devaluation of Nigerian currency against foreign currency and negative attitude of the government and its agencies towards library development.

2.4.2 Accessibility and information technology

Lawson (2010:137) argues that librarians struggle to maintain and expand accessibility in an increasing complex environment. Bazillion and Braun (2000:24) state that "librarians with traditional skills have suffered a relative loss in status". Webb et al. (2007:125) acknowledge the impact of new information technology changes in institutional communication. Rowley and Roberts (2009:197) advocate that information professionals, including mainly librarians, should change and adapt with technological changes as we have in today's research environment. De Bruyn (2007:114) notes that technology change goes hand in hand with changes in access to information. Doraswamy (2010:5) asserts that "modern libraries adopt modern information techniques to render its services more differently". Niu and Hemminger (2012:336) concede that electronic resources such as electronic journals, online databases and digital libraries focus largely on the content of their resources rather than simply on physical buildings. Tenopir, Hitchcock and Pillow (2003:36-37) discuss a number of advantages with the use of online information sources, including access to adequate technology and users being well-equipped with the required information technology skills. The advantages cited by them include convenience, timeliness, the ability to search across a wide range of journal articles, the ability to search within an article and interact with multiple levels of information objects, the

possibility of downloading or printing the desired document or segment, the currency of information, the speed of access and the ability to send articles to colleagues instantly. In addition, Herman (2001:453) mentions that the use of online databases purposefully enables users to gain access to many sources of information.

Heath, Kelleher, Sangwand and Wood (2010:165) maintain that digital collections positively influence researchers' information-seeking needs and habits. With the use of electronic resources, it is possible for the libraries to make information more accessible to users than ever before (Okeke 2008:12). However, Campbell (2006:18) outlines that even before the web was introduced, libraries, including research libraries have started to create digital libraries of trustworthy information. Brophy (2005:52) notes that the print-based model and digital model are still complementary to each other and they both create benefits for libraries. Woodward (2010:1) underlines that no matter how technology changes, it is still the role of the librarian to have a positive impact on providing access to available resources.

In terms of web-based information, researchers face many challenges in accessing them. Hoggan (2002) recalls that high-quality information may be difficult to access because of poorly designed websites or associated fees and each web-based resource seems to hold such a vast quantity of information that it is easy to assume that one has conducted a comprehensive search, when, in fact, other resources contain unique, relevant information. Hoggan (2002) lists some of the major challenges that research scientists face when accessing web-based information. They are:

- Information overload - the volume of available information is more than any one information retrieval system can index, more than any library can purchase and more than any scientist can read (Belefant-Miller & King 2001:100-104). The lack of central organisation and indexing on the web makes the information overload even more confusing because the precision of search engine results is often low (that is, many irrelevant documents are retrieved). At the same time, no search engine can index the entire contents of the web, so searches also have poor recall with respect to all relevant information on the web.

- Website navigation - to retrieve electronic journal articles, users must navigate a vast number of websites and each publisher structures its website differently. This can be very challenging because the websites are not always designed for easy navigation. Sometimes it is very difficult to determine which link on the crowded homepage leads to the right article content. Often the links to "subscribe today" are much more prominent.
- Preprints - scientific research is very competitive, and researchers must keep up to date with the latest developments in their field. Preprints on the web can be very difficult because they are poorly organised and because most of them are in PDF or PostScript format and therefore are not indexed by most search engines (He & Hui 2001:278).
- Financial concerns - peer-reviewed articles are available on the web, but they are usually published in fee-based e-journals. Researchers access these resources via personal online subscriptions or, more commonly, institutional online subscriptions paid for by their libraries (Tenopir & King 2001:180). For researchers not associated with an institution, such as retirees or independent consultants, these fees are barriers to information access (Line 2001:175). Some private-sector online services offer free content, but they are much more likely to go out of business than the fee-based services (Tenopir & King 2001:181). Thus, financial concerns can limit a researcher's access to scholarly information.
- Loss of browsability - another challenge for researchers is the loss of browsability of today's electronic journals. However, researcher's interest in electronic journals has increased dramatically in recent years, largely because of their convenience advantage and the improved quality of figures which are now available in PDF format. The emphasis that today's researchers place on electronic journals may come with a corresponding loss of coincidental readings (Schevitz 2002). Electronic journals are not as browsable as print journals and this may have a marked impact on the range of articles read by researchers, who have traditionally depended on browsing to find most of the articles they read.
- Reliability - print journals do not experience technical difficulties. However, when a publisher's server goes down, access to electronic content is temporarily

lost. Compounding the problem is the fact that access to many electronic resources is rented rather than owned, so if the institution cancels a subscription - access to backfiles is lost. With a print journal, on the other hand, the previous volumes of the journal would still be available after a subscription has been cancelled. Because of these issues, librarians and researchers cannot rely completely on electronic resources.

- Scholarly misconduct and misinformation - scholarly misconduct includes plagiarism, fabrication of results and manipulation of data (Calvert 2001:234). Researchers have been known to manipulate numbers and even publish lies (Woolston 2002). In addition, many publications include incorrect bibliographic citations and other errors. It is already difficult for editors of print journals to detect scholarly misconduct and other errors, and the chance for misinformation to slip past an e-journal editor is even more likely given the faster turnaround time of online-only journals (Calvert 2001:236). Online journals may actually attract dishonest scholars who want to pad their resumes with quick, fabricated publications (Calvert 2001:234). In addition, scholars can publish results and papers on their personal websites without peer review. Online discussion groups often contain biased information or information taken out of context (Calvert 2001:237). Thus, the potential for misinformation on the web is a real concern for research scientists.

2.5 FACTORS AFFECTING THE INFORMATION-SEEKING BEHAVIOUR OF RESEARCHERS

In any endeavour that has to do with information research, there are so many hurdles to overcome and it is imperative to appreciate the factors that will influence such an endeavour's' successes and the challenges (Downing, MacAdam & Nicholas 1993:6). Wilson (1981, 1996 & 1999) models of information behaviour show how psychological, demographical, role-related, interpersonal, environmental and source-related characteristics influence the information-seeking behaviour of researchers. Wilson's models further point out that the decision to seek information is dependent on motivation which may have a cognitive origin or be emotionally based as in the need to reinforce previous values. Bhatti (2009:8) notes that information-seeking behaviour may be

determined by a wide variety of user needs, which may include personal, professional, entertainment and so on. Likewise, Krikelas (1983:63), Leckie et al. (1996:180-182) and Leckie (2005:161) state that work-related situations (as a factor) reveal the information needs of professionals and thus their information-seeking behaviour.

Leckie et al. (1996) stress that the way information is sought is influenced by various factors. They use the phrase "factors affecting information seeking" to denote the "information is sought" process. The factors affecting information seeking are connected with the sources of information, the awareness of information and the outcomes of information-seeking behaviour. These factors make up the last three components in Leckie et al.'s (1996:180-185) model of information behaviour. The factors are discussed below:

i. Source of information – Professionals seek information from various types of sources, which can be depicted as formal (e.g. conferences, journals) or informal (personal conversations); internal (sources within the organisation) or external (sources outside the organisation); oral or written (written sources entail paper copies and electronic texts) and personal (these sources involve personal knowledge and experience, professional practices sources). A combination of multiple sources may also be required to satisfy an information need.

ii. Awareness of information – The professional's awareness of information sources and/or information content can determine the path that information seeking will take. A few important factors are linked to information awareness. They are as follows:

- Familiarity and prior success – The professionals will often select a source based on authors they already know and have used before in their project work.

- Trustworthiness – This has to do with the professional's faith that a source will provide accurate information. The source must not be socially risky when confidentiality is an issue.

- Packaging – This is crucial when information is needed through a specific medium or in a specific format.

- Timeliness – The professional must obtain the required information immediately or within an acceptable period of time. The usefulness of the information will reduce if it is obtained either too early or too late.

- Cost – The time factor and the funds available will determine the amount of effort and expenditure a professional will spend in seeking for information from any source. Cost of information is not just in terms of money paid for information but can also be defined in psychological and physical terms, for instance, the time and effort involved in acquiring the information.

- Quality – The observed worth or value and relevance of the sought information to the task ought to be the primary criteria with which professionals select an information product or service.

- Accessibility – This has to do with proximity of the information as well as other considerations such as whether the language used is known to the professionals or not. However, most professionals perceive their own collections to be most accessible.

iii. Outcomes of information seeking – The ideal outcome of any information-seeking process is that the obtained relevant information is put to use, the information need of the professional is met and the professional accomplishes the task that drives him/her to seek the information. This depicts the final stage of information usage. On the other hand, there is the possibility that the outcome of the information-seeking process may not satisfy the information needs of the information-seeking professional resulting in additional information seeking being required.

Phabha, Connoway and Olszowski (2007:77-79) discuss the factors that negatively impact information-seeking behaviour. They are:

- The feeling of information users that they obtained sufficient information and that they consulted trusted sources.
- Lack of time and limited financial resources.
- Nature of the problem to be answered or question to be solved.
- Nature of task at hand and task-domain knowledge.
- Context, situation or setting in which the information user is living or working.
- Particular search system.
- Motivation level of the information user and his/her information-seeking ability.

Perley et al. (2007:177) briefly give reasons why information seekers do not physically visit the library and why they tend to use library websites through remote access. These are:

- Limited time due to other work/tasks.
- Convenient access to a computer with internet connection.
- Lack of awareness of available library services.
- Poor arrangement of a full range of library collections and resources.
- Inconvenient library opening and closing hours.
- Inconvenient physical location of library premises.
- Availability of resources from the internet.

Nel (2015:51) in her South African study gives factors that play a role in the information-seeking behaviour of researchers and they are listed as follows:

- Information needs: These include topic, complexity, topic familiarity, prior topic search experience, purpose and type of search.
- Information seeker: This includes demography (e.g. age, gender, academic level), discipline, time, awareness of service and sources, knowledge of service and sources, search skills.
- Information source: This includes location of the information source, format of the information delivery system (print vs. electronic), and ease of access to the source (convenience).

Nel advises that these factors are very important and should be taken into account by libraries when developing services and purchasing products to address the information-seeking behaviour of researchers.

Niu and Hemminger (2012:336) comment that many factors have been established to influence the specific information-seeking behaviours of academic scientists which inarguably apply to industrial researchers, among them are demographic (age and gender of participant), psychological (confidence of the participant in finding information), role-related (academic position that the participant holds) and environmental (department type and distance to the library) factors. They point out that of all the factors that have an effect, academic position was the most important determinant of information behaviour. Correspondingly, Evans and Saponaro (2005:22-23) state that some factors influence people when they seek information, but the factors they mention can be placed within the broad classification identified above in Niu and Hemminger (2012) study. The factors they mentioned include level of education, cultural background, group membership and so on. According to Anderson et al. (2001:132-136), factors affecting the information-seeking behaviour of researchers include accessibility, task characteristics, information carrier characteristics, user characteristics and demography.

2.5.1 Accessibility

This is based on Zipf (1949) principle of least effort which holds that people strive to solve their problems in such a way that seeks to minimise the total work that must be expended. Zipf (1949:1) explains this more specifically as the degree to which "people strive to minimise the probable rate of work expenditure (over time)". In the same vein, Hardy (1982) applied Zipf's principle suggesting that people take the path of least resistance when seeking information rather than focusing primarily on quality. Anderson et al. (2001:133) discuss about accessibility as an information-seeking factor in terms of preference for seeking information from one's own store of information as opposed to seeking information from others such as preference for oral communication as opposed to written communication, communication with sources inside the organisation as opposed to communication with sources outside the organisation, and direct communication with a

source as opposed to communication through mediating carriers such as those provided by library personnel, who are not authorities in the discipline under study.

2.5.2 Task characteristics

Task characteristics, as determinants of information-seeking behaviour, have been studied from two perspectives. The first focused on task classification such as that used in the study of R&D laboratories by Katz and Tushman (1979). They classify tasks on a scale from high to low complexity, i.e. basic research, applied research, development and technical service. The second classification uses broader measures such as task uncertainty and task complexity. Jain and Triandis (1997:xiv) characterises R&D organisations as having considerable uncertainty since the output can never be predicted perfectly from the various inputs used. Galbraith (1977:6–7) succinctly views uncertainty as, "the difference between the amount of information required to perform the task and the amount of information already possessed by the organisation". Rogers (1983:112) holds that when individuals face uncertainty, they typically seek information. In a study of civil service workers in Finland, a qualitative model was developed that posits that as task complexity increases, the complexity of the information needed increases and invariably information-seeking behaviour also becomes more complex (Byström & Järvelin 1995).

2.5.3 Information carrier characteristics

A substantial amount of the literature points to characteristics of written information carriers as a factor that affects information-seeking behaviour. Various authors identify carrier characteristics such as accessibility (Culnan 1983, 1985; O'Reilly 1982), quality (O'Reilly 1982), ease of use (Hardy 1982), usefulness (Swanson 1987), promptness or the time it takes to deliver the information (Hardy 1982) and cost (Mick, Lindsey & Callahan 1980; Swanson 1987). Anderson et al. (2001:135) are of the opinion that despite differences in measures used and characteristics studied, the literature provides evidence of two competing written carrier characteristics, which are accessibility and quality.

2.5.4 User characteristics

Several researchers have investigated carriers in terms of a person's prior use. The concept of successful prior use of a carrier as a factor in information-seeking behaviour was also upheld by Culnan (1985), Hardy (1982), Johnson, Donohue, Atkin & Johnson (1995), Johnson (1996) and Swanson (1987). A review by Leckie et al. (1996) concludes that accessibility and familiarity are more important than perceived quality.

Early works by March and Simon (1958) and Allen (1977) note that information seekers are more likely to obtain information from carriers familiar to them rather than seek new carriers and that this practice becomes self-reinforcing. Wilson (1977:54) proposes that non-users of a particular carrier are likely to underestimate the existence of the carrier's potentially useful information and to overestimate the difficulty of obtaining the desired information.

A second stream of work focuses on the user's perception of the relevance or utility of the information to the task at hand. Swanson (1987:136) identifies a factor he calls 'value' which includes the attributes of importance, relevance, meaningfulness, usefulness and value. Johnson et al. (1995) adopt the Evans and Clarke (1983:239) concept of 'salience' or "the perceived applicability of information to a problem that he or she faces". In a multivariate analysis, these authors discover that 'importance' is one of several factors included in their comprehensive model.

2.5.5 Demography

Some early studies suggested that demographic factors such as tenure, experience and education affect information-seeking behaviour (Keller & Holland 1978; O'Reilly 1982). Yi, Lin and Kishimoto (2003) also identify three aspects of demographic factors, which include gender, age and level of education. These mentioned demographic variables were clearly interrelated and significant findings which were tested independent of other factors and were found to account for little variance. Johnson et al. (1995:283) argue that an information seeker's level of education probably has the most important consequences for his or her information-seeking behaviour. However, when these variables were cast into a multivariate model, their impact was found to be very low or non-significant.

Vakkari and Kuokkanen (1997:551) also consider the impact of education and experience. However, they conclude that task complexity reflects a worker's experience with a task and accordingly, "the more acquainted the enquirers are with a task the less complex they perceive it". Thus, these authors decided to exclude demographics from their analysis. Johnson et al. (1995) and Johnson (1996) propose a comprehensive approach that identifies five antecedents to information seeking: (1) demographics (2) direct experience (3) salience (4) individual beliefs about the outcomes of information and (5) carrier characteristics. Johnson and his associates studied a large state government agency providing engineering and technical services and ascertained that direct experience, salience and carrier characteristics are the primary determinants of choice. The evidence suggests that demographic considerations are not major factors in information seeking.

2.6 DETERMINANTS OF RESEARCHER'S INFORMATION-SEEKING BEHAVIOUR

According to Julien in Ikoja-Odongo and Mostert (2006:145), "the field of information-seeking behaviour in information science can broadly be defined as that which is concerned with determining user's information needs, searching behaviour and subsequent use of information". Fatima and Ahmad (2008:141) conceptualise information-seeking behaviour as a term that encapsulates a set of actions that an individual takes to express his or her information needs, seek information, evaluate and select information, and finally use this information to satisfy his/her needs. Bhatti (2009:8) observes that information-seeking behaviour may be motivated by a wide variety of needs such as personal, professional, entertainment and so on. Orlu, Imeh and Okike (2016:1-4) point out that information-seeking behaviour and use are influenced by the individual's information needs (which are determined by the individual's socio-economic status and their surrounding environment) combined with the goals for which the information is sought, the methods available for meeting the needs, and the information seeker's personality traits (intelligence/creativity, pragmatism/idealism etc). Raza, Sarwat and Upadhyay (2010:9) are of the opinion that information-seeking behaviour differs from one discipline to another and from one institution or library to

another. From the perspective of library and information science, the process of information seeking is often dependent on a task (Byström 2000), a discipline (Ocholla 1999) or the research stage process (Kuhlthau 2004). In addition, information behaviour embraces information seeking along with the totality of other unintentional or passive behaviours, as well as purposive behaviours that do not include seeking (an example is avoiding information) (Case 2012:5).

Niu et al. (2010:870) state that "the literature concerning information behaviour is quite large, and some of it focused on occupations, roles, and demographic groups". Examining the literature, it was discovered that several studies on information-seeking behaviour have been done by academic researchers, including physical scientists, life scientists, social scientists and humanists. Such studies include studies done by Connaway, Dickey and Radford (2011), Emmanuel and Jegede (2011), Haines et al. (2010), Hemminger, Lu, Vanghan and Adams (2007), Okonoko et al. (2015), Pareek and Rana (2013) and Wang, Dervos , Zhang and Wu (2008). Very few studies have been published that focus on the information-seeking behaviour of researchers of research institutions in a wide range of occupations and settings especially in non-academic settings. Examples of such studies are studies done by Acheampong and Dzandu (2015), Ellis and Haugan (1997) and Raza et al. (2010). But, no studies have covered researchers of any federal research institution in Nigeria. Therefore there is a need for research to be carried out to cover the Nigerian context of researchers' information behaviour.

2.6.1 Information-seeking behaviour related studies

Case (2012:5) states that information behaviour begins with uncertainty and it represents the activity used to find information that is needed. Information seeking is seen as a fundamental activity in the life of any individual (Kuhlthau 2004:13) with Bates (2002:3) corroborating that information seeking has to be reflected upon in connection with all the information that comes to a human being during his/her life cycle and not just considering those moments when a person actively seeks information. Kuhlthau (1999:13) describes information seeking as a complex inquiry process that involves learning from a diverse range of inconsistent and incompatible sources and can have important implications on the way systems and services are designed. Marchionini

(1995:6) portrays information seeking as a basic human process closely related to learning and problem-solving which is capable of producing excellent solution mechanisms. Libraries must understand the information-seeking behaviour of users to re-engineer their services and provide information efficiently (Lakshmi, Chinnasamy & Venkatachalam 2011:179).

Information seeking is seen as a process in which humans engage to purposefully change their state of knowledge (Ikoja-Odongo & Mostert 2006:148). Similarly, Kuhlthau (1991:361) describes information seeking as "the user's constructive activity of finding meaning from information in order to extend his/her state of knowledge on a particular topic". For Yoon and Nilan (1999:871), information seeking is "a dynamic process of a user making sense that involves cognitive behaviour at the level of individual perception and an associated communicative behaviour". Therefore, information seeking is a complex process consisting of social, communicative and interactive behaviour (Fourie 2004:70).

Prasad (1992:9) stipulates that information-seeking behaviour essentially refers to the strategies and actions undertaken to locate discrete knowledge elements. He explains that some process takes place in information-seeking behaviour, which is also applicable to researchers. The process entails identifying objectives, defining needs, accessing information systems, establishing sources of information, acquiring information, using information and satisfaction/dissatisfaction. Reddy and Jansen (2008:257) argue that information-seeking behaviour involves the researcher being able to identify available resources that will positively assist him/her to find the relevant information needed during a research process in an effective and efficient way. In other words, the quick identification of needed resources by a researcher will shorten the time taken for his/her actions and strategies making research time faster than planned.

Research by Connaway, Dickey and Radford (2011) focuses on convenience as a critical factor in information seeking. The research discovers that convenience has a big impact on the choice of information resources, satisfaction with the source, ease of access and time taken to access and use the information source. This can be linked to different demographic categories (e.g. age, group, gender, academic roles etc) where for example

younger researchers especially prefer the more convenient Google as a starting point for information seeking. A national study of information-seeking behaviour of academic researchers in the USA conducted by Hemminger et al. (2007) reveals that new technologies and information delivery systems are responsible for changes in the way researchers search for information. They point out that researchers were observed to prefer electronic methods for searching and accessing scholarly information and highlight the impact of collaborative information sharing among researchers.

Niu and Hemminger (2011:17) observe that the information-seeking behaviour of scientists could be said to be conditioned by what library and information services are available, such as, considering the distance to be covered to get to the library, available electronic database and so on. Spezi (2016:15-16) stresses that we should be conscious that in a global, ever more open information world, where searching can be conducted seamlessly, anywhere and anytime, different researchers are going to do it differently. Raza et al. (2010) investigate the information-seeking behaviour of biomedical researchers working at a Central Drug Research Institute. They observe that these researchers search for information by doing subject searches on the library's online public access catalogue and the library's international information database network. The authors conclude that information-seeking behaviour differs among disciplines and libraries based on available online resources and databases.

Ellis and Haugan (1997) identify and describe the information-seeking patterns of research scientists in an industrial environment. The identification and description of the researchers are done according to eight categories namely surveying, chaining, monitoring, browsing, distinguishing, filtering, extracting, and ending (Ellis & Haugan 1997:395-400). With these the role of information seeking in relation to the performance of research tasks was determined (Ellis & Haugan 1997:400). Information seeking is clearly seen to be most extensive in the initial phase of a project when both formal and informal channels are utilised.

2.7 ICT ADOPTION BY RESEARCHERS AS THEY SEEK FOR RESEARCH INFORMATION

Kim and Crowston (2011:2) simply define adoption as a user's initial acceptance of an object. The object here refers to different ICT instruments that are available to researchers and that they make use of in their research routines. Kusumaningtyasa and Suwarto (2015:297) express ICT adoption as the willingness to take for usage the new innovation related to computer and internet use. There is an increasing interest in studying the adoption and use of ICTs by researchers in various disciplines (as seen in the studies of Pearce, 2010; Procter, Williams, Stewart, Proschen, Snee, Voss & Asgari-Targhi 2010; Ponte & Simon 2011), given the consensus about the impact of these technologies on scientific methods and practices (as seen in the studies of Dutton 2010 and Nielsen 2012). Gelb, Maru, Brodgen, Dodsworth, Samii and Pesce (2008:6) are of the opinion that the effective adoption of ICTs now has a proven record in many parts of the world and a demonstrated potential to accrue significant economic, social and environmental benefits at local, national and global levels with the past decades witnessing numerous attempts to understand the mechanisms of adoption of technological innovation.

Various studies have been carried out regarding researchers' technology adoption and use, such as studies regarding specific researchers' groups' and different researchers' groups' ICT adoption and use in Africa, Asia, Europe and South America. The study by Raza et al. (2010) of researchers at the Central Drug Research Institute (CDRI), Lucknow, India points out that researchers adopt five major ICT-based services which are circulation services, OPAC (Online Public Access Catalogue), xeroxing (photocopying), CD-ROM and microfiche reading. Xeroxing (45%) and OPAC (42%) are the two ICT-based services that are most adopted by researchers. Also, Dzandu and Dadzie (2012) examine the impact of ICTs on information provision in six selected Institutes of Council for Scientific and Industrial Research (CSIR). The institutes involved in the study are the ones based in the capital city of Ghana, Accra. They are the Animal Research Institute (ARI), the Food Research Institute (FRI), the Institute of Industrial Research (IIR), the Institute for Scientific and Technological Information

(INSTI), the Science and Technology Policy Research Institute (STEPRI) and the Water Research Institute (WRI). The participants are the research officers in the selected institutes. The majority of the respondents indicate that they use computers, internet services and databases, and virtually use them every day. Inter-library lending and document delivery (ILL/DD) services and OPAC appear to be rarely used by the research officers [contrary to the study of Raza et al. (2010)], and most of them did not respond to the questions relating to ILL/DD and OPAC. The study shows that most of the research officers are aware of and use computers, internet service and databases as they seek for research information.

The study carried out by Arcila- Calderón, Piñuel and Calderín (2013) demonstrates that Latin American researchers in the communication field embrace ICT tools as they carry out their research with their orientation being towards using such tools for data analysis. Some tools like simulation or web analysis software (8.23%) and grids or clusters (11.08%) have a low rate of adoption. ICT tools such as content analysis software (25.32%), online survey software (38.92%), tools for graphic visualisation, management and creation (43.35%), spreadsheets (44.62%) and databases (57.91%) are well distributed among researchers. Agwu, Uche-Mba and Akinnagbe (2008) study on the adoption and use of ICTs by agricultural and extension researchers indicates that out of 24 ICT facilities listed, 14 facilities are frequently used by the agricultural and extension researchers and these facilities with their mean scores include internet (x = 2.25), television set (x = 2.07), voltage stabilizer (x = 2.17), radio set (x = 2.25), printer (x = 2.02), flash drive (x = 2.10), diskette (x = 2.20), computers (x = 2.20), uninterrupted power supply (UPS) (x = 2.08), mobile phone (x =2.58), photocopier (x=1.92), CD-ROMs (x=1.80), fixed telephone (x=1.70) and e-mail (x = 2.30). These data show that mobile phone, internet, e-mail and radio set are ranked as ICT facilities that are well adopted by agricultural and extension researchers while fixed telephone, CD-ROMs and photocopier are the least adopted ICT facilities.

The study carried out by Obioha (2005) shows that all the research officers at the Nigerian Institute for Oceanography and Marine Research (NIOMR) knows what ICTs are and the tools that make up ICTs with their exposure to ICTs. One hundred percent of

the researchers use ICT tools. These results demonstrate that ICT awareness, use and application are not new to these researchers. The exposure of the researchers to ICTs being two to five years indicates that they have a marginal level of exposure to ICTs (80% of respondents have 2–5 years exposure). Most of the respondents make use of the internet, computer systems, peripherals, CD-ROMs and telephones. The ICT tools employed for information seeking and use and the percentages of their adoption are (a) radio - 20 researchers (11.6%), (b) telephone - 33 researchers (19.2%) (c) computer system/CD-ROM - 172 researchers (100%) (d) internet/www/e-mail - 172 researchers (100%) and (e) cable TV - 7 researchers (4.1%). The interviews conducted indicate that majority of researchers in this institute make more use of internet, electronic mail and telephone in seeking for information in the office. At home, they rely on cable TV and radio.

The study by Atiso and Adkins (2015) shows that ICTs are completely integrated into the work life of Ghanaian R&D scientists. Ghanaian scientists are keenly aware of such technologies, although they are not taking full advantage of most or all of them. When compared to Obioha (2005), all Ghanaian R&D scientists in the study of Atiso and Adkins also make use the internet. But they use it to access databases (both foreign and local ones). In fact, most scientists have home internet access in addition to that which they have at work, which speaks volumes of how greatly they have adopted this technology. These have become a routine part of scientists' works, although their use of ICTs could be expanded. The most used ICT is the electronic mail, which recorded 100 percent for researchers' use. The investigations conducted in this study confirm the usefulness and adoption of ICT among research scientists in selected research organisations in the country, which help achieve a furtherance of increase in the understanding of online information behaviour of research scientists.

The results of various studies indicate that most researchers are conversant with the role of ICTs and thus the adoption of ICTs as well as they seek for research information on a day-to-day basis.

2.8 INFLUENCE OF RECENT TECHNOLOGIES ON INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIOUR

Bresnahan and Yin (2017:95) describe recent technologies as a new wave of innovative ICTs that are moving into the organisations or institutions replacing and complementing existing technologies. Bresnahan and Yin (2017:108) elucidate that a collection of technologies has surfaced and it is associated with big data such as web searching, online social interaction or other communication, mobile app usage associated with mobile devices adoption, and so on. These recent technologies as they are adopted by users create questions: What valuable influence will come from the application of these recent ICTs, and what influence will these have on the information needs and information-seeking behaviour of users (researchers in the context of this study)? Today there is an academic debate about these questions, based on opinions of various researchers informed by their investigations of the actual application of these new ICTs in various research institutions. This study will assess the influence of these recent technologies on the information needs and information-seeking behaviour of FIIRO's' researchers.

As stressed earlier, recent technologies involve the use of mobile devices and its various applications, the use of social media tools and so on. Therefore, it is important to simply know the meaning of mobile devices and social media. Technopedia (2018) defines mobile device as a handheld tablet or other devices that is made for portability (both compact and lightweight) with embedded characteristics of new data storage, processing and displaying technologies enabling these small devices to do nearly anything that had previously been traditionally done with larger personal computers. Likewise, Wei (2013:52) describes mobile devices to encompass a range of hand-held devices from mobile phones, tablets, and e-readers to game consoles primarily as a personal, interactive, internet-enabled and user-controlled portable platform that provides for the exchange of and sharing of personal and non-personal information among users who are inter-connected. Stoop (2017) maintains that cellphones are being used more and more for scientific purposes with them being used by scientists to prepare, conduct and analyse experiments. He stresses that cellphones are rapidly getting a central spot in the evolution of social networks and virtual reality and also open science (a broad term that reflects

how technology is changing the future of science, making research more open collaborative, transparent and efficient).

Kapoor, Tamilmani, Rana, Patil, Dwivedi and Nerur (2018) state that social media allows relationship forming between users from distinct backgrounds, resulting in an inflexible social structure. Greenwood and Gopal (2015:814) acknowledge that when social media is being referred to, applications such as Facebook, WhatsApp, Twitter, YouTube, LinkedIn, Pinterest, and Instagram often come to mind. They further acknowledge that these applications are driven by user-generated content and are highly influential in a myriad of settings. Kapoor et al. (2018) admit that considering the relevance of social media to various stakeholders, and the numerous consequences associated with its use, social media has attracted the attention of researchers from various fields. In relation to industrial researchers, findings on their social media utilisation will go a long way in solving the problems of their information needs and also help in shaping their information-seeking behaviour.

Various studies have demonstrated the influence of recent technologies on the information needs and information-seeking behaviour of a number of researchers in some research fields. Caldero, Calderin and Aguaded (2015) study describes the usage of some social media tools by communication and media researchers. Their findings indicate that, except for Twitter, communication researchers have an adoption rate of chats, Facebook and blogs close to 50%. The case of Twitter is particularly low since only 28% of researchers adopt it. However, the research data clearly show that many researchers are aware of transformations in scientific practices based on recent technologies adoption. The study done by Arcila- Calderón, Piñuel and Calderín (2013) demonstrates that Latin American researchers in the communication field have a positive attitude towards e-research and frequently use at least one basic e-tool, but there is evidence of a very limited use of advanced technologies by them. According to their findings, about half of the researchers use tools such as chats (41.14%), blogs (48.1%) and social networks like Facebook and Twitter (62.34%).

Briceño, Arcila-Calderón and Said-Hung (2012) examine the habits of a community of high-energy particle physicists in Latin America. The results of their survey confirm a

trend of using traditional tools of electronic academic publication (arXiv and Spires) and other shared data management systems, but reveal a low level of interest in the use of web 2.0 tools such as Facebook, blogs and Twitter. This serves as a reminder that each scientific discipline maintains distinct habits in the areas of scientific collaboration and communication. Pearce (2010) studies the technology adoption by researchers focusing on the web and e-science infrastructures to enhance research. The study contributed to the empirical evidence of a widespread use of web 2.0 tools for scientific diffusion (up to 43%) among scholars in a British university. The researchers use instant messengers, wikis and blogs.

The study by Atiso and Adkins (2015) shows that in terms of recent technologies usage and influence, Ghanaian R&D scientists mostly use LinkedIn. LinkedIn is a network that is used by most professionals. Its main purpose is to help people network professionally. The basic service is free. Ghanaian R&D scientists were observed to use the LinkedIn website to find out about colleagues known and unknown to them to boost research information sharing and collaboration. Twitter was not used by any of these research scientists. Other social media such as Pinterest, YouTube and blogs were used by scientists. These findings also suggest a potential for exploiting social media to promote scholarly communication. The results indicate that for most researchers, these technologies are the primary media through which Ghanaian research scientists perform their routine work, despite access challenges.

Agwu, Uche-Mba and Akinnagbe's (2008) study reveals that mobile phone, e-mail and internet are the three foremost recent technologies that influence the information needs and information-seeking behaviour of researchers with them having mean scores of 2.58, 2.30 and 2.25 respectively. All these findings on recent technologies bordering on mobile phone usage, social media tools usage, internet usage and electronic mail utilisation by researchers only lead to one thing - that researchers' information needs and information-seeking behaviours are influenced by recent technologies in different ways based on their availability, the dexterity of researchers in using them and the level of adoption of these technologies by different researchers.

2.9 THE USEFULNESS OF ICTS IN RESEARCH

According to Gay and Blades (2005) in Akpan (2014:260), information and communication technologies (ICTs) encompass the effective use of equipment and computer software to access, retrieve, convey, store, organise, manipulate and present data and information with these ICTs which include telephone, computers and the internet. Atiso and Adkins (2015:1) explain ICTs to be a general term that encompasses mostly communication devices or applications which include radio, television, cellular phones, computers and its networks such as the internet, satellite system and many more services associated with them. Marker, McNamara and Wallace (2002:4) define ICTs as technologies that assist or simplify communication and the processing and transmission of information electronically. Likewise, Kim and Crowston (2011:3) describe ICTs to be information technology artefacts that enable people's communication and information access. They argue that ICTs can include any physical device (such as cellphones and cyber-infrastructure), any computer application (such as Microsoft Office), or any internet or web service (such as Facebook and Twitter). Additionally, Australian Curriculum, Assessment and Reporting Authority (2010) adds to the explanation of ICTs to incorporate the range of digital-related hardware and software used to support the capture, storage, transmission and retrieval of data. The Australian Curriculum, Assessment and Reporting Authority maintain that apart from computers and mobile devices such as mobile phones, ICTs include peripheral devices such as scanners, printers, speakers and hand-held devices such as digital cameras, digital media players, calculators and data probes. Dzandu and Dadzie (2012) submit that ICT facilities and services that are available in libraries include computers, access to the internet and its resources, local area networks (LANs), compact disc-read only memory (CD-ROM) databases, online databases, online public access catalogues (OPACs), fax machines, photocopiers, interlibrary lending and document delivery (ILL/DD) services, computer laboratories, scanners, printers, microfiche readers and telephones, and many others.

Information and communication technologies are on the lips of every nation of earth's citizenry because they bring innovation into information seeking and knowledge acquisition (Obioha 2005:303). The innovation, development, expansion and application

of ICTs have resulted in great advancement in science, technology, socio-political sphere and so on in Africa and Nigeria in particular. Dzandu and Dadzie (2012) are of the opinion that ICTs are tools that any sector can use to deliver its services following the ICTs revolution that has turned the whole planet into a global village where communication (scientific collaboration) among people has become independent of physical distance and time. Likewise, Beñat, Soumitra and Bruno (2013) state that ICT tools, services and models have the potential to bring about development in research. The report indicates a positive correlation between economic growth, job improvement and research and development (R&D) in developing economies. With research and development centres having to deal with complex repositories, where they store, compute and retrieve data, ICTs have become invaluable (Arcila-Caldero, Calderin and Aguaded 2015:527). ICTs could augment traditional library functions such as those of the online public access catalogue, reference and bibliographic services, document delivery, current awareness services, and audio-visual services, which may in turn positively affect users' access and ability to use information (Atiso & Adkins 2015:2). Dzandu and Dadzie (2012) state that research scientists are expected to undertake research as part of their work and the ability to perform this task effectively is dependent on the availability and adoption of some ICT facilities and services. Hey, Tansley and Tolle (2009: xvii) indicate that ICTs allow the production, analysis, curation and sharing of huge amounts of information that may configure the entire scientific process and activity. The incorporation of ICTs in scientific routines has affected the way in which scientists do their work (Borgman 2007:126; Dutton 2010:3). These days, there are several commercial and non-commercial organisations with a wide range of ICT instruments that can be used for various research projects with the benefits from the adoption of these ICTs being related to the quantity and quality of research being turned out (Arcila-Caldero et al. 2015:527).

2.10 INFORMATION SERVICES OFFERED TO RESEARCHERS

According to Lynch **(**1983:401), information service is described as "the personal assistance given by a librarian either in the form of referral to likely sources of information or in the form of information itself". Lynch **(**1983:416) further explains that

the change in information needs necessitates the change in information systems with the purpose of information service being that of the facilitation of the connection of an information system with human beings who need what that system contains. Adeyinka (2014:54) points out that:

> Scientists in research and development institutions (RDIs) require the use of information services to gain access to frontier knowledge nationally and internationally to keep abreast of developments in inventions and innovations, which they also need to adapt to the local environment, while creating awareness for the dissemination of their research results.

Wilson (1977:1) and Kuhlthau (2004:2) indicate that "any policy for library system development should be based on an understanding of individual information gathering behaviour". The information-gathering behaviour of any user of an information-service provider will depend on the need of the user with an understanding that the user is the needed drive in designing information servives and systems by the service or system provider (Connaway 2015:6; Prasad 2012:5; Sridhar 1995:28). As a result, Kakai, Ikoja-Odongo and Kigongo-Bukenya (2004:562) observe that "understanding the actual needs of information users and taking steps to satisfy them is the first step towards effective service provision". The main idea is that the service provider tends to become subjective, whereas, in most cases, the customer or user of the service is the best judge (Booth 1993:7). Stone (2010:156) further adds that it is useful to listen to users in terms of offering them appropriate information services.

In providing appropriate and adequate information services, several propositions and challenges have surfaced according to some scholars. De Jager and Nassimbeni (2002: 168) indicate that searching skills should primarily include "familiarity with information resources, with the library and with various means of accessing resources in different media". Wilson (2004:1) acknowledges that "many libraries today are too financially pressed to do much more than the minimum helpful intervention in the information-seeking process". Poll and Boekhorst (2007:105) state that "most libraries are trying to assess their users' opinions on the services they supply". Another major suggestion which is also a challenge facing libraries relates to developing and updating collections and

services to meet the needs of multiple generations of users with differing approaches to information seeking (Connaway 2015:6). Ekene, Agbo and Onyekweodiri (2016:2) are of the opinion that it is evident that the evaluation of research library information services is relevant to the growth of the library and its parent organisation. This will always affect the researchers; however, the question of what to evaluate arises. According to Wilson (2010), some of the organisational functions that could be evaluated include: (i) internal operations relating to information materials (such as cataloguing and classification, indexing, etc.), (ii) new programmes of service delivery, (iii) new possibilities for technological support to services and (iv) library/information services to users. However, Popoola (2008) stresses that "the information resources and services available in institutional information systems (library, archives, records offices, documentation centres, and data centres) must be capable of supporting research activities".

Various studies have been carried out regarding information services offered to different users of information including researchers. A study done by Anwar and Eisenschitz (1983) reveals that a large number of researchers feel that they have not been keeping in touch with the scientific literature due to deficient library collections and services. They recommend that science and technology libraries should periodically survey the information needs of their users, assess their collections and facilities, and strengthen their promotional activities. Haines et al. (2010) argue that libraries have an opportunity to capitalise on their positive reputation and on the desire of basic science researchers for more centralised information to create new information resources and services such as institutional repositories. They stress that challenges in communication are complicated by the fact that researchers do not hold the same assumptions about the role of libraries in accessing information that library professionals do and libraries have made efforts to improve communication with users by instituting liaison programmes, creating websites and portals designed to make access to resources easy and convenient, and offering training and instruction in the use of various resources. They mention some of the information services offered by the libraries, which include interlibrary loan service, document delivery service, use of EndNote, email or telephone of the reference desk, databases and electronic journals, subject guides available on the library's website and liaison programmes. Haines et al. (2010) also suggest that the library could provide a

meeting space (which the libraries already do provide but researchers are not aware of) and commence a programme in which researchers interact with individual librarians with subject expertise. Mount (1995) points out that the type of information services provided by information centres vary in nature. This includes information consultation, searching, selective dissemination of information (SDI), translation of foreign materials, learning and reading services, providing trade literature, user education and subject information research.

Agyemang and Badu's' 2008 research on the use of library and information services by nuclear scientists in Ghana aims at making suggestions that would help to improve nuclear information service delivery in the country. Some of the nuclear scientists use their organisational libraries, but the frequency of use of the libraries and other local information services is low. The study suggests the need for a deliberate campaign by information workers in the nuclear sector to encourage the use of their resources and services. Adeyinka (2014) mentions library services, internet services and communications services as the three information services that are considered to be used by researchers in research and development institutions (RDIs) in Nigeria. The choice of these three information services is based on the justification that they are some of the information services mainly required at the institutional and individual levels of use by researchers in RDIs. Respondents in Adeyinka's study indicate that they use internet services, closely followed by communications services, more frequently than library services on a weekly basis. In almost all the RDIs, the frequency of the use of library services in terms of physical visit is reported to be on the decrease, while there is an increase in the use of internet services. The increased use of internet services confirms that strictly physically accessible library services are now available virtually.

Uganneya et al.'s' (2012) study involves six purposively selected agricultural research libraries in Nigeria namely: the library of National Root Crop Research Institute of Nigeria, the library of Veterinary Research Institute of Nigeria, the Library of Cocoa Research Institute of Nigeria, the library of University of Agriculture Makurdi, the library of University of Agriculture Abeokuta and the library of the University of Agriculture Umudike. The study discovers that reference and circulation services are excellently

provided by the agricultural research libraries in Nigeria. The majority of the users indicate that they are satisfied with the quality of provision of reference and circulation services by the agricultural research libraries. However, referral service and shelf management of books were rated not satisfactory. Irregular internet services, expensive internet services, outdated material and staff unresponsiveness are some of the constraints to user satisfaction. The study recommends that there is the need for librarians to design a system that can facilitate and enhance referral services between the library and users. Uganneya et al. (2012:88) argue that an adequate shelf management system that would allow proper shelf arrangement of books should also be put in place. Likewise, Umar (2009:92) points out that transactional service such as circulation, reference and photocopying are in most cases provided on a regular basis by agricultural research libraries in Nigeria, but they have to be improved upon to reflect modern-day development in order to aid research.

The study carried by Ekene, Agbo, and Onyekweodiri (2016) assesses the available library resources and services provided in two medical libraries in south-east Nigeria. It seeks to determine the type of library services provided in the two selected libraries as well as ascertain the extent of availability and the level of adequacy of the available resources. The types of library services in the two medical libraries include reference services, document delivery services, computerised literature search, searching medical databases, internet browsing, current awareness services, selective dissemination of information, reprogaphic services, interlibrary loan and intralibrary loan. The findings show that reference services, searching medical databases and current awareness services are rated by the respondents to be the most adequate of all the services listed. The results of the study also indicate that the library users all agreed that reference services, current awareness services and reprographic services are available in the library. Other services such as internet browsing, computerised literature searching, document delivery services etc. are not available. On the other hand, Ekene, Agbo and Onyekweodiri observe that these same services which the users said are not available, are provided in one way or the other, but the users are not aware of them

2.11 SUMMARY OF LITERATURE REVIEW

This chapter covers researchers' information behaviour which includes information needs, information seeking, information sources, information sharing and collaboration majorly in the academic setting especially the universities. Most of the literature found and reviewed was in the context of developed countries. The rather little deal of the literature that was found in the context of developing nations did not address the issues surrounding the information needs and information-seeking behaviour of industrial researchers. The current study brought to the forefront the context of a developing country in the African context by focusing on a foremost federal research institute in Nigeria.

In addition, the reviewed literature showed that existing research has largely employed the use of either the qualitative or quantitative method singly rather than adopting the mixed method that is also suited for investigating information-behaviour inclined research problems. This study adopts the mixed method approach.

This study departs from studies in extant literature where there is hardly any application of research paradigms in investigating research problems. This study uses the pragmatism paradigm philosophy that allows for the use of the triangulation of qualitative and quantitative method to gain a deeper understanding of the different perspectives of the research problem being investigated.

The next chapter presents the theoretical framework adopted by the study to investigate the research problem.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.1 INTRODUCTION

This chapter discusses background information on the theoretical framework and the model (Wilson (1999) model of information behaviour) that this study will adopt. According to Bertram (2004:143), a theoretical framework guides and affects how researchers design a study and how they collect and analyse the research data. In addition, theoretical framework is an empirical or quasi-empirical theory of social and/or psychological processes at a variety of levels (grand, mid-range and explanatory levels) that can be applied as a 'lens' in order to understand a phenomenon (Anfara & Mertz 2006:27)

Kousoyiannus in Aina (2004:4) depicts a model as a simplified representation which includes the main features of the real situation it presents - models will serve the purposes of analysing and predicting. Frankfort-Nachmias and Nachmias (2008:44) state that a model defines those aspects of the real world which the scientists consider to be relevant to the problem investigated and makes unambiguous the significant relationships among those aspects. A model may be expressed as a "framework for thinking about a problem and may evolve into a statement of the relationships among theoretical propositions" (Wilson 1999:250). Bates (2005:3) believes that a model could correctly guide research within a particular field. Cohen, Manion and Morrison (2007:12) observe that the term 'model' is used instead of or interchangeably with 'theory' more often than not. However, Järvelin and Wilson (2003:2) are of the opinion that models are seen as being broader than scientific theories owing to the fact that they provide the basis for the precondition of theory formulation, providing the conceptual and methodological tools for formulating hypotheses and theories. Cohen, Manion and Morrison (2007:13) stress that an accurately formulated model can be of great help in achieving clarity and focusing on key issues on the nature of the phenomenon.

Ikoja-Odongo and Mostert (2006:154) argue that it is of great significance to review a number of information behaviour models that are considered to play a fundamental role

while choosing the appropriate theoretical framework for the purpose of a particular study. Bates (2005:3) indicates that models are most helpful and suitable at the description and prediction stages of understanding a phenomenon under study. Pettigrew and McKechnie (2001) note that even if there is a significant number of information behaviour models that are commonly evaluated and others that are specifically applied to the LIS sub-fields, Case (2002, 2006, 2007, 2012), Jeong and Kim (2005) and Fisher and Julien (2009) maintain that it is still a core task of a researcher to identify and apply the most appropriate model that can be used as described by Stilwell (2010), Ikoja-Odongo and Mostert (2006) and Byström and Hansen (2005).

However, the background information on the theoretical framework and Wilson (1999) model of information behaviour that this study adopts will not be properly discussed except the conceptualisation of information, information needs, information seeking and information use are sufficiently explained.

3.2 CONCEPTUALISING INFORMATION, INFORMATION NEEDS, INFORMATION SEEKING AND INFORMATION USE

This study seeks to investigate the information needs and information-seeking behaviour of researchers at FIIRO in Nigeria. This involves identifying the patterns of information seeking/use and the sources available and how they are used. It also involves looking at potential sources of information that may not be known by the researchers and how their availability could help to address their needs. This section addresses the concepts of information, information needs, information seeking and information use as outlined in the following objectives:

a) To examine the information needs of FIIRO's' researchers.
b) To analyse the information sources used by FIIRO's' researchers.
c) To assess the factors affecting the information-seeking behaviour of FIIRO's' researchers.

The above objective was addressed by answering the following research questions:

i. What are the information needs of FIIRO's' researchers in Nigeria?

ii. What are the information sources that are used by FIIRO's' researchers in Nigeria?
iii. What are the factors affecting the information-seeking behaviour of FIIRO's' researchers?

As stated by Case (2007:41), "in order to discuss and study a concept, we first need to define it, in the process, we may identify and define other ideas that are related to (and sometimes derived from) the concept under study." In the case of information, 'information behaviour', 'information seeking', 'information source' and 'information use' are among the terms that make up the concept of information.

3.2.1 Defining information

It is essential to define the word 'information', because other key concepts used in this study are built upon the concept of information. The term information is defined, understood and interpreted differently across a vast array of disciplines (Losee 1997:254). In the same line of thought, Mutshewa (2006:34) observes that even though information has been contextualised throughout various disciplines such as communication, information science and information systems, each of these disciplines still has a different emphasis. In the context of this study, it is important to define the word 'information'.

Many scholars have tried frequently to define information in the field of information science but they could not come up with one universally acceptable definition of the concept of information (Bawden 2007:2). Zhang and Benjamin (2007:1935) argue that information is associated with the some concepts. They name some of them such as fact, data, knowledge, intelligence, news, communication, instruction representation and mental experience. The study uses Kaniki (2001) definition as the acceptable meaning of the concept of information for the purpose of this research. Kaniki (2001:191) defines and contextualises information as ideas, facts and imaginative works of the mind and data of value, which are potentially useful in decision-making, question answering and problem-solving.

This study agrees with the reasons briefly outlined by Bitso (2011:18) relating to the problems and complexities pertaining to the concept of information such as the fact that

information is too vast a concept to define and examine. In this context, this study also considered the following additional complexities:

- Weller (2008:11) provides that "information faces the problematic issue of definition".
- No one seems to know exactly what information is (Fox 1983:3).
- Information must not be confused with meaning (Weaver 1949:8).
- Information means any difference that makes a difference to a conscious-human mind (Bateson 1972:453).
- Dervin and Nilan (1986:16) observe that information is seen as something constructed by human beings.
- Lasch (1995:162) states that information is usually perceived as the precondition of debate, and it is better described as its by-product.
- Taylor (1991:221) indicates that information is the product of a certain element of the information environment. It generally reflects the assumptions made by a defined group of people concerning the nature of their work-related tasks.
- Smith (1991:85) describes information as a property of matter, any message or document used for purpose of communication.
- Kuhlthau (2008:68) argues that the impact that information creates is what the user is interested in and what motivates information-seeking process.
- Case (2012:56-57) discusses five problematic issues in defining the term 'information'. The discussion deals with the following 'assumptions' that information must reflect utility, physicality, structure/procedure, intentionality, and truth.
- Lane, Chisholm, and Mateer (2000:1) further explain that "information is what we need to know, when we need to know it".

3.2.2 Information needs

The term "information need" does not necessarily imply that people are "in need of" information as such but that the use of information can lead to the satisfaction of a more basic need (Wilson 1981:5-6). Ingwersen and Järvelin (2005:20) note that "information

need signifies a consciously identified gap in the knowledge available to an actor". Ikoja-Odongo and Mostert (2006:147) argue that information need may involve general or specific information of which general information refers to current information on topics of interest, while specific information encompasses finding solutions and problem-solving.

Wilson (1981:6) mentions that the use of information can lead to the satisfaction of a more perceived need and this line of thinking leads to Wilson's point of view that information is a secondary need rather than a basic need. However, Green (1990:65-67) discusses four multiplicities of need and these include: firstly, a need is always instrumental because it involves reaching an anticipated goal. Secondly, a need is usually contestable and it differs from a want. Thirdly, a need is related to the concept of necessity. Fourthly, a need is not always necessarily a state of mind because a need may not be well recognised or may be misunderstood by the inquirer. Fourie (2010:35) supports Green's fourth characteristic of a need and states that "information needs are not always recognised". Allen (2011:2165) perceives that "an explicit information need activates a conscious analytical process of information seeking".

3.2.3 Information sources

Case (2007:8) observes that people rarely use formal sources; instead they gather and rely on informal sources throughout their lives mainly friends and family members. Fisher and Julien (2009:332) emphasise that the interpersonal and the internet source constitutes two types of information sources that dominate the literature in information behaviour related studies. Wilson (1997:561-562) indicates that there are three important characteristics of a good information source and these include:

- Accessibility: an information source is expected to be easily accessible to a user.
- Credibility: an information source is assumed to be reliable in the quality and accuracy of information delivered to a user.
- Channel of communication: even though it is not strictly a characteristic of information source as well as the first two features (accessibility and credibility),

but an information source can reflect the proper channel to be used in order to effectively communicate or deliver a message.

Agarwal, Xu, and Poo (2011:1088) identify six different types of information sources, which include face-to-face, letters/snail mails, phone/online chat, email/online forum, books/manuals, and online information. For the purpose of this study, an information source is considered as something that contains information. According to the argument of Yi (2007:667), the resources and services that qualify for libraries are based on users' (researchers for the current study) information needs for research and analysis in changing situations.

3.2.4 Information-seeking behaviour

Wilson (2000:49) defines information-seeking behaviour as the purposive seeking for information as a consequence of a need to satisfy a goal. In the course of seeking, the individual may interact with manual information systems such as a newspaper or a library or with computer-based systems such as the World Wide Web. McKenzie (2003:19) opines that during the information-seeking process, people implement various strategies in a purposive way to fill an information gap. Kuhlthau (2008:68) asserts that the main objective of information seeking is related to the accomplishment of the task that initiated the search, not simply the collection of information as an end in itself. For the purpose of this study the research task that researchers engage in becomes a major concern during the information-seeking process undertaken by the researchers.

Wilson's (2000:49) definition of information-seeking behaviour, is generally supported by Prabhavathi (2011:34) and is adopted for the purpose of this study, in the sense that, researchers seek information with the main purpose of satisfying research needs or other related everyday life needs. During this information-seeking process, they tend to consult both printed and electronic resources. Researchers interact with information professionals such as research librarians with a specific purpose in mind; they also browse the internet or web-based information resources, which may involve a research and non-research activity.

3.2.5 Information use

Wilson (2000:50) maintains that information use behaviour "consists of the physical and mental acts involved in incorporating the information found in the person's existing knowledge base". Case (2002:258) comments that "information needs and uses need to be examined within the work, organisational and social settings of the users". Choo (2006:65) says that "the outcome of information use is a change in the individual's capacity to act". Hollnagel (1980:1984) suggests that "information science is concerned with the use of information by humans". Rioux (2005:171) depicts information use as a useful communicative tool to share information, and this communication process may lead to acquiring other information or enabling individuals to address some information needs. Many people search information from a variety of sources and they use information received in different ways (Byström & Hansen 2005:1055). For the purpose of the current study, the term 'use' will refer to locating and obtaining information to address information needs.

3.2.6 Information exchange

Information requirements are applied more when information is exchanged and it consists of some aspects such as accessibility and relevance of information (Järvelin and Ingwersen 2005:1). Lampert (2008:6) observes that "access and exchange of information is nearly instantaneous". This translates to the fact that having access to information is very important for end-users (De la Flor and Ramsden 2004:133). Idiegbeyan-Ose and Akpoghome (2009:22) signify that people use various communication channels in order to transfer relevant messages from a reliable source to the particular user of the message (receiver). Consequently, Pauleen and Yoong (2001:194) reveal that communication channels are fundamentally divided into three categories and these are face-to-face, conventional and internet-based communication channels.

3.2.7 Information service

Prabhavathi (2011:34) shows that in the course of seeking, a person may interact with manual information systems, for example, a library, or with computer-based systems such as the web. Wilson (2006:661) also observes that two subsystems generally occur within

the information system; these are the mediator (human being) and the technology. Brophy (2000:169) argues that information services continue to reflect a wide range of interconnected services such as internet services, web sources and commercial databases. Scheeren (2010:10) declares that "collateral to the internet is the use of electronic databases, which use the internet for access but provide information that is always credible".

Wilson (2006:666) recommends that information specialists, including librarians and other services providers "should have a better understanding of the user and be able to design more effective information systems". Cloutier (2005:333) identifies two main types of information services and these include research services and document delivery services. Interestingly, both types are fundamentally used by researchers within the research environment, especially during the process of carrying out scientific research.

3.3 INFORMATION BEHAVIOUR MODELS

When compared with other LIS sub-fields, human information behaviour is the sub-field where researchers are among the highest users of theories when it comes to information studies (McKechnie, Pettigrew and Joyce 2000:57). Fisher, Erdelez and Mckechnie (2005) give 72 theories of information behaviour. Du Preez (2008:29) notes that "the models that have been developed to date by information behaviour researchers are not necessarily applicable to all user groups". Though it is not compulsory to discuss every model in detail it is important to acknowledge the existence of key information seeking-behaviour related models in the literature. Therefore the present study identifies some of the influential information behaviour models from different groups of authors that are relevant to researchers' information needs and information-seeking behaviour with just five models being discussed briefly. The models to be briefly discussed are Wilson (1981), Krikelas (1983), Dervin (1983), Ellis (1989) and Kuhlthau (1991).

3.3.1 Wilson, 1981

This model can be traced back to the year 1981. Wilson's 1981 model of information-seeking behaviour is one of the most cited models (Wilson 2000). Wilson's first set of three models was published in 1981 but a revised, general model on information-seeking

behaviour (based on the second and third models of 1981) was published in 1996. Wilson (1981) model (in Wilson 1999:252) is based on two main propositions: firstly, that information need is not a primary need, but a secondary need that arises out of needs of a more basic kind; and secondly, that in the effort to discover information to satisfy a need, the information searcher is likely to meet with difficulties/obstructions of different kinds.

Wilson (1981:2) theorises that:

> …information-seeking behaviour results from the recognition of some need, perceived by the user that may take several forms. For example, the user may make demands upon formal information systems (such as libraries, on-line services, Prestel or information centres). The systems information functions in addition to a primary, non-information (such as estate agents' offices or car sales agencies, both of which are concerned with selling, but which may be used to obtain information on current prices, areas of 'suitable' housing, or details of cars that hold their second hand value.

The assertion above elucidates the developing information need of a person that will lead to making a demand on available information systems if there is an identifiable information need to be met. At this phase the individual exhibits varying behaviour depending on the kind and the level of prior knowledge and the skill that he/she possesses that assists in making helpful information choices.

Wilson (1981) suggests that the basic needs can be defined as physiological, cognitive or affective. Furthermore, he notes that the context of these needs is dependent on the individual, or the role demands of the person's work or life, or the environments (political, economic, technological, etc.) within which that life or work takes place. Wilson (1999) explains this 1981 model to be a macro model or a model of the gross information-seeking behaviour. Wilson (1999) submits that the model implies hypotheses about information context without making them explicit and that it does not indicate the processes whereby a person is affected by context, nor how context then affects his/her perception of barriers to information seeking.

The strength of Wilson (1981) model has been brought to light by a number of researchers. Ingwersen and Järvelin (2005) depict Wilson (1981) model as one of the best theoretical models on information seeking. They reveal that the model has entrenched in it the notion of information, information need, information seeking and utilisation. Ingwersen and Järvelin (2005) further indicate that Wilson's 1981 model recognises many factors affecting information behaviour though it does not analyse work tasks and individual situations or contexts in detail. Ellis (1993) puts forward that Wilson's 1981 model is remarkably applicable to the study of the needs underlying information-seeking behaviour of users. Furthermore, Ellis points out that Wilson's 1981 model is appropriate for uncovering the facts of everyday life of the people being investigated.

Case (2006) in his criticism of Wilson 1981's model says the model ascribes little or no importance to documentary information sources that form the largest information sources. Wilson (1999) in his assessment of his own model also says that the model does not cover a particular group of people's information behaviour thereby limiting it to specific roles for which the information sought is applied. Prigoda and Mckenzie (2007) in their evaluation of the model indicate the fact that Wilson's 1981 model ignores questions of sources, characteristics and personal preferences of users. They also add that the model generalise information seeking irrespective of users' occupation or roles without analysing type and extent of information sources or the sufficiency of available information to meet the needs of information users.

The weaknesses of Wilson's 1981 model of information behaviour make it inappropriate for this study because it does not extensively cover how information can be applied and exchanged among professionals. In addition, the model ignores personal information preferences, does not consider the situation of individuals and it underestimates documentary sources. The model does not also take into consideration the success or failure of information use as a result of satisfaction or non-satisfaction with respect to job outcomes.

3.3.2 Krikelas, 1983

The model was developed by Krikelas in 1983 in an effort to unify the field of user studies that he described as lacking a single theoretical approach. The model was concerned about the recurring failure in library and information science to establish a distinction between use studies and user studies and the difficulties encountered in reaching a consensus on how information is defined (Fisher, Erdelez & Mckechnie 2005:225).

Ikoja-Odongo and Mostert (2006:149) explain concerning the model that the individual recognises an inadequacy in his/her knowledge which requires resolution in order to deal with the problem and this will lead the user on a search for information through various information sources (human sources, information systems or any other information resources). The process may result in either success or failure; in the case of the latter, the process can be repeated (Hayden n.d.).

The strength of Krikelas's model is seen from the perspective of it not being restricted to examining the information behaviour of one type of occupation. Spink, Foster, Prabha, Silipigni Connaway, Olszewski and Jenkins (2007) submit that the characteristics of Krikelas' 1983 model cover all areas of human information behaviour but concentrate more on immediate needs. However, Zaborowski (2008:17) criticises Krikelas' model from the angle of the model being simple, a one-dimensional flowchart with no single part of the process encompassing the other. Other models demonstrate that information seeking is not a linear process, but one that requires information seekers to gather information, reassess and seek additional information. Additionally, Shenton and Fitzgibbons (2010) indicate that the model has been developed on the assumption that information needs relate to motivation and the information sources for users' circumstances. However, it does not suit predictable professional job roles like that of the industrial researchers.

Considering the above-mentioned criticisms, this study will not adopt Krikelas' model since it does not address all the study variables, research questions and has been designed to address only qualitative research approaches.

3.3.3 Dervin, 1983

Dervin's sense-making theory has advanced since the year it was developed and cannot be perceived simply as an information-seeking model. Dervin (1983) states that sense-making is central to all communicating situations be it intra-personal, inter-personal, mass, cross-cultural, societal or inter-national. With respect to this centrality, the sense-making approach is seen as having wide applicability.

Dervin (1983) states that the term "sense-making" is a label for a coherent set of concepts and methods used to study how people construct sense of their worlds and, in particular, how they construct information needs and the uses for which information is put in the process of sense-making.

Dervin (1983) expounds that sense-making is carried out in terms of four constituent elements which are:

- a situation in time and space, which defines the context in which information problems arise.
- a gap, which identifies the difference between the contextual situation and the desired situation.
- an outcome, that is, the consequences of the sense-making process.
- a bridge, that is, some means of closing the gap between situation and outcome.

Wilson (1999:253) explains that the strong point of Dervin's model lies partly in its methodological consequences, since, in relation to information behaviour, it can lead to a way of questioning. Wilson (1999:253) further clarifies that this can reveal the nature of a problematic situation, the extent to which information serves to bridge the gap of uncertainty or confusion and the nature of the outcomes from the use of information.

3.3.4 Ellis, 1989

Ellis (1989:178) explains the diverse kinds of behaviour manifest in the act of information seeking in terms of features as dissent to stages. The features he pinpointed include:

- Starting: the means employed by the user to begin seeking information (searching for information).
- Chaining: following footnotes and citations in known material or 'forward' chaining from known items through citation indexes.
- Browsing: semi-directed or semi-structured searching.
- Differentiating: using known differences in information sources as a way of filtering the amount of information obtained.
- Monitoring: keeping up-to-date or current awareness searching.
- Extracting: selectively identifying relevant material in an information source.
- Verifying: checking the accuracy of information.
- Ending: which may be explained as 'tying up loose ends' through a final search.

According to Wilson (1999:254), Ellis made no claims to the effect that the different kinds of behaviour constitute a single set of stages; he only adopted the use of the term 'feature' instead of 'stage'.

Wilson (1999) identifies that the significance of Ellis's model is enhanced by the fact that it has strong similarities with other influential models, such as that of Kuhlthau (1988, 1991 and 1993), especially in terms of the various types of activities or tasks carried out within the overall information-seeking process. Choo, Detlor and Turnbull (2000) maintain that Ellis's model is also important because it is built on empirical research and has been applied in many subsequent studies and with various groups of users. Conversely, Ikoja-Odongo and Mostert (2006:149-150) argue that Ellis points toward behaviours not necessarily occurring in a sequential order but it is the information seeker in terms of the unique circumstances of the information-seeking activities that will determine the pattern at that specific point in time.

This model will not be adopted in this study because Ellis's grouping of actual information-seeking behaviour activities among scientists suggests that information retrieval systems could increase their usefulness by including features that directly support the activities mentioned in the model. Undoubtedly, most of the information-

seeking behaviour features in Ellis's model are now being supported by capabilities available in Web browsers (Choo, Detlor, & Turnbull, 2000).

3.3.5 Kuhlthau, 1991

Kuhlthau's model complements that of Ellis. Kuhlthau (1991:361) explicates that the model connects to stages of the 'information search process' (ISP), associated feelings, thoughts and actions and the applicable information tasks. Kuhlthau (1991:366-368) characterises the six stages of Kuhlthau's ISP model to be initiation, selection, exploration, formulation, collection and search closure/presentation.

Wilson (1999:255) argues that Kuhlthau's model is more general than that of Ellis in drawing awareness to the feelings associated with the various stages and activities. In this regard, Kuhlthau acknowledges her debt to Kelly's personal construct theory (Kelly 1963) which "...describes the affective experience of individuals involved in the process of constructing meaning from the information they encounter" (Kwasnik 1991:364). The fundamental proposition is that the feelings of uncertainty associated with the need to search for information give rise to feelings of doubt, confusion and frustration and that those feelings change, as the search process proceeds and is increasingly successful (Kuhlthau 2005:231). In addition, as relevant materials are collected confidence increases and is associated with feelings of relief, satisfaction and a sense of direction (Kuhltahu 2005:231).

Shah and González-Ibáñez (2010) affirm that Kuhlthau's model is one of the most illustrative models of information seeking that thoroughly describes a user's perspective. Weiler (2005) also expresses Kuhlthau's model as acceptable across the user groups because of its inclusiveness. However, Meyer (2009) after examining Kuhlthau's model showed that there is still much debate on what factors influence information search behaviour. The model covers cognitive and affective skills of users making it to be specifically desirable for the study of young learners' information behaviour. For example, Botha (2014) holds forth that Kuhlthau's model focused on learning in middle childhood information behaviour. The model therefore is limited to the early educational

environment and directed at the initial stage of information seeking that is judgmental, and does not cover professional and occupational information seekers.

This study adopts Wilson's 1999 model of information-seeking behaviour as its theoretical framework.

3.4 WILSON'S 1999 MODEL OF INFORMATION BEHAVIOUR: THEORETICAL MODEL THAT GUIDED THE STUDY

Wilson's 1999 model is an updated version of Wilson's models of information behaviour from 1981 (earliest form of the model) to 1999 (the latest form of the model was originally published in 1996). It is the revised general model and is compatible with its previous versions when the user overcomes barriers to seeking information. The model also drives the direction of information behaviour research from "system-centric" to "person-centric" investigations by proposing information-seeking behaviour as a new lens, in combination with information use, to study the dynamic process experienced by users for satisfying information needs. Wilson (1999) put forward a problem-solving model as a way of integrating the research in the field of information behaviour. Wilson (2000) highlights that the model considers information seeking, searching and uses to be associated with the following stages of a goal-directed problem-solving process: problem recognition, problem definition, problem resolution and solution statement. Wilson's 1999 model states that information-seeking behaviour can be seen as a goal-determined behaviour where a particular type of information helps to solve a set of problems. Wang (2013:13) emphasises that in the process of seeking, searching, and using information to solve a problem, a user can interact with three categories of information namely problem information, domain information and problem-solving information. Wang explains that problem information is about the structure, properties and requirements of the problem at hand where users can access it in the problem environment or document. Domain information is about facts, concepts, laws and theories while the problem-solving method discusses the methods of problem treatment, that is, how a particular problem should be formulated and solved. This is critical for solving the problem and can only be implemented by experts.

Wilson's 1999 model presents how information needs arise and it identifies the factors that can prevent the task of searching for information. Some factors are resource based and these include: availability of information, awareness of availability, issues related to the ease of use of information resources (Kaniki 2001). In relation to creating awareness, Cassell and Hiremath (2013:10) and Lawson (2000:45) consistently underline the importance of marketing and promotion of available library resources. Ikoja-Odongo and Mostert (2006) briefly identify two main factors that may create barriers to obtaining useful information. These are internal factors (personal) and external factors (environmental), and these factors are underlined in Wilson's 1999 model. According to Aina (2004), there are other factors that also create barriers in obtaining useful information such as high cost, illiteracy and lack of ICT infrastructure especially in the current technology age.

Figure 3.1 shows the diagram of Wilson's 1999 model. It helps to reveal the core elements or variables of this model that will be applied to the current study in terms of the theoretical framework. Wilson (1999:251) points out that the scope of the diagram in Figure 3.1 is much greater than merely the concept of information needs and it is intended to cover all vital elements or variables involved in the information behaviour process. Wilson's model does not simply specify a sequence of events, but it goes further and depicts a sequence of human behaviour by referring to relevant variables as listed below. Little wonder that, Miles and Huberman (1984:18) observe that a theoretical model contributes to correctly understanding the key variables or elements under study.

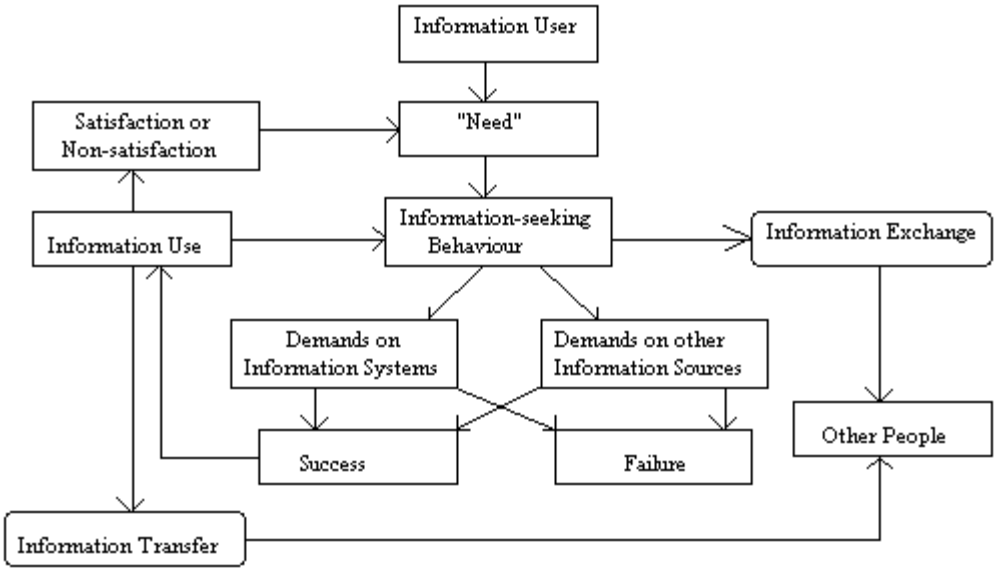


Figure 3.1: Wilson's model of information behaviour (Wilson 1999:251)

Wilson's 1999 model indicates that an information user often has different needs and many information-seeking patterns are involved in the process of consulting various sources of information. Wilson's 1999 model indicates that information users have needs and these needs may originate from a previous level of satisfaction or non-satisfaction with acquired information. The first core variable of Wilson's 1999 model is the information user, which is the researcher for this study. In other words, the motives and purposes of the information users give rise to information use and requirements (Dervin 1992:64). It is evident that according to Wilson's 1999 model, information needs determine the information systems and sources to be used and influence the way in which the information would be used (information use) or exchanged (information exchange). An information user may personally utilise information or s/he may exchange information received with the other people (information transfer). Wilson (1999:251) notes that an individual makes use of information (information use) found and may either fully or partially satisfy the perceived need.

Wilson's 1999 model was initially based upon two key points. Firstly, the model considers an information need as a secondary need that arises out of a more basic or primary need. Secondly, during the process of discovering information, the seeker tends to meet with barriers of different kinds and these barriers include: personal, interpersonal

and environmental barriers (Wilson 1999:252). Interpersonal problems are likely to come into play if the information source is a person (Wilson 1997:559). Wilson (1999) model reveals that only an expressed need can be identified and satisfied by information users either by themselves or with the support from others usually being frequently information professionals. According to Case (2007), there are various types of need and these include conscious (expressed) needs and unconscious (unexpressed) needs. Davies and Harrison (2007:79) state that the expressed or articulated need is an actual perceived need and it normally demands an answer, but unexpressed needs are not recognised as information needs. Chowdhury and Chowdhury (2011:29) and Rhode (1986:52) observe that where information needs remain frequently unexpressed or poorly expressed, information specialists should appropriately support information users/seekers. Wilson's 1999 model indicates that an information user often has different needs where many information-seeking patterns are involved in the process of consulting various sources of information.

Wilson (2005:31) indicates that Wilson's 1999 general model involves three main views of information seeking and these include: the context of the seeker, the system utilised (manually or electronically) and then, information resources that might be drawn upon. Wilson's 1999 model also highlights the information-seeking process and provides a feedback loop where the information seeking is thought of as 'iterative' in numerous phases, rather than 'successive' (Wilson 1999:267). Wilson's 1981 model considers feedback to be an essential element of the total information-seeking process (Wilson 1981:2), which is also essentially part of Wilson's 1999 model. Wilson's 1999 model reflects key elements of Wilson's revised general model with regard to its focus on information users, their information needs, their information-seeking behaviour and their context. In particular it emphasises the impact of personal and cultural influences on information use which relate to Wilson's intervening variables (psychological, demographic, role related/interpersonal, environmental and source characteristics).

According to Wilson (1999:251), the success of the information-seeking process explains the use of information and it then justifies the satisfaction of a perceived need. Therefore, an information user may personally utilise information or s/he may exchange information

received with other people (information transfer). Wilson (1999:251) notes that an individual makes use of the information found and may either fully or partially satisfy the perceived need. Remarkably, Wilson (1999:251) also stresses the information to be exchanged with other people, a process known as information transfer, in the process of seeking and using acquired information. In addition, Wilson (1999) model of information behaviour considers the involvement of other people and various media through information exchange towards information-seeking behaviour.

Basically, a user consults or demands numerous information systems or other sources of information (Wilson 1999:251). The result of these demands leads either to success/satisfaction due to useful information received or to failure/dissatisfaction due to unhelpful information or poor service. Wilson (1999:251) further notes that formal or informal information sources can be consulted, by an information user for the purpose of getting to the point of satisfaction (success) of the expressed need. Coming from the environmental scanning perspective, Choo (2002:85) distinguishes between a formal search and an informal search. A formal search involves systematically retrieving information which is pertinent for a specific purpose or particular issue, while an informal search is relatively unstructured and it has different forms. Undeniably, researchers acquire information from both formal and informal sources. Wilson (1999:251) argues that users may consult multiple sources of information depending on the nature of their information need. For example, during the seeking process, an individual may interact with people face-to-face or electronically (Wilson 2000). After interacting with diverse sources of information, what is predominantly available may likely differ from what a user really needs in order to satisfy his/her perceived need (Taylor 1990). According to Macintosh-Murray and Choo (2006), in this case, a user may experience dissatisfaction or failure. However, researchers undeniably acquire information from both formal sources, for example from books, journals, etc. and an informal network as a means of support and exchange of information, for instance, researchers also interact and obtain information from colleagues.

According to Wilson (1999:251), the success of the information-seeking process explains the use of information and then identifies the satisfaction of a perceived need. Wilson

indicates that the information seeker may or may not be successful at finding relevant information. If successful, the individual then makes use of the information found that may either fully or partially satisfy the need. Although schematically, there is not a direct arrow key from the 'failure' component to the 'need' component, Wilson has textually acknowledged that failure to satisfy the perceived need generally leads to repeating the search process and the current study considers this point of view. In addition, Wilson's 1999 model also indicates that the failure of the seeking process basically leads to a new research process (re-initiated) regardless of the stage/step at which the information seeker has experienced the failure while seeking information in order to satisfy a perceived need.

Wilson's 1999 model of information behaviour considers the involvement of other people and various offices through information exchange in information-seeking behaviour. Thus, information-seeking behaviour of researchers at FIIRO inevitably involves different people and various offices where information can be obtained. Wilson (1999:250) stipulates that models can be depicted conceptually or theoretically and accordingly, using a model allows the general objectives of the study to be accomplished and the research questions to be answered successfully. Wilson's 1999 model of information behaviour will be specifically applied for the purpose of the present study.

3.5 CRITICISMS AND STRENGTHS OF WILSON'S 1999 MODEL

Ikoja-Odonjo and Mostert (2006:154) state that each model in the information behaviour sub-field has its own strengths and weaknesses. Wilson's 1999 model is not an exception to this rule.

3.5.1 Strengths

Al-suqri and Al-Aufi (2015:103) state that the ability of Wilson's models (including Wilson's 1999 model) to continue serving as frameworks for developing and testing new combinations of information behaviour constructs and theories with a wide range of users groups from different parts of the world illustrates the rigour, relevance, and utility of the models in a rapidly changing landscape of information environment. For instance in 2011, Al-Suqri developed an integrated type of model that has to do with social science information-seeking behaviour intermingling Wilson's 1996 revised model of

information behaviour with other established models. This was to enable him to study information-seeking among social science faculty in an Omannian university and promote future development in LIS in the Middle East.

The strength of Wilson's 1999 model is also concerned with the circumstance that it does not simply designate a sequence of events, but it goes beyond that and describes a sequence of human behaviour by referring to relevant variables (Majyambere 2014:46). On this subject, Miles and Huber (1994:18) remark that a theoretical model contributes to correctly bring the key variables under study into clear focus. According to Majyambere (2014:46), the attributes of the model include information user, information need, information-seeking behaviour, demands on information systems and other information sources. Other attributes are success or failure, information use, information exchange or transfer, other people and satisfaction or non-satisfaction.

Wilson's 1999 model points to the fact that it remains one of the macro-behaviour models based on its development and the addition of other theoretical models of behaviour, which makes it a richer source of hypotheses and further research than Wilson's earlier model.

Again, Al-Suqri and Al-Aufi (2015:13) add that Wilson's 1999 model of information behaviour is a very clear model and a much-needed depiction of the inter-relationship between information behaviour, information seeking and information retrieval. Finally, Wilson's 1999 model provides a framework to explain goal-oriented information-seeking behaviour (Al-suqri & Al-Aufi 2015:13).

3.5.2 Criticisms

Wilson's 1999 model is criticised in that the model's central focus is on the general processes of information seeking and not on the information search context or the types of information that is available (Al-Suqri & Al-Aufi 2015:104).

Consequently, Al-suqri (2007) highlights that with respect to this, "the generic models may not fully explain the information behaviour of various actors in different contexts seeking a variety of information". For example, Wilson admits that his 1981 model paid

inadequate attention to contextual factors: "the limitations of this kind of model, however, are that it does little more than provide a map of the area and draw attention to gaps in research: it provides no suggestion of causative factors in information behaviour and, consequently, it does not directly suggest hypotheses to be tested" (Wilson 1999:251). However, none of these limitations can affect the outputs of the current study since the study does not primarily focus on either causes or hypothesis viewpoints.

Again, Wilson's 1999 model is limited to defining and solving problems (Al-Suqri &Al-Aufi 2015:103). For instance, Wilson's 1999 general model involves three main elemental views of information seeking - the context of the seeker, the system utilised which has to do with defining problems (either manual or electronic) and the information resources that are drawn upon (which has to do with solving problems).

3.6 OTHER RESEARCH WORKS BASED ON WILSON'S 1999 MODEL

The researcher regards Wilson's 1999 model to be more comprehensive and appropriate to the problem under study. The reason for choosing Wilson's 1999 model is that it allows for a description and explanation of users information behaviour. DeCuir-Gunby (2008:127) notes that some studies are merely guided by a single theory or one model. This study also applied just only one model. Wilson's model has been developed and updated - from 1981 to the 1999 model, to show its currency and relevance. Moore (2002:303) mentions that "the basic model provides a framework for analysis". This model has been successfully used more frequently in the LIS field. For instance, this model has been applied in the African context with examples of such empirical studies explained below.

Wilson's 1999 model was used by Umunnakwe and Eze (2015) in their study of the information needs and information-seeking behaviour of secondary school teachers in Imo State, Nigeria. The researchers built their study on Wilson's 1999 model because of the advantage of it being the latest model proposed after further well-articulated modifications which are also applicable in this current study. The recent modifications suit the scope being covered in this study.

Ogba (2011) explores the information needs and information-seeking behaviour of final year law students in Ekiti State University, Nigeria. The focus is on e-library and online database (that is, OPAC and card catalogue) with Wilson's 1999 model applied to the study's interpretation. The study shares some semblance with the current study in that the underlying set of ideas of her study (that relates to Wilson's 1999 model) such as information behaviours exhibited by users, factors affecting information-seeking behaviour and library services as offered by library are investigated in the current study.

The study of Acheampong and Dzandu (2015) on information-seeking behaviour of crops research scientists in Ghana is modelled along Wilson's 1999 information behaviour model as a guide to examine and discuss issues of information-seeking behaviour among crop research scientists. This current study also examines and discusses underpinning matters as it relates to the information-seeking behaviour of FIIRO's' researchers with respect to their information needs.

Mostert and Ocholla (2005) in their investigation of the information needs and information-seeking behaviour of parliamentarians in South Africa also use Wilson's 1999 model on information seeking and they also evolve an extended new model adapted from Wilson's 1999 model on information seeking proposing and explaining information seeking strategies popular to parliamentarians in South Africa. This current study also discusses an extended new model adapted from Wilson's 1999 model to explain the information behaviour of FIIRO's' researchers.

In her study spanning a period of three years, from 2000 to 2002, Fourie (2002) reviews web information seeking/searching adopting Wilson's 1999 model. This present study relates to Fourie's (2002) study in that it discusses Wilson's viewpoints as they concern the variety of methods people employ to discover, and gain access to information resources, and information-searching behaviour being defined as a sub-set of information seeking. It is particularly concerned with the interactions between the information user (with or without an intermediary) and computer-based information systems.

Fourie's 2010 study also applies Wilson's model in the study of the information behaviour of patients and families in palliative cancer care. This current study also adopts

this method in studying the different information needs reported by FIIRO's' researchers with credence added to the obtained information from library professionals' perceptions thereof. This study shares semblance with Fourie's 2010 study in that it studies a federal industrial research setting (industrial researchers in need of research information) being supported by the FIIRO library. This can make a difference in their information behaviour and it is worth being researched into.

The use of Wilson's 1999 model provides a rationale for this investigation and explains the findings by providing the coherent picture of FIIRO researchers' information needs and information-seeking behaviour.

3.7 APPLICATION OF WILSON'S 1999 MODEL OF INFORMATION BEHAVIOUR IN THE STUDY

Case (2012:12) asserts that "a model describes a relationship among concepts but is tied more closely to the real world". Wilson (1999:251) points out that the scope of Wilson's 1999 model diagram in Figure 3.1 is much greater than merely about the concept of information needs and it is intended to cover all vital elements involved in the information behaviour process. Essentially, Wilson's 1999 model is a general model and can assist in apprehending a better understanding of vital features of human behaviour, including researchers. According to Sharma (1992) and Allen (1996), understanding the user is half the battle in providing information services. Alongside, Dervin and Nilan (1986) argue that system-oriented studies traditionally have not led to improvement in the design of information systems and many recent studies have focused largely on user-oriented systems with the researchers being put at the centre point in the current study as the information user.

Figure 3.1 enables us to accept the simplicity and comprehensiveness of Wilson's model in the sense that it is characterised by a one-dimensional flowchart in which almost all arrows are pointing in one direction. Wilson's model also allows us to consider a strong connection that exists between a 'user' and 'use', rather than merely recognising the role of 'use or system' itself as seen occurring in some traditional approaches in information behaviour studies in the late 1970s and in the beginning of the 1980s (Wilson 1999:250). Wilson's 1999 model is beneficial to those working in the LIS field since it draws

attention to information needs, information users and how they look for information, what they do with the information and how they act when they fail to obtain the acquired information at any stage and then restart their information-seeking/searching process. Consequently, the information need and information-seeking behaviour of researchers at FIIRO inevitably involves different people and various media where information can be sought in the act of the information-seeking process.

This section examined the core variables of Wilson's 1999 model within the context of this study. The discussion of the theoretical framework played a role in appreciating and understanding Wilson's 1999 model for the purpose of the present study. According to Kumar (2011:40), the core variables obtained from a theoretical framework developed the solid basis for any research enquiry. Table 3.1 presents the general picture that reflects the research relationship between the theoretical framework of the study, objectives and research questions forming the groundwork for the study.

Table 3.1: Mapping of theoretical framework construct to objectives, questions and instruments

Attributes of Wilson's 1999 model	**Objectives**	**Questions**	**Instruments**
Information needs	O1 To examine the information needs of FIIRO's researchers in Nigeria	Q1 What are the information needs of FIIRO's researchers in Nigeria?	- Questionnaire - Interview - Content analysis - Observation
Information-seeking behaviour	O3 To evaluate the accessibility of information by FIIRO's researchers in Nigeria O4 To assess the factors affecting information-seeking behaviour of FIIRO's researchers in Nigeria	Q3 How do FIIRO's researchers in Nigeria access information? Q4 What are the factors affecting the information-seeking behaviour of FIIRO's researchers in Nigeria?	- Questionnaire - Interview - Content analysis - Observation

Information sources, systems and use	O2 To analyse the information sources used by FIIRO's researchers in Nigeria. O4 To evaluate the accessibility of information by FIIRO's researchers in Nigeria O5 To investigate the level of availability and adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria O6 To investigate the purposes of ICT resources and services to FIIRO's researchers in Nigeria	Q2 What are the information sources that are used by FIIRO's researchers in Nigeria? Q4 How do FIIRO's researchers access information? Q5 What is the level of availability and adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria? Q6 What is the purpose of ICT resources and services to FIIRO's researchers in Nigeria?	- Questionnaire - Interview - Content analysis - Observation
	O7 To examine the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers O8 To make recommendations on how information services offered by the FIIRO library can be improved based on the exploitation of FIIRO's researchers' experiences on information seeking	Q7 What is the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers? Q8 How can information services offered by the FIIRO library to FIIRO's researchers be improved upon based on the outcome of this study?	

3.8 SUMMARY

This chapter discussed Wilson's 1999 model of information behaviour developed by Timothy DeCamp Wilson. Other influential information behaviour models such as Wilson (1981), Krikelas (1983), Dervin (1983), Ellis (1989) and Kuhlthau (1991) were also briefly discussed. In Wilson's 1999 model, information need, information seeking,

information exchange and information use, among other attributes, were clearly integrated. This chapter also highlighted the strengths and weaknesses of the model.

Wilson's 1999 model was found to be suitable as a framework for this study because it continues to serve as a framework for developing and testing new combinations of information behaviour constructs with a wide range of user groups from different parts of the world to which FIIRO's' researchers and librarians are no exception. In addition, the model is very clear and shows the inter-relationship between information behaviour and information seeking with information needs being incorporated into every facet of the model.

Chapter Four presents the research methodology employed in this study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 INTRODUCTION

Chapter 4 discusses the research methodology of the study. This chapter presents the procedures that were involved in carrying out this study, which include: the research design, study area, target population, sample size, sampling procedures and techniques, instrument for data collection, validity and reliability of the instrument, procedure for data collection, data analysis and presentation and the summary of the chapter.

According to Cohen, Manion and Morrison (2007:47), research methods are connected with a range of procedures that are used in research to gather data that is used as a basis for inference and interpretation, for the purpose of explanation and prediction. Blaikie (2010:8) asserts that research methods are centred on the procedure preferred for gathering data and analysis. Likewise, research methods are basically techniques applied to carry out research studies (Marshall & Rossman 2006:40; Walliman 2011:7). Lapan et al. (2010:10) and Silverman (2013:124) emphasise that research methods mean data collection techniques or tools that make research possible.

Neuman (2011:2) remarks that the terms 'methodology' is broader and encompasses method. Welman, Kruger and Mitchell (2005:2) suggest that while research methodology considers and makes clear the logic behind research methods and techniques, it has much a wider scope than research methods (such as opinion polls), which in sequence have a wider scope than research techniques. Leedy and Ormrod (2010:12) describe research methodology as the general approach a researcher follows when carrying out a research. Schensul (2012:71) observes that research methodology is characteristically believed to be the research design. Methodologies take account of complete designs and frameworks utilised for a particular study (Lapan et al. 2012:1). Research methodology as a concept encompasses the term research method and includes the choice of research methods for a research project (Paltridge & Starfield 2007:119). Creswell and Plano Clark (2007:5) feel that research methodology can be compared to the philosophical framework and the basic assumptions of a research project, that is, it is considered as a framework that touches on

the entire process of a research project being carried out. Ngulube (2015:127) describes methodology as being strategic to the process of research since it is viewed as the lens through which a researcher sees when making decisions on acquiring knowledge about social phenomenon and getting answers to the research questions.

4.2 RESEARCH PARADIGM

Jackson (2003:37) describes a paradigm as a "set of ideas, assumptions and beliefs that shapes and guides the activity of a particular scientific community". Similarly, Bhattacherjee (2012:17) views paradigms as mental models or frames (belief systems) which shape the design and conduct of research. A paradigm is a fundamental model which represents or illustrates an in-depth understanding of what people see and the way people comprehend the model (Babbie 2011:32). Somekh and Lewn (2011:20) maintain that paradigms present significant frameworks of views for thinking about research methodology.

Bhattacherjee (2012:17) explains that the recognition of paradigms is crucial to making sense and reconciling variance in people's perceptions of the same social occurrence. Ngulube (2015:127) states that ontology and epistemology form the paradigmatic base of research in a subject field. He expounds that ontology means philosophical assumptions about the nature of knowledge, or the nature and existence of social reality, while epistemology stands for what constitutes that knowledge and ways of knowing. Ngulube further explains that these two concepts are the basis on which any known research in social science is framed. The paradigms - positivist paradigm, interpretivist paradigm and pragmatist paradigm (the domain of multi-paradigm) are discussed in the section below.

4.2.1 Positivist paradigm

According to Bhattacherjee (2012:18), positivism is about the notion that science or knowledge creation should be constrained to what can be observed and measured. He states that positivism has a tendency to rely absolutely on theories that can be tested directly. Sale and Brazil (2004:353) observe that the positivists opine that quantitatively "all phenomena can be reduced to empirical indicators which represent the truth". Turner (1992:157) opines that, fundamentally, positivism entails the process of collecting data,

observing regularities and extracting laws. From the perspective of a positivist, McNeill and Chapman (2005:15) reveal that people's life experiences are governed by laws. Positivist researchers at some point normally tend to determine predictions of human behaviour in order to gain the truth. Ngulube (2015:127) shows that the ontology of positivism is realism. This means that social reality can be observed and studied objectively and scientifically, independent of the observer. The epistemology of positivism is objectivism and dualism (Guba & Lincoln 1994:110). This shows that positivists believe that human experiences of the world are objective, reflecting on independent reality, thus providing the foundation for human knowledge (Weber 2004:6). Ngulube (2015:127) states that the methodology of positivism is quantitative.

4.2.2 Interpretivist paradigm

The interpretivist paradigm depicts that the best way to study social order is through the subjective interpretation of participants involved, such as by interviewing different participants and reconciling differences among their responses using their own subjective viewpoints (Bhattacherjee 2012:19). Ngulube (2015:127) states that the methodology of interpretivism is qualitative. Hussain, Elyas and Nasseef (2013:2376) point out that rich and detailed data are collected within this paradigm and it essentially concerns human beings and their interrelationships. Consequently, researchers can obtain a deep and immense understanding of the phenomenon under study. The ontology of interpretivism is relativism (Ngulube 2015:127). This means that the concept of reality is shaped by the ideologies and cultural beliefs of individuals and that reality is local and specific in nature. Aliyu, Bello, Kasim and Martin (2014:81) indicate that the epistemology of interpretivism is subjectivism or transactional. Ngulube (2015:127) clarifies that subjective knowledge is generated in the interprevist paradigm. This means that participants cannot be separated from the knowledge they already have about a phenomenon.

4.2.3 Pragmatist paradigm

Pragmatism is a deconstructive paradigm that encourages the use of mixed method in research and: "sidesteps the contentious issues of truth and reality" (Feilzer 2010:8) and it

"focuses instead on 'what works' as the truth regarding the research questions under investigation" (Tashakkori & Teddlie 2003:173). This paradigm places "the research problem" as central and applies all approaches to understanding the problem (Creswell 2014:11). Ngulube (2015:127) states that pragmatism (otherwise known as methodological pluralism) was born out of an attempt to bridge the gap between interpretivist and positivist epistemologies. Ngulube (2015:127) further notes that mixed methods research (MMR) is in the domain of multi-paradigms adopted in a research project since it utilises both the positivist and the interpretivist paradigms.

The intent of establishing basic foundation on a number of research philosophies and approaches is to bring forth the possible assumptions of each, which directs the choice of a particular paradigm for this research. This study adopted the positivist paradigm. This study focused on a positivist, deductive single-case study research in information science. This allowed the combination of quantitative and qualitative approaches to gather contextual data to enhance the understanding of human behaviour. The justification behind the choice of approach is the research questions, where the use of either quantitative or qualitative approaches does not completely address the research problem, whilst a combination of approaches does (Creswell & Plano Clark 2011). The research questions one to eight of this study outlined in section 1.6 were suited to both quantitative and qualitative approaches.

The study also follows the suggestions of Shanks (2002:84) for researchers undertaking positivist, deductive case study research which includes developing a clear understanding of key concepts and assumptions within the positivist paradigm including theory and proposition, providing clear and unambiguous definitions of the units and interactions when using any theory, carefully defining the boundary of any theory used in the case study, considering using fuzzy propositions and move to post-positivism, carefully selecting the case study site particularly as done in this single-case study research and recognising that generalisation from positivist and single case studies is inherently different from generalisation from single experiments.

In addition, Aliyu, Bello, Kasim and Martin (2014:83) affirm that the positivist paradigm emphasises that genuine, real and factual happenings could be studied and observed scientifically and empirically and could as well be elucidated by way of lucid and rational

investigation and analysis. They further state that the decisive factor for assessing and appraising the soundness and validity of a systematic scientific and logical theory to find out whether or not a researcher's facts view point are reliably consistent and dependable by means of the knowledge researchers are capable to achieve by means of their senses. The study also considers and builds on this philosophical stance.

4.3 RESEARCH APPROACHES

According to the works of Creswell (2013) and Rule and John (2011), research approaches are described as ways or techniques of designing and conducting research. Likewise, Ngulube (2015:128) further explains research approach to be the means through which data collection and analysis procedures are determined and controlled. Kothari (2004:5) stresses that research approaches point to the fact that there are two basic methods or approaches to research: the quantitative approach and the qualitative approach. The quantitative approach concerns the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion, while the qualitative approach to research embraces the subjective assessment of attitudes, opinions and behaviour. However, several authors and several scientific research studies recommend the mixed method approach where both quantitative and qualitative approaches are combined in a single study to be able to conduct a comprehensive research.

4.3.1 Quantitative approach

According to Leedy and Ormrod (2010:94), the quantitative research approach involves exploring amounts or quantities of one or more variables of interest. Quantitative research approaches relate to studying variables that are statistically based and they offer solutions to questions bordering the researcher's craving to know (Creswell 2014). Johnson and Christensen (2012:39) state that a variable that varies in degree or amount is referred to as a quantitative variable and it typically has to do with numbers. As described by Kalof, Dan, and Dietz (2008:59), it is characteristic for a thorough research project to have independent variables denoting the 'cause' and the dependent variables signifying the 'effect'.

Mugwisi (2013:154), Sharpe and Koperwas (2003:29) and Harwell (2011:147) state that the quantitative approach applied in research depends a lot on the deductive method as data analysis of the research is being carried out. Mugwisi (2013:154) stresses that the process of deductive reasoning in the quantitative approach starts with certain premises or abstract ideas such as hypothesis or theories and then culminates in depicting a logical conclusion from them. With respect to this study, the core variables are information related to needs, seeking behaviour, sources, uses and system providing information (Wilson 1999:51).

4.3.2 Qualitative approach

As stated by Fox and Bayat (2012:7) and Green (2005:46), the qualitative approach to research is the widespread paradigm of research when it comes to the field of social science. These researchers note that qualitative research approaches are scientifically constructed to describe events, people and matters (still integrating people and events) and do not depend on numerical data, although they noted that qualitative approach may also utilise quantitative techniques. Silverman (2013:122) stresses that the "qualitative research is more than one thing". The understanding of this can be seen in Braun and Clarke (2013:25) who state that the qualitative approach to research functions as an umbrella word covering a range of interpretive practices. According to Locke, Silverman and Spirduso (2010:183), the major purpose of interpretive research is "to understand a situation from the perspective of the participant". Neuman (2011:157) notes that in qualitative research, research procedures are particular and replication is very rare with measures being created in an improvised manner and these measures are often specific to the individual setting or researcher.

Silverman (2013:11) recognises that the qualitative research approach is suitable for investigating human behaviour, which is an objective that this study sets out to achieve. Additionally, Kumar (2011:104) expounds that the qualitative research approach has the tendency to become more flexible during the research process and its central focus is on understanding "value, beliefs and experiences of people". The qualitative approach supports knowing human behaviour as it relates to researchers in this study and understanding researchers from the perspectives of their values, beliefs and experiences

as they engage in their research projects. According to Merriam (2009:5), the qualitative approach to research assists researchers to comprehend "how people interpret their experience, how they construct their worlds and what meaning they attribute to the experience".

Bayat (2012:69) and Neuman (2011) pinpoint six qualitative methodologies namely biographical, case studies, ethnography, grounded theory, phenomenology and content analysis. Relatedly, Merriam (2009:21-22) and some authors as mentioned below also initially proposed six general methods used while carrying out qualitative research and these comprise:

- Basic qualitative research: This seeks to understand how people make sense of the world surrounding them.
- Phenomenology: This concentrates on the fundamental structure of the phenomenon under study (Edmonds & Kennedy 2013:136).
- Grounded theory: This seeks to establish a functional theory about the phenomenon of interest (Eich 2008:176).
- Ethnography: This concentrates on comprehending social meaning (Brewer 2000:6) and understanding human society and cultural groups (Creswell 2014:218).
- Narrative analysis: This is frequently based on storytelling in a literary way (Edmonds and Kennedy 2013:129; Pinnegar & Daynes 2007:4). This approach is applied more in the qualitative social science (Chase 2010:208).
- Critical qualitative research: This involves critiquing and changing society.

4.3.3 Mixed method approach

Johnson, Onwuegbuzie, and Turner (2007) state that the mixed method research (MMR) approach is acknowledged as the third major research approach with the qualitative and quantitative research approaches. Jiyane (2013:97) states that the MMR approach is a new approach that incorporates terms such as 'triangulated studies' as described by Johnson et al. (2007:118) and 'integrated research', 'hybrid research method', 'blended research', 'multiple methods' and 'multi-methods research' as described by (Ruberg,

Chen & Martin 2006:5). Ngulube (2015:127) says that the MMR approach brings together the strengths of both the qualitative and quantitative approach to construct a comprehensive and broad-based research.

This study applied both the quantitative and qualitative research approach, described as triangulation. Neuman (2011:149) makes clear that triangulation is often used by quantitative and qualitative social researchers because it permits them to view a phenomenon from a number of different angles. According to Hussein (2009:2), triangulation involves the use of multiple methods primarily quantitative and qualitative methods, in studying similar phenomena for the purpose of increasing study credibility. Yeasmin and Rahman (2012:156) argue that triangulation in the social sciences embraces the combination of two or more theories, data sources, methods or investigators in one study of a single phenomenon to converge on a single construct. Hussein (2009:2) maintains that the use of quantitative and qualitative paradigms in the same study has resulted in scientific debate among some researchers arguing that the two paradigms differ epistemologically and ontologically but both paradigms are designed to understand a particular subject area with both having strengths and weaknesses. Shih (1998) identifies the two main reasons for triangulation, which are; the use of triangulation for confirmatory and for completeness purposes.

The quantitative approach (which has a strong dominance in this study) is used in the study to test the information needs and information-seeking behaviour of researchers at FIIRO Nigeria while the qualitative approach was used to collect qualitative data needed to clarify areas that were not adequately covered in the quantitative data collection phase. Both quantitative and qualitative data were obtained and were used in this study. They were obtained using the questionnaire, interview, observation and content analysis research instruments. Quantitative data that was generated from the data collection instruments was analysed using the SPSS software.

4.4 RESEARCH DESIGN

In relation to research design, Leedy and Ormrod (2010:87) posit that in terms of its formulation, a researcher should take into consideration a viable research problem, the

kind of data that an investigation into the problem will require, and a practicable means of collecting and interpreting the data collected. According to Durrheim (2006:35), research design allows the researcher to achieve the research objectives of his/her study in a suitable manner. With the research questions being derived from the research objectives, Bogdan and Biklen (2007:234) and Kumar (2011:4) maintain that research design allows a researcher to appropriately answer the poised question. Ngulube (2015:128) puts forward that research design ascertains and regulates data collection and analysis procedures of a research.

4.4.1 Case study

According to Bhattercherjee (2012:93), case study also known as case research is a method of intensively studying a phenomenon over time within its natural setting in one or a few sites. Aina (2002:20) adds that a case study research involves an in-depth study of a unit, which could be a person, a family, a group, an institution or even an entire community. This study was a case study. A case study design was applicable because there was a clearly distinguishable case within boundaries, and the objective of the study was to obtain an in-depth understanding of the case (Creswell 2013). The Federal Institute of Industrial Research Oshodi Nigeria is a research institution with different departments. A case study is suitable as each department is considered a single case study in order to arrive at an in depth understanding of the case.

As stated by Aina (2002:20), the objective of case research is to gather extensive data about the unit being studied with all variables connected with the unit, both internally and externally, being thoroughly identified and investigated. Creswell (2013:97) argues that a case study is viewed as an exploration or in-depth analysis of a bounded system of a single case or multiple cases over a period of time with a single case or multiple cases being studied over time to gain information or, in multiple cases, to compare information within a specific environment under study or a research situation.

As stated by Kazdin (2011), single-case research design is a type of research that demonstrates experimental control within a single case and thoroughly appraises an involvement with one case or a small number of cases. According to Smith (2012), single-case study design refers to the participant or cluster of participants with

participants in a single-case design providing their own control data for the purpose of comparison in a within-subject rather than a between-subjects design. Daymon and Holloway (2011:119) submit that a single-case study design presents the researcher with a prospect to conduct an in-depth exploration of a particular phenomenon.

The justification of the choice of the usage of only one research institute out of many research institutes for this single-case research design lies in the benefits of single-case studies as highlighted by Gustafsson (2017) which include the fact that they are not as expensive and time consuming as multiple-case studies, they are better when the researcher wants to create a high-quality theory because they produce extra and better theory, they give the researcher a deeper understanding of the subject explored, they describe the observable outlook of a phenomena under study richly and the researcher can question old theoretical relationships and explore new ones (this is because a more careful study is made). Therefore, FIIRO being used as the only organisation for research in this single-case study affords low cost for this study, reduces time frame for the conduct of this research, gives a deeper understanding of FIIRO as an organisation, a 'single-outcome' study like this also provides room for the more postmodern approaches within LIS theory and lastly, it furnishes empirically-rich/context-specific/holistic account or description of the specific phenomena – information needs and information-seeking behaviour of FIIRO's' researchers.

One limitation of single-case study designs is the difficulty of generalising their results to other subjects, because of the small number of subjects that are investigated (Nock, Michel & Photos 2007:348). In addition, while they do possess obvious limitations, it should be noted that any research method involves essential benefits; the characteristic weaknesses of any one method, however, can potentially be offset by situating them within a more expansive, pluralistic mixed-method research strategy as provided in this study.

Case research can be adopted in a positivist manner for the purpose of theory testing or in an interpretive manner for theory building (Bhattercherjee 2012:93). Willig (2013:101) feels that the flexibility and strength of a case study design has resulted in it being used in both qualitative and quantitative research approaches and has also been applied in many

disciplines like sociology, history, education, social anthropology and psychology. This study utilised the case study method that combines both quantitative and qualitative research in its data collection process.

4.5 STUDY AREA AND POPULATION

This section is focused on where the study was carried out and the objects of investigation. The study was carried out at the Federal Institute of Industrial Research Oshodi (FIIRO), Lagos, Nigeria. It serves as a federal research institute carrying out industrial research. It occupies a land area of five hectares. The area is multicultural. The researchers working at the institute have different academic backgrounds. The premises have buildings housing its research laboratories, engineering, administration, food pilot plants, staff clinic, staff canteen and other facilities

Schensul (2012:72) depicts a study population as the people that form the focus of analysis of the research questions of a project study. Neuman (2011:224) expresses a population to be the total collection of all units of analysis about which the researcher desires to make specific conclusions. In a similar fashion, Gray (2014:688) represents a population as the totality of people, organisations, objects or occurrences from which a sample is drawn. Babbie and Mouton (2012:173), Brink, Van der Walt and Van Rensburg (2012:131) and Polit and Beck (2012:738) depict a population as the entire group of persons who are of interest to the researcher and who meet the stipulated criteria that the research shows interest in studying, or a set of individuals having some common qualities. For instance, a population can assume different people or entities in different settings - it can be an organisation, a printed document, an online document, a social action that is measurable or a large, well-defined group.

Biemer and Lyberg (2003:29) describe a target population as “a group of persons or other units for whom the study results will apply”. FIIRO is a well-established research institute and one of the research institutes situated in Nigeria. The target population consisted of all the researchers of FIIRO. i.e. 165 researchers (excluding six Directors who are also researchers) that are found in all FIIRO departments as highlighted in section 1.2.4 and the library staff (consisting of five professional librarians and three non-

professional librarians) of the FIIRO library. For the library, the study population was reduced to five professional librarians who work at the FIIRO library providing professional expertise to the researchers to meet their information needs. The six directors were excluded from the study because in the course of carrying out the pilot study the researcher observed the lackadaisical attitude of the Directors towards participating in the research largely due to the sensitivity of their position. They do not want to be identified with giving information that negatively portrays the mediocre approach of the government of Nigeria to the researchers and the FIIRO management. They are afraid of being dismissed from the federal civil service possibly as a result of divulging sensitive information. The five professional librarians were chosen because of their expertise in the field considering their wealth of experience over those of the three other library staff that are non-experts.

4.6 SAMPLING

Kothari (2014:147) defines sampling as a statistical method or procedure of finding a representative population to collect data or information about an entire population by examining only an integral portion of it. From another viewpoint, Gravetter and Forzano (2009:144) describe sampling as "the process of selecting individuals to participate in a research study". Similarly, Kumar (2011:397-398) opines that sampling is the procedure of selecting a few respondents (a sample) from a bigger group (population) to become the foundation for estimating the occurence of information of interest to one. Maree and Pietersen (2010:172) state that sampling can be divided into two types, namely probability or non-probability sampling. The two sampling methods were used for the purpose of this study.

4.6.1 Probability sampling

Bhattacherjee (2012:67) describes probability sampling as a technique in which every unit in the population has a chance (non-zero probability) of being selected in the sample, and this chance can be accurately determined. Additionally, Kumar (2011) observes that for a design to be called probability sampling, it is necessary that each element in the population should have an equal and independent chance of being selected in the sample with the term equal implying that the probability of selection of each element in the

population is the same; that is, the choice of an element in the sample is not influenced by other considerations such as personal preference. Bhattacherjee (2012:67) summarily states that probability sampling has two attributes in common which are: every unit in the population has a known non-zero probability of being sampled and the sampling procedure will involve random selection at some point.

Teddlie and Tashakkori (2009:171), Neuman (2011:227) and Leedy and Ormrod (2010:205) ascertain five probability sampling methods summarised below:

- Simple random sampling - In this method, a researcher creates a sampling frame and uses a pure random process to select cases, this makes certain the addition of each and every sample of the population so that each sampling element will have an equal chance of being selected.
- Systematic sampling – It is a special kind of random sampling. It involves the selection of the first unit of the sample from the population based on the process called randomisation, and the remaining units of the sample are selected from the population at fixed intervals of ***n***, where ***n*** is the sample size.
- Stratified sampling – In this method, the population is divided into several sub-populations (called 'strata') that are individually more homogeneous than the total population, and the items are selected from each stratum to constitute a sample. Members within each stratum have similar attributes but the members between strata have dissimilar attributes.
- Cluster sampling - In this method, the total population is divided into a number of relatively small sub-divisions which are themselves clusters of still smaller units and then some of these clusters are randomly selected for inclusion into the overall sample. With this method, it is desirable for each cluster to be a miniature of the entire population so that the full variability of the population is captured.
- Multi-stage sampling - This method employs more than one stage to sample the population and helps in the design of a smaller sampling frame which will make a study realistic in terms of cost and time. The principle of this method makes allowance for economic considerations when the geographical area to be covered is very vast and travel costs need to be reduced.

The probability sampling methods adopted for this study were random and stratified sampling. The researchers were placed into sub-populations (strata) according to departments in the institute, that is, according to departments (areas of research) of the research institute which are Food Technology Department, Project Design and Development Department, Biotechnology Department, Chemical Fibre and Environmental Technology Department, Production, Analytical and Laboratory Management Department and Planning, Technology Transfer and Information Management Department.

4.6.2 Non-probability sampling

Bhattacherjee (2012:69) explains non-probability sampling as a sampling technique in which some units of the population have zero chance of being selected or where the probability of selection cannot be accurately determined. Bhattacherjee further adds that it is typical that units are selected based on certain non-random criteria, such as quota or convenience and as a result may be subjected to a sampling bias. Kumar (2011) states that non-probability sampling design does not follow the theory of probability in the choice of elements from the sampling population and they are used when the number of elements in a population is either unknown or cannot be individually identified and, in such situations, the selection of elements is dependent upon other considerations.

Neuman (2011:220), Kothari (2004:59), Bhattercherjee (2012:69-70) and Leedy and Ormrod (2010:211-213) underscore convenience sampling, quota sampling, expert sampling, snowball sampling, and purposive or judgemental sampling as non-probability sampling techniques.

- Convenience sampling - This is a technique in which a sample is drawn from that part of the population that is close to hand, readily available, or convenient.
- Quota sampling - In this technique, the population is segmented into mutually exclusive subgroups (just as in stratified sampling), and then a non-random set of observations is chosen from each subgroup to meet a predefined quota.
- Expert sampling - This is a technique that has to do with respondents being chosen in a non-random manner based on their expertise on the phenomenon being studied.

- Snowball sampling – In applying this technique, the researcher starts by identifying a few respondents that match the criteria for inclusion in his/her study, and then asks them to recommend others they know who also meet his/her selection criteria.
- Purposive sampling – In applying this technique, the researcher uses a wide range of methods to locate all possible cases of a highly specific and difficult to reach population.

The non-probability sampling technique adopted was expert sampling. In this sampling technique, five professional librarians of the FIIRO library were interviewed based on their knowledge about the study and the population of the study. The advantage of this approach is that experts tend to be more familiar with the subject matter than non-experts - opinions from a sample of experts are more credible than a sample that includes both experts and non-experts.

4.6.3 Sample frame

Bhattacherjee (2012:66) describes sample frame as an accessible section of the target population (normally a list with contact information) from which a sample is drawn. In this study, a sample frame was obtained from the records department of FIIRO. All researchers, except the six Directors who are also researchers, were selected for inclusion in the study.

4.6.4 Sample size

Burns and Grove (2009:721) describe sample size as the number of subjects or participants recruited and that consented to take part in a study. Ngulube (2005:134) identifies that sample size has to be representative of the population because a sample that is very small reduces the efficacy of results. Collins (2011:361) states that the larger the sample size selected, the smaller the error in estimating the characteristics of the population. In addition, Somekh and Lewin (2011:223) express that irrespective of the fact that a larger sample size will bring about accuracy in population characteristics estimate, it will have increased research cost. Neuman (2014:267) emphasises that a key notion of sample size is that the smaller the population, the larger the sampling ratio has

to be for a sample that has a high probability of yielding the same results as the entire population.

For the researchers, the sample size was the target population which was 171 researchers minus the six Directors. This brought the sample size for researchers to 165. With this, the sample size is a representative one comprising all the researchers from the six departments at FIIRO. For the librarians, the sample size was the five professional librarian staff members out of the eight library staff members. Table 4.1 summarily shows the target population and the study population.

Table 4.1: Target and study population of the current study

	Target population	**Study population**
FIIRO's researchers	165	165
FIIRO's librarians	8	5

4.7 DATA COLLECTION PROCEDURES AND INSTRUMENTS

This section relates the procedures, methods and instruments that were used by the researcher in collecting research data for the current study.

4.7.1 Data collection procedures

A letter of consent was obtained from the Director-General (see Appendix F) after the researcher wrote a letter to the Director requesting permission to conduct research at the institute (see Appendix E). Before questionnaires were distributed to researchers, interviews were conducted with the professional librarians and an observation of the institute's library was done. Despite this permission from the Director-General, the researcher still had some challenges obtaining responses from the researchers and professional librarians owing to the fact that some of them were afraid that they would be penalised for talking about the state of the institute. However, they were convinced to participate after the researcher pleaded with them that the study was an academic project and not for victimising any respondent, and that their participation would be kept confidential as stated in the consent form (see Appendix F).

The study involved five research assistants, one of whom is a postgraduate student in the Department of Microbiology at the University of Lagos. The research assistants that administered the copies of the questionnaire were trained for two hours at the engineering building of the institute. The researcher educated the research assistants on three important principles which are respect for the participants and treating them with dignity, beneficence (which entails that a study should provide a maximum amount of benefit to society and sometimes to individual participants while it also reduces risks to research subjects) and the principle of justice (this principle refers to ensuring reasonable and non-exploitative procedures that are administered fairly). The researcher also educated the research assistants on confidentiality and how it is different from privacy. Also, the research assistants were put through the process of obtaining the informed consent of respondents and their competence were also assessed based on a 10-item quiz.

4.7.2 Data collection instruments

According to Zikmund (2003:72), because there are many research techniques, there also exist many methods of data collection. Kothari (2004:95) argues that the researcher would first and foremost have to decide which sort of data s/he would be using for his/her study and it is this data that will be collected. Consequently, the data will determine the selection of the appropriate method of data collection and the fitting choice of research instruments. Fundamentally, a research instrument as a tool for primary data collection can be utilised to collect data only after the research design has been plainly articulated.

Quinlan (2011:286) reveals that questionnaires or structured interview schedules are popular research tools for quantitative inquiry while interviews are mainly used to collect qualitative data. The instruments that were used to collect data for this study included the questionnaire, interview, observation of behaviour and content analysis research instrument and these yielded both quantitative and qualitative data. Primary data were collected using the questionnaire, interview and observation research instruments.

Data was collected between October 2017 and November 2017.

4.7.2.1 Questionnaire

Bhattacherjee (2012:74) describes the questionnaire as a research instrument comprising a set of questions or items intended to capture responses from respondents in a standardised manner with the questions being unstructured or structured. Kalof et al. (2008:118) depict a questionnaire as a set of structured questions which can easily be answered by respondents. Gray (2014:337) indicates that in a questionnaire, people answer to the same set of questions in a prearranged order. Walliman (2011:97) argues that questionnaires are initially designed for gathering quantitative data, but it may also serve for collecting qualitative data. Likewise, Taylor, Sinha and Ghoshal (2006:6) note that questionnaires take many forms and may be designed to elicit quantitative and/or qualitative data. Gillham (2007:5-8) and Kothari (2004:100-101) distinctly explain key benefits of using a questionnaire as the main data collection instrument and these comprise:

- Low cost in time and money.
- Easy to obtain information from people very quickly.
- Respondents can complete the questionnaire when it suits them.
- Analysis of answers to closed questions is straightforward.
- Less pressure for an immediate response with respondents having adequate time to give well thought out answers.
- Respondents, who are not easily approachable, can also be reached conveniently.
- Lack of interviewer bias with answers being in respondents' own words.
- Respondents' anonymity.

4.7.2.1.1 Formation of questionnaire

Neuman (2011:277) reveals that to formúlate a good questionnaire the researcher has to put together questions that flow easily and unhindered with the respondents understanding of their contributions to the study. Rea and Parker (2005:46) suggest that the questionnaire should be as brief as possible while still covering the subject matter required for the study. However, Neuman (2011:292) holds forth that researchers prefer long questionnaires since they are more cost effective, but admitted that there is no absolute proper length with this as such is dependent on the respondents' characteristics.

Neuman (2011), Gray (2014), Dawson (2009), and Leedy and Ormrod (2010) draw attention to some elements to avoid in the formation or construction of individual questions in a questionnaire which are religiously applied in this study and they are as follows:

- Prejudicial language: avoid language that contains sexist, racist or other discriminatory stereotypes.
- Imprecision: avoid indistinct phrases such as 'average' regularly since they are likely to be interpreted differently by the respondents.
- Questionnaires should be clear, neat and easy to follow.
- Sensitive questions: it is suggested that questions that deal with sensitive issues such as ethnicity, religion, income, and so on, be placed at the end of the questionnaire.
- Double questions should be avoided because they are impossible to answer by the respondent.
- Assumptive questions: avoid questions that make assumptions about people's beliefs or behaviour.

Dawson (2009:89) elucidates that once a researcher has chosen the questionnaire for data collection, the next step is to decide whether to construct closed-ended or open-ended questions, or both. Eriksson and Kovalainen (2008:85) underscore that open-ended questions basically enable the researcher to obtain more detailed answers. Similarly, Gray (2014) agrees that open-ended questions are designed to tap into more detailed perceptions and attitudes than is possible with close-ended questions, and they usually generate qualitative data. Bryman and Bell (2011:249-250) and Dawson (2009:30-31) talk about the three fundamental types of a questionnaire. They are:

- Closed-ended questionnaire - Most questions in this type of questionnaire have closed-ended response choices with a fixed list of alternative responses to choose from for each question. Closed questions have some advantages in that they are easy to complete, and resultant data is easy to organise and analyse because answers are pre-defined but they may sometimes leave out relevant information.
- Open-ended questionnaire - Open questions help a researcher to receive detailed responses in a free manner but they require time and effort for proper data

capturing and analysis of findings. Some researchers will quantify the answers at the data analysis stage.

- Combination of both - Czaja and Blair (2005:18) reveal that the combination of both open and closed questions within a questionnaire promote the reliability of the responses. This style has been adopted by many researchers.

The study employed a questionnaire which included both closed-ended and open-ended questions with the purpose of making respondents to provide additional remarks, thus generating both quantitative and qualitative responses

4.7.2.2 Interviews

According to Matthews and Ross (2010:219), an interview is simply described as a particular type of conversation between two or more people. Similarly, Gray (2014:369) defines an interview as a conversation between people with one person acting as a researcher. Brink, Van der Walt and Van Rensburg (2012:157), Leedy and Ormrod (2010:188) and Polit and Beck (2012:731) also add to the definition of an interview by describing it as a method of data collection in which an interviewer obtains responses from a participant on a face-to-face encounter or through a telephonic or electronic means. Johnson and Turner (2003:308) enumerate the strengths of the interview procedure as follows:

- It can provide comprehensive information.
- Very quick improvement to a research study is achieved for telephone interviews.
- It allows good interpretive validity.
- It is a good tool for measuring attitudes and most other content of interest.
- It permits the act of probing when the interview process is ongoing.
- There is moderately high measurement validity for well-constructed and well-tested interview protocols.

Bhattercherjee (2012:95) notes that an interview (either open-ended/unstructured or focused/structured) is by far the most popular data collection technique for case study research. Gray (2014:369) opines that there are a number of situations in which the interview is the most practical research technique for a research study. These situations take account of where the objective of the research is in order to examine feelings or

attitudes of a category of respondents or where it is likely that people enjoy talking about their work rather than filling in questionnaires. Eriksson and Kovalainen (2008:80) propose three common types of qualitative interviews, which include: a structured interview which adheres to a particular order of questions, semi-structured interview which is systematic and at the same time more detailed, and the unstructured interview which is free to the extent that it can take any direction. On the other hand, Gray (2014:373-374) identifies five categories of interviews, namely: structured interviews, semi-structured interviews, non-directive interviews, focused interviews and informal conversational interviews.

In this study, the face-to-face type of interview was used to obtain data from the librarians. The researcher scheduled formal appointments with FIIRO's' librarians at the institute to carry out the interviews. The questions included in the interview schedule were of open-ended nature which was so designed to permit free responses from the respondents rather than such ones limited to specific alternatives. According to Onwuchekwa (2017:90), an advantage of the face-to-face (FtF) interview is that it gives the interviewer varying possibilities to create a good interview ambience during the data collection phase. Another advantage of FtF interviews as stated by Mugwisi (2013:169) is that they have the marked advantage of enabling the researcher to establish a bond with potential respondents and in this way gain their cooperation and support towards achieving his/her goals.

4.7.2.3 Observations

According to Kumar (2011:14), observation technique involves systematically, purposefully selecting, watching, listening and recording an interaction or phenomenon as it takes place. The observation method is the most commonly used method especially in studies relating to behavioural sciences (Kothari 2004:96). Acccording to Ramdass and Aruni (2009:32) and Walliman (2011:95), observation techniques can be part of both qualitative and quantitative research in which data can be collected by manual, mechanical, electrical or electronic means. Kumar (2011:142) states that "narrative and descriptive recording is mainly used in qualitative research, while for quantitative study an observation is recorded in categorical form or on a numerical scale". Payne and Payne (2004:166) talk about participation observation that is employed in this study. They

describe it as data collection over a sustained period of time by watching, listening, and asking questions as people go about their day-to-day activities while the researcher adopts a role from the setting and becomes a partial member of the group in question. Bernard (2006:341) explains that participation observation involves getting close to people and making them feel comfortable enough with your presence so that you can observe and record information about their lives.

According to Neuman (2011:387), there are different roles that a researcher can play when involved in a research setting as an observer. These roles range from that of a complete observer, to observer-as-participant, participant-as-observer, and finally a complete participant. A complete observer role is when a researcher is behind a one-way mirror is taken on an 'invisible role', while an observer-as-participant is when a researcher is known from the beginning but has limited respondents. A participant-as-observer role is when a researcher is noticeable and is an intimate friend of the respondents and, lastly, a complete participant role is when a researcher acts like a member and obtains secret information as an insider.

As stated by Cohen, Manion and Morrison (2007:305), participant observation can be structured, semi-structured or unstructured. Neuman (2011:325) and Kothari (2004:96) put forward that structured observation consists of a predetermined set of categories of activities or phenomena that should be studied, where a researcher watches what is happening in a social setting that is highly organised and follows systematic rules for observation and documentation. According to Cohen, Manion and Morrison (2007:397), semi-structured observation has an agenda of issues but gathers data to illuminate these issues in a far less predetermined or systematic manner. Unstructured observation does not have predetermined ideas of particular aspects that need focus; rather events are observed and recorded as they take place.

Nieuwenhuis (in Maree 2007:84) cautions that before a researcher uses observation as a data gathering technique, the purpose and focus of the observation must be clearly defined in order to articulate what exactly will be observed. Kothari (2004:96) also points out weaknesses that can arise when this technique is adopted. They are: it is an expensive method; the information provided by this method is very limited; sometimes unforeseen

factors may interfere with the observational task; at times, the fact that some people are rarely accessible to direct observation creates obstacle for this method to collect data effectively.

For this study, the observer-as-participant role was mostly adopted. Semi-structured observation was also applied. The researcher probed the presence of any trace of information giving material and the way they were sought by the researchers at the institute. In particular, the researcher was on the lookout for the presence and use of technology at the FIIRO library. As said by Ramdass and Aruni (2009:71), observations can be made on objects, for example the absence or presence of certain facilities or structure, state of cleanliness, and so on. The observation method was used in the study in order to complement the data collected from interviews and questionnaires, in particular the state of libraries and other facilities within the research institute. The observation schedule for libraries addressed the following:

- Physical location (also, standalone building or attached?)
- Size, lighting
- Shelving and sitting space
- Office space
- Library guides
- Availability of computers and other ICTs (including internet, printing facilities)
- Collection outlook and usage (browse date stamps).

Observation gave the researcher genuine first-hand experience and also explained some issues and opinions that were raised by the researchers (in the questionnaires administered) and librarians (in the interviews with them). This gave a better understanding of why things are the way they are, rather than depending only on what the researchers and librarians said. These are invaluable items of information that cannot be elicited through face-to-face interviews or questionnaire.

4.7.2.4 Content analysis

According to Neuman (2014:371), content analysis involves the researcher gathering and analysing the content of a text - the content can be words, meanings, pictures, symbols,

ideas, themes or any communicated message while the text is anything written, visual, or spoken that serves as a medium for communication. Similarly, Bhattercherjee (2012:115) describes content analysis as "the systematic analysis of the content of a text (e.g., who says what, to whom, why, and to what extent and with what effect) in a quantitative or qualitative manner". According to Dawson (2009:122), content analysis as an instrument for data collection can be employed for open-ended questions which have been included as part of questionnaires. Bhattercherjee (2012:115-116) pinpoints that content analysis can typically be conducted as follows:

- The researcher begins by sampling a selected set of texts from the population of texts for analysis when there are many texts to analyse.
- The researcher identifies and applies rules to divide each text into segments that can be treated as separate units of analysis. This process is called unitising.
- The researcher constructs and applies one or more concepts to each unitised text segment in a process called coding in which a coding scheme is used based on the themes the researcher is searching for or uncovers as he/she classifies the text in his/her research.
- The coded data is analysed, often both quantitatively and qualitatively, to determine which themes occur most frequently, in what contexts and how they are related to each other.

According to Elo and Kyngas (2008:114), a benefit of content analysis is that huge volumes of textual data and diverse textual sources can be sorted and used in supporting evidence in a research. As stated by Bhattercherjee (2012:116), content analysis has several limitations among which is the fact that the coding process is restricted to the information available in a text and sampling must be done carefully to avoid sampling bias. Content analysis in this study is utilised to analyse the qualitative data from responses to the open-ended questions in the questionnaire and the interviews.

4.8 PRETESTING THE DATA COLLECTION INSTRUMENTS/PILOT STUDY

According to Mugwisi (2013:172), a pre-test assists in determining whether or not a research instrument is adequately designed to capture the required data from the

respondents. Presser (2004:2) maintains that pre-testing is a suitable way to evaluate questionnaires in advance. Sheatsley (1983:226) feels that the importance of pre-testing is basically to identify the likely difficulties and weaknesses in a questionnaire and make changes at the early stage. According to McNeill and Chapman (2005:45) and May (2011:107), pre-testing is an important stage during the research process because it effectively assists in identifying ambiguities with changes being made where necessary. As stated by Rea and Parker (2005:31), a pre-test of the draft questionnaire evaluates critical factors such as the following:

- Questionnaire clarity: Will respondents understand the questions? Are the response choices sufficiently clear to elicit the desired information? Any ambiguities may confuse the respondents, leading to undesired information.

- Questionnaire comprehensiveness: Are the questions and response choices sufficiently comprehensive to cover a reasonably complete range of alternatives? Questions may be irrelevant, repetitive or incomplete, in which case they will need to be revised.

- Questionnaire acceptability: Unacceptability may result from excessive questionnaire length or an undue consideration of ethical and moral standards, for instance, questions that are perceived to invade the privacy of respondents.

The questionnaire was pre-tested on seven researchers of the Federal Institute of Industrial Research Oshodi, Nigeria. It was ensured that at least one researcher was taken from each department for the pre-test. These researchers were used for the pre-test in order to ensure that the wording used in the questionnaire was clear and understandable. The pre-testing of the questionnaire was done to guarantee the validity and reliability of the main research tool used for data collection. In addition, the semi-structured interview schedule for librarians was also piloted with a professional librarian of the institute. The observation guide was reviewed by academics and revised by the researcher.

4.9 VALIDITY AND RELIABILITY OF INSTRUMENTS USED IN THE STUDY

As stated by Leedy and Ormrod (2010:27), the concepts of reliability and validity of research instruments have an influence on the extent to which researchers are able to learn from and take a broad view on the issues they have investigated in the course of their research. Burton and Bartlett (2009:25) point out that validity and reliability of instruments should always be considered as compulsory elements that will yield very rich data. Neuman (2011:196) maintains that validity and reliability are necessary to get distinctive results. It is necessary to ensure the reliability and validity of a research instrument is not in doubt. Kerlinger and Lee (2000:641) maintain that if one does not know the reliability and validity of one's data, little confidence can be put in the results obtained and the conclusions drawn from the results of the research. Leedy and Ormrod (2010:91) opine that the researcher should provide evidence that the instruments have a reasonable degree of validity and reliability. McMillan and Schumacher (2001:428-429) observe that the use of multiple research instruments increases the validity and credibility of the research.

4.9.1 Validity

According to Bhattacherjee (2012:58) and Mynhardt (2011:14), validity is described as the extent to which an instrument adequately represents the underlying construct that it is supposed to measure. Kumar (2011:184) points out that validity in the broader sense refers to the ability of a research instrument to demonstrate that it is finding out what it is designed for. Gray (2014:155) and Neuman (2011:188) discuss that validity depicts how well the operational and conceptual definitions interconnect with each other; that is to say it addresses the question of how well the social reality being measured through research matches with the constructs researchers use to measure it. Tredoux and Smith (2006:163-164) subscribe that validity is in two forms. They are internal and external validity. Edmonds and Kennedy (2013:4-5) state that internal validity mostly applies to experimental research because it naturally deals with causal inferences whereas external validity involves choosing the proper probability sampling technique. Tredoux and Smith (2006:167) further observe that external validity is helpful in describing the social world.

Gray (2014:155-158), Neuman (2011:192-194), Bhattacherjee (2012:58) and Leedy and Ormrod (2010:92) describe four categories of validity as follows:

- Face validity: It is the extent to which, on the surface, an instrument looks like it is measuring a particular characteristic. Face validity refers to whether an indicator seems to be a reasonable measure of its underlying construct "on its face".
- Content validity: It is associated with validating the content of a test or examination. It is often considered when a researcher wants to assess people's achievement in some area.
- Criterion validity: It is the extent to which the results of an assessment instrument correlate with another, presumably related measure. If answers about the new and established measures are highly correlated, then it is usually assumed that the new measure possesses criterion validity. According to Bhattacherjee (2012:58-60), this type of validity includes four sub-types: convergent, discriminant, concurrent, and predictive validity. Convergent validity refers to the closeness with which a measure relates to (or converges on) the construct that it is purported to measure. Discriminant validity refers to the degree to which a measure does not measure (or discriminates from) other constructs that it is not supposed to measure. Concurrent validity examines how well one measure relates to other concrete criterion that is presumed to occur simultaneously. Predictive validity is the degree to which a measure successfully predicts a future outcome that it is theoretically expected to predict.
- Construct validity: It is the extent to which an instrument measures a characteristic that cannot be directly observed but is assumed to exist based on patterns in people's behaviour. These patterns or traits have to be operationally defined before they can be measured.

4.9.2 Reliability

According to Bhattacherjee (2012:56), reliability is described as the degree to which the measure of a construct is consistent or dependable. Hair, Black, Babin, Anderson and Tatham (2006:3) explain that reliability generally refers to the extent to which a variable

or set of variables is consistent in what it is intended to measure. Silverman (2013:210) defines reliability as ‘‘the degree of consistency with which instances are assigned to the same category by different observers or different occasions”. Leedy and Ormrod (2010:29) state that reliability is the consistency with which a measuring instrument yields a certain result when the entity being measured has not changed. Neuman (2011:190) points out that in order to improve reliability, pilot tests [among others] can be done, where one or more drafts or preliminary versions of a measure are developed and tried before applying the final version. Leedy and Ormrod (2010:93), Neuman (2011:189-190), and Gray (2014:159) recognises the following ways of measuring reliability:

- Stability: It measures the scores achieved on the same test on two separate occasions, assuming what is being measured does not itself change.

- Equivalence: It is the extent to which two different versions of the same instrument yield similar results.

- Internal consistency: It is the extent to which all of the items within a single instrument yield similar results. It measures the extent to which a test or questionnaire is homogenous in order for a reliability coefficient to be calculated.

- Inter-judge reliability: It compares the consistency of observations when more than one person is judging.

In order to make certain the validity of the research instrument, face and content validity was ensured. Face validity was jointly ensured by the researcher and the research assistants on the field through a methodological distribution of the instruments and monitoring of the administration process. A pilot study was carried out before the main study in order to test the validity and reliability of the research instruments. Teijlingen and Hundley (2001:1) describe a pilot study as a miniversion or a full-scale version of a study specifically formulated to pre-test a particular research instrument such as a questionnaire or an interview schedule. However, Rea and Parker (2005:32) argue that at

the pre-test stage, the main focus is not statistical accuracy, but feedback concerning the overall quality of the questionnaire.

4.10 DATA ANALYSIS

Brink, Van der Walt and Van Rensburg (2012:193) and Polit and Beck (2012:556) state that the purpose of a data analysis is to organise, provide structure to and elicit meaning from data. According to Creswell (2013:180) and Neuman (2011:460), data analysis in qualitative research entails the researcher preparing and organising the data for analysis into conceptual categories, then reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in figures, tables or a discussion. This definitely, involves content analysis with the responses from interviews, questionnaires and observation schedules being analysed using content analysis. Bhattercherjee (2012:115) emphasises that content analysis is the systematic analysis of the content of a text (in this case, the content of data collection instruments used such as interview, observation and questionnaire research instruments to know who says what, to whom, why, to what extent and with what effect) in a qualitative or quantitative manner. Analysis was done using common and recurring words and terms from the respondents' vocabulary. Neuman (2011:460) stresses that the advantage of coding data is that it makes a large volume of data manageable. FIIRO's' librarians were interviewed and assigned codes directly after each interview in order to avoid any omission of important data.

Interview, questionnaire and observation results were transcribed in the original language used in the data collection process (English). This was done to prevent or avoid the challenge expressed by Temple (2002:844) that "concepts across languages vanish into the space between spoken otherness and written sameness".

Quantitative data was analysed using the SPSS software. According to Bailey (1994:389), statistics that are used to infer the truth or falsify a hypothesis is called inferential statistics whereas descriptive statistics do not seek to make any inference but merely provide a description of the sample data. From the quantitative perspective of the study, data analysis involved the use of simple frequencies, percentages, numerical

summations and written descriptions. The descriptive statistics was also used in describing the variables in the instruments adopted in the research.

4.11 SUMMARY

This chapter explains the research approaches that are employed in the study which are the quantitative and qualitative approach. It described and discussed the paradigm and design underpinning the study and how the case study design was selected due to the nature of the research problem investigated. The population of the study, sampling techniques, data collection instruments and data analysis methods were comprehensively discussed in this chapter. Research instruments were triangulated with the aim of obtaining more comprehensive data. Pre-testing of research instruments and evaluation of research methods were coherently discussed to ensure validity and reliability of research findings is not in doubt.

The next chapter presents the analysis, interpretation and discussion of data.

CHAPTER FIVE

ANALYSIS, INTERPRETATION AND DISCUSSION OF DATA

5.1 INTRODUCTION

This chapter presents results emerging from data obtained through questionnaires administered, interviews conducted and observations done for the study. Data is analysed and interpreted according to various issues that relate to the objectives of the study outlined in section 1.5. This chapter also discusses the research findings in line with the objectives and research questions of this study (as outlined in sections 1.5 and 1.6) in relation to the data presented and the literature reviewed in Chapter 2. Marshall and Rossman (1999:150) define data analysis as the method of bringing order, structure and meaning to the mass of collected data. In addition, Creswell (2013:44) indicates that data analysis is mutually inductive and deductive and ascertains patterns or themes. Schwandt (2007:6) is of the opinion that, in broad terms, data analysis does not proceed in a linear fashion and that it is the activity of making sense of interpreting and theorising data that signifies a search for general statements among categories of data. The results in this chapter are presented through frequencies, percentages, numerical summations and written descriptions.

Descriptive and thematic analyses are both used in this chapter. The study investigates the information needs and information-seeking behaviour of researchers in an industrial research institute in Nigeria. The chapter is divided into various sections, namely background information of researchers, the information needs of researchers, information sources used by researchers, evaluating the accessibility of information by researchers, factors affecting the information-seeking behaviour of FIIRO's researchers in Nigeria, the level of availability and adoption of ICTs within the institute and its influence on the use of alternative sources by FIIRO's researchers in Nigeria in getting research information, purposes of ICT resources/services, the influence of recent technologies on the information needs and information-seeking behaviour of FIIRO's researchers on information services provision to meet researchers' information needs, data from interviews and data from observations.

5.2 RESPONSE RATE AND PROBLEM ENCOUNTERED

The response rates of research projects enlighten the researchers on the relative percentage of their project sample that did not respond to their instruments and may provide an understanding of the causes and explanations on why selected persons or groups did not respond (Onwuchekwa 2017:100). According to Nulty (2008:306), response rates are typically considered to be the most widely used statistical information for judging the acceptability of projects that use the questionnaire as the main research instrument.

The distribution of the respondents based on their departments indicates that researchers were from six departments, namely - Food Technology Department (FT), Project Development and Design Department (PDD), Biotechnology Department (BD), Chemical, Fibre and Environmental Technology Department (CFET), Production, Analytical and Laboratory Management Department (PALM) and Planning, Technology Transfer and Information Management Department (PTTIM). Out of 165 questionnaires that were administered to respondents in these six departments, a total of 121 were returned (a completion rate of 73%). Inaccuracies were identified in seven of the questionnaires and they were discarded and not analysed: hence, the usable returns totalled 114 (67%).

At different times during data collection, the response rates were not encouraging. Factors responsible for this include the mobile nature of researchers as they carry out research from one location to another, researchers who were on study leave within and outside the country and the fear that this study might be used to victimise them if the truth is told about the Nigerian civil service. The fear problem was solved by the researcher explaining to the respondents that it is just a study and the consent form signed by them already indicates and assures that their participation would be kept confidential (see Appendix F).

5.3 BACKGROUND INFORMATION OF RESEARCHERS

This section of the questionnaire consists of questions that solicit for information under the following sub-headings: department, highest qualification, gender, age range, the

number of years the researcher has worked as a researcher in FIIRO and the main area of the researcher's research in the department the researcher worked.

Wilson's 1999 model of information behaviour guided this study. The first core variable of this model (section 3.4) takes account of the 'information user' and as such, it is essential to describe the respondents involved in the study.

The characteristics of the respondents and their academic details are not part of the objective of this study, but the background information provided by the respondents enabled the researcher to provide a broad picture of the respondents.

5.3.1 Distribution by departments in FIIRO

Respondents were asked to indicate the departments where they work and carry out research. The distribution of the respondents by their departments as shown in Table 5.1, indicates that 30 (26%) of the respondents are in FT, while 20 (18%) are from PDD. Twenty-five (22%) of the respondents are from BD, 21(18%) are from CFET, 14 (12%) are from PALM and 4 (4%) are from PTTIM. As revealed in this study, it is not a surprise that the highest number of respondents come from FT (30; 26%) since FT has the highest number of researchers at FIIRO, that is 45 (Table 1.1).

Table 5.1: Distribution of researchers by department N=114

Department	**Frequency**	**%**
Food Technology	30	26
Project Development and Design	20	18
Biotechnology	25	22
Chemical Fibre and Environmental Technology	21	18
Production, Analytical and Laboratory Management	14	12
Planning, Technology Transfer and Information Management	4	4
Total	**114**	**100**

5.3.2 Distribution of researchers by highest qualification

In this demographic distribution, respondents were asked to indicate their highest qualifications. The results are shown in Table 5.2 below. Analysis of the results indicates that out of 114 respondents in the study, 40 (35.1%) have a bachelor's degree, 21 (18.4%) have a post-graduate diploma, 35 (30.7%) have a master's degree and 18 (15.8%) have a

doctoral degree. The results show that greater percentage of the respondents have a bachelor's degree, while a doctoral degree is the qualification that the lower percentage of the respondents has. The fact that the respondents possessing a bachelor's degree constitute more than one third of the respondents and doctoral degree holders constitute the least percentage of respondents does not augur well for thorough research work. Researchers are expected to possess postgraduate degrees so that they can be vast in the art of research. However, there are indications that the Director-General of the institute had been encouraging researchers to study for their master's and doctoral degree qualifications. As revealed earlier (section 5.2), this confirms that some of the respondents are on study leave for higher programmes within and outside the country.

Table 5.2: Distribution of researchers by highest qualification N=114

Qualification	Frequency	%
Bachelor's Degree	40	35.1
Post-graduate Diploma	21	18.4
Master's Degree	35	30.7
DPhil/PhD	18	15.8
Total	**114**	**100**

5.3.3 Distribution of researchers by gender

In this demographic description, respondents were asked to indicate their gender. The results are shown in Table 5.3. The analysis of the results indicates that out of 114 respondents in the study, 60 (52.6%) are males and 54 (47.4%) are females. The results show that males respondents are more than females respondents by a percentage difference of 5.2%. This also shows a close range between the number of male and female researchers in relation to gender. This is a good development for research at FIIRO considering the clamour for gender equality in workplaces.

Table 5.3: Distribution of researchers by gender N=114

Gender	Frequency	%
Male	60	52.6
Female	54	47.4
Total	**114**	**100**

5.3.4 Distribution of researchers by age range

Respondents were asked to indicate their age range in the questionnaire. The age range distribution as shown in Table 5.4 reveals that the majority (49; 43.0%) of the respondents are between 30 and 39 years of age, whereas 16 (14.0%) are 50 years and older. Twenty-four (21.1%) of the respondents were between the ages of 20 and 29 years and 25 (21.9%) of the respondents are between 40 and 49 years of age. The results show that the lowest percentage of age range is found in the 50 years and above age range. This implied that the number of respondents nearing the retirement age of 60 as stipulated by the civil service rule is the least number of respondents in this study. The positive implication is that many young researchers can grow with senior researchers and learn from them, making the knowledge transfer process easy without the creation of a knowledge vacuum when old researchers leave the institute. The negative implication is that it raises the issue of brain drain (human capital flight) where senior researchers leave for greener pastures abroad. This study concurs with the studies of Chikwe et al. (2015) and Mba and Ekeopara (2012) that raised the subject of brain drain in Nigeria hampering research development and by inference adversely affecting economic growth.

Table 5.4: Distribution of researchers by age range N=114

Age Range	Frequency	%
20 – 29 Years	24	21.1
30 – 39 years	49	43.0
40 – 49 years	25	21.9
50 years and above	16	14.0
Total	**114**	**100**

5.3.5 Distribution of researchers based on number of years they had worked in FIIRO as researchers

This question required respondents to indicate the number of years they have worked as researchers in FIIRO only. Overall, 39 (34.2%) of the respondents have worked as researchers in FIIRO for 1 to 5 years, followed by 26 (22.8%) for 6 to 10 years, 18 (15.8%) for 16 to 20 years, 17 (14.9%) for 11 to 15 years, 8 (7.0%) for 26 years and above and 6 (5.3%) for 21 to 25 years. A breakdown of the stated descriptive analysis is provided in Table 5.5 below.

As indicated in Table 5.5, 72% of the respondents are found in the lower categories of 1 to 5 years, 6 to 10 years and 11 to 15 years. The fact that most of the respondents are concentrated at the lower categories of the number of years that respondents have worked as researchers inferred that the researchers at these lower categories should be well-equipped and trained or more experienced researchers are needed to complement the ones available at the institute in the form of employment of experienced researchers or collaborative research with experienced researchers outside the institute, which could be within or outside the country. This finding concurs with Kumwenda, Niang, Orondo, William, Oyinlola, Bongo and Chiwona (2017), which indicated that young African researchers indicated that the lack of experienced researchers is a major challenge that young African researchers face in their career development. As a result, they crave for the establishment of mentorship programmes where research knowledge would be passed on from experienced researchers to young researchers.

Table 5.5: Distribution of researchers based on years of working as a researchers in FIIRO N=114

Numbers of years respondents had worked as researchers	F	%
1 – 5 years	39	34.2
6 – 10 years	26	22.8
11 – 15 years	17	14.9
16 – 20 years	18	15.8
21 – 25 years	6	5.3
26 years and above	8	7.0
Total	**114**	**100**

5.4 THE INFORMATION NEEDS OF RESEARCHERS

This section of the questionnaire consists of questions which solicit information under the following sub-headings: information-seeking purposes, type of information the respondents require and the information the respondents need in terms of personal needs. These questions address objective one. The second attribute of Wilson's 1999 model of information behaviour refers to the information needs of users/seekers. In this context, the information user/seeker refers to the respondents involved in this study.

5.4.1 Information needs based on information-seeking purposes of researchers

The respondents were asked to indicate their purpose for seeking information. Overall, all the respondents (114; 100%) did indicate that they require information when carrying out research, 75 (65.8%) of the respondents require information when solving personal needs, 62 (54.4%) require information for general awareness, 57 (50%) require information when attending to clients' needs (consultation), 44 (38.6%) require information for work-related discussions and 41 (36.0%) require information when attending to academic needs. Table 5.6 provides a summary of the findings according to the category of users.

Table 5.6: Information seeking purposes N=114

Information-seeking purposes	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
When carrying out research	30	100.0	20	100.0	25	100.0	21	100.0	14	100.0	4	100.0	114 (100)
When solving personal needs	19	63.3	15	75.0	14	56.0	14	66.7	10	71.4	3	75.0	75 (65.8)
When attending to clients need (consultation)	16	53.3	12	60.0	5	20.0	12	57.1	8	57.1	4	100.0	57 (50)
When attending to academic needs	9	30.0	7	35.0	8	32.0	9	42.9	6	42.9	2	50.0	41 (36.0)
For general awareness	18	60.0	9	45.0	13	52.0	10	47.6	9	64.3	3	75.0	62 (54.4)
For work related discussion	6	20.0	5	25.0	7	28.0	8	38.1	4	28.6	4	100.0	34 (29.8)

*** Multiple responses received**

Key

FT - Food Technology Department, PDD - Project Development and Design Department, BD - Biotechnology Department, CFET - Chemical, Fibre and Environmental Technology Department, PALM - Production, Analytical and Laboratory Management Department, PTTIM - Planning, Technology Transfer and Information Management Department

The respondents evidently indicate how their information-seeking purposes would explain their information needs. This finding, therefore, indicates that the majority of the respondents' information needs based on information-seeking purposes were information needs on carrying out research, solving personal needs and for general awareness. This meant that respondents should be provided with relevant information in the indicated principal areas for there to be thorough research by the respondents. This finding concurs

with the work of Idiegbeyan-Ose et al. (2014), which revealed that science and technology researchers mostly seek for information to satisfy their information needs on research works, current issues and general knowledge. Similarly, this finding also concurs with the work of Okonoko et al. (2015:87), which revealed that researchers sought information mainly when carrying out research, updating knowledge and when utilising current awareness services. Additionally, this study is also in agreement with the work Mugwisi (2013) which revealed that most agricultural researchers (who are also scientists and technologists like FIIRO's researchers) mostly sought information for research purposes. This outcome revealed that industrial researchers just like researchers of other science and technology fields value information on past, current and future research works in no small way to innovatively extend the frontiers of knowledge created through research above any other type of information.

5.4.2 Type of information required by researchers

As indicated by the respondents, the type of information required by most of the BD respondents is information on molecular biology and genetics (21; 84.0%), while the least required information type by this group was information on analytical research (5; 20.0%). A breakdown of the detailed analysis is provided in Table 5.7 below.

Table 5.7: Information type required by BD researchers N=25

Information type required by respondent	Frequency	%
Enzyme technology	15	60.0
Molecular biology and genetics	21	84.0
Waste biology and fermentation	19	76.0
Analytical research	5	20.0
Laboratory management and services	9	36.0
Agricultural science	12	48.0
Biochemistry	10	40.0
Microbiology	20	80.0
Product development	10	40.0

*** Multiple responses received**

The type of information required by most CFET respondents is information on environmental technology (9; 42.9%) while the least required information type by this

group is information on material development and metallurgy (1; 4.8%). A breakdown of the detailed analysis is provided in Table 5.8 below.

Table 5.8: Information type required by CFET researchers N=21

Information type required by respondent	Frequency	%
Chemical technology	7	33.3
Environmental technology	9	42.9
Packaging technology	4	19.0
Polymer and textiles	2	9.5
Pulp and paper technology	3	14.3
Materials development and metallurgy	1	4.8
Microbiology	6	28.6
Product development	7	33.3
Product quality evaluation	5	23.8

*** Multiple responses received**

The type of information required by most FT respondents is information on enzyme technology (24; 80.0%) while the least required information type by this group is information on analytical research (5; 16.7%). A breakdown of the detailed analysis is provided in Table 5.9 below.

Table 5.9: Information type required by FT researchers N=30

Information type required by respondent	Frequency	%
Enzyme technology	24	80.0
Nutrition and toxicology	9	30.0
Baking and milling	12	40.0
Product quality evaluation	21	70.0
Analytical research	5	16.7
Food safety and quality management	14	46.7
Microbiology	17	56.7
Biochemistry	15	50.0
Agricultural sciences	8	26.7
Packing technology	6	20.0

*** Multiple responses received**

The type of information required by most PALM respondents is information on production (8; 57.1%) while the least required information type by this group is information on microbiology (1; 7.1%). A breakdown of the detailed analysis is provided in Table 5.10 below.

Table 5.10: Information type required by PALM researchers N=114

Information type required by respondent	Frequency	%
Analytical research	7	50.0
Food safety and quality management	6	42.9
Agricultural sciences	3	21.4
Production	8	57.1
Project and process development	2	14.3
Microbiology	1	7.1
Product quality evaluation	6	42.9

*** Multiple responses received**

The type of information required by most PDD respondents is information on mechanical engineering (15; 75.0%) while the least required information type required by this group is information on works and services (6; 30.0%). A breakdown of the detailed analysis is provided in Table 5.11 below.

Table 5.11: Information type required by PDD researchers N=20

Information type required by respondent	Frequency	%
Fabrication technology	7	35.0
Mechanical engineering	15	75.0
Materials development and metallurgy	8	40.0
Prototype equipment and design specification	9	45.0
Works and services	6	30.0
Product development	13	65.0
Agricultural sciences	12	60.0
Project and process development	9	45.0

*** Multiple responses received**

In contrast, all departments indicate that they require all the information types available. It was evident that in some instances, information specific to each department's focus/mandate is the type of information that is most sought for across the divide. For example, information on mechanical engineering is the type of information that is most sought for by the PDD department (Table 5.11), information on enzyme technology is the type of information that is most sought for by FT department (Table 5.9), information on analytical research by PALM department (Table 5.10), environmental technology information is the type of information most sought for by the CFET department (Table 5.8), and molecular biology and genetics information is the type of information that is most sought for by the BD department (Table 5.7). The agricultural science information

type was sought by all the departments except the CFET department with both the BD and PDD departments seeking for the agricultural science information type the most.

The PTTIM respondents required all the information types that are mentioned by all respondents with no information type being highly ranked than the other in their case. This is because the role of the PTTIM respondents is to have the knowledge of all the research projects carried out by all FIIRO's respondents in order for them to be able to transfer the discoveries from these research projects to clients in the form of technology/knowledge transfer and adoption.

Some respondents have some information type required in common. The BD and CFET respondents have the product development information type in common (Tables 5.7 and 5.8). The CFET and FT respondents have the packaging technology, product development, microbiology and product quality evaluation information types in common (Tables 5.8 and 5.9). The FT and PALM respondents share product quality evaluation and food safety and quality management information in common (Tables 5.9 and 5.10). The PALM and PDD respondents share project and process development and agricultural sciences information types in common (Tables 5.10 and 5.11).

There are 27 different information types showing the intricate information needs of the respondents based on information types pointing to some instances of a dissimilar and similar type of information among respondents according to their departments. This reveals the complexity of respondents' information needs and it means that information should be provided to the different respondents based on their specific and a common information type in order for respondents' information needs to be well catered for by the library. This finding agrees with the work of Idiegbeyan-Ose et al. (2014:148) that revealed that science and technology researchers have complex information needs because of their varying areas of specialisation. Likewise, this finding concurs with Nel (2015:135) who observed that information needs of researchers are in composite groupings which means that they have field-specific needs for information which connote the type of information needed by them and thus the complexity. Furthermore, the findings concur with the position of Kaniki (2004:83) who revealed that researchers have needs that are common to them. The consequence of these finding points to the fact that the information types required by industrial researchers will always vary in spite of the

similarities the information types can also share at some point. This ambiguity calls for continuous research to know the information behaviour of industrial researchers in order to provide the right information types to meet their information needs.

5.4.3 Information needs of researchers based on main area of research

The respondents were requested to indicate their main area of research which reflects their core area of specialisation. Table 5.12 indicates that of the respondents who completed the questionnaire, 14 (12.3%) (which is the highest) are into enzyme technology, followed by 10 (8.8%) who are into baking and milling, 8 (7.1%) are into nutrition and toxicology, 7 (6.1%) of the respondents indicated their main areas waste biology/fermentation and environmental technology, and 6 (5.3%) of the respondents indicated their main areas to include analytical research, chemical technology, product development and product quality evaluation. A further 5 (4.4%) indicate both fabrication technology and project/process development, 4 (3.5%) indicate production, food safety/quality management, molecular biology/genetics, packaging technology, material/metallurgy, prototype equipment design/specification and technology transfer and finally, 2 (1.8%) of the respondents, which is the least, indicate the areas polymer/textile, pulp/paper technology and works/services.

Table 5.12: Distribution of researchers by main area of research N=114

Main area of research	Frequency	%
Analytical research	6	5.3
Production	4	3.5
Food safety and quality management	4	3.5
Enzyme technology	14	12.3
Molecular biology and genetics	4	3.5
Waste biology and fermentation	7	6.1
Chemical technology	6	5.3
Environmental technology	7	6.1
Packaging technology	4	3.5
Polymer and textile	2	1.8
Pulp and paper technology	2	1.8
Product development	6	5.3
Nutrition and toxicology	8	7.1
Baking and milling	10	8.8
Product quality evaluation	6	5.3
Fabrication technology	5	4.4
Materials and metallurgy	4	3.5

Project and process development	5	4.4
Prototype equipment design and specification	4	3.5
Works and services	2	1.8
Technology transfer	4	3.5
Total	**114**	**100.0**

It is not surprising that the main areas of research, enzyme technology, and baking and milling are the main areas that have the two highest numbers of respondents. This is because they are areas that were well researched by the FT respondents with the highest number of respondents (Table 5.1). Table 5.9 also concurs with the finding that enzyme technology is the main area of research. Enzyme technology information is the most sought for by the FT respondents. This means that considerable attention should be given to the information needs of respondents carrying out research in enzyme technology and baking/milling departments in terms of provision of materials to support their research activities.

5.4.4 Information needs of researchers based on their personal needs

Overall, the majority (86; 75.4%) of the respondents indicate that they require health information in terms of their personal needs while the least required information indicated is cultural information (22; 19.3%).

The information needed by most of the FT respondents in terms of their personal needs is finance and investment (20; 66.7%) while the least needed information is cultural information (3; 10%).

The information needed by most of the PDD respondents in terms of their personal needs is health information (16; 80%) while the least needed is cultural information (1; 5%).

The information needed by most of the BT respondents in terms of personal needs is general knowledge acquisition (20; 80%) while the least needed is cultural information (2; 8%).

The information needed by most of the CFET respondents in terms of their personal needs is health information (19; 90.5%) while the least needed is information on collaboration in terms of research (8; 38.1%).

The information needed by most of the PALM respondents in terms of personal needs is personal and career development information (11; 78.6%) while the least needed is cultural information (1; 7.1%).

The information needed by most of the PTTIM respondents in terms of personal needs is information on general knowledge acquisition and health (4; 100%) with the two having the same percentage while the least is research funding that no PTTIM respondent indicated. The detailed information needs on the personal needs of respondents are shown in Table 5.13 below.

Table 5.13: Information needed by researchers in terms of personal needs N=114

Information needed in terms of personal needs	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
General knowledge acquisition	14	46.7	12	60.0	20	80.0	11	52.4	9	64.3	4	100.0	70 (61.4)
Research funding	12	40.0	5	25.0	7	28.0	12	57.1	8	57.1	0	0.0	44 (38.6)
Personal and career development	17	56.7	13	65.0	13	52.0	10	47.6	11	78.6	2	50.0	66 (57.9)
Health	19	63.3	16	80.0	18	72.0	19	90.5	10	71.4	4	100.0	86 (75.4)
Collaboration in terms of research	7	23.3	4	20.0	6	24.0	8	38.1	5	35.7	2	50.0	32 (28.1)
Finance and investment	20	66.7	15	75.0	14	56.0	9	42.9	7	50.0	3	75.0	68 (59.6)
Culture	3	10.0	1	5.0	2	8.0	14	66.7	1	7.1	1	25.0	22 (19.3)
Sports and entertainment	11	36.7	6	30.0	12	48.0	9	42.9	3	21.4	2	50.0	43 (37.7)

*** Multiple responses received**

It is important to discuss the personal information needs of respondents that participated in the study since respondents are humans's and they have to consider everyday life matters while they carry out their research activities. It is important to note that health issues are related to foremost life concerns and is mentioned by 86 (75.4%) of the respondents. Finance and investment, is rated the second personal need by 78 (68.4%) of the respondents, which shows that respondents need means to satisfy their needs.

Respondents need a broad view of knowledge in order for them to have a good foundation for what they should research hence, general knowledge acquisition is indicated by 70 (61.4%) of the respondents as the third rated personal need. This concurs with the study by Vickery and Vickery (1992:17) which revealed that an individual with valuable needs will require different types of general information to satisfy his/her curiosity. This desire for information ranges from current affairs, social and political events to legal and financial matters. In addition, the findings also agree with the work of Idiegbeyan-Ose et al. (2014:148) and Okonoko et al. (2015:83-84) which revealed that researchers need varying information on personal health, business, sports/entertainment, current awareness (general knowledge) and employment.

A contradiction in the findings is shown in Table 5.6 which reveals that 100% of the respondents indicated that they needed information for research purposes, whereas research funding is revealed as the fifth personal need among eight personal needs mentioned by 44 (38.6%) of the respondents showing a low drive among respondents for the funding of their research works which is supposed to be foremost. This might be due to pessimism from the angle of the respondents based on fact that past research works by these respondents were not funded by the government and research funding agencies as well as the lack of interest in research by policy makers. This finding concurs with Bello (2012:37) who pointed out that obtaining funds for research involves a lot of bureaucracy, the competitive nature of available funds, inaccessibility to funding agencies, inadequacy of funds to complete research projects and delay in releasing funds to researchers. In addition, this finding also concurs with the work of Kumwenda et al. (2017) who cited lack of funds and lack of interest in research by policymakers as major challenges facing African researchers.

Collaboration in terms of research is also mentioned by 32 (28.1%) of the respondents which is low compared to what researchers should strive for in terms of collaborative works with other researchers. This concurs with section 5.3.5 which shows that most of the respondents are concentrated in the lower categories of the number of years that respondents have worked as researchers and which established the fact that they had less collaborative research due to their lower number of years of working as researchers.

Culture is also mentioned as a personal need, although it is the least ranked with 22 (19.3%) of the respondents indicating so. Being professionals the respondents are willing to move across tribes with different cultures when they do research. Therefore, they need to keep themselves abreast of the different cultures of people to fit into the society when carrying out research in order to obtain facts for meaningful research.

5.5 INFORMATION SOURCES USED BY RESEARCHERS

This section of the questionnaire consists of questions which solicit for information under the following sub-headings: importance of different information sources, frequency of usage of information sources, consultation sequence of information sources, information sources preference and reasons for preference of information sources. These questions address objective two.

Wilson's 1999 model of information behaviour demonstrates that when seeking for information, people may use more than one source to satisfy their information needs by either consulting just one source or multiple sources. This purports that based on Wilson's (1999) model, respondents sought information from several sources to satisfy their information quest without restricting themselves to a specific information source.

5.5.1 Importance of different information sources

The respondents were asked to indicate the importance of different sources of information in keeping up-to-date with scientific developments in industrial research with respect to their related fields. It is revealed that journal articles are considered very important with 105 (92.1%) of the respondents indicating so. This is followed by internet sources (94; 82.5%). Specifically, journal articles are very important to all the respondents (100%) of the BT department. The responses further reveal that newsletters (28; 24.6%) constitute the source considered by the respondents to be the least important. Detailed analysis is shown in Table 5.14.

Table 5.14: Importance of information sources N=114

Information Source	Relative Importance	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
		F	%	F	%	F	%	F	%	F	%	F	%	
Journal articles	Very important	28	93.3	19	95.0	25	100.0	19	90.5	11	78.6	3	75.0	105 (92.1)

	Important	2	6.7	1	5.0	0	0	2	9.5	3	21.4	1	25.0	9 (7.9)
	Not important	0	0	0	0	0	0	0	0	0	0	0	0	0 (0.0)
Review articles	Very important	19	63.3	12	60.0	22	88.0	13	61.9	8	5731	3	75.0	77 (67.5)
	Important	11	36.7	7	35.0	3	12.0	8	38.1	6	42.3	1	25.0	36 (31.6)
	Not important	0	0	1	5.0	0	0	0	0	0	0	0	0	1 (0.9)
Conference abstracts and proceedings	Very important	16	53.3	13	65.0	16	64.0	16	76.2	6	42.9	1	25.0	68 (59.6)
	Important	12	40.0	7	35.0	9	36.0	5	23.8	8	57.1	3	75.0	44 (38.6)
	Not important	2	6.7	0	0	0	0	0	0	0	0	0	0	2 (1.8)
Books	Very important	16	53.3	12	60.0	16	64.0	10	47.6	7	50.0	2	50.0	63 (55.3)
	Important	14	46.7	8	40.0	9	36.0	10	47.6	7	50.0	2	50.0	50 (43.9)
	Not important	0	0	0	0	0	0	1	4.8	0	0	0	0	1 (0.9)
Professional meetings/ workshops	Very important	12	40.0	17	85.0	15	60.0	8	38.1	3	21.4	2	50.0	57 (50.0)
	Important	16	53.3	3	15.0	10	40.0	13	61.9	10	17.4	2	50.0	54 (47.4)
	Not important	2	6.7	0	0	0	0	0	0	1	7.1	0	0	3 (2.6)
Sources of contents (content pages)	Very important	4	13.3	2	10.0	14	16.0	1	4.8	1	7.2	3	75.0	25 (21.9)
	Important	20	66.7	16	80.0	19	76.0	20	95.2	10	71.4	1	25.0	86 (75.4)
	Not important	6	20.0	2	10.0	2	80.0	0	0	3	21.4	0	0	13 (11.4)
Indexes and abstracts of journals	Very important	5	16.7	2	10.0	5	20.0	3	14.3	4	28.6	2	50.0	21 (18.4)
	Important	23	76.7	15	75.0	17	68.0	18	88.7	8	57.1	2	50.0	83 (72.8)
	Not important	2	6.7	3	15.0	2	8.0	0	0	2	14.3	0	0	9 (7.9)
	No response	0	0	0	0	1	4.0	0	0	0	0	0	0	1 (0.9)
Research reports/ patents/ facts sheets	Very important	20	66.7	12	30.0	3	12.0	11	52.4	4	28.6	2	50.0	52 (45.6)
	Important	10	33.3	7	35.0	19	76.0	9	42.9	10	71.4	2	50.0	57 (50.0)
	Not important	0	0	1	5.0	3	12.0	1	4.8	0	0	0	0	4 (3.5)
Technical reports	Very important	7	23.3	14	70.0	4	16.0	2	9.5	1	7.1	1	25.0	29 (25.4)
	Important	18	30.0	6	30.0	14	56.0	18	85.7	11	7836	3	75.0	70 (61.4)
	Not important	5	16.7	0	0	6	24.0	1	4.8	2	14.3	0	0	14 (12.3)
Pamphlets/ leaflets	Very important	1	3.3	1	5.0	18	72.0	17	81.0	2	14.3	1	25.0	40 (35.1)
	Important	17	65.7	14	70.0	6	24.0	4	19.0	4	28.6	3	75.0	48 (42.1)
	Not important	12	40.0	5	25.0	0	0	0	0	8	57.1	0	0	25

														(21.9)
Internet sources	Very important	25	83.3	19	95.0	21	84.0	17	810	11	78.6	1	25.0	94 (82.5)
	Important	5	16.7	1	5.0	4	16.0	3	14.3	3	21.4	2	50.0	18 (15.8)
	Not important	0	0	0	0	0	0	1	4.8	0	0	1	25.0	2 (1.8)
Theses and dissertations	Very important	11	36.7	2	10.0	4	16.0	2	9.5	3	21.4	2	50.0	24 (21.1)
	Important	17	56.7	16	80.0	18	72.0	15	71.4	7	50.0	1	25.0	74 (64.9)
	Not important	2	6.7	2	10.0	2	8.0	4	19.0	4	28.6	1	25.0	15 (13.2)
Newsletters	Very important	2	6.7	0	0	0	0	3	14.3	1	7.1	1	25.0	7 (6.1)
	Important	21	70.0	18	90.0	18	72.0	13	61.9	6	42.9	2	50.0	78 (68.4)
	Not important	7	23.3	2	10.0	6	24.0	5	23.8	7	50.0	1	25.0	28 (24.6)
Library catalogues	Very important	2	6.7	2	10.0	3	12.0	2	9.5	1	7.1	0	0	10 (8.8)
	Important	19	63.3	17	85.0	18	72.0	18	85.7	9	64.3	4	100.0	85 (74.6)
	Not important	9	30.0	1	5.0	3	12.0	1	4.8	4	28.6	0	0	18 (15.8)
Face to face conversation /discussions with colleagues	Very important	9	30.0	14	70.0	13	52.0	10	47.6	6	42.9	1	25.0	53 (46.5)
	Important	20	66.7	6	30.0	11	44.0	10	47.6	7	50.0	3	75.0	57 (50.0)
	Not important	1	3.3	0	0	1	4.0	1	1.8	1	7.1	0	0	4 (3.5)
Email/ blogs/ webinar/ discussion forums	Very important	13	43.3	7	35.0	10	40.0	10	47.6	2	14.3	0	0	42 (36.8)
	Important	6	53.3	13	65.0	12	48.0	11	52.4	10	71.4	4	100.0	56 (49.1)
	Not important	1	3.3	0	0	2	8.0	0	0	2	14.3	0	0	5 (4.4)
Librarian/ library staff	Very important	2	6.7	1	5.0	3	12.0	2	9.5	2	14.3	1	25.0	11 (9.6)
	Important	25	83.3	17	85.0	20	80.0	19	90.5	8	57.1	2	50.0	91 (79.8)
	Not important	3	10.0	2	10.0	1	4.0	0	0	4	28.6	1	25.0	11 (9.6)
Knoweldgeable person in the field	Very important	22	73.3	19	95.0	21	84.0	13	61.9	11	78.6	2	50.0	88 (77.2)
	Important	8	26.7	1	5.0	4	16.0	8	38.1	3	21.4	1	25.0	25 (21.9)
	Not important	0	0	0	0	0	0	0	0	0	0	1	25.0	1 (0.9)

*** Multiple responses received**

Table 5.14 implies that various sources of information are used by the respondents concurring with Wilson's 1999 model which highlights the use of many sources of information by users. This finding concurs with Grefsheim and Rankin (2007) who pointed out that journals are the most important information resources for researchers.

Similarly, this finding also concurs with the work of Pantry and Griffith (2009) which revealed that researchers obtain and use information from a large spectrum of information sources. In terms of the importance rating, the last three information sources in descending order were librarian/library staff (9.6%), library catalogues (8.8%) and newsletters (6.1%). This concurs with sections 5.6.2, 5.8.5, 5.10.1, 5.11.1, 5.11.2, 5.11.4, 5.11.5 and 5.11.9, which highlight how the institute's library is poorly used by respondents due to outdated library materials.

5.5.2 Frequency of usage of information sources

Having identified the importance of information sources for scientific development in industrial research, the respondents were required to indicate how often they consulted the sources. Table 5.15 below provides a summary of the responses.

Table 5.15: Frequency of usage of information sources N=114

Information Source	Relative Importance	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
		F	%	F	%	F	%	F	%	F	%	F	%	
Journal articles	Often	25	83.3	18	90.0	25	100.0	21	100.0	12	85.7	3	75.0	104 (91.2)
	Sometimes	5	16.7	2	10.0	0	0	0	0	2	14.3	1	25.0	10 (8.8)
	Never	0	0	0	0	0	0	0	0	0	0	0	0	0 (0.0)
Review articles	Often	21	70.0	13	65.0	22	88.0	11	52.4	7	50.0	2	50.0	76 (66.7)
	Sometimes	9	30.0	6	30.0	2	8.0	10	47.6	7	50.0	2	50.0	36 (31.6)
	Never	0	0	1	5.0	0	0	0	0	0	0	0	0	1 (0.9)
Conference abstracts and proceedings	Often	6	20.0	14	20.0	20	800	11	52.4	2	14.3	2	50.0	55 (48.2)
	Sometimes	22	73.3	6	30.0	5	20.0	10	47.6	11	78.6	2	50.0	56 (49.1)
	Never	2	6.7	0	0	0	0	0	0	1	7.1	0	0	3 (2.6)
Books	Often	19	63.3	12	60.0	13	52.0	11	52.4	8	57.1	3	75.0	66 (57.9)
	Sometimes	9	30.0	8	40.0	11	44.0	10	47.6	6	42.9	1	25.0	45 (39.5)
	Never	2	6.7	0	0	1	4.0	0	0	0	0	0	0	3 (2.6)
Professional meetings/ workshops	Often	10	33.3	11	55.0	11	44.0	6	28.6	2	14.3	1	25.0	41 (36.0)
	Sometimes	18	60.0	9	45.0	13	52.0	15	71.4	11	78.6	2	50.0	68 (59.6)
	Never	2	6.7	0	0	1	4.0	0	0	1	7.1	1	25.0	5 (4.4)

Sources of contents (content pages)	Often	2	6.7	2	10.0	3	12.0	2	9.5	0	0	1	25.0	10 (8.8)
	Sometimes	28	93.3	16	80.0	16	64.0	19	90.5	14	100.0	2	75.0	95 (83.3)
	Never	0	0	2	10.0	5	20.0	0	0	0	0	1	25.0	8 (7.0)
Indexes and abstracts of journals	Often	16	53.3	6	30.0	5	20.0	1	4.8	6	42.9	2	50.0	36 (31.6)
	Sometimes	14	46.7	13	65.0	19	76.0	20	95.2	8	57.1	2	50.0	76 (66.7)
	Never	0	0	1	5.0	0	0	0	0	0	0	0	0	1 (0.9)
Research reports/ parents/ facts sheets	Often	16	53.3	14	70.0	2	8	12	57.1	3	21.4	3	75.0	50 (43.9)
	Sometimes	11	36.7	6	30.0	22	88.0	7	33.3	11	78.6	1	25.0	58 (50.9)
	Never	3	10.0	0	0	0	0	2	9.5	0	0	0	0	5 (4.4)
Technical reports	Often	2	6.7	14	70.0	18	72.0	1	4.8	1	7.1	4	100.0	40 (35.1)
	Sometimes	22	73.3	6	30.0	6	24.0	16	76.2	9	64.3	0	0	59 (51.8)
	Never	6	20.0	0	0	0	0	4	19.0	4	28.6	0	0	14 (12.3)
Pamphlets/ leaflets	Often	2	6.7	14	70.0	18	72.0	1	4.8	1	7.1	4	100.0	40 (35.1)
	Sometimes	22	73.3	6	30.0	6	24.0	16	76.2	9	64.3	0	0	59 (51.8)
	Never	6	20.0	0	0	0	0	4	19.0	4	28.6	0	0	14 (12.3)
Internet sources	Often	30	100.0	20	100.0	25	100.0	21	100.0	13	92.9	4	100.0	113 (99.1)
	Sometimes	0	0	0	0	0	0	0	0	1	7.1	0	0	1 (0.8)
	Never	0	0	0	0	0	0	0	0	0	0	0	0	0 (0.0)
Theses and dissertations	Often	12	40.0	1	5.0	5	12.0	9	42.9	0	0	1	25.0	28 (24.6)
	Sometimes	15	50.0	17	85.0	16	56.0	12	57.1	8	57.1	3	75.0	71 (62.3)
	Never	3	10.0	2	10.0	3	12.0	0	0	6	42.9	0	0	14 (12.3)
Newsletters	Often	1	3.3	19	95.0	3	12.0	9	42.9	0	0	1	25.0	33 (28.9)
	Sometimes	21	70.0	1	5.0	14	56.0	12	57.1	8	57.1	3	75.0	59 (51.8)
	Never	8	26.7	0	0	7	28.0	0	0	6	42.9	0	0	21 (18.4)
Library catalogues	Often	1	3.3	19	95.0	5	20.0	10	47.6	0	0	4	100.0	39 (34.2)
	Sometimes	19	63.3	1	5.0	14	56.0	9	42.9	12	85.7	0	0	55 (48.2)
	Never	10	33.3	0	0	5	20.0	2	9.5	2	14.3	0	0	19 (16.7)

Face to face conversation / discussions with colleagues	Often	20	66.7	8	40.0	20	80.0	8	38.1	5	35.7	2	50.0	63 (55.3)
	Sometimes	10	33.3	12	60.0	4	16.0	13	61.9	9	64.3	1	25.0	49 (43.0)
	Never	0	0	0	0	0	0	0	0	0	0	1	25.0	1 (0.9)
Email/ blogs/ webinar/ discussion forums	Often	15	50.0	5	25.0	11	44.0	7	33.3	4	28.6	4	100.0	46 (40.4)
	Sometimes	12	40.0	14	70.0	11	44.0	12	57.1	9	64.3	0	0	58 (50.9)
	Never	3	10.0	1	5.0	2	8.0	2	9.5	1	7.1	0	0	9 (7.9)
Librarian/ library staff	Often	3	10.0	2	10.0	2	8.0	1	4.8	1	7.1	1	25.0	10 (8.8)
	Sometimes	21	70.0	17	85.0	18	72.0	19	90.5	8	57.1	2	50.0	85 (74.6)
	Never	6	20.0	1	5.0	4	16.0	1	4.8	5	35.7	1	50.0	18 (15.8)
Knowledgeable person in the field	Often	23	76.7	18	90.0	18	72.0	12	57.1	11	78.6	1	25.0	83 (72.8)
	Sometimes	7	23.3	2	10.0	7	28.0	9	42.9	3	21.4	3	75.0	31 (27.2)
	Never	0	0	0	0	0	0	0	0	0	0	0	0	0 (0.0)

*** Multiple responses received**

The responses indicate that internet sources are the most frequently used information source with 113 respondents (99.1%) indicating this. It is followed by journals (104; 91.2%), consulting with knowledgeable persons in the field (83; 72.8%) and review articles (76; 66.7%). The least used resources are newsletters (21; 18.4%), library catalogue (19; 16.7%), pamphlets/leaflets (14; 12.3%) and technical reports (13; 11.4%). This concurs with section 5.5.1 which show newsletters to be the least important information source.

Another ratification for the frequency of usage of internet sources is that 61 (53.5%) of the respondents report feeling very different after using electronic sources. They show that they have used completely different internet sources than they had five years ago (section 5.8.4). This shows their attraction to accessing information via electronic sources (internet). Furthermore, in support of the internet as the most frequent source, this finding established that loss of browsability is revealed as the major challenge faced by the respondents when accessing web-based information (section 5.7.3).

This finding concurs with Grefsheim and Rankin (2007) and Haines et al. (2010) who confirmed that online sources (internet) were overwhelmingly preferred by all types of scientists and researchers due to their convenience advantage and immediacy characteristics. In addition, Acheampong and Dzandu (2015:88) discovered that research scientist prefer journal articles in electronic format to print format: they clearly stated that it might be due to occasional usage of information centres/libraries. This is clearly indicated in this study with the low frequency with which the library and librarians/library staff sources are being utilised (section 5.5.1). FIIRO's' researchers utilised and trusted internet sources as a dependable source of information because the FIIRO library did not have sufficient and up-to-date information sources to provide research information for their research works.

5.5.3 Consultation sequence of information sources

The topmost sequence preferred by respondents is the sequence: internet→personal collection→colleagues→library (72; 63.0%). The second preferred sequence is: internet→colleagues→personal collection→library (40; 35.0%). The last preferred sequence is library→internet→personal collection→colleagues (2; 2.0%). The detailed sequence of consultation is shown in Table 5.16. This shows that the internet is well preferred by the respondents for information needs consultations. This concurs with the study done by Fry and Talja (2007) which revealed that there is a greater preference for electronic sources (internet) among researchers in the science discipline. Other studies that agree with this finding include Brown (2010), Case (2008), Hart and Kleinveldt (2011), Neal (2009) and Nicholas et al. (2010).

Table 5.16: Sequence of consultation when in need of information N=114

When information is required	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Internet→personal collection→colleagues →library	19	63.3	13	65.0	15	60.0	14	66.7	9	64.3	2	50.0	72 (63.0)
Internet→colleagues →personal collection→library	11	36.7	7	35.0	10	40.0	7	33.3	5	35.7	0	0	40 (35.0)

Library→internet→personal collection→colleagues	0	0	0	0	0	0	0	0	0	0	2	50.0	2 (2.0)
Total	**30**	**100.0**	**20**	**100.0**	**25**	**100.0**	**21**	**100.0**	**14**	**100.0**	**4**	**100.0**	**114 (100.0)**

5.5.4 Information sources preference

The respondents were asked to indicate the preferred information sources to satisfy their information needs in terms of research journal articles/reference materials in relation to whether they would want them in print copies, electronic copies or both. Table 5.17 shows that the majority of the respondents (80; 70.2%) prefer both electronic and print copies of research journal articles/reference materials. Thirteen (11.4%) of the respondents preferred print copies while 21 (18.4%) preferred electronic copies. In addition, the respondents were asked to indicate the sources they consult first. The majority (104, 91.2%) indicates that they first consult electronic sources while eight (7.0%) of the respondents consult print sources with two respondents not responding to this question.

Table 5.17: Information sources preference to satisfy researchers' information needs N=114

Information sources preference	**FT**		**PDD**		**BT**		**CFET**		**PALM**		**PTTIM**		**ΣF & %**
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	
Print copy only	2	6.7	7	35.0	2	8.0	1	4.8	1	7.1	0	25.0	13 (11.4)
Electronic copy only	3	10.0	3	15.0	4	16.0	7	33.3	3	21.4	1	0	21 (18.4)
Both (print and copy)	25	83.3	10	50.0	19	76.0	13	61.9	10	71.4	3	75.0	80 (70.2)
Total	**30**	**100.0**	**20**	**100.0**	**25**	**100.0**	**21**	**100.0**	**14**	**100.0**	**4**	**100.0**	**114**

Compared to Table 5.16 in which respondents indicated internet sources, this finding reveal that the majority of the respondents prefer both electronic and print copies of research journal articles/reference journals compared to just electronic copies. This concurs with section 5.7.3 where power outage is a challenge indicated by respondents, and this can affect the use of electronic sources hence, the alternative use of print sources

pointing to reliability of both sources (Table 5.18). This also concurs with the fact that despite the library having no internet access and subscription to e-resources (section 5.12.6), respondents are able to subscribe to electronic resources themselves (section 5.6.1) and access these resources mostly at home (section 5.6.7) possibly because they also have their own power-generating sources. This concurs with Latham and Watkins Africa Practice (2016:1) which indicate that there is a widespread practice of self-generation of power in the commercial, industrial and residential sectors with many individuals and businesses owning their generators to compensate for lack of access to energy supply.

This current study can be juxtaposed with Brown's 1999 work on the information sources used by scientists in which he showed that the ultimate preferred source for information was the printed journal article. This present finding clearly shows that despite the ease of access that comes with electronic sources obtained from the internet (as seen in section 5.6.1), with the majority of the respondents indicating the internet as a way of obtaining journal articles, respondents still use print copies to satisfy their information needs. The respondents state the reason for this to be the reliability of both print and electronic copies when combined for a research (Table 5.18). This finding also concurs with the affirmative stand of Brown (2010:187) which revealed that "although the digital infrastructure facilitates new kinds of interaction, it has not altered the essential nature of scholarly communication".

5.5.5 Reasons for preference of information sources

The respondents reveal the reasons for their preference of information sources to satisfy their information needs as indicated in section 5.5.4. Eighty (70.2%) of the respondents agree that both print and electronic copies are reliable to give research information when combined in terms of usage by the respondents. The detailed reasons for preference of information sources are shown in Table 5.18. This concurs with section 5.5.4 where the respondents prefer both electronic and print sources.

Table 5.18: Reasons for preference of information sources N=114

Reasons	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Wider range and access of information for electronic copies	2	6.7	2	10.0	2	8.0	6	28.6	2	14.3	1	25.0	15 (13.2)
Availability of print copy without internet access	2	6.7	7	35.0	2	8.0	1	4.8	1	7.1	0	0.0	13 (11.4)
Easy to scan or look through phones for electronic copies	3	10.0	3	15.0	4	16.0	7	33.3	3	21.4	1	25.0	21 (18.4)
Use of gadgets like smart phones for electronic copies	3	10.0	3	15.0	4	16.0	7	33.3	3	21.4	1	25.0	21 (18.4)
Reliability of both print and electronic copies combined	25	83.3	10	50.0	19	76.0	13	61.9	10	71.4	3	75.0	80 (70.2)
Convenience and cost effectiveness of electronic copies	3	10.0	3	15.0	4	16.0	7	33.3	3	21.4	1	25.0	21 (18.4)
Bulkiness and expensiveness of print copies	2	6.7	7	35.0	2	8.0	1	4.8	1	7.1	0	0.0	13 (11.4)

*** Multiple responses received**

5.6 EVALUATING THE ACCESSIBILITY OF INFORMATION BY RESEARCHERS

This section of the questionnaire solicits for information under the following sub-headings: obtaining or accessing journal articles, frequency of accessing online journals outside the institute, ease of accessibility of information by respondents at the institute's library and other factors that will further aid accessibility of research information at the institute's library. Other questions solicited from the respondents in this section were specification of databases/archives/indexes and location of access to the specified databases/archives/indexes. These questions addressed objective three.

5.6.1 Obtaining or accessing journal articles

The respondents were asked to indicate how they obtain journal articles for their research works. Table 5.19 provides a detailed analysis. Respondents report that they obtain their

journal articles mainly from the internet (82; 71.0%) by using search engines such as Google and Yahoo to retrieve uploaded journals. Others in descending order are personal subscription to online versions (51; 44.7%), personal subscription to print journals (45; 39.5%), e-archive (17; 14.9%) and document delivery (1; 0.9%). The respondents do not obtain their journal articles via the library's online/electronic version, library's print subscription and interlibrary loan.

This means that the frequency of use of the internet (use of search engines like Google and Yahoo) as indicated by the respondents to retrieve research journal articles above personal subscription to online versions, personal subscription to print journals, library online/electronic version, e- archive, inter-library loan, library print subscription and document delivery does not portend well for research works at FIIRO. This concurs with responses in sections 5.6.2 and 5.6.7 below which indicated that the majority of respondents access online journals/databases/archive/indexes outside the institute especially at home. This also points to the factor of poor infrastructure as indicated in section 5.6.4.

This finding agrees with Acheampong and Dzandu (2012) who revealed that researchers at the Council for Scientific and Industrial Research Crops Research Institute in Ghana preferred to access most of the information they need for their research using their own computers (accessing electronic resources). In addition, researchers at the Council for Scientific and Industrial Research Crops Research Institute also complained on the poor state of the institute's information centre with the information centre lacking resources (current and relevant materials) and equipment. This is also the case of FIIRO where there is no respondent that accesses journal articles through library print subscription and online/electronic version in the library.

Table 5.19: Ways of obtaining journal articles N=114

Ways of obtaining journal titles	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Personal subscription to print journals	11	36.7	9	45.0	12	48.0	10	47.6	1	7.1	2	50.0	45 (39.5)

Personal subscription to online version	9	30.0	12	60.0	14	56.0	9	42.9	4	28.6	3	75.0	51 (44.7)
Library online/electronic version	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)
Library print subscription	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)
E- archive	0	0.0	14	70.0	0	0.0	0	0.0	3	21.4	0	0.0	17 (14.9)
Inter library loan	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)
Document delivery	0	0.0	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	1 (0.9)
Internet using Google, yahoo e.t.c	20	66.7	13	65.0	19	76.0	16	76.2	10	71.4	4	100.0	82 (71.9)

*** Multiple responses received**

5.6.2 Frequency of accessing online journals outside the institute

The respondents identified how often they access online journals outside the institute. Table 5.20 gives the detailed analysis. Ninety-two (80.7%) of the respondents often access online journals outside the institute, 17 (17.9%) sometimes access online journals outside the institute, while 5 (4.4%) never access online journals outside the institute.

This concurs with sections 5.12.6 and 5.13.6 which indicate that the library has no internet connection and working server. This makes most of the respondents to access online journals outside the institute since the institute's library does not meet their requirements for the provision of online journals (section 5.6.1). Therefore, 80.7% of the respondents had to settle for the alternative of accessing online journals outside the institute.

This finding agrees with the study of Jagboro (2003) in which researchers indicated that they obtain electronic resources from cybercafés (outside their institution). However, he cited that this attitude was due to the proximity of cybercafés to user facilities. In the case of FIIRO's' researchers, their attitude of preferring to access online journals outside the institute is as a result of the lack of this facility in their institution.

Table 5.20: Accessing online journals outside the institute's library N=114

Frequency of access	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Often	20	66.6	16	80.0	23	92.0	19	90.5	11	78.6	3	75.0	92 (80.7%)
Sometimes	5	16.7	4	20.0	2	8.0	2	9.5	3	21.4	1	25.0	17 (14.9%)
Never	5	16.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5 (4.4%)
Total	30	100.0	20	100.0	25	100.0	21	100.0	14	100.0	4	100.0	114 (100.0)

5.6.3 Ease of accessibility of information by respondents at the institute's library

The respondents were asked about the ease with which they access information at the institute's library. Out of 114 respondents, 40 (35.1%) indicate that information accessibility at the institute's library is easy whereas 74 (64.9%) indicate otherwise. This means that respondents did not find obtaining information at the institute's library easy. This concurs with section 5.7.2 where respondents have challenges with circulation and issuing in the manual environment of the library and section 5.7.3 where respondents have the major challenge of electrical power instability with searching web information in the library. Undeniably, all the above factors affect the ease of accessing information by respondents.

This finding gives credence to Ugah (2007) who indicated that in developing countries accessibility issues arise as a result of bibliographic or intellectual access to the content of the library being inadequate, connection to poor indexing system in the library catalogue or of the library collection itself, the circulation policy of the library being inefficient, unplanned shelving methods and lack of guides to library collection arrangement. These mentioned factors were also glaring in this study with respect to the FIIRO library.

5.6.4 Factors responsible for difficulty faced in accessing information

The respondents who indicate that accessing information at the institute's library is not easy were further asked about the factors responsible for this difficulty they face. The result in Table 5.21 shows that the lack of recent books (77; 67.5%) is a major factor. This is followed in descending order by poor infrastructure (74; 64.9%), environment

(64; 56.1%), bibliographic obstacles (43; 37.7%), costs of accessing information (32; 28.1%), lack of awareness (27; 23.7%) and declining budgets and rising costs (5; 4.4%).

Lack of recent books being a major challenge shows the attraction of the respondents towards the characteristic of up-to-date information (the need for current books) in their quest to obtain information and the lack of it. For the purpose of emphasis in this study, respondents who indicate that accessibility of information is easy for them at the institute's library also suggested provision of more recent books in different fields as a major factor that would further aid accessibility of information at the institute's library (section 5.6.5). This shows an accent to this factor by all the respondents. Section 5.12.3 also confirmed that librarians indicate that respondents are concerned with more current books than outdated ones. Poor infrastructure at the library being ranked second points to the lack of adequate supply of electricity as well as the need for information communication facilities such as fixed telephones, internet and computers. This information corroborates section 5.7.3 where 91 (79.8%) of the respondents indicate electrical stability problem as a challenge to accessing electronic resources. This is evidenced during the observation period of the library and the interviews with professional librarians (section 5.12.6). The institute, including the library, was without supply of electricity for about a month.

The environment being ranked as the third challenge is also validated by the interviews during which the participants mention the challenge of the absence of library guides to reinforce library rules and regulations (for instance, no noise, use of phones, etc.), with some patrons communicating very loudly and disturbing other patrons while using the library (section 5.13.5). In addition, the library environment has to contend with wide ranges of temperature. With the air-conditioning system not in full working condition, at the time of observing the library, poor ventilation is a major challenge that discouraged respondents from accessing library materials (section 5.13.1). Even if windows were opened another environmental challenge of noise from the hooting sound of vehicles sets in. The library environment is supposed to encourage the respondents to come and study, get research materials and meet with their colleagues and library staff/librarians for a crossbreed of research ideas, but this is also lacking at the institute's library.

With the lack of recent books, poor infrastructure and poor library environment being the highly ranked factors, these clearly show that the institute's management and library staff have a lot of work to do towards having respondents' information needs attended to. The findings concur with the works of Kamba (2008) and Ugah (2007) that listed inadequate library collections, high cost of international journals and books, poor infrastructure/environment and poor funding as major challenges affecting accessibility of information in research libraries.

Table 5.21: Factors responsible for the difficulty faced in accessing information N=114

Factors	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Lack of awareness	3	10.0	3	15.0	4	16.0	13	61.9	2	14.3	2	50.0	27 (23.7)
Information explosion	1	3.3	1	5.0	2	8.0	2	9.5	2	14.3	1	25.0	9 (7.9)
Bibliographic obstacles	19	63.3	5	25.0	4	16.0	10	47.6	2	14.3	3	75.0	43 (37.7)
Environment	23	76.7	13	65.0	7	28.0	17	81.0	3	21.4	1	25.0	64 (56.1)
Declining budgets and rising costs	0	0.0	0	0.0	5	20.0	0	0.0	0	0.0	0	0.0	5 (4.4)
Costs of accessing information	7	23.3	2	10	12	48.0	6	28.6	4	28.6	1	25.0	32 (28.1)
Library staff	2	6.7	1	5.0	2	8.0	2	9.5	2	14.3	1	25.0	10 (8.8)
Poor infrastructure	25	83.3	15	75.0	5	20.0	19	90.5	8	57.1	2	50.0	74 (64.9)
Lack of recent books	21	70.0	12	60.0	17	68.0	18	85.7	8	57.1	1	25.0	77 (67.5)

*** Multiple responses received**

There was a contradiction in the assertion by 33 (28.9%) of the respondents that limited financial resources is the least information-seeking factor that influence their information-seeking behaviour (Table 5.25), compared to the costs of accessing information being ranked as the fifth factor out of nine factors for the difficulty faced by respondents in accessing information. Thirty-two (28.1%) of the respondents indicate this (Table 5.21). With respondents having varying alternatives to accessing information since the institute and its library cannot guarantee this (Table 5.38 and section 5.10.1), this should come with a cost that should be reflected in their responses. The study of Meho and Tibbo (2003) of the information behaviour of researchers revealed that lack of funds

limited researchers' access to research materials, thus affecting their research. However, this contradiction could be as a result of researchers getting information from colleagues and knowledgeable people from their field at no cost. Case (2012:8-9) also revealed that the reality in any research environment is that researchers tend to use both formal and informal sources (including colleagues and relatives as informal sources).

5.6.5 Other factors that will further aid accessibility

The respondents who indicate that accessing research information at the institute's library is easy for them had to further indicate the other factors that could further aid accessibility of research information at the institute's library. Table 5.22 reveals that the provision of more recent books in different fields (45; 39.5%) was a major factor that will further aid accessibility of research information at the institute's library. Other factors in descending order included the adoption of electronic services (43; 37.7%), improved computer availability for online searching (29; 25.4%), adequate shelving (24; 21.1%), well-catalogued books (22; 19.3%), improved indexing (11; 9.6%) and well-trained library staff (9; 7.9%). This means that by addressing these factors that are lacking or inadequate in the library, accessibility to information by respondents will be improved. The results agree with section 5.7.3 that also shows that lack of recent books is indicated as a major factor inhibiting accessibility of research information.

This finding agrees with Okonoko, Njideka and Mazah (2015:87) who revealed that factors such as provision of recent books, orientation on the importance and use of catalogue, training and retraining of library staff and researchers, improved internet connection, automation of the library and provision of electronic resources will further aid accessibility of information in the library.

Table 5.22: Factors that will further aid accessibility of research information at the institute's library N=114

Factors	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Provision of more recent book in different fields	11	36.7	5	25.0	5	20.0	11	52.4	11	78.6	2	50.0	45 (39.5)
Adequate shelving	3	10.0	3	15.0	2	8.0	3	14.3	12	85.7	1	25.0	24 (21.1)
Electronic services adoption	1	3.3	5	25.0	4	16.0	10	47.6	12	85.7	2	25.0	43 (37.7)
Well trained	1	3.3	3	15.0	1	4.0	2	9.5	2	14.3	0	0.0	9 (7.9)

library staff													
Improved computer available for online search	9	30.0	0	0.0	4	16.0	8	38.1	8	57.1	0	0.0	29 (25.4)
Well catalogued books	2	6.7	4	20.0	2	8.0	5	23.8	8	57.1	1	25.0	22 (19.3)
Improved indexing	2	6.7	5	25.0	0	0.0	2	9.5	0	0.0	2	50.0	11 (9.6)

*** Multiple responses received**

5.6.6 Specification of databases/archives/indexes

The respondents had to indicate the databases/archives/indexes in the field of science and technology they have used in the preceeding six months. The database/archive/index used most by the respondents is Google scholar (86; 75.4%). The others in descending order were Research Gate (74; 64.9%), Africa Journals Online (65; 57.0%), Web of Science Citation Indexes (60; 52.6%), Science Citation Index and Science Information Database were both indicated by 53 (46.5%) of the respondents, Science Open (27; 23.7%), Scopus (26; 22.8%) and Agricultural/Environmental Science Database and SciFinder Scholar on the Web were both indicated by 24 (21.1%) of the respondents. Table 5.23 provides the detailed analysis. This implied that respondents used article databases/archives/indexes to a large extent and they used more multidisciplinary databases than subject-specific databases. This finding gives credence to Hightower and Caldwell (2010) who asserted that the majority of surveyed researchers in their study use Google Scholar and that it is easy to use multidisciplinary databases like Google Scholar, which is preferred over subject-specific databases like SciFinder Scholar. Additionally, this highlights the fact that although the library has no internet access, the respondents have alternative access through own data subscriptions to ISPs with the use of computers mostly at home and at the office (section 5.6.7) and the usage of cell/mobile phones and internet from facilities of business centres outside the institute (section 5.8.5). With these, they can access Google Scholar, which is a web search engine which is freely accessible and is used by most respondents.

Table 5.23: Databases/archives/indexes in the field of science and technology used in the last six months N=114

Databases/archives/indexes	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Africa Journals Online	14	46.7	15	75.0	15	60.0	11	52.4	8	57.1	2	25.0	65 (57.0)
Agricultural & Environmental Science Database	5	16.7	2	10.0	6	24.0	3	14.3	6	42.9	2	25.0	24 (21.1)
Science Citation Index Expanded	8	26.7	16	80.0	9	36.0	5	23.8	11	78.6	4	100.0	53 (46.5)
Science Open	6	20.0	3	15.0	8	32.0	4	19.0	5	35.7	1	25.0	27 (23.7)
Science Information Database	10	33.3	9	45.0	14	56.0	10	47.6	7	50.0	3	75.0	53 (46.5)
Scifinder Scholar on the Web	3	10.0	1	5.0	9	36.0	7	33.3	2	14.3	2	50.0	24 (21.1)
Scopus	9	30.0	6	30	4	16.0	3	14.3	3	21.4	1	25.0	26 (22.8)
Web of Science Citation Indexes	13	43.3	12	60.0	12	48.0	12	57.1	9	64.3	2	50.0	60 (52.6)
Research Gate	20	66.7	11	55.0	15	60.0	17	81.0	8	57.1	3	75.0	74 (64.9)
Google Scholar	19	63.3	16	80.0	18	72.0	17	81.0	12	85.7	4	100.0	86 (75.4)

*** Multiple responses received**

5.6.7 Location of accessing the databases/archives/indexes

The respondents indicate where they accessed the databases/archives/indexes. The majority of the respondents access the internet from home (74; 64.9%), followed by the office (21; 18.4%) then from another library outside the FIIRO library (10; 8.8%) and the FIIRO library (7; 6.1%). Table 5.24 shows the details. This means that access to these databases/archives/indexes is not provided by the institute and its library due to the lack of internet connection resulting in an implication of the respondents not having confidence in the institute's library. As a result, the respondents might have had access to the electronic library catalogue of other libraries. It is established in this study, that majority of the researchers often access online journals outside the institute with 92 (80.7%) of the respondents indicating that they do so (section 5.6.2). Section 5.8.5 shows that 104 (91.2%) of the respondents indicate that information technology use in the

library has not affected their visiting the library. Section 5.13.6 shows that the library only has six computers with four being available to patrons with no internet connection. These statements agree with the findings of this study.

However, the work of De Groote and Dorsch (2003) indicated that many users, including researchers, choose to access online resources remotely with convenience and strong internet connection playing the major role in this choice. However, it was not the case for FIIRO where the lack of internet access ensured that the respondents accessed databases from home utilising own data subscription, search engines and online resources of other libraries.

Table 5.24: Location where the databases/archives/indexes selected were accessed N=114

Location	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
FIIRO library	2	6.7	2	10.0	0	0	1	4.8	1	7.1	1	25.0	7 (6.1)
Office	7	23.3	3	15.0	4	16.0	3	14.3	3	21.4	1	25.0	21 (18.4)
Home	16	53.3	13	65.0	19	76.0	15	71.4	9	64.3	2	50.0	74 (64.9)
Another library outside FIIRO library	3	10.0	2	10.0	2	8.0	2	9.5	1	7.1	0	0.0	10 (8.8)

5.7 FACTORS AFFECTING THE INFORMATION-SEEKING OF FIIRO'S RESEARCHERS IN NIGERIA

This section of the questionnaire consists of questions that solicits for information under the following sub-headings: factors affecting information-seeking behaviours of researchers, challenges faced when searching for information in a manual environment, challenges faced when searching for information on the web, formal training/orientation on searching for scientific/technical information in a manual environment/web resources, training/orientation received by researchers (manual environment), training/orientation received by researchers (on web resources searching) and time taken to find information at the institute's library without assistance. These questions address objective four.

5.7.1 Factors affecting information-seeking behaviour of researchers

The respondents were asked to indicate the factors that affect their information-seeking behaviour and as a result influence their information-seeking behaviour. The respondents revealed that trustworthiness (96; 84.2%) is considered the topmost information-seeking factor influencing their information-seeking behaviour as they seek for information.

Limited financial resources (33; 28.9%) are revealed by the respondents as the least information-seeking factor that influence their information-seeking behaviour. Detailed analysis is shown in Table 5.19.

Table 5.25: Factors that influenced information-seeking behaviour N=114

Factors forming behaviour	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Time	14	46.7	15	75.0	10	40.0	10	47.6	11	78.6	3	75.0	63 (55.3)
Limited financial resources	5	16.7	10	50.0	8	32.0	5	23.8	3	21.4	2	50.0	33 (28.9)
Source of information	24	80.0	11	55.0	20	80.0	19	90.5	10	71.4	4	100.0	88 (77.2)
Nature of problem	26	86.7	13	65.0	21	84.0	15	71.4	12	85.7	4	100.0	91 (79.8)
Accessibility	23	76.7	17	85.0	20	80.0	18	85.7	11	78.6	4	100.0	93 (81.6)
Familiarity and prior success	20	66.7	14	70.0	19	76.0	20	95.2	9	64.3	3	75.0	85 (74.6)
Trustworthiness	22	73.3	18	90.0	22	88	19	90.5	11	78.6	4	100.0	96 (84.2)

*** Multiple responses received**

Wilson's 1999 model of information behaviour shows that so many factors will affect the information behaviour of researchers, including psychological, demographic, role-related, interpersonal, environmental and source-related characteristics. Additionally, Wilson's 1999 model identifies that the decision to seek information is dependent on motivation, which may have a cognitive origin or be emotionally based as in the need to reinforce previous values.

The need to get concrete and trusted information for laudable research works from the perspective of information-carrier characteristics has exerted considerable pressure on the respondents, as indicated by 96 (84.2%) of the respondents revealing trustworthiness as a major factor affecting their information-seeking behaviour and thus influencing their behaviour. In addition, accessibility which is also an information-carrier characteristic is also ranked second with 93 (81.6%) of the respondents indicating this. In agreement with the findings stated in this study, Anderson et al. (2001:135) pronounced that despite differences in measures used and characteristics studied, the literature provides evidence of two competing carrier characteristics that influence information behaviour, that is,

accessibility and quality in the form of trusted sources (trustworthiness). Essentially, the revelation of the key factors of trusted information sources and access to the sources are indisputable as they are important in shaping information-seeking behaviours of industrial researchers.

5.7.2 Challenges faced when searching information in a manual environment

The respondents reveal the challenges they have searching in a manual environment. Topmost among the challenges revealed was circulation (78; 68.4%) and the least challenges are indexing and cataloguing/classification, with both indicated by 26 (22.8%) of the respondents. This is shown in Table 5.26 below. This implies that basic functions of the library such as circulation and issuing are not well understood by the respondents and not adequately attended to by information specialists (librarians). This means that respondents are not well assisted at the circulation desk, there is poor communication between the respondents and librarians, materials are not properly shelved and librarians are not resolving issues that had to do with respondents' queries. This finding concurs with Uganneya et al. (2012) who indicated that respondents indicated poor shelf management of books and library staff unresponsiveness which invariably affected circulation and issuing in research libraries. This also concurs with findings of this study in section 5.7.4 where 93 (81.6%) of the respondents indicate that they have not received any formal training/orientation in searching in a manual environment. Section 5.7.5 also concurs with the above mentioned assertion, with just 11 (9.6%) of the respondents receiving formal training/orientation in circulation.

Table 5.26: Challenges in searching information in manual environment N=114

Challenges	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Indexing	4	13.3	7	35.0	9	36.0	3	14.3	2	14.3	1	25.0	26 (22.8)
Issuing	16	53.3	14	70.0	16	64.0	14	66.7	10	71.4	3	75.0	73 (64.0)
Circulation	19	63.3	12	60.0	19	76.0	13	61.9	11	78.6	4	100.0	78 (68.4)
Cataloguing/ Classification	3	10.0	9	45.0	5	20.0	2	9.5	4	28.6	3	75.0	26 (22.8)
Time	6	20.0	6	30.0	4	16	5	23.8	8	57.1	2	50.0	31 (27.2)

*** Multiple responses received**

5.7.3 Challenges faced when searching information on the web

The respondents indicate the challenges they have with searching web resources. Topmost among the challenges revealed is electrical power stability (91; 79.8%). The least among the challenges are issues with referencing e-resources (37; 32.5%). This is shown in Table 5.27. Lack of power stability discourages searching web resources because it affects internet connectivity and brings about extra cost. This concurs with Eke, Omekwu and Agbo (2014:18) and Obioha (2005:312) who cited unstable power supply as a problem encountered while searching web resources.

Table 5.27: Challenges faced searching electronic resources N=114

Challenges	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Issues with referencing e-resources	12	40.0	6	30.0	6	24.0	3	14.3	8	57.1	2	50.0	37 (32.5)
Reliability of e-resources	16	53.3	9	45.0	7	28.0	7	33.3	7	50.0	2	50.0	48 (42.1)
Electrical power stability	24	80.0	15	75.0	21	84.0	17	81.0	11	78.6	3	75.0	91 (79.8)
HTML documents	11	36.7	12	60.0	4	16.0	5	23.8	6	42.9	1	25.0	39 (34.2)

*** Multiple responses received**

In terms of major challenges faced by the respondents when accessing web-based information, they further indicated in descending order: loss of browsability (50; 43.9%), scholarly misconduct and misinformation (40; 35.1%), information overload (25; 21.9%), reliability of information (19; 16.7%), website navigation (14; 12.3%) and financial concern (11; 9.6%). This is shown in Table 5.28. This indicates that loss of browsability, scholarly misconduct and misinformation were issues that must be addressed for respondents to enjoy the act of information seeking. This implies that electronic journals are not as browsable as print journals and this may have a marked impact on the range of materials read by respondents who depend on the internet as revealed in this study and the potential for misinformation on the web being real, which is a concern for respondents which brings about the issue of trustworthiness as mentioned in section 5.7.1

This observation concurs with the study of Hoggan (2002) in which loss of browsability, scholarly misconduct and misinformation were indicated as challenges to harnessing web-based information by researchers. This also concurs with section 5.7.4 which indicates that 75 (65.8%) of the respondents have not received training/orientation for web resources searching and section 5.7.6 with just 10 (8.8%) of the respondents who have received training/orientation in determination of web information reliability indicating that respondents are poorly trained.

Table 5.28: Major challenges faced when accessing web-based information N=114

Major challenge faced	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Information overload	12	40.0	4	20.0	5	20.0	2	9.5	1	7.1	1	25.0	25 (21.9)
Website navigation	2	6.7	3	15.0	3	12.0	3	14.3	1	7.1	2	50.0	14 (12.3)
Financial concerns	4	13.3	2	10.0	2	8.0	1	4.8	1	7.1	1	25.0	11 (9.6)
Loss of browsability	12	40.0	7	35.0	7	28.0	20	95.2	1	7.1	3	75.0	50 (43.9)
Reliability of information	2	6.7	9	45.0	3	12.0	3	14.3	1	7.1	1	25.0	19 (16.7)
Scholarly misconduct and misinformation	10	8.8	12	60.0	14	56.0	2	9.5	1	7.1	1	25.0	40 (35.1)

*** Multiple responses received**

5.7.4 Formal training/orientation on searching for scientific/technical information in manual environment/web resources

The respondents were asked to indicate whether they have received formal training/orientation on how to search for scientific/technical information in a manual environment or web resources. Twenty (17.5%) of the respondents have received formal training/orientation with respect to how to search in a manual environment while 93 (81.6%) of the respondents have not received formal training. For web resources, 28 (24.6%) of the respondents have received training/orientation while 75 (65.8%) of the respondents have not received training/orientation. The detailed analysis is shown in Table 5.29. This shows that trainings/orientation for searching a manual environment and for web resources searching are poor at the institute. Given that the library has no internet access, it could be possible that the probability of introducing training would be minimal.

As also highlighted in section 5.6.7, most researchers paid for and accessed e-resources from home. The implication of this is that respondents would have problems with fundamentals relating to searching for information in the manual and web environment. This concurs with section 5.7.2 where respondents have challenges with circulation and issuing (for manual environment) and section 5.7.3 where respondents have challenges with web navigation (for web environment).

Table 5.29: Researchers trained on searching for scientific/technical information in manual environment/web resources N=114

Challenges	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Yes (received training for manual environment)	3	10.0	6	30.0	5	20.0	4	19.0	1	7.1	1	25.0	20 (17.5)
No (not received training for manual environment)	27	90.0	14	90.0	20	80.0	17	81.0	13	92.9	2	50.0	93 (81.6)
Yes (received training for web resources)	5	16.7	8	40.0	8	32.0	5	23.8	0	0	2	50.0	28 (24.6)
No (not received training for web resources)	25	83.3	12	30.0	7	68.0	16	76.2	14	100.0	1	25.0	75 (65.8)

5.7.5 Training/orientation received by researchers (manual environment)

The respondents were asked to reveal the training they received for searching in a manual environment. Fifteen (13.2%) of the respondents received formal training/orientation in indexing (the highest) while seven (6.1%) of the respondents received formal training/orientation in classification/cataloguing (the lowest). The detailed analysis is shown in Table 5.30. The respondents are poorly trained and they would need an appreciation or orientation programme of the catalogue and classification system of the library and how to locate resources on the shelves. This concurs with Table 5.26 considering the major challenges respondents had when searching in a manual environment. This finding gives credence to Okonoko, Njideka and Mazah (2015:86)

who indicated that the majority of researchers complained of inadequate knowledge of the use of catalogue hindering their search for information.

Table 5.30: Training/orientation received by researchers (manual environment) N=114

Challenges	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Indexing	3	10.0	4	20.0	3	12.0	3	14.3	1	7.1	1	25.0	15 (13.2)
Classification /Cataloguing	1	3.3	2	10.0	1	4.0	1	4.8	0	0.0	0.0	0.0	7(6.1)
Circulation	1	3.3	2	10.0	6	24.0	2	9.5	0	0.0	0.0	0.0	11(9.6)

*** Multiple responses received**

5.7.6 Training/orientation received by researchers (web resources searching)

The respondents indicated the training/orientation they received in searching web resources. Twenty-five (21.9%) of the respondents have received training/orientation in searching databases (the highest) while 10 (8.8%) of the respondents have received training/orientation in the determination of web information reliability (the lowest). The detailed analysis is shown in Table 5.31. The respondents are poorly trained. This concurs with Table 5.27 with 48 (42.1%) of the respondents citing reliability of e-resources as a challenge in searching electronic resources which are web resources. This corroborates with Nel (2015:135) who indicated that researchers need thorough knowledge in information searching involving knowledge about tools to search for information, database/literature searches, access to resources (e-collections and document delivery) and knowledge about resources (to know which sources to access to obtain the latest or relevant information – web information reliability).

Table 5.31: Training/orientation received by researchers (web resources) N=114

Challenges	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Use of databases	3	15.0	6	30.0	7	28.0	5	23.8	2	14.3	2	50.0	25(21.9)
Use of search engines	2	6.7	8	40.0	6	24.0	4	19.0	2	14.3	2	50.0	24(21.1)
Advanced searching	5	16.7	5	25.0	3	12.0	3	14.3	1	7.1	2	50.0	19(16.7)

Determination of web information reliability	2	6.7	2	10.0	1	4.0	2	9.5	1	7.1	2	50.0	10(8.8)

*** Multiple responses received**

5.7.7 Time taken to find information at the institute's library without assistance

The respondents were asked about the time it takes them to find information in the institute's library without anybody's assistance or guidance. Seventy-seven (67.5%) of the respondents indicate that it took them one day, 16 (14.0%) indicate that it was difficult to find the needed information and no respondents indicate that the information is difficult to find without proper assistance/guidance. Their detailed responses are given in Table 5.32 below.

Table 5.32: Time taken to find information at the institute's library without assistance N=114

Time	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Within a day	16	53.3	17	85.0	20	80.0	11	52.4	10	71.4	3	75.0	77 (67.5)
Within a week	5	16.7	2	10.0	1	4.0	2	9.5	3	21.4	1	25.0	14 (12.3)
Within a month	1	3.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1 (0.9)
Over a month	1	3.3	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	2 (1.8)
Difficult to find the needed information	3	10.0	0	0	4	16.0	8	38.1	7	7.1	0	0	16 (14.0)
Difficult to find without proper assistance/ guidance	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)

As observed in sections 5.6.4 and 5.6.5, factors responsible for making respondents face difficulty as they access information and factors that aid further accessibility include the lack of awareness, information explosion, bibliographic obstacles, shelving, cataloguing of books and indexing. This concurs with the point stressed in sections 5.7.4, 5.7.5 and 5.7.6 that the training/orientation of respondents in manual and web resources searching is poor. Consequently, respondents need adequate training/orientation for them to be able to utilise the available library resources adequately with respect to time. Fourteen (12.3%) of the respondents indicate that it took them one week to find information after

searching at the institute's library without assistance and 16 (14%) of the respondents indicating that it was difficult to find needed information after searching the institute's library point to the same thing – the problem of lack of awareness, information explosion, bibliographic obstacles, shelving, cataloguing of books and indexing. These are factors that are relative to time for finding information in the library and will adversely affect researchers' information-seeking behaviour with respect to time.

5.8 THE LEVEL OF ADOPTION OF ICTS WITHIN THE INSTITUTE AND ITS INFLUENCE ON THE USE OF ALTERNATIVE SOURCES IN GETTING RESEARCH INFORMATION BY FIIRO'S RESEARCHERS IN NIGERIA

This section of the questionnaire consists of questions which solicit for information under the following sub-headings: ICT skills/competencies of researchers, ICT resources access in the office/organisation, ICT infrastructure of office/department, effects of electronic dissemination of research information on information-seeking habits and use of information technology at the institute's library. These questions address objective five.

5.8.1 ICT skills/competencies of researchers

The respondents were asked to indicate their ICT skills/competencies. Prakash and Kannappanavar (2016:162) revealed that ICT skills/competencies automatically equate the ability to search, locate, evaluate and use information. This makes the available research information to be sufficiently adopted by users. Twenty-six (22.8%) of the respondents indicate that their skills are very good, 72 (63.2%) of the respondents indicate good and 16 (14.0%) of the respondents indicate fair. None of the respondents indicate that their ICT skills/competencies are poor. These results show that the respondents are well rated with respect to ICT skills/competencies. Table 5.33 provides the summary of the results. This did not come by surprise since the majority of them embraced the use of mobile phone/iPad, desktop/laptop and internet as they seek for research information (sections 5.5.2, 5.8.5 and 5.10.1).

This finding gives credence to Salau and Saingbe (2008:5) and Dzandu and Dadzie (2012) who indicated that the majority of researchers were highly skilled and competent in terms of ICTs. In addition, this finding concurs with the study of Obioha (2005:309)

which indicated 100% of the researchers of the Nigerian Institute of Oceanography and Marine Research indicated that they were skilled and competent in ICT tools.

Table 5.33: ICT skills/competencies of researchers N=114

ICT Skills/ competencies	FT		PDD		BT		CFET		PALM		PTTIM		ΣF
	F	%	F	%	F	%	F	%	F	%	F	%	
Very good	5	7	4	20.0	4	16.0	9	42.9	3	21.4	1	25.0	26 (22.8)
Good	17	56.7	14	70.0	20	80.0	11	52.4	8	57.1	2	50.0	72 (63.2)
Fair	8	26.7	2	10.0	1	4.0	1	4.8	3	21.4	1	25.0	16 (14.0)
Poor	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0)
	30	100.0	20	100.0	25	100.0	21	100.0	14	100.0	4	100.0	114 (100.0)

5.8.2 ICT resources access in the office/organisation

The respondents were asked to indicate the ICT resources that they had access to in the office/organisation. The majority (98; 86.0%) had access to a mobile/cell phone. Email was ranked second (95; 83.3%) and internet third (74; 64.9%). The ICT resources they had least access to were land phone and fax with both being indicated by 2 (1.8%) of the respondents. Table 5.34 provides a breakdown of the results. This implies that respondents had easy access to mobile/cell phones and, by extension, had access to the internet and the usage of mobile/cell phones to their check email. This is connected with the ICT revolution and penetration in Nigeria in relation to the spread in the use of mobile/cell phones. In connection with this, Isabona (2013:20) reported that cell phones are transforming the Nigerian society in so many ways including research. This finding agrees with that of Eruvwe, Sambo and Salami (2014:119) who revealed that the majority of researchers in their study agreed that cell phones helped to solve their problems and helped them in meeting their information needs. Similarly, Obioha (2005) also pointed out that the mobile phone was ranked as an ICT facility that was well adopted by researchers in her study while the fixed telephone was one of the least adopted ICT facilities. The mobile/cell phone functions as an alternative source for FIIRO's' researchers in getting research information with the lack of internet connection in the institute and the FIIRO library.

Table 5.34: ICT resources access in the office/organisation if available i.e. Yes N=114

If available i.e Yes													
ICT resources and services	**FT**		**PDD**		**BT**		**CFET**		**PALM**		**PTTIM**		**ΣF & %**
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	
Computers	11	36.7	16	80.0	19	76.0	17	81.0	7	50.0	2	50.0	72 (63.2)
Printers	7	23.3	5	25.0	4	16.0	12	57.1	3	21.4	2	50.0	33 (28.9)
Land telephone	1	3.3	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	2 (1.8)
Fax	0	0.0	0	0.0	2	8.0	0	0.0	0	0.0	0	0.0	2 (1.8)
Television	1	3.3	2	10.0	2	8.0	8	38.1	0	0	0	0	13 (11.4)
Radio	3	10.0	7	35.0	4	16.0	4	19.0	1	7.0	1	25.0	20 (17.5)
Mobile/ cell phone	30	100.0	16	80.0	20	80.0	21	100.0	7	50.0	4	100.0	98 (86.0)
Video recorder	2	6.7	3	15.0	2	8.0	0	0.0	0	0.0	1	25.0	8 (7.0)
Internet	22	73.3	16	80.0	16	64.0	10	47.6	7	50.0	3	75.0	74 (64.9)
Email	28	93.3	18	90.0	18	72.0	18	85.7	10	71.4	3	75.0	95 (83.3)

*** Multiple responses received**

Table 5.35 below shows the number of respondents that do not have access to ICT resources in the office/organisation. It shows that many respondents do not have access to land phone (112; 98.2%), video recorder (105; 92.1%), television (101; 88.6%), radio (89; 78.1%), fax (86; 75.4%) and printers (80; 70.2%). This result concurs with Table 5.33 above with many of the respondents that do not have access to ICT resources as indicated in this section. This finding also agrees with Obioha (2005) who indicated that fixed telephone lines were for the directors only (showing low access to land phone), while the majority of researchers of the Nigerian Institute for Oceanography and Marine Research just like FIIRO's researchers settled for mobile/cell phone usage.

Table 5.35: ICT resources not accessible in the office/organisation if not available i.e No N=114

If not available (i.e No)													
ICT resources and services	**FT**		**PDD**		**BT**		**CFET**		**PALM**		**PTTIM**		**ΣF & %**
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	
Computers	19	63.3	4	20.0	5	20.0	4	19.0	6	42.9	2	50.0	40 (35.1)
Printers	23	76.7	15	75.0	20	80.0	9	42.9	11	78.6	2	50.0	80 (70.2)
Land telephone	29	96.7	19	95.0	25	100.0	21	100.0	14	100.0	4	100.0	112 (98.2)

Fax	4	100.0	20	100.0	23	92.0	21	100.0	14	100.0	4	100.0	86 (75.4)
Television	29	96.7	18	19.0	19.0	92.0	13	61.9	14	100.0	4	100.0	101 (88.6)
Radio	24	80.0	12	60.0	21	84.0	17	81.0	13	92.9	2	50.0	89 (78.1)
Mobile/ cell phone	0	0.0	4	20.0	5	20.0	0	0	5	35.7	0	0.0	14 (12.3)
Video recorder	27	90.0	17	85.0	23	92.0	21	100.0	14	100.0	3	75.0	105 (92.1)
Internet	8	26.7	4	20.0	9	36.0	11	52.4	5	35.7	1	25.0	38 (33.3)
Email	2	6.7	2	10.0	7	28.0	3	14.3	4	28.6	1	25.0	19 (16.7)

*** Multiple responses received**

An inconsistency in this finding is that despite the level of ICT resources accessed by the respondents in the office/organisation (see Table 5.34), 74 (64.9%) of the respondents still indicate that they access databases/archives/indexes from home. Is it that FIIRO researchers do not maximise the mobile/cell phone resources they have (including the email and the internet attached to it)? This inconsistency could be as a result of the mobile nature of the researchers, working more from their stations than their offices. Most times they could reside in their stations which are also home to them. This showed that they did not access enough research information when they were in the office/organisation (section 5.6.7).

5.8.3 ICT infrastructure of office/department

The respondents were asked to rate the ICT infrastructure of their office/department. Only 1 (0.9%) of the respondents indicate that the ICT infrastructure in his office/department is very good, 39 (34.2%) of the respondents indicate good and 74 (64.9%) of the respondents indicate that ICT infrastructure is poor. This concurs with section 5.7.3 which indicates a lack of power stability that hinders ICT usage by respondents. Table 5.36 provides a detailed analysis. This shows that the ICT infrastructure at the institute is not encouraging and it needs to be fixed for thorough research work supported by research information to take place at the institute. This also points to reasons for low usage of databases from the library as highlighted in Table 5.24 above. This concurs with the finding of Osofisan and Osunade (n.d) where they revealed that the number of laptops in most institutes is few, with the computer-to-researcher ratio

being very low. It was also discovered that the computing needs of the administrative staff gains priority over that of researchers. They indicate that this might be due to the low priority of computing facilities on the institute's lists of needs. This is also the case with FIIRO. At FIIRO, some desktops and laptops are personally provided by the researchers with the institute not placing priority on the provision of computer systems for researchers.

Another contradiction exists based on the finding of this section compared to the finding of section 5.8.2 where majority of the respondents (98; 86.0%) have access to the mobile/cell phone, 95 (83.3%) have access to the email and 74 (64.9%) have access to the internet. This inconsistency could be as a result of researchers providing themselves with virtually all the ICT resources they need for their research through personal laptops/computers, cell phones, personal subscription to internet service providers and business centres and not the institute.

Table 5.36: Rating ICT infrastructure of office/organisation N=114

Rating	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Very good	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	1 (0.9)
Good	6	20.0	12	60.0	11	440	5	23.8	4	28.6	1	25.0	39 (34.2)
poor	24	80.0	8	40.0	14	56.0	16	76.2	10	71.4	2	50.0	74 (64.9)
Total	30	100.0	20	100.0	25	100.0	21	100.0	14	100.0	4	100.0	114 (100.0)

5.8.4 Effects of electronic dissemination of research information on information-seeking habits

The respondents indicate the effect of electronic dissemination of research information on information-seeking habits of the respondents in the last five years. Sixty-one (53.5%) feel that they use completely different sources than they have done five years ago, 37 (32.5%) feel the same and indicate that they still use the same sources they have used five years ago, while 1 (0.90%) feels no influence at all which shows that the researchers do not really know if they are using different sources or the same as they did five years ago. Table 5.37 provides the breakdown of results. This means that the majority of the respondents valued and embraced the use of the internet with them using completely different electronic information sources to obtain information for their research even if it

is not provided by the institute. This concurs with Tables 5.16 and 5.15, which indicate that electronic resources are used by the majority of the respondents. This points to electronic dissemination of information for easy access and usage of research information that ICTs provided. The finding also concurs with the work of Sahu and Singh (2010:305), where 63.9% (the majority) of science researchers indicated that their information-seeking habit was affected by electronic dissemination of information in the past 5 years.

Table 5.37: Effect of electronic dissemination of research of information on researchers in the last 5 years N=114

Effect	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Very different (I use completely different sources than I did five years ago)	20	66.7	9	45.0	16	64.0	7	33.3	6	42.9	3	75.0	61 (53.5%)
About the same (I still use the same sources as I did five years ago)	6	20.0	10	50.0	8	32.0	6	28.6	7	50.0	0	0	37 (32.5%)
None(no influence)	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	1 (0.9%)

5.8.5 Use of information technology at the institute's library

The respondents were asked to indicate the effect of the use of information technology on their visit to the institute's library. Ten (8.8%) of the respondents revealed that the use of information technology at the library has caused them to use the library while 104 (91.2%) indicate that information technology use in the library has not affected their visit to the library. All the respondents that reveal that information technology has encouraged them to visit the institute's library point to printing, photocopying and scanning as information technology services that attract them to the library.

The respondents that have not visited the library indicate that they have been using alternatives. The alternatives being used by the respondents are shown in Table 5.38 and they are shown in descending order. They include the use of the mobile phone/iPad (103; 90.4%), personal laptop/desktop with own subscription to internet data (88; 77.2%) and external internet facilities, that is, business centres (15; 13.2%). This concurs with section 5.8.1 where it is indicated that the majority (98; 86.0%) of the respondents have access to

mobile/cell phones, 95 (83.3%) have access to email and 74 (64.9%) have access to the internet. However, the indicated ICTs are personally provided. Obioha (2005) corroborates that the Nigerian Institute for Oceanography and Marine Research indicated that they had to turn to the alternative of mobile phones because of inadequate ICT infrastructure of the research institution and its library. In addition, credence was given to this finding by Agwu, Uche-Mba and Akinnagbe (2008) which indicated that among the 24 ICT facilities listed as adopted and used by researchers, the mobile phone was ranked first, followed by the internet.

This finding harmonises with Table 5.19 which indicated that respondents used the internet to obtain uploaded journals and they personally subscribed to online and print journals. In addition, Table 5.20 shows that the majority of the respondents often access online journals outside the institute. Additionally, Table 5.24 reveals that the majority of the respondents accessed databases/archives/indexes from home with just seven (6.1%) of the respondents accessing information from the FIIRO library. All these point to the lack of adequate information technology infrastructure to access information at the FIIRO library causing the majority of the respondents not to visit the library.

Table 5.38: Alternatives used by researchers that ICT utilisation at the institute's library did not affect their visit to the library N=114

Alternative	FT		PDD		BT		CFET		PALM		PTTIM		ΣF
	F	%	F	%	F	%	F	%	F	%	F	%	
Use of personal laptop/desktop with personal subscription to internet data	24	80.0	15	75.0	19	76.0	17	81.0	10	71.4	3	75.0	88 (77.2)
Use of mobile phone/ipad	26	86.7	19	95.0	23	92.0	20	95.2	11	78.6	4	100.0	103 (90.4)
External internet facilities business centers	2	6.7	6	30.0	3	12.0	3	14.3	1	7.1	0	0.0	15 (13.2)

*** Multiple responses received**

Another contradiction is the inconsistencies of respondents and their alternatives, as seen in Table 5.38 above, compared to ICT resources to which they have access in the office/organisation vis-à-vis the finding that 74 (64.9%) of the respondents still rate the

ICT infrastructure of their office/department to be very poor. However, this contradiction still hinges on the internet being personally provided by the respondents.

5.9 PURPOSES OF ICT RESOURCES/SERVICES

The respondents were further requested to indicate the purposes of the above ICT resources and services, with six options to choose from. This addresses objective six. Table 5.39 provides a summary of the results.

Table 5.39: Purposes for ICT resources and services N=114

Purpose	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
To communicate with researchers	28	93.3	9	45.0	24	96.0	20	95.2	6	42.9	4	100.0	91 (79.8)
Professional communication with colleagues	21	70.0	13	60.0	0	0.0	17	81.0	11	78.6	3	75.0	65 (57.0)
Personal communication with friends	14	46.7	7	35.0	0	0.0	10	47.6	10	71.4	3	75.0	44 (38.6)
For purposes of research	29	96.7	14	70.0	25	100.0	21	100.0	8	57.1	4	100.0	101 (88.6)
For educational purposes	28	93.3	11	55.0	24	96.0	21	100.0	12	85.7	3	75.0	99 (86.8)
To communicate with publishers	2	6.7	5	25.0	0	0.0	6	28.6	4	28.6	1	25.0	18 (15.8)

*** Multiple responses received**

Most respondents (101; 88.6%) indicate that they use ICTs for research, followed by for educational purposes (99; 86.8%) and communicating with researchers (91; 79.8%). The least cited purpose for ICT resources and services is communicating with publishers (18; 15.8%). This means that researchers strongly need research information for their projects from the indication of their use/purpose for ICTs. With 84.2% of the respondents not requiring ICT resources and services for communicating with publishers, it also implies that many FIIRO's researchers do not publish scientific articles. Therefore, they have to be encouraged to do more research that are publishable and worthy of being deposited in the FIIRO library. This concurs with Ani and Onyancha (2012) who revealed that researchers in non-university based research institutions publish research articles at a lower level compared to university-based researchers. This will definitely affect the

availability of local research information for researchers in terms of meeting their information needs.

In addition, this concurs with section 5.4.1 where respondents indicate that they require information for carrying out research, work-related discussion (i.e. communicating with other researcher) and attending to academic needs (i.e. educational purposes). They use ICT resources/services available to them to achieve the stated purposes. This concurs with the finding of Naved and Nishat (2009:25) which stated that researchers use a variety of ICT products and services for their research work and they prove very helpful in finding needed information quickly and easily. They also help the researchers to access, manage, integrate, evaluate, create and communicate research information more easily.

5.10 THE INFLUENCE OF RECENT TECHNOLOGIES ON THE INFORMATION NEEDS AND INFORMATION-SEEKING BEHAVIOUR OF FIIRO'S RESEARCHERS

This section of the questionnaire asked questions on usage of mobile phones/iPads in getting research information, social media tools utilisation and the most effective ways for the library to keep respondents informed about their changing information needs. These questions address objective seven. All these questions pivot on the use of these devices and tools as recent technologies that ultimately influence information behaviour. Mobile phone, iPad and social media tools are recent technologies in Nigeria with them coming with several features that support information needs and information-seeking behaviour.

5.10.1 Usage of mobile phones/iPads in getting research information

The respondents were asked to indicate the frequency with which they use mobile phones/iPads in obtaining research information. In agreement with Table 5.38, 110 (96.5%) of the respondents indicate that they often use mobile phones/iPads and 4 (3.5%) of the respondents indicate that they sometimes use mobile phones/iPads, with no respondent indicating never to have used them. All the respondents (114; 100%) indicate

that they consider the mobile phone/iPad more helpful in obtaining research information than using the FIIRO library.

This study supports the findings of Eruvwe et al. (2014:123) that revealed that the mobile phone is well utilised by researchers in accessing research information because the library cannot satisfy their information needs. The majority of the researchers gave the reasons for the use of cell phones as: the lack of current materials in the library, facilitation of information delivery and information exchange.

5.10.2 Social media tools utilisation

The respondents were asked to indicate the social media tools they utilise when carrying out research work or when communicating with other researchers. The detailed analysis is shown in Table 5.40. The social media tools that are very often used by respondents are WhatsApp (103; 90.4%) followed by Google+ (96; 84.2%). The social media tool least used as indicated by the responses is instagram (7; 6.1%). The social media tool that had the highest number of responses in terms of non-usage is Pinterest (65; 57.0%). Table 5.40 provides a detailed analysis of the responses. Despite Instagram not being used frequently (all the time), it is still used by 55 (48.2%) of the respondents. This means that the respondents still use it for their research works.

All these findings still uphold the fact that respondents utilise the electronic resources obtained from the internet using mobile phone devices with ICTs completely incorporated into the work life of FIIRO's researchers. Therefore, the respondents are influenced positively by recent technologies in terms of addressing their information needs and constructively shaping researchers' information-seeking behaviour. It could also be stated that with majority of the respondents embracing the use of mobile phones/iPads, the indication of the adoption of various Web 2.0 tools by the respondents in this study in carrying out research work or when communicating with other researchers has not come by surprise.

This study corroborates the findings of Atiso and Adkins (2015) which showed that ICTs are completely integrated into the work life of researchers. In their study, the most used ICT (the email, which was indicated by 100% of the researchers) was used in conjunction

with social media tools such as LinkedIn, Pinterest, YouTube and blogs as we have in the present study. In the current study, although with variations in their usage, respondents utilise Web 2.0 tools in accessing scholarly communication towards obtaining research information for their works and communicating with other researchers.

Table 5.40: Social media tools that researchers utilised when carrying out research works or when communicating with other researchers N=114

Social media tools	Rating	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
		F	%	F	%	F	%	F	%	F	%	F	%	
Facebook	Very often	7	23.3	4	20.0	13	52.0	18	85.7	1	7.1	0	0	43 (37.7)
	Often	11	36.7	12	60.0	5	20.0	2	9.5	6	42.9	2	50	38 (33.3)
	Sometimes	3	10.0	13	15.0	4	16.0	0	0.0	3	21.4	1	25.0	14 (12.3)
	Never	9	30.0	1	5.0	3	12.0	1	4.8	4	28.6	1	25.0	19 (16.7)
Twitter	Very often	8	26.7	3	15.0	11	44.0	3	14.3	2	14.3	0	0	27 (23.7)
	Often	7	23.3	13	65.0	7	28.0	16	76.2	3	21.4	1	25.0	47 (41.2)
	Sometimes	2	6.7	1	5.0	1	4.0	0	0.0	3	21.4	1	25.0	8 (7.0)
	Never	13	43.3	3	15.0	6	24.0	2	9.5	4	28.6	2	50.0	30 (26.3)
Linkedln	Very often	7	23.3	3	15.0	12	48.0	15	95.2	2	14.3	2	50.0	41 (36.0)
	Often	12	40.0	13	65.0	6	24.0	6	4.8	6	42.9	0	0.0	43 (37.7)
	Sometimes	8	26.7	2	10.0	5	20.0	0	0.0	3	21.4	0	0.0	18 (15.8)
	Never	3	10.0	2	10.0	2	8.0	0	0.0	3	21.4	2	50.0	12(10.5)
Google+	Very often	28	93.3	10	50.0	23	92.0	20	95.2	13	92.9	2	50.0	96 (84.2)
	Often	2	6.7	8	40.0	1	4.0	0	0.0	1	7.1	0	0.0	12 (10.5)
	Sometimes	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.50	1 (0.9)
	Never	0	0.0	2	10.0	1	4.0	1	4.8	0	0.0	1	2.50	5 (4.4)
Instagram	Very often	1	3.3	1	5.0	3	12.0	1	4.8	0	0.0	1	25.0	7 (6.1)
	Often	9	3.0	13	65.0	13	52.0	17	81.0	2	14.3	1	25.0	55 (48.2)
	Sometimes	9	30.0	2	10.0	2	8.0	3	14.3	6	42.9	0	0.0	22 (19.3)
	Never	11	38.7	4	20.0	7	28.0	0	0.0	4	28.9	2	50.0	28 (24.6)

Pinterest	Very often	0	0.0	0	0.0	1	4.0	9	42.9	0	0.0	1	25.0	11 (9.6)
	Often	0	0.0	2	10.0	2	8.0	10	47.6	1	7.1	1	25.0	16 (14.0)
	Sometimes	1	3.3	4	20.0	12	48.0	2	9.5	1	7.1	0	0.0	20 (17.5)
	Never	29	96.7	14	70.0	10	40.0	0	0.0	10	17.4	2	50.0	65 (57.0)
Wikipedia	Very often	20	66.7	2	10.0	3	12.0	9	42.9	6	42.9	1	25.0	41 (36.0)
	Often	2	6.7	8	40.0	15	52.0	10	47.6	1	7.1	1	25.0	37 (32.5)
	Sometimes	6	20.0	9	45.0	5	20.0	2	9.5	7	50.0	1	25.0	30 (26.3)
	Never	2	6.7	1	5.0	3	12.0	0	0.0	0	0.0	1	25.0	7 (6.1)
WhatsApp	Very often	28	93.3	17	85.0	23	92.0	51	100.0	10	71.4	4	100.0	103 (90.4)
	Often	0	0.0	0	0.0	2	8.0	0	0.0	1	7.1	0	0.0	3 (2.6)
	Sometimes	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)
	Never	0	0.0	3	15.0	0	0.0	0	0.0	0	0.0	0	0.0	3 (2.6)

*** Multiple responses received**

5.10.3 Most effective ways for the library to keep respondents informed about their changing information needs

The respondents were asked to indicate the most effective ways they wanted the library to keep them informed of their changing information needs, that is, preference for receiving library communications (for instance, when they are working on a new project). Their responses in descending order are telephone (97; 85.1%), email (67; 58.8%), department meeting (35; 30.7%) and written memos (21; 18.4%). Therefore, respondents would want to be communicated to via telephone as the most effective way they want the library to keep them informed about their changing information needs.

The contradiction here is that in Table 5.34, only 2 (1.8%) of the respondents indicate that they had access to a telephone (landline). Mobile phone would have been preferred since most respondents had access to such device as a recent technology embraced by majority of the respondents (sections 5.8.5 and 5.10.1). Since 98 (86%) of the respondents use mobile/cell phones (sections 5.8.5 and 5.10.1), the use of short message service (SMS) would be reasonable as an effective way that the library can keep researchers informed about their changing information needs.

However, Akinbode, Adekunmisi and Olasore (2016:53) affirmed that librarians use smart phones for personal and official uses but the use of smart phones for library services including communicating with library users, is occasional compared to the high usage for personal uses (personal downloading and calling and sending SMS to friends, family and colleagues).

5.11 INFORMATION SERVICES PROVISION TO MEET RESEARCHERS' INFORMATION NEEDS

This section of the questionnaire sought to solicit information under the following sub-headings: visit to the institute's library, time spent at the institute's library, assistance from library staff during information seeking, finding information sought for at the institute's library, consulting other libraries apart from the institute's library and collection of books/journals and services offered by the institute's library. Other questions are actions taken after search failure, type of information services preferred by researchers as offered by the institute's library, satisfaction with present information services, new or different information services researchers would want provided by the library, shortcomings of the library in supporting information needs, successes of the library in supporting information needs and other comments on library resources/information services that the institute's library offers. These questions address objective eight.

5.11.1 Visit to the institute's library

The respondents were asked to indicate how often they frequented the library. Twenty (17.5%) of the respondents indicate that they are regular visitors to the institute's library, whereas 94 (82.5%) of the respondents reveal that they are not regular visitors to the institute's library because they do not always find the information they seek (section 5.11.4). The above assertion points to the lack of recent books (Table 5.21) and no internet connection (section 5.11.10). This showed that the library is not well utilised by the researchers in terms of obtaining information to meet their information needs and it requires a lot of upgrade in terms of its collections and services rendered to attract respondents. This is a recurring problem highlighted throughout the study. This concurs with sections: 5.7.2, 5.7.3, 5.6.4, 5.6.5, 5.6.1, 5.6.2, 5.6.7, 5.8.5, 5.11.4, 5.11.6, 5.11.8,

5.11.9, 5.11.11, 5.11.13, 5.12 and 5.13. These sections point to the various inadequacies of the library, which include infrastructural deficiency, a lack of recent books, no internet facilities, poor shelving, power outage and poor library environment.

This finding agrees with Oguche (2013:51-52) who indicated that researchers of the Nigerian Institute of Advanced Legal Studies poorly visit the library due to a lack of recent books and online databases. This was revealed in the rating that 22.2% of the researchers visit the library daily, 26.7% weekly, 11.1% monthly and 6.7% quarterly.

5.11.2 Time spent at the institute's library

The respondents were asked to indicate the hours spent in the institute's library per week. Fourteen (12.3%) of the respondents spend less than 5 hours per week, 7 (6.1%) of the respondents spend 5 to 10 hours per week and 3 (2.6%) of the respondents spend 10 to 20 hours per week. None of the respondents spend above 20 to 30 hours per week. From the results shown in Table 5.41, time spent at the library is low. This concurs with the results of the interview and the researcher's observation (see sections 5.12 and 5.13) which clearly stated that lack of recent books, poor library environment and poor infrastructure are the major challenges in the library which must have discouraged the respondents from spending time in the library.

Table 5.41: Time spent at the institute's library if researchers visit N=114

Time spent	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Less than 5hrs/ week	4	13.3	2	10.0	2	8.0	4	19.0	1	7.1	1	25.0	14 (12.3)
5-10 hrs/week	2	6.7	1	5.0	3	12.0	0	0.0	1	7.1	0	0.0	7 (6.1)
10-20 hrs/week	2	6.7	0	0	0	0	0	0	1	7.1	0	0	3 (2.6)
20-30hrs/week	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)

5.11.3 Assistance from library staff during information seeking

The respondents were asked to indicate the frequency with which they requested assistance during information seeking from the library staff. Only 1 (0.9%) of the

respondents indicate often, 90 (78.9%) reveal they sometimes request for assistance while 22 (19.3%) indicate that they never did. The detailed analysis is shown in Table 5.41. The frequency of not requesting assistance by the respondents during information seeking from the library staff was linked to limited visits to the library due to library's poor collection and inadequate services rendered (section 5.11.1). A total of 96 (84.2%) of the respondents indicate that they do not always find the information they seek from the library (section 5.11.4). As a result, the respondents visit other libraries to get information (section 5.11.5) and seek alternatives to obtain information such as the use of mobile phones, business centres with internet facilities and own data subscription with a personal desktop/laptop (sections 5.8.5 and 5.10.1).

However, in contrast, Federer (2013) established that most researchers had a limited awareness of the types of services that librarians can offer and as a result most researchers did not request for assistance for a specific service, but instead provided an overview of their research and data management practices to the librarians, who then identified gaps or limitations in the researchers' approaches that could be addressed by their particular skill sets. The onus lies on FIIRO's' librarians to create awareness for services available at the FIIRO library so that researchers can use the library for their research as they ask for assistance.

Table 5.42: Frequency of asking for assistance during information seeking by researchers from library staff N=114

Request for assistance	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Often	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	1 (0.9%)
Sometimes	16	53.3	18	90.0	23	92.0	20	95.2	10	71.4	3	75.0	90 (78.9%)
Never	14	46.7	2	10.0	0	0.0	1	4.8	4	28.6	1	25.0	22 (19.3%)

5.11.4 Finding information sought for at the institute's library

The respondents were asked to indicate if they always find the information they seek from the institute's library. Eighteen (15.8%) of the respondents indicate that they always find the information they seek from the institute's library while 96 (84.2%) respondents

indicate that they do not always find the information they seek from the library. This is captured on Table 5.21 which shows that 77 (67.5%) of the respondents cite the lack of recent books as a factor responsible for difficulty faced in accessing information at the institute's library. The finding also gives credence to the lack of internet connection in the library (section 5.11.10) with the respondents having to pay for their own internet and subscription to journals and accessing them at home, as indicated in section 5.6.7 and Table 5.20. The respondents also seek for alternatives such as mobile phone usage in getting information and the use of business centres with internet facilities (Table 5.38).

5.11.5 Consulting other libraries apart from the institute's library

The respondents were asked to indicate if they consult other libraries apart from institutional library. Twenty-seven (23.7%) of the respondents indicate that they did not consult other libraries apart from the institute's library and 87 (76.3%) of the respondents indicate that they consult other libraries to obtain the information they needed. The respondents also access electronic resources from outside the institute's library especially from their homes using their own data subscription (Tables 5.20 and 5.24). They also use alternatives like mobile phones (Table 5.38).

Regarding the respondents that consult other libraries, the libraries they consult in their descending order are University of Lagos main library (12; 10.5%), public libraries (11; 9.6%), Lagos State University main library (10; 8.8%), University of Ibadan main library (5; 4.4%) and the International Institute for Tropical Agriculture library (2; 1.8%). This conforms with the details in sections 5.9.6 and 5.9.12 where the institute's library in terms of its collection and present information services rendered are poorly rated. These resulted in the researchers consulting other libraries. In addition, it could be said that most of the researchers that consult other libraries especially university libraries are postgraduate students of these universities.

5.11.6 Collection of books/journals and services offered by the institute's library

The respondents were asked to rate the institute's library in terms of its collection of books, journals and services offered. Fifty-six (49.1%) of the respondents rate the library

to be poor, 40 (35.1%) rate the library to be fair, 13 (11.4%) rate the library to be good and 5 (4.4%) rate the library to be very good. Generally, there are fluctuations in how the resources are rated; for example, Tables 5.35 and 5.36 show how respondents rate ICTs infrastructure in the office/organisation differently in relation to how accessible they are. In Table 5.38, there is high usage of personal mobile phones and external internet access by respondents to complement the inadequacies of the institute's library.

This finding concurs with Ekene, Agbo and Onyekweodiri (2016) assessment of available resources and library services provided by two research libraries in Nigeria stating that books, journals and services such as reprography, current awareness, photocopying and printing were provided but not without some hindrances, as observed from the responses of users that revealed that not all of them were adequate, even though they were available. Other services such as internet browsing, computerised literature searching and document delivery services were not available.

The respondents were also asked to indicate whether library staff and librarians do assist them in the conduct of their research. Fourteen (12.3%) of the respondents indicate that library staff and librarians do assist with photocopying, 15 (13.2%) indicate that the library staff assist in the preparation of bibliographies, 20 (17.5%) indicate that library staff assist with searches for books that are relevant to their research and 79 (69.3%) indicate that library staff give no assistance at all. In addition, in terms of librarians' helpfulness, 14 (12.3%) of the respondents indicate librarians have been helpful, 22 (19.3%) indicate that librarians have not been helpful and 78 (68.4%) are neutral in their responses.

The above stated findings agree with the sections 5.11.9, 5.11.10 and 5.11.11 that point to shortcomings of the institute's library in terms of it not providing the desired sources, access and services for researchers to obtain information.

5.11.7 Actions taken after search failure

The respondents were asked to indicate the actions they took after search failure. Action taken, in descending order were as follows: consulting colleagues and librarians (47; 41.2%), visiting another library (27; 23.7%), borrowing from a friend (25; 21.9%) and

finding from a friend (22; 19.3%). None of the respondents indicate that they would take no action and come back later and try the reserved collection after search failure. This conforms to the details of section 5.11 because there is no reserved collection in the FIIRO library from the observation of the library. Furthermore, this highlights the fact that 41.2% of the respondents still believe in the institution of the library/librarian, which constitutes the majority who indicate that they consult librarians after search failure.

5.11.8 Types of information services preferred by researchers as offered by the institute's library

The respondents were asked to indicate the type of services they preferred as offered by the institute's library. The type of information services mainly preferred by the respondents is newspaper-clipping services as stated by 48 (42.1%) of the respondents, and the least preferred information service is inter-library loan with no respondent indicating it. Table 5.43 provides a detailed analysis. The preference of newspaper-clipping services is an indication of the poor quality of service at the institute's library - a pointer to the depth of the alternatives sought by the researchers as mentioned earlier. This conforms to the details in sections 5.7.5, 5.10.1 and 5.11.5 which observed that the majority of the respondents access online journals outside the institute's library, use mobile phones in getting research information and consult other libraries because of the poor information services rendered by the library. One hundred and fourteen (100%) of the respondents who preferred information when carrying out research (section 5.4.1) could never have obtained sufficient information from newspaper-clipping services while all other major library services needed by them to obtain research information are not indicated, especially with none of the respondents indicating inter-library loan services.

This study concurs with Ezeala and Yusuff (2011) who indicated that research institute libraries in Nigeria are ineffective in their service provisions. All these results showed poor information services rendering in terms of providing adequate research information for researchers.

Table 5.43: Information services type preferred by researchers as offered by the institute's library N=114

Information services	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Abstracting / indexing services	9	30.0	1	5	12	48.0	1	4.8	5	35.7	1	25.0	29 (25.4)
Circulation	19	63.3	0	0.0	2	8.0	5	23.8	10	71.4	3	75.0	39 (43.2)
Content page service	6	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6 (5.3)
Database/OPAC search browsing	2	6.7	0	0.0	2	8.0	0	0.0	0	0.0	0	0.0	4 (3.5)
Display board service	1	3.3	0	0.0	5	20.0	0	0.0	0	0.0	0	0.0	6 (5.3)
Inter library loan	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0 (0.0)
Newspaper clipping services	16	53.3	10	50.0	9	42.9	10	47.6	1	7.1	2	50.0	48 (42.1)
Reference service (SDI: Selective dissemination of information)	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2 (1.8)
Printing, scanning and photocopy facilities	11	36.7	9	45.0	10	40.0	0	0.0	0	0.0	2	50.0	32 (28.1)
Technical enquiry services	10	33.3	5	25.0	2	8.0	0	0.0	0	0.0	1	25.0	18 (15.8)

*** Multiple responses received**

5.11.9 Satisfaction with present information services

The respondents were asked if they were satisfied with the present information services offered by the institute's library. Nineteen (16.7%) of the respondents indicate that they are satisfied with the present information services offered by the library, whereas 95 (83.3%) indicate otherwise. The respondents that indicate that they were not satisfied with the present information services offered by the library reveal the reasons as follows in descending order: (i) unavailability of journal/database subscription [both online and print] (95; 83.3%), (ii) old books (93; 81.6%), (iii) no internet facilities (93; 81.6%), (iv) no inter-library loan services (64; 56.1%) and (v) no well-directed vision and mission on information services provision (10; 8.8%). This conforms with section 5.9.6 where it was shown that 49.1% of the respondents rate the library to be poor and only 4.4% of the respondents rate the library to be very good.

In addition, the indication of no internet facilities by 81.6% of the respondents is the reason the majority of the researchers (64.9%) access databases more from home as highlighted earlier in section 5.6.7.

This finding corroborates with Ekene, Agbo and Onyekweodiri (2016) who indicated that services such as internet browsing, computerised literature searching and document delivery services were not available in their assessment of available resources and library services provided by two research libraries in Nigeria.

5.11.10 New or different information services researchers would want provided by the library

The respondents were asked to identify new or different information services they would want the institute's library to provide. One hundred and four (91.2%) of the respondents reveal that they want a standard and modern library with internet facilities and an electronic library (automation of the library), 63 (55.3%) reveal that they want inter-library loan services and 23 (20.2%) reveal that they want the library to subscribe to online journals. This conforms with the details of section 5.11.9 since it points to the shortcomings of the library revealed in this study such as a lack of recent books and no internet connection. The mention of inter-library loan services as an information service that respondents are not satisfied with and also cited as one of the new or different information services they would want the institute's library to provide speak volumes about obtaining research information for the respondents through collaboration with other libraries (section 5.11.9).

5.11.11 Shortcomings of the library in supporting information needs

The respondents were asked to reveal the shortcomings of the institute's library. The shortcomings of the library as revealed by the respondents in descending order are (i) lack of up-to-date materials (88; 77.2%) (ii) research materials not adequate (81; 71.1%) (iii) poor library environment (61; 53.5%) (iv) insufficient reading space/furniture (57; 50.0%) and (v) retraining of library staff and librarians (17; 14.9%). This conforms with the details of section 5.9.6 where it is stated that 49.1% of the respondents rate the institute's library to be poor. In addition, this section agrees with sections 5.5.5, 5.6.3,

5.6.4, 5.6.1, 5.6.2, 5.6.7, 5.8.5, 5.10.1, 5.11.1, 5.11.2, 5.11.4, 5.11.5, 5.11.6, 5.11.8, 5.11.9 and 5.11.10 which state library shortcomings such as outdated collections, infrastructural deficiencies, poor environment and lack of internet facilities.

5.11.12 Successes of the library in supporting information needs

The respondents were asked to reveal the successes of the institute's library in supporting their information needs. The successes of the library as reveal by the respondents are librarians/library staff are willing to assist, irrespective of the fact that so many things are out of place in the library (80; 70.2%). This contradicts what was indicated by the respondents in section 5.11.6 which states that 79 (69.3%) of the respondents reveal that library staff/librarians do not assist at all in the conduct of research. In addition, librarians do assist in tracking the history and statistics of some facts/concepts (6; 5.3%).

5.11.13 Other comments on library resources/information services that the institute's library have offered

The respondents were asked to add other comments on library resources/information services that the institute's library has offered. Many of the respondents still emphasised so many points they have stated earlier in the questionnaire. Other comments as disclosed by the respondents are:

> "Though the library does printing, scanning and photocopying, they still need to improve on these services"
>
> "Electronic resources are urgently needed in this institute, that is, new online journals combined with print journals. Science and technology databases must also be provided for thorough research work".
>
> "There are too many old books in the library; we want the provision of recent textbooks".
>
> "More funds must be provided so that we can experience improvement in newspaper-clipping services".
>
> "The world is changing; our library should go electronic – there should be provision for library electronic services".

5.12 DATA FROM INTERVIEWS

This section covers responses from interviews conducted with five professional librarians at the institute's library. The interviews aimed to capture information from the participants for data on the information services available to the respondents. The participants were excluded from completing the main questionnaire. They provided their opinions on the status of the institute's library and information services, which the respondents had evaluated in the main questionnaire.

An interview schedule was prepared to assess the state of the institute's library based on responses from the participants operating the institute's library. The interview schedule was sent to the participants ahead of the interview to familiarise themselves with the questions. Clarity with respect to responses of the participants was also sought during data analysis through telephone calls.

The interview addressed issues of background information of the participants and questions aimed at having a comprehensive view of membership of the institute's library, information needs of respondents, information sources used by respondents, accessibility of information, collection development/utilisation and library user support including database subscriptions/utilisation. Other issues addressed by the interview were factors affecting information-seeking behaviour, ICT infrastructure in the library, information services/partnership by the institute's library, skill acquisition and professional development of the participants, and the challenges they faced in providing information to respondents.

All the five participants were interviewed successfully. Therefore, there was a 100% response rate for the interviews conducted for professional librarians. This shows a sense of commitment and professionalism from them and is a pointer to their ability to ensure smooth operations if the needed information materials to support respondents is provided for them to carry out their professional responsibilities.

5.12.1 Background information, membership, sitting and shelving space

The FIIRO library has well-educated, experienced and always available professional librarians. All the five participants have excellent qualifications in library science. Two

participants hold a Higher National Diploma, two have a bachelor's degree and one has a master's degree. In terms of working experience, one participant has five years experience, one has ten years experience, two have 13 years working experience and one has 21 years working experience.

The library's opening hours are in line with normal working hours of every working day (Monday to Friday) of the civil service of Nigeria, excluding public holidays. However, the library is open to patrons from 9:00am, one hour short from 8:00am which is the normal opening hour of the institute, and closed at 3:30pm, instead of 4:00pm for normal closing time to tidy up work for the day by completing work on proper shelving, circulation and arrangement of furniture.

The participants state that membership is open to all the institute's employees, other government departments (apart from FIIRO) who find the library useful for their quest for information. Researchers, students (degree and non-degree students, industrial attachment trainees) and the members of the public are also allowed on request and through proper screening. The statement below indicates this assertion:

> "Apart from our researchers and other FIIRO staff we also allow outsiders like university students, industrial attachment students. In fact, we allow outsiders based on request…"

In terms of the adequacy of sitting and shelving space, none of the participants expressed satisfaction. They feel that the library space for sitting and shelving is no longer adequate for what the modern-day library of the institute requires. This assertion is seen in the statements of participants such as:

> "The library is small and we will require another one".

> "Additional space is needed for patrons to portray a modern-day library".

> "The sitting space in the library is not just enough".

> "Shelving of library collection is poor we need space and shelves urgently".

They also express the need for more offices for the librarians. This is seen in statements like:

> "There should be provision of more offices for librarians".

> "Additional office space for library personnel is required with modern furniture".

They also point to the fact that modern-day reading furniture that is ideal for library users are needed. This is clearly pointed out in statements like:

> "Library furniture is obsolete".

> "Modern-day reading furniture cannot be found here".

> "For the library furniture, I think we should talk about stone age".

5.12.2 The information needs of researchers

The participants indicate that no category of respondents could be said to frequent the library most. The participants reveal that scientists, technologists and engineers visit the library depending on their personal or project information demands with respect to the time that the information is needed with no category of respondents being more than the other. This is seen in statements like:

> "I do not think that researchers of a particular field come to the library more than the other".

> "We've had varying number of researchers and engineers at different times visiting the library depending on the project at hand".

The participants indicate that the information that respondents need most is science and technology-based information as pursued by the respondents based on the mandate of the institute. This is seen in the remark below.

> "Science and technology-based information is what we require in the library according to the institute's mandate in order to satisfy our researchers".

The participants point out that the information needs that they are aware of that cannot be addressed by them are information needs that are not related to the mandate of the institute because they do not have those information resources in the institute's library. The remark below shows this.

> "Information needs that are not the mandate of the institute may not be known to us and cannot be addressed by us because we don't have the information resources".

5.12.3 The information sources used by researchers

The participants point out that the information sources used by respondents include books, journals and research reports related to the institute's mandate. The participants reveal that books are more used by the respondents than other library materials. Remarks below depict the stated assertions.

> "Researchers always use books, journals and research reports in this library".

> "Researchers here utilise books a lot in fact the most".

By comparison, this contradicts what the respondents indicate. They indicate that the internet sources are the most used information source (section 5.5.2).

The participants made known that there is no subject area whose usage of books by the respondents supersede the others. This is seen in the remark below.

> "We have not noticed the books of a particular subject area being used more than the other".

There are indications that the respondents are concerned with more current sources whether it is books, journals and research reports than old volumes of materials. This is seen in the statement below.

> "I am aware that researchers appreciate and use current books, journals and research reports a lot in this library".

The library collections in terms of numbers are fairly satisfactory with the participants estimating 14,849 books, 223 journal titles, more than 250 research reports and 100 conference proceedings. This contradicts the responses in Table 5.14, where respondents indicate that journals are the most used information source as it ranks first, conference proceedings ranks fifth, books take the sixth position and research reports take the ninth position among 18 ranked information sources used by respondents. The participants are not sure of the number of multimedia collections which consist of microfiche, slides, films, videotapes, digital photographs and so on. However, the multimedia collections are small with the available ones outdated. This conforms with the details in section 5.8.1, where the majority of the respondents indicate that they do not have access to the multimedia ICT resources such as video recorder and television. This is seen in the comment below.

> "There are multimedia collections such as microfiche, slides, films, videotapes, digital photographs and so on but I do not know the number and they are small collections anyway".

The respondents indicate that newspapers are not well archived. Most of the library collections are not current with very few volumes having date stamps of years 2005, 2007 and 2009. As verified later in the observations, it is evident that the collections are outdated, although some current books and journal titles are available as donations or exchanges, which are still with the Assistant Chief Librarian. These are seen in comments such as:

> "Most of the library collections here are not current"
>
> "We can only see here few titles of 2005, 2007, 2009…"
>
> "We have some collections, that is, books and journals available as donations and exchanges but not shelved for now".

There was no material/library collection held by the library of other language that needs translation.

5.12.4 Factors affecting information-seeking behaviour of researchers

The professional librarians indicate the time/period that information is mostly sought for by the respondents is when research activities commence, that is, immediately after project defence each year. These participants point out that they offer assistance to respondents at any time whenever they are searching for research information. This assertion corroborates what is stated by the respondents in section 5.11.13. This is seen in the remark below.

> "Whenever researchers need assistance we are always there for them especially after project defence every year".

5.12.5 Library collections

The participants indicate that the institute's library collection does not follow a particular budget pattern that is known to them. The participants reveal that the Chief Librarian presents a proposed list of library materials for acquisition every year, but budget is based on management's discretion. The participants also reveal that titles are added based on available funds. They indicate that the library occasionally receives donations of books and other materials from individuals, governmental and non-governmental organisations. Researchers, librarians and management participate in the selection of library materials with the institute's library not having a library committee. However, the participants reveal that the management of the institute has the final say in the library collections. Statements as listed below depict the assertions above.

> "The Chief librarian presents the acquisition list to management every year".

> "Library collections are added based on the funds that are available as decided by the management".

> "Some books, journals and other materials were donated some few years ago by individuals, government and non-government organisations".

> "The Management has a final statement on our collections since there is no instituted committee".

5.12.6 ICT infrastructure in the library

Participants indicate that the adoption of ICTs by the institute's library had helped the process of communicating research information to respondents in the library and made it easy by bringing about timely access to library resources and access to a wide range of information materials. Participants also added that they make photocopies for respondents with the assistance of ICT, but they often run out of paper. The participants reveal that the library has two working photocopiers. Other ICT items the participants indicate are a projector and screen, two digital cameras, CD-ROMs, eight flash drives and two DVDs. These are seen in comments such as:

> "ICTs made easy conversion and transfer of soft copy to hard copy".
>
> "Timely access has been made possible by ICTs".
>
> "Wide range of information is made accessible by ICTs".
>
> "A lot of photocopies are made for researchers but paper availability is a problem".

Participants indicate that the typical procedures of the library such as cataloguing and, circulation have not been automated, but the plan is a top priority by management. Comments written below made by the participants confirm this.

> "Cataloguing process has not been automated".
>
> "Circulation and cataloguing in this library have not been automated".
>
> "Not yet but the process of automating the library or should I say computerisation process is in top gear according to management".

The participants disclosed that the institute's library have no webpage and do not have internet connection, but that the respondents personally subscribed to internet service providers (ISPs) for their data. They connected using their laptops, iPads and smart phones. This confirms the details of section 5.6.2. The participants indicate that when they have internet connection in the library, they experienced challenges with the use of

the ICTs infrastructure in the library as they attended to respondent's information needs. Respondents themselves complained about their services: such challenges included unstable power supply, inadequate computer systems, lack of networked printers, internet disruptions due to payment issues, internet service provider issues and internet bandwidth issues.

> "The internet has not been available for some time now and I am aware that we the librarians and most researchers subscribe to ISP personally using modems with desktops and laptops or the use of cell phones and iPads".

> "Librarians and researchers alike know how electricity instability is a major problem in Nigeria and how it has affected both researchers and librarians in enjoying ICTs infrastructure when we have internet connection…"

> "Inadequate computers and modern networked printers are problems here".

> "Internet disruptions coming from the angles of management are not paying for the service as at when due, internet service provider (ISP) not providing good services and bandwidth palaver…"

Participants indicate that they do not make use of Web 2.0 (social media) in communicating with respondents with respect to addressing their information needs. However, a participant mentioned that she uses WhatApps when communicating and sharing information with one or two researchers. Remarks written below confirm this.

> "Social media is not used by librarians in this library…"

> "We need to first and foremost talk about upgrading library resources and having the profile of researchers with their phone numbers before we can use Web 2.0"

> "I have used WhatApps in communicating and sharing research information with one or two researchers and I still use it".

The library has six computers and four of the computers were available to respondents. The library does not subscribe to electronic resources/journals and does not provide access to open source available on the internet because there is no connectivity.

"Electronic services are missing in the library and we do not have electronic journal access".

"Accessing Open Source resources is of course impossible without the internet".

"No journal or database subscription".

The reasons above explain why the respondents indicate that they do not access databases/archives/indexes through the library but at home (own subscriptions) (section 5.6.7). It also explains why Google Scholar is favoured by the respondents (section 5.6.6).

5.12.7 Information services/partnership by institute's library

The participants indicate that the library supports respondents at the institute by providing relevant information based on respondents' requests to support research and development (R&D) activities of the respondents and, by making provision for proposed lists of books by respondents in terms of accommodating this in library acquisition as demanded by the management of the institute. They reveal that electronic resource services are not provided at present but reference services are provided. The library does provide current awareness services to respondents such as notice boards with current information when available. The library currently does not provide any user education programme to respondents. This corroborates section 5.7.4 which indicates that the majority of the respondents have no formal training/orientation in searching scientific/technical information in a manual/web environment. These are indicated in the remarks below.

"Providing timely and important research information based on request".

"We forward what the researchers want in terms of library collections to management in the form of acquisition".

"Electronic resources services are not available in the library".

"Reference services are provided to researchers".

> "For now, the library does provide current awareness services by using notice boards and shelves to draw attention to new additions".

> "Presently, there is no user education arrangement by the institute's library and we have raised this issue several times…"

Participants reveal that the institute's library collaborates with other libraries/information centres nationally in the areas of exchange of newsletters and magazines. Access to library holdings and complementary copies of the institute's research findings are given out on the Director-General's approval. As the central library of the institute, the participants reveal that the library disseminates the institute's R&D achievements to other Ministry of Science and Technology libraries, libraries of higher institutions and the organised private sector in order to promote research enhancement and collaboration. Statements to support these assertions are written below.

> "Researchers from other government institutions do come to FIIRO to access our holdings".

> "The library exchanges newsletters and magazines and we give complimentary copies of our findings on DG's order".

> "We disseminate the institute's research and development achievements to other libraries such as libraries of other organisations under Ministry of Science and Technology and higher institutions and private sector…"

The information services and products currently provided to support the information needs of respondents as identified by the participants include book loan service, provision of techno-economic information to satisfy respondent's technical enquiry quest, photocopying services, retrospective search for old journal editions and research reports and journal content page. Participants reveal that the researchers are satisfied within the limits of the library holdings, although there is room for improvement on services rendered to respondents. The participants propose recommendations towards improving information service delivery to researchers. Comments to support these assertions are written below.

"We offer services like book loan service, techno-economic information service, photocopying service and journal content page provision".

"There is a provision for a retrospective search for old journal editions and research reports as requested by some researchers".

"I want to believe that researchers are satisfied within the limits of the services that are available to us".

The participants made known that the strengths of the library are in the fact that, there are well-educated and well-trained library professionals to attend to respondents, proper documentation and storage of in-house generated information, especially FIIRO publications by the library, provision of current research information immediately when it is available and the availability of professional librarians throughout the working hours from Monday to Friday. Some of the remarks are:

"A strength that is undisputed here is our academic qualifications and trainings".

"We are always here from Monday to Friday to provide available information".

"There is proper documentation of FIIRO publications".

"We disseminate research information immediately we get them".

Although the librarians feel that they are providing the required services to respondents, the respondents feel otherwise. As shown in section 5.11.6, it was revealed that 69.3% of the respondents asserted that library staff and librarians do not assist them in conducting research.

The major challenge that the library is confronted with is the unavailability of funds to enable it offer modern-day library services to satisfy the information needs of respondents and other users. Other weaknesses include out-of-date collections, lack of ICTs and access to the internet and electronic databases, absence of a say in budgetary provisions to implement meaningful acquisitions and side-lining or disregarding of the library/library staff in terms of institutional operations. Some of the comments are:

"The library is not well funded".

"Internet must be reawakened".

"ICTs needs must be urgently attended to".

"We want to be involved in budgets, operations, acquisitions…"

"Books are old and need to be updated and we need to offer electronic library services to make researchers happy".

The mentioned shortcomings above conform with the details of section 5.11.6 where 49.1% of the respondents rate the institute's library to be very poor in terms of the collection of books/journals and services offered.

5.12.8 Skills acquisition and professional development

Four out of the five participants indicate that in the past two years they have been trained in the use of ICTs in the processing, storage and dissemination of information by the institute in the form of skills or professional development initiatives to provide support to respondents in terms of their information needs. They give comments such as:

"We are trained on ICTs usage – in relation to processing, disseminating and storing information"

"Trainings are received by the librarians and library staff in ICTs utilisation, dissemination and storage of information"

5.13 DATA FROM OBSERVATIONS

The researcher embarked on physical observation of the institute's library to ascertain its status. This helps to consolidate the information generated from the questionnaire sent to the researchers and the interview schedule with the five professional librarians of the institute. The observation centres on the physical infrastructure of the library, the specific location, size, lighting, shelving and office space. The assessment also considers user assistant features such as guides and posters, the availability of computers and other ICTs, as well as the collections outlook and utilisation of the library materials. In

addition, other facilities present within the research institute (apart from the library) that pertains to the information needs and information-seeking behaviour of researchers as seen by the researchers are also documented.

Various observations were made at the institute's library - among them: infrastructure, layout and material type and availability of ICTs.

5.13.1 Physical location

The library is located within the research institute as part of the main administration building located at the rear end of the first floor and very close to the main gate. Generally, this makes the library more accessible to users within and outside the institute. In terms of physical maintenance, it is observed that the institute's library is neglected: some air-conditioning units are not repaired and they are dusty, chairs and tables are old and not well maintained (section 5.11.1). With the air conditioning system not in full working condition, the windows that are opened during the working hours of the library to improve ventilation and thus allowing the library collection to be exposed to dust and moisture.

5.13.2 Size and lighting

The size of the institute's library was not commensurate with the number of researchers working in the FIIRO library. Therefore, the space is considered inadequate. In terms of lighting, although the lighting system is sufficient if all the 25 double fluorescent fittings are all working (compared to the library space), however, just four are working, leaving various parts of the library dark.

5.13.3 Shelving and sitting space

Shelving space is identified as one of the major challenges affecting the library. For instance, some documents and books are placed on one of the reading tables while some new books are kept in the office of the Assistant Chief Librarian awaiting shelving because of lack of shelving space. These may not be accessible for researchers to browse unlike when the books are on the shelves. In addition, some books are lying on top of each other on the shelves because of lack of shelves for proper shelving. This could also

affect the ease of locating materials.This affects the library negatively in attracting researchers to the facility (see section 5.7.1).

The FIIRO library is observed to have a sitting capacity of 30, three big tables, surrounded with 24 chairs for library users with an audio-visual desk and circulation desk.

5.13.4 Office space

The FIIRO library is observed to have two offices: one for the Principal Librarian and one for the Assistant Chief Librarian. There is also a visitor's cubicle cut out of the space meant for library users' space, but not enclosed so as to look like a room. Therefore, some users of the library could still read there.

5.13.5 Library guides

Library guides aid users by providing indications of where to locate the different facilities within the library. There are visible library guides in the form of big stickers on all 20 shelves indicating the kinds of library materials they contain and the fields of study and research the library materials set cover. Furthermore, the library guides indicated the section accessible to users and the section accessible to library staff only.

However, the guides do not reinforce library rules and regulations (for instance, no noise, use of phones, etc.). Few patrons using the library are seen to be communicating very loudly, disturbing other library patrons. There are no library guides to indicate sections like a circulation desk, visitor's cubicle, audio-visual table and the two offices of the Principal Librarian and Assistant Chief Librarian.

5.13.6 Availability of computers and other ICTs

The library has some ICTs. The institute's library has six computers, three printers, two photocopiers and one server (see section 5.11.6). One computer is originally designed for circulation but is not being used for this function due to a lack of automation, one computer is for the audio-visual unit and the remaining four are for library users. The

computers have no internet access. The server and one photocopier are not working as at the time of this observation.

5.13.7 Collection outlook and utilisation

The library collections are not good enough to support modern-day industrial researchers. The collections are mainly volumes of periodicals and books dating back from the pre-1960s to the early 1970s. The early 1980s and early 1990s collection of books and journals are more in most instances, with none of these collections being more than the other. These collections are visibly old as exhibited by the browning of covers and book edges.

At the institute's library, there are some new titles of encyclopaedia of foods and their healing power published in 2007 and 2010 (five of them) and these are shelved at the reference book section.

5.13.8 Other facilities present within the research institute that relates to information services

Some of the offices and laboratories of researchers visited are observed to have internet sockets especially at the Dr. Koleoso Building. However, the internet sockets are not working at the time of observation.

5.14 SUMMARY

This chapter presents the analysis and interpretation of data collected using the research instruments of questionnaire, interview and observation as well as the discussion of the findings of the study. Descriptive and thematic analyses are both used in this chapter. The demographic characteristics of the respondents reveal that they were drawn from the six departments at FIIRO, and sufficiently represent the target population of respondents. Male respondents are more than the female respondents although, with a small margin - the majority of respondents are experienced in terms of years of experience and have qualifications ranging from a bachelor's degree to PhD.

The chapter also looks at the information-seeking purposes of respondents, type of information the respondents require and the information the respondents need in terms of

personal needs. Overall, all the respondents indicate that they require information when carrying out research, 75 (65.8%) of the respondents require information when solving personal needs, 62 (54.4%) require information for general awareness, 57 (50.0%) respondents require information when attending to clients' needs (consultation), 44 (38.6%) require information for work-related discussions and 41 (36.0%) respondents require information when attending to academic needs. In addition, the majority (86; 75.4%) indicate that they require health information in terms of their personal needs, while a small number require information indicated by the respondents as cultural information (22; 19.3%). The respondents indicate that internet sources are the most frequently used information source. At the top of resources that are least used are newsletters, library catalogue, pamphlets/leaflets and technical reports.

The respondents indicate the factors that affected their information seeking and as a result influence their information-seeking behaviour. The respondents reveal that trustworthiness is considered the most important information-seeking factor influencing their information-seeking behaviour as they seek for information. Limited financial resources are revealed by the respondents as the factor least experienced.

The respondents reveal the challenges they encounter in searching in a manual environment. Most important among the challenges revealed is circulation and the least important is indexing and cataloguing/classification. The respondents indicate the challenges they have with searching web resources. They are electrical power stability, referencing e-resources, loss of browsability, scholarly misconduct and misinformation, information overload, reliability of information, website navigation and financial concern.

The respondents indicate the frequency with which they use mobile phones/iPad in obtaining research information. A total of 110 (96.5%) of the respondents indicate that they often use mobile phones/iPad with no respondent indicating never. All the respondents indicate that they consider the mobile phone/iPad more helpful in obtaining information than using FIIRO library. The respondents are asked to identify new or different information services they would want the institute's library to provide. The respondents reveal that they want a standard and modern library with internet facilities,

automation of the library, inter-library loan services and subscription to online journals by the library.

The institute's library is found wanting in terms of meeting the information needs of researchers due to outdated materials and the unavailability of an internet facility to make electronic resources available to the respondents. Most of the respondents indicate that they are not satisfied with library collections and the information services rendered despite their glaring need for research information. This is corroborated by interviews of professional librarians and observations of the library. The major weakness of the library is unavailability of funds to achieve modern-day library services to respondents. Other weaknesses include outdated collections, lack of ICTs and access to the internet and electronic databases, lack of a say in budgetary provisions to implement meaningful acquisitions and relegation of the library/library staff in terms of institutional operations.

The next chapter presents the summary, conclusions and recommendations.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents a summary of the findings, conclusion as well as recommendations that emerge from the study that investigates the information needs and information-seeking behaviour of researchers in an industrial research institute in Nigeria.

6.2 RESEARCH QUESTIONS

The principal research question is: "What are the information needs and information-seeking behaviour of researchers of the Federal Institute of Industrial Research Oshodi in Nigeria?" The eight sub-questions underpinning the study (section 1.5) that are developed from the principal research question (section 1.3) are as follows:

i. What are the information needs of FIIRO's' researchers in Nigeria?
ii. What are the information sources that are used by FIIRO's' researchers in Nigeria?
iii. How do FIIRO's' researchers in Nigeria access information?
iv. What are the factors affecting the information-seeking behaviour of FIIRO's' researchers in Nigeria?
v. What is the level of adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's' researchers in Nigeria?
vi. What is the purpose of ICT resources and services to FIIRO's' researchers in Nigeria?
vii. What is the influence of recent technologies on the information needs and information-seeking behaviour of FIIRO's' researchers?
viii. How can information services offered by the FIIRO library to FIIRO's' researchers be improved upon based on the outcome of this study?

6.3 SUMMARY OF FINDINGS

The summary of findings is divided into two sections: the findings based on the principal research question and the findings based on the five sub-questions underpinning the study.

6.3.1 Findings based on the principal research question

It is important to collate findings of the study in order to ensure that the study has successfully achieved its objectives (section 1.4). The study yields a good response rate of 73% based on 121 respondents out of a possible 165 (section 5.2). The principal question contained two main parts, which are the information needs and information-seeking behaviour of researchers at FIIRO Nigeria. The first part reflects on the information needs revolving around the research works the respondents engage in, which lead the respondents to be involved in different information-seeking behaviour. Therefore, research work is a core need for respondents at the researched institute in the study. Wilson's 1999 information behaviour model functions as a theoretical framework for the study (section 3.7) and confirms that based on the kind of need, information users will engage with multiple information-seeking patterns by consulting various systems and other sources to collect information that can assist them in satisfying a perceived need.

The study coherently links the research findings and discussion with the literature review and Wilson's 1999 model (Figure 3.1). The study highlights the research and personal information needs of the researchers. The study reveals that information needs of researchers are inter-linked in the sense that they all have related personal needs coupled with the need for scientific and technologically based information to address their engagement in industrial research projects and the need for information services related to science and technology research.

Therefore, the study investigates the major information-seeking behaviour of researchers that helps them to meet perceived needs, including sources they consults from inside and outside the research institute, usefulness of sources they consult and major problems experienced while searching for information. It is important to note that the present study identifies that library resources and services are not satisfactory, resulting in researchers

seeking for multiple alternative sources to getting research information and communicating with one another.

6.3.2 Findings based on eight sub-questions

Findings of the study in relation to each research sub-question are presented in this section.

6.3.2.1 What are the information needs of FIIRO's researchers in Nigeria?

The findings reveal that researchers have both research and personal information needs as they carry out their research work at the institute. This study reveals that information-seeking purposes of researchers and their information needs are interconnected with information-seeking purposes pointing to how information needs will be met. The researchers evidently indicate how their information-seeking purposes will explain their information needs. All the respondents indicate that they require information in the descending order of: when carrying out research, when solving personal needs, for general awareness, when attending to client's needs (consultation), for work-related discussions and when attending to academic needs. In terms of personal needs, the respondents' needs include general knowledge acquisition, research funding, personal and career development, health, collaboration in terms of research, finance and investment, culture and sports and entertainment. However, the study uncovers that health issues are the foremost personal need while the least is cultural needs.

The findings also point to the complex information needs of industrial researchers, based on the information type required by the researchers. This explains the dissimilar type of information among researchers according to their departments (Tables 5.8 to 5.12). This study reveals that there are 27 different types of information that all categories of researchers indicate showing that they would need information for all these as researchers. Part of the complexities is that different categories of researchers have information needs that are common to them. Researchers of different departments share some similarities in the type of information they require. This explains the intricacy involved in meeting researchers' information needs.

6.3.2.2 What are the information sources that are used by FIIRO's researchers in Nigeria?

The findings make known that both formal and informal sources are consulted by the researchers. They include journal articles, review articles, conference abstracts and proceedings, books, professional meetings/workshops, content pages, indexes and abstracts of journals and research reports/parents/facts sheets. Others are technical reports, pamphlets/leaflets, internet sources, theses and dissertations, newsletters, library catalogues, face-to-face conversation/discussions with colleagues, email/blogs/webinars/discussion forums, librarian/library staff and knowledgeable persons in the field. Wilson's 1999 model indicates that during the information-seeking process, a person often consults multiple sources to satisfy an information need and these sources may involve digital or manual sources. It is important to note that the internet is the information source commonly used to obtain information by the researchers who participate in this study, while content pages and librarian/library staff are the least used information sources. The findings also reveal that journal articles as an information source is considered to be very important by the researchers, followed by internet sources and then knowledgeable persons in the field. The least important information source is newsletters.

The majority of the researchers indicate that they first consult electronic sources before consulting print sources. The researchers reveal that the preferred information sources to satisfy their information needs in terms of research journal articles/references materials are a combination of both electronic and print copies giving the reason that both print and electronic copies are reliable in providing concrete research information when combined in terms of usage by the researchers.

6.3.2.3 How do FIIRO's researchers in Nigeria access information?

Forty (35.1%) respondents reveal that information accessibility at the institute's library is easy and 74 (64.9%) indicate that it is not easy. As a result, the study establishes that approximately two-third of the respondents do not find accessing information at the institute's library easy. The researchers who do not find accessing information at the institute's library easy reveal that the topmost factor responsible for the difficulty faced

by them in accessing research information at the institute's library is lack of recent books (the majority). Similarly, the majority of researchers who indicate that accessibility of information at the library is easy also indicate provision of more recent books in different fields as a major factor that would further aid accessibility of research information at the library. This is a pointer to the importance of this factor and a validation of the fact that it has to be addressed by the management of the institute. Other factors in descending order are poor infrastructure, environment, bibliographic obstacles, costs of accessing information, lack of awareness and the least being declining budgets and rising costs.

Most of the researchers obtain journal articles using the internet (use of search engines like Google and Yahoo). Other means of obtaining research journal articles in descending order include personal subscription to online versions, personal subscription to print journals, archives and document delivery. The researchers never obtain research journal articles via library online/electronic version, inter-library loan and library print subscription.

The findings establish that the majority of the researchers often access online journals outside the institute and to corroborate this assertion, the majority of the researchers indicate that information technology usage in the library has not affected their visits to the library. The databases/archives/indexes that are indicated by the researchers that they have used in the preceeding six months are Google scholar, followed by Research Gate, Africa Journals Online, Web of Science Citation Indexes, Science Citation Index and Science Information Database, Science Open, Scopus, and Agricultural and Environmental Science Database/SciFinder Scholar on the web. All these databases/archives/indexes are mainly accessed from home.

6.3.2.4 What are the factors affecting the information-seeking behaviour of FIIRO's researchers in Nigeria?

As stated in Chapter 3, Wilson's 1999 model of information behaviour shows that so many factors would affect information behaviour of researchers. These range from psychological, demographical, role-related, interpersonal, environmental and source-related characteristics influence. The researchers indicate that the factor that affect their information seeking and therefore influence their information-seeking behaviour the most is trustworthiness. Others in descending order are accessibility, nature of problem, source

of information, familiarity and prior success and time while the least factor is limited financial resources.

The researchers put forward specific information challenges that have to do with searching information in a manual and web environment. For challenges in the manual environment, the respondents reveal that the most important challenge is circulation, followed by issuing and the least challenges are indexing and cataloguing/classification. For challenges in searching electronic resources, the researchers reveal the most important challenges to be electrical power instability followed by reliability of e-resources, HTML documents and the least being issues with referencing e-resources. Another factor affecting information-seeking behaviour of researchers is the lack of adequate formal training/orientation with respect to searching for information in the manual and web environment with most of the researchers indicating that they have not received adequate training in manual and web searching of research information.

6.3.2.5 What is the level of adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria?

Seventy two (63.2%) of the respondents indicate that they have good ICT skills/competencies with none of the respondents indicating that they have poor ICT skills/competencies. This is that the respondents have a very sound knowledge of the application of ICTs. The majority (98; 86.0%) have access to mobile/cell phone. Email is ranked second (95; 83.3%) and internet third (74; 64.9%). The ICT resources they have least access to are land phone and fax with both being indicated by 2 (1.8%) of the respondents. This implies that respondents have easy access to mobile/cell phones and, by extension, have access to the internet and the usage of mobile/cell phones to check email. This is connected with the ICT revolution and penetration in Nigeria.

Only 1 (0.9%) of the respondents indicate that the ICT infrastructure in his office/department is very good with 74 (64.9%) of the respondents indicating that the ICT infrastructure is poor. This shows that the ICT infrastructure at the institute is not encouraging and it needs to be fixed for thorough research work supported by research information to take place at the institute. This also points to reasons for low usage of

databases from the library. In terms of electronic dissemination of research information on information-seeking habits, 61 (53.5%) of the respondents feel that they have used completely different sources than they have done five years ago. This means that the majority of the respondents value and embrace the use of the internet with them using completely different electronic information sources to obtain information for their research even if it is not provided by the institute.

The researchers have been using alternatives in terms of the ICTs they utilise in accessing information. They use mobile phone/iPad, personal laptop/desktop with a personal subscription to internet data and external internet facilities (business centres) in accessing information. The majority of the researchers indicated that they often use mobile phones/iPads with no researcher indicating never. Furthermore, all the researchers indicate that they consider the mobile phone/iPad more helpful in accessing research information than using the FIIRO library.

6.3.2.6 What is the purpose of ICT resources and services to FIIRO's researchers in Nigeria?

Most respondents (101; 88.6%) indicate that they use ICTs for research, followed by educational purposes (99; 86.8%) and communicating with researchers (91; 79.8%). The least cited purpose for ICT resources and services is communicating with publishers (18; 15.8%). This means that researchers strongly need research information for their projects from the indication of their use/purpose for ICTs. With just 15.8% of the researchers citing that the purpose for ICT resources and services is to communicate with publishers, it infers that most of them do not publish scientific articles.

6.3.2.7 What is the influence of recent technologies on the information needs and information-seeking behaviour of the FIIRO's researchers?

The majority of the respondents embrace the use of the mobile phone and iPad. The respondents also indicate the adoption of various Web 2.0 tools in accessing information or when communicating with other researchers. The social media tools the respondents utilise include WhatsApp, Google+, Facebook, LinkedIn, Wikipedia, Twitter, Pinterest and Instagram.

Therefore, the respondents are influenced positively by the adoption of recent technologies as it affects the way they address their information needs in a positive direction and it constructively shapes researchers' information-seeking behaviour.

6.3.2.8 How can information services offered by the FIIRO library to FIIRO's researchers in Nigeria be improved upon based on the outcome of the study?

According to Ankpa's work in year 2000, progressively more, users' satisfaction with information services provision is being recognised as an important factor affecting a researcher's productivity. Nel (2015:162) supports Ankpa's assertion of the importance for the library and librarians (information specialists) to support the researcher in the context of the research environment. Nel (2015:163) further states that "researchers view library collections and information resources as the library's most important contribution to their research". Despite the fact that respondents in this study indicate that they are not satisfied with the library collections and the information services rendered, the reality is that the key to research productivity still rests in the productivity of the institute's library from the angle of the information services it is expected to provide towards providing the information needs of researchers.

In order for the FIIRO library to improve on the information services offered to FIIRO's researchers, the following can be done based on the outcome of the study:

- Recent books are to be purchased by the institute based on expert advice from professional librarians according to researchers' requests for acquisition of new books.
- Professional librarians need to stay cognisant of information needs, information-seeking behaviour and research activities of researchers of the institute and the departments they are meant to serve with information. This is to help get them prepared to excellently respond to researchers' information needs even if it will involve the professional librarians paying scheduled and unscheduled visits to the departments.
- Professional librarians need to be conversant with and be aware of events, trends and changes in the local as well as international research environments. They also need to be well versed in research trends and events applicable to industrial

researchers as it relates to their areas of interest. For instance, professional librarians can ensure that they stay informed via subscription to online current awareness services and services on topics related to industrial research, especially as it relates to FIIRO's departments.

- Resuscitating the internet in order for the researchers to have easy and unlimited access to electronic information.
- Investment in electronic resources by the institute. This is because researchers want to access library resources and collections anywhere they are (even outside the institute) each and every time they need it.
- Upgrading of the collection of building practices of the institute's library, which includes specialised referencing databases and full-text databases in their collection to serve researchers. This will improve access to online resources especially online journals.
- The need for a structural upgrading of the institute's library in terms of the space to work on research by researchers is a very important issue that should be addressed. Library space should be designed to incorporate a variety of needs, which must include a quiet space to work and study, and a library room that is well equipped with technology and equipment to assist researchers in writing research publications (e.g. adequate computer systems, printers, scanners, modern audio-visual equipment, etc.). There should also be good ventilation with a working air-conditioning system. As researchers also mentioned, personal communication with colleagues to keep up-to-date is essential, the institute's library should facilitate this by providing a seminar room.
- The library should have a functional webpage. Apart from the physical space, this can be utilised by professional librarians/library staff to create online discussion rooms and research collaboration platforms for researchers (as a virtual research environments). With the good adoption of social media tools by researchers observable in this study, professional librarians can play an excellent role in organising the shared information and archiving it for the purpose of information preservation.

- Setting up of initiatives for collaboration, communication and partnerships between research institutions by the FIIRO management to allow access to information and collections not owned by FIIRO, especially as it concerns inter-library loan services.
- It is important for library staff/professional librarians to be retrained and in turn train researchers on the job in order to manage maintainable, existing and all-embracing information resources services.
- There is the need for a well-directed vision and mission statements on information services provision for researchers that would be strategically and systematically pursued and implemented by all and sundry.
- An all-encompassing factor that should be prioritised is funding. All the above improvement strategies can only come to fruition with adequate funding from the FIIRO management and the Federal Ministry of Science and Technology.

6.4 CONCLUSIONS

The conclusions based on the objectives are hereby stated below.

6.4.1 Conclusion on the information needs of researchers

The conclusion is that researchers have both research and personal information needs as they carry out their research work at the institute, the information-seeking purposes of researchers and their information needs are interconnected with information-seeking purposes pointing to how information needs will be met. Researchers also have complex information needs based on the type of information required which varies for different categories of researchers according to department and they also share some information needs in common.

6.4.2 Conclusion on the information sources that are used by researchers

The conclusion is that researchers consult both formal and informal sources for their information needs and various sources of information are used by the respondents (both print and electronic). The internet is the information source most commonly used by the researchers who participated in this study to obtain information, although this is self-

provided. Content pages and librarian/library staff are the least used information sources, scholarly journals are very important to researchers and the unavailability of internet access is said to affect access to databases and electronic resources at the institute's library.

6.4.3 Conclusion on how researchers access information

The conclusion is that about two-thirds of the respondents do not find accessing information at the institute's library easy. The factor most responsible for the difficulty faced by researchers in accessing research information at the institute's library is a lack of recent books and the lack of internet connection. Most of the researchers obtained journal articles making use of the internet (use of search engines like Google and Yahoo), their own data subscription and mostly outside the institute, especially at home. The researchers never obtained research journal articles via library online/electronic version, inter-library loan and library print subscription. The databases/archives/indexes that the researchers have used in the preceeding six months are more multidisciplinary than subject specific with these electronic resources mainly being accessed from home. The researchers use alternatives in accessing research information with the alternatives being the mobile phone/iPad, personal laptop/desktop with own data subscription and external internet facilities (business centres). The majority of the researchers indicate they prefer mobile phones/iPads to the institute's library in relation to accessing information and the majority of the researchers utilise web 2.0 tools when accessing scholarly information for their projects and also communicating with other researchers.

6.4.4 Conclusion on the factors affecting the information-seeking behaviour of researchers

The conclusion is that the topmost factor that affects researchers' information seeking and as a result influences their information-seeking behaviour is trustworthiness. Specific factors affecting their searching for information in the manual environment are circulation and issuing with indexing and cataloguing/classification being the factor that affect them the least. Specific factors affecting their searching for information in the web environment are electrical power instability, reliability of e-resources, HTML documents,

issues with referencing e-resources, loss of browsability, scholarly misconduct and misinformation, information overload, reliability of information, website navigation and financial concern. Another factor affecting the information-seeking behaviour of researchers is the lack of adequate formal training/orientation with respect to searching for information in a manual environment and searching for web resources.

6.4.5 Conclusion on the level of adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria

This objective reveals that FIIRO's' researchers are skillful and competent in relation to ICT applications to satisfy their information needs when they exhibit their information-seeking behaviour. However, the institute lacks the ICT infrastructure for FIIRO's' researchers to fully adopt ICTs – the institute does not have internet connection with ICT equipment not also sufficiently provided. Considering this gap, the researchers have been using alternatives in terms of the ICTs they utilise in accessing information. They use mobile phone/iPad, personal laptop/desktop with personal subscription to internet data and external internet facilities (business centres) in accessing information as viable alternatives.

6.4.6 Conclusion on the purpose of ICT resources and services to FIIRO's researchers in Nigeria

Most respondents use ICT resources and services for research, educational purposes and communicating with researchers in this order. The least cited purpose for ICT resources and services is that of communicating with publishers which connotes that most of them do not publish scientific articles. ICT resources and services for research being ranked as the foremost purpose also suggest that researchers strongly need research information for their laudable projects.

6.4.7 Conclusion on the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers

All the respondents indicate that they consider the mobile phone/iPad more helpful in obtaining research information than using the FIIRO library. The respondents also

indicate the adoption of various Web 2.0 tools in accessing information or when communicating with other researchers such as WhatsApp, Google+, Facebook, LinkedIn, Wikipedia, Twitter and Instagram. This shows that recent advancements in telecommunication have influenced researcher's information behaviour towards technology adoption in solving information need issues.

6.4.8 Conclusion on the suggestions to improve information services of researchers by the library

The study offers insightful suggestions on how the FIIRO library can improve on the information services offered to FIIRO's researchers. This can be seen in section 6.3.2.8 based on the outcome of the study. The study concludes that an intensive effort is necessary to improve the state of the institute's library in terms of its collection development and internet connection as information is vital in research undertakings of the researchers.

6.5 RECOMMENDATIONS

The recommendations originate from the respondents' suggestions for an enhanced science and technology-based information services system that gives adequate information to satisfy researchers' needs as they seek for information and observed facts from the literature reviewed on the subject. In this regard, the following recommendations are hereby proposed.

6.5.1 Recommendation on information needs of researchers

The library staff/professional librarians can hand out quarterly questionnaires aimed at obtaining responses from researchers in a bid to satisfy their information needs (both new information needs and the improvement on satisfying the existing ones).

The study found challenges created by research activities and the institute's library environment and institutional goals affecting the information needs of researchers. There is the need for greater clarity regarding the roles and responsibilities of all those involved in the research activities – researchers, research institute itself and national body (Federal Ministry of Science and Technology), as well as the institute's library. The institute's

library must address the information needs of researchers and discover trends in the overall research library environment for the purpose of application.

The study ascertains that researchers of the different departments at FIIRO require different types of information and prefer different types of information sources to satisfy their need for research information. To sufficiently deal with their information needs as they seek for research information, this study recommends that inside each department, an outline of researchers should be designed to categorise fields of specialisation as well as their different information requirements for specific research. This outline may also entail the time when information is sought, different formats, cell phone numbers of the researchers, titles of various helpful books/journals for specific research and information on forthcoming local and foreign short-term scientific and technological trainings. This outline can be used by the library staff/professional librarians to address both old and new information needs of the diverse researchers of the institute and can assist the researchers in terms of determining scientific and technological trainings they can attend towards meeting their needs for information. In doing this, cell phones and email facilities could be used to forward electronic documents to researchers. In section 5.10.3, it is recognised that these two media are the two most effective ways for the library to keep respondents informed about their changing information needs. In addition, SMS could also be used to communicate information to researchers.

6.5.2 Recommendation on the information sources used by researchers

It should also be made compulsory for all researchers to register and deposit completed research works and books at the institute's library. The database of submitted complete research works and books would include both electronic and print formats. The electronic version would allow for remote access on the intranet or internet. Subsequently, the institute's library will provide copies of such materials for reference purposes.

Funding is one of the main challenges affecting the provision of information resources for research at the institute. The institute needs to be provided with funds for an upgrade of their information resources and increased funding of the library should be encouraged with prompt release of all approved funds to the institute's library The Federal Ministry

of Science and Technology and of course the institute's management should earmark easily accessible funds in budgets to help the library update and replace their outdated collections.

6.5.3 Recommendation on access of information by researchers

There is also the need for the development of the webpage of the institute's library or a website that is user friendly based on funds availability. This is to enhance remote access to information, downloads and communication.

The publishing environment has recorded significant advancement and much research and scholarly material is now available online (open access initiatives). Therefore, the institute should improve connectivity to these materials within the institute and with other research institutes and government institutions.

Given the fact that researchers consider access to information resources for their research very highly, this study recommends that collections development and management must be viewed as priority for the library.

Taking into consideration that researchers prefer online information resources, which are easy to access and use, it is further advised that in order to include access to information not owned by the institute, the institute's library must set up more partnerships and become involved in collaboration initiatives, which would also involve inter-library loan services initiatives.

Researchers should comply with loan transaction due date so that other researchers can also have unhindered access to available library resources.

6.5.4 Recommendation on the factors affecting the information-seeking behaviour of researchers

The institute's ICT infrastructure needs to be developed in order to enhance access to research information as researchers seek for research information. An information audit should be carried out to ascertain the current state of ICTs within the institute in order to enable the ministries that have been saddled with ICT responsibilities and the institute to budget for ICTs resurgence. The government of Nigeria has Federal Ministries such as

the Federal Ministry of Information and Culture and the Federal Ministry of Communication that have been empowered with and should fulfil their mandates of empowering government parastatal organisations with ICTs. The institute's infrastructure needs to be upgraded with modern information technology gadgets ranging from modern ergonomic computer systems, servers, internet and networking tools, expansive bandwidth devices, scanners, printers, among other gadgets.

The institute should utilise alternative sources of power supply (solar, generators) so that e-resources access is guaranteed.

6.5.5 Recommendation on level of adoption of ICTs within the institute and its influence on the use of alternative sources in getting research information by FIIRO's researchers in Nigeria

Internet services in the library should be resuscitated as quickly as possible with databases being subscribed to and Open-Access source encouraged.

6.5.6 Recommendation on the purpose of ICT resources and services to FIIRO's researchers in Nigeria

The FIIRO library should liaise with the FIIRO management for the unhindered provision of internet services and by extension the provision of electronic version of journals by subscribing to them, provision of e- archive, inter-library loan services and document delivery services.

6.5.7 Recommendation on the influence of recent technologies on information needs and information-seeking behaviour of FIIRO's researchers

The study brought to light the fact that mobile phone/iPad has become a very reliable research tool used by researchers due to its wide usage in Nigeria as well as the use of social media tools (Web 2.0). This suggests the encouragement of their utilisation for research and for more investment in such resources.

6.5.8 Recommendation on improving information services provided by the library

As indicated by the researchers, the study reveals that there is no clearly defined mission and vision statement for the provision of information services as indicated by researchers.

Consequently, it is imperative for a well-directed mission and vision statement to be in place that would facilitate the provision of information services to the researchers.

Professional librarians need to be more involved in institutional as well as research departments' goals and initiatives of the institute and become more involved in the research activities of the researchers they support. They need to provide customised research support products that are aligned with institutional goals.

It is recommended that the institute's professional librarians should be retrained and empowered in terms of resources required to conduct searches and send documents to researchers.

FIIRO should build relationships with other research institutions and research service providers (both within and outside the country), particularly where there will be a symbiotic relationship between groups. This is especially the case with information services for research that the researchers expressed dissatisfaction with. This will involve collaboration with some research institutions (be it local/international or private/public) producing research publications to support FIIRO's researchers with scientific and technological research activities and this will be available based on request.

The periodic assessment of the institute's library should be carried out in terms of its effectiveness based on user approach.

6.6 IMPACT OF FINDINGS ON INFORMATION NEEDS OF RESEARCHERS

This study contributes to the existing body of knowledge on the information needs of researchers, especially for federal research institutions in Nigeria under the Federal Ministry of Science and Technology.

The findings in the study will help to increase information utilisation, sharing and collaboration among researchers.

The findings of this study may be used by library professionals, policy makers, directors, director-generals, research institution managers, university authorities, researchers and

students undertaking studies on the subject in Nigeria and possibly other developing countries. The findings will also serve as a guide for further research into improving collections development, infrastructure improvement to support researchers and critical areas where training is needed to improve information service delivery.

The recommendations in this study when implemented should be able to assist in improving information sources and services provision by the institute's library to FIIRO's researchers and by extension to other research libraries with the goal of boosting researchers' productivity.

6.7 CONTRIBUTION TO KNOWLEDGE AND LITERATURE

The contributions to knowledge and literature are as follows:

- The findings of the study will contribute to the information behaviour theory of science and technology researchers by revealing additional aspects such as the strong usage of the alternatives of smart phones/iPads and Web 2.0 as against the traditional library, the context in which the research occurs, the information user group (FIIRO's researchers) and the aspect of training researchers in accessing manual and web resources.
- The present study helps to determine how and to what extent the different research methods used in the study will contribute to research and insight into the information needs and information-seeking behaviour of researchers.
- The findings will provide useful research output that can be used widely within institutions of higher learning and research institutions.
- The study adds to the germane information materials that can be offered to industrial researchers.

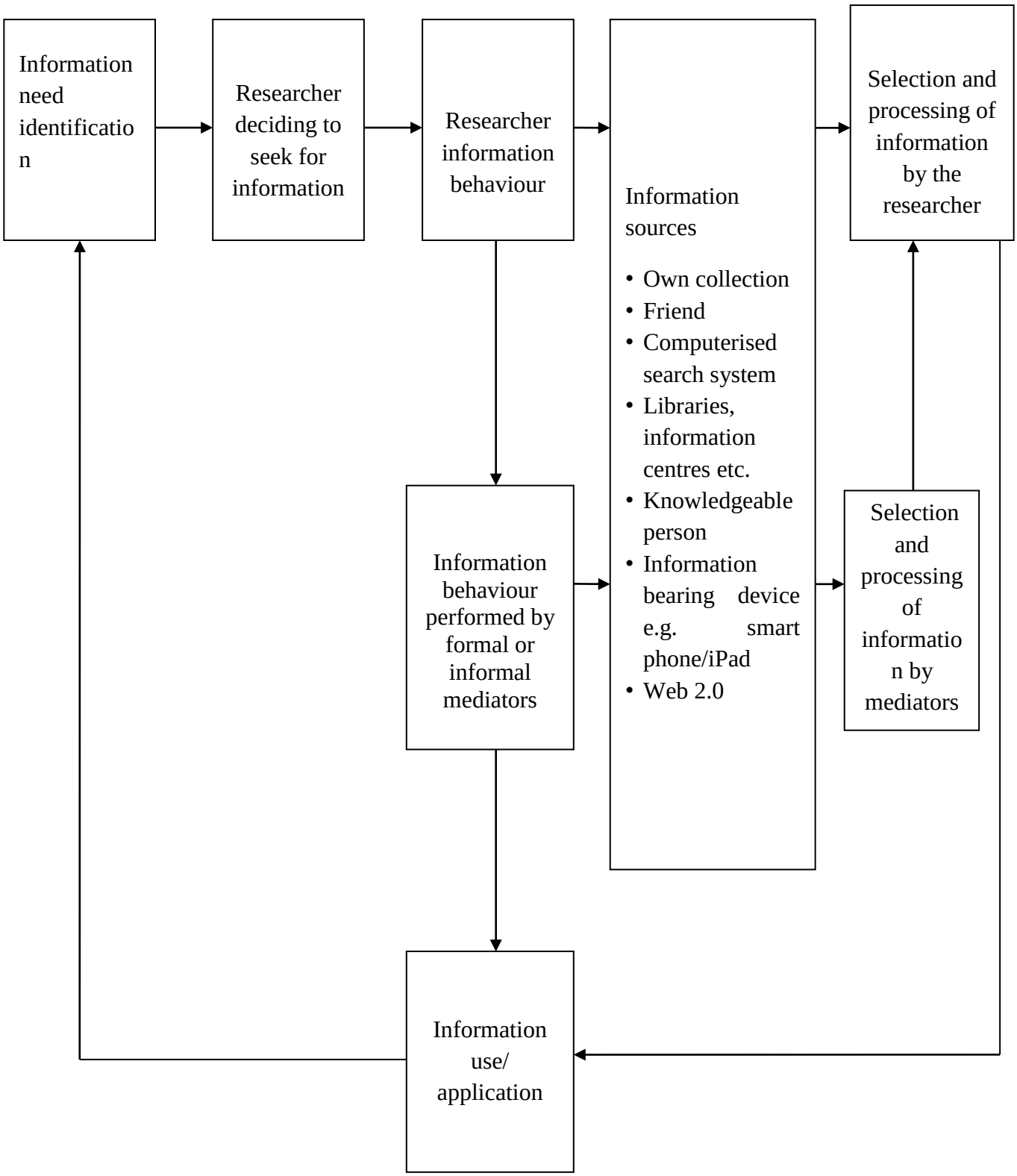
At this juncture, a new proposed model of information behaviour for researchers is presented. This model is based on the empirical findings of the study and ideas from other models which are presented in Chapter 3. All the models discussed in Chapter 3 are valuable and are considered significant in explaining the information needs and information-seeking behaviour of researchers.

To this effect, the researcher's proposed model of information behaviour suggested for this study and presented in Figure 6.1 is a result of the ideas of Wilson's 1999 model of information behaviour in Chapter 3.

Figure 6.1 shows two basic approaches to information seeking as researchers satisfy their information needs – a researcher seeking for information personally or a researcher using the assistance or services of people, devices or systems. A researcher applies his own knowledge and available resources and interacts with search systems, devices and information services (making use of databases, catalogues, archives, search engines etc.). The researcher may also select and process the acquired information personally (the use of smart phones/iPads or Web 2.0) or make use of various mediators and their services (information specialists, subordinates, co-workers), and utilise the effects of their information seeking and processing. The researcher may almost entirely depend upon mediators, and s/he acts freely only at the stage of mental processing of information. However, essentially it is a mediator who engages in systematic information activities: asking, seeking and searching, for this kind of researcher.

However, it should be noted that the recognition of a major behaviour is very important for the design and organisation of a system that provides information for a particular category of researchers, and the first crucial step of any research conducted into researchers' behaviour and needs.

Figure 6.1: A new proposed researcher's information behaviour model



Source: Own

6.8 SUGGESTIONS FOR FURTHER RESEARCH

The study focuses on the information needs and information-seeking behaviour of the researchers at the Federal Institute of Industrial Research Oshodi. The researcher believes that it is necessary to carry out further research on the topic. Such studies may include:

1. Researches covering the use of other information behaviour models [apart from Wilson's 1999 model used in this study] to describe the information needs and information-seeking behaviour of FIIRO's' researchers should be carried out.
2. The investigation of the financial angle of the information needs and information-seeking behaviour of FIIRO's researchers in the context of how much they spend in obtaining or accessing research information should be undertaken. This emanates from the fact that the study indicate that researchers accessed information resources from their institute's offices and homes using their personally provided resources which results in them incurring some expenses.
3. Use a different methodological approach, such as focus group discussions for researchers and questionnaires for professional librarians.
4. Future studies should take into account investigating how other ICTs such as Web 2.0, among others, influence the information behaviour of the researchers.
5. An academic study is needed to identify the ICT knowledge gaps of researchers and propose the necessary content that should be covered during information skills/competencies training for researchers. This emanates from the contradiction that the study highlights that the researchers have a high level of ICT skills/competencies but have poor formal training in the area of searching manual and web information (sections 5.5.4 to 5.5.6).

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APPENDICES

APPENDIX A: QUESTIONNAIRE ON INFORMATION NEEDS AND INFORMATION SEEKING BEHAVIOUR OF RESEARCHERS IN AN INDUSTRIAL RESEARCH INSTITUTE IN NIGERIA

Dear participant,

I am a PhD student in the Department of Information Science, University of South Africa (Unisa), South Africa. I am undertaking a doctoral research on information needs and information seeking behaviour of researchers in an industrial research institute in Nigeria. The purpose of the study is to investigate information needs and information seeking behaviour of researchers in an industrial research institute in Nigeria.

As a researcher of the Federal Institute of Industrial Research Oshodi Nigeria, you have been selected to (voluntarily) participate in the study. Consequently, I hereby request that you complete this questionnaire as appropriate. I wish to assure you that all responses will be treated in utmost confidence and used only for the purpose of the research.

Thanking you for your cooperation.

Mr. Olayinka Makinde with Student number 58528318 (powermakinde@yahoo.com)

Instruction for completing the questionnaire

Most of the questions in this questionnaire require you to tick the answers as they apply to you. However, a few questions will need you to fill in short answers.

Section A - Background information of researchers

1. Department/Location:

Food Technology Department	[ ]
Project Development and Design Department	[ ]
Biotechnology Department	[ ]
Chemical Fibre and Environmental Technology Department	[ ]
Production, Analytical and Laboratory Management Department	[ ]

Planning, Technology Transfer and Information Management [ ]

2. Indicate your highest qualification:

Bachelor's degree [ ] Post-graduate diploma [ ] Master's degree [ ] DPhil/PhD [ ]

Other (please specify): ……

3. Gender: Male [ ] Female[ ]

4. Age range: 20 – 29 [ ] 30 – 39 [ ] 40 – 49 [ ] 50 years and above [ ]

5. For how many years have you worked as a researcher in FIIRO?

1 – 5 [ ] 6-10 [ ] 11-15 [ ] 16 -20 [ ] 21-25 [ ] 26 years and above [ ]

6. In the department you work, what are your main areas of research?

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Section B - The information needs of researchers

7. As a researcher when do you require information? (Select all options applicable to you)

When carrying out research	[ ]
When solving personal needs	[ ]
When attending to clients' needs (consultation)	[ ]
When attending to academic needs (e.g. writing professional exam etc.)	[ ]
For general awareness	[ ]
For work related discussions	[ ]

Other (please specify): ……

8. What type of information do you require as a researcher? (Select all options applicable to you)

Analytical research	[ ]	Food safety & quality management	[ ]
Laboratory management & services	[ ]	Polymer & textiles	[ ]
Electrical & electronics engineering	[ ]	Fabrication technology	[ ]
Packing technology	[ ]	Nutrition & toxicology	[ ]
Agricultural sciences	[ ]	Microbiology	[ ]
Biochemistry	[ ]	Baking & milling	[ ]
Mechanical engineering	[ ]	Enzyme technology	[ ]
Analytical marketing	[ ]	Pulp & paper technology	[ ]
Production	[ ]	Chemical technology	[ ]
Project & process development	[ ]	Materials development & metallurgy	[ ]
Works & services	[ ]	Environmental technology	[ ]
Product development	[ ]	Product quality evaluation	[ ]
Waste biology & fermentation	[ ]	Molecular biology & genetics	[ ]

Prototype equipment design & specifications [ ]

Other (please specify): .....

9. What information do you need as a researcher in terms of your personal needs?

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Section C - Information sources used by researchers

10. When in need of information, in which sequence do you make your consultation? (Please range the sequence of consultation from 1 to 4)

Library [ ]

Internet [ ]

Colleagues [ ]

Personal collection [ ]

11. When in need of information, which sources do you consult first?

Print sources [ ] Electronic sources [ ]

12. If given the option, which information sources would you prefer to satisfy your information needs in terms of research journal articles/references material? (Please range the sequence of preference from 1 to 3)

Print copy [ ]

Electronic copy [ ]

Both (Print & Electronic) [ ]

13. Please provide reason(s) for your preference sequence of information sources in question 12

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14. How important are the following sources of information (formal or informal) in keeping up-to-date with scientific developments in industrial research (your own and related fields)?

Scale: 1= very important 2= important 3= not important

Information source	**Relative importance**
Journal articles	
Review articles	
Conference abstracts and proceedings	

Books	
Professional meetings/ workshops	
Sources of contents (content pages)	
Indexes and abstracts of journals	
Research reports/ patents /fact sheets	
Technical reports	
Pamphlets/ leaflets	
Internet sources	
Theses and dissertations	
Newsletters	
Library catalogue	
Face-to-face conversations/ discussions with colleagues	
Email/ blogs/webinar/ discussion forums	
Librarian/ library staff	
Knowledgeable person in the field	

15. How often do you consult the following information sources using the scale below:

Scale: 1= Often 2= Sometimes 3= Never

Information source	**Frequency of access**
Journal articles	
Review articles	

Conference abstracts and proceedings	
Books	
Professional meetings/ workshops	
Sources of contents (content pages)	
Indexes and abstracts of journals	
Research reports/ patents /fact sheets	
Technical reports	
Pamphlets/ leaflets	
Internet sources	
Theses and dissertations	
Newsletters	
Library catalogue	
Face-to-face conversations/ discussions with colleagues	
Email/ blogs/webinar/ discussion forums	
Librarian/ library staff	
Knowledgeable person in the field	

16. How do you become aware of other less recent books and journal articles? (Select all options applicable to you)

Citations at end of journal articles [ ]

Citations at end of book chapters [ ]

Browsing through older volumes [ ]

From the librarian/ library staff [ ]

Retrospective searching of indexes/ abstracting tools [ ]

Personal communication [ ]

Other (please specify): .....

Section D – Factors affecting information seeking behaviour of researchers

17. What factors affect your information seeking as a researcher and as a result form your information seeking behaviour when you seek for information related to your research work? (Select all options applicable to you)

Time [ ]

Limited financial resources [ ]

Source of information [ ]

Nature of the problem [ ]

Accessibility [ ]

Familiarity and prior success [ ]

Trustworthiness [ ]

Other (please specify): .....

18. What challenges do you have with searching information in a manual environment? (Select all options applicable to you)

Indexing [ ]

Issuing [ ]

Circulation [ ]

Cataloguing/Classification [ ]

Time factor [ ]

Other (please specify): .....

19. What challenges do you have with searching electronic resources? (Select all options applicable to you)

Issues with referencing e-resources	[ ]
Reliability of e-resources	[ ]
Electrical power stability	[ ]
HTML documents	[ ]

Other (please specify): .....

20. Have you ever received any formal training or orientation as to how to search for scientific/technical information in a manual environment? Yes [ ] No [ ]

21. Have you ever received any formal training or orientation as to how to search for scientific/technical information in an electronic/web environment? Yes [ ] No [ ]

22. If Yes in question 20, what was covered in the formal training or orientation for searching scientific/technical information in manual environment?

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23. If Yes in question 21, what was covered in the formal training or orientation for searching scientific/technical information in electronic/web environment?

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Section E - Evaluating the accessibility of information by researchers

24. Is the accessibility of information easy for you as a researcher at the institute's library? Yes [ ] No [ ]

25. If No in question 24, what factors are responsible for the difficulty faced by you as a researcher in the accessibility of research information at the institute's library? (Select all options applicable to you)

Lack of awareness	[ ]
Information explosion	[ ]
Bibliographic obstacles	[ ]
Environment	[ ]
Declining budgets and rising costs	[ ]
Costs of accessing information	[ ]
Library staff (lack of skills or cooperation/unwilling to help)	[ ]
Poor infrastructure	[ ]

Other (please specify): ……

26. If Yes in question 24, what other factors will further aid accessibility of research information at the institute's library for researchers?

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27. What major challenges do you face as a researcher when accessing web-based information? (Select all options applicable to you)

Information overload [ ]

Web site navigation [ ]

Financial concerns [ ]

Loss of browsability [ ]

Reliability of information [ ]

Scholarly misconduct and misinformation [ ]

Other (please specify): ……

28. How do you obtain journal articles? (Select all options applicable to you).

Personal subscription to print journals [ ]

Personal subscription to online version [ ]

Library's online/electronic version [ ]

Library's print subscription [ ]

E-archive [ ]

Interlibrary loan [ ]

Document delivery [ ]

Other (please specify): ……

29. How often do you access online journals outside the institute?

Often [ ] Sometimes [ ] Never [ ]

30. How has electronic dissemination of research information affected your information-seeking habits in the last five years?

Very different (I use completely different sources than I did five years ago.)[ ]

About the same (I still use the same sources as I did five years ago.) [ ]

None (no influence) [ ]

31. Specify the databases/archives/indexes in the field of science and technology that you have used in the last six months? (Select all options applicable to you)

Africa Journals Online [ ]

Agricultural & Environmental Science Database [ ]

Google scholar [ ]

Science Citation Index Expanded [ ]

Science Open [ ]

Scientific Information Database [ ]

SciFinder Scholar on the Web [ ]

SCOPUS [ ]

Web of Science Citation Indexes [ ]

Other (please specify): ……..…

32. Where did you access these databases/archives/indexes that you selected in question 31?

FIIRO Library [ ]

Office [ ]

Home [ ]

Another library outside FIIRO library [ ]

Section F – Information communications technology infrastructure at the institute

33. Which ICT resources do you have access to in the office/organisation? (Select all options applicable to you)

ICT resources and services	**Availability**	
	Yes	**No**
Computers		
Printers		
Land telephone		
Fax		
Television		
Radio		
Mobile/Cell phone		
Video recorder		
Internet		
E-mail		

Other (please specify): .....

34. For what purposes do you use the above ICT resources and services? (Select all options applicable to you)

To communicate with researchers	[ ]
Professional communication with colleagues	[ ]
Personal communication with friends, etc	[ ]
For purposes of research	[ ]
For educational purposes	[ ]
To communicate with publishers	[ ]

35. How would you rate the ICT infrastructure of your office/department?

Very good [ ] Good [ ] Poor [ ]

36. How would you rate your ICT skills/ competencies?

Very good [ ] Good [ ] Fair [ ] Poor [ ]

37. Has the use of information technology affected your visit to the institute's library?

Yes [ ] No [ ]

38. If yes in question 37, in which ways?

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39. If No in question 37, what alternatives have you been using? Please explain

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40. How often do you use mobile phones/iPad in getting research information?

Often [ ] Sometimes [ ] Never [ ]

41. Do you consider the mobile phone/iPad more helpful in getting research information than using FIIRO library? Yes [ ] No [ ]

42. Please rate the social media tools that you utilise when carrying out research work or when communicating with other researchers using the scale below:

Scale: 1= Very often 2= Often 3= Sometimes 4= Never

Social media tool	**Usage**
Facebook	
Twitter	
LinkedIn	
Google+	
Instagram	
Pinterest	
Wikipedia	

Other (please specify): ……

Section G - Information services provision to meet researcher's information needs

43. Are you a regular visitor to your institute's library: Yes [ ] No [ ]

44. If Yes in question 43, how many hours do you spend in the library per week?

Less than 5hrs/week [ ]

5-10hrs/week [ ]

10-20hrs/week [ ]

20-30hrs/week [ ]

45. How often do you request for assistance during information seeking from library staff?

Often [ ] Sometimes [ ] Never [ ]

46. Do you always find the information you are seeking for from the library? Yes [ ]No[ ]

47. Do you consult other libraries other than your institutional library? Yes [ ] No [ ]

48. If Yes in question 47, indicate which ones:

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49. How would you rate the institute's library, in terms of its collection of books, journals and services offered?

Very good [ ] Good [ ] Fair [ ] Poor [ ]

50. Generally when you try to search for a particular piece of information yourself (i.e. without anybody's assistance, guidance, etc.), please state how long it takes to find the needed information in the library?

Within a day [ ]

Within a week [ ]

Within a month [ ]

Over a month [ ]

Difficult to find the needed information without proper

assistance/guidance [ ]

51. What actions do you take after search failure?

No action [ ]

Come back later and try reserved collections [ ]

Try another library [ ]

Find from a friend [ ]

Borrow from a friend [ ]

Consult staff member (i.e. colleague and librarian) [ ]

Others (please specify): ……

52. How do the librarians and library staff assist you in the conduct of your research? (Selection of research projects, selection of research tools, preparation of bibliography, by providing bibliography etc.)

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53. How helpful are the librarians and library staff in assisting you to find information for your research?

Helpful [ ] Neutral [ ] Not very helpful [ ]

54. What type of information services do you prefer as offered by the institute's library? (Select all options applicable to you)

Abstracting/Indexing services [ ]

Circulation [ ]

Content page service [ ]

Database/OPAC search browsing [ ]

Display board service [ ]

Inter library loan [ ]

Newspaper clipping services [ ]

Reference service (SDI: Selective dissemination of information) [ ]

Printing, scanning and photocopy facilities [ ]

Technical enquiry services [ ]

Others (please specify): ……

55. How do you rate the type of information services that you prefer as delivered by your institute's library staff?

Information services delivered by library staff	**Excellent**	**Good**	**Poor**
Abstracting/Indexing services			
Circulation			
Content Page Service			
Database/OPAC search Browsing			
Display Board Service			
Inter Library Loan			

Newspaper Clipping Services			
Reference Service (SDI: Selective dissemination of information)			
Current Awareness Services)			
Printing, scanning and photocopy facilities			
Technical Enquiry Services			

56. Are you satisfied with present information services? Yes [ ] No [ ]

57. If No in question 56, explain:

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58. What new or different information services would you like to see provided by the library?

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59. What would be the most effective way for the library to keep you informed about your changing information needs i.e. preference for receiving library communications? (For example: when you are working on a new project)

Email	[ ]
Telephone	[ ]
Department meetings	[ ]
Written memos	[ ]

Other (please specify): ……

60. In your own opinion, what are the shortcomings of the library in supporting your information needs?

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61. In your own opinion, what are the successes of the library in supporting your information needs?

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62. Please feel free to add any other comments on library resources/information services that your library has offered.

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Thank you very much for your co-operation and time.

APPENDIX B: INTERVIEW SCHEDULE FOR PROFESSIONAL LIBRARIANS

Date: .....

A. Background information

1. Personal information

i Status (position in the library): ……..

ii Gender: ……

iii. Years of experience as a librarian at the institute: .....

iv. Highest qualification obtained: ……

2. What are the library's opening and closing times?

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3. What is the membership of library patrons/users especially researchers?

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4. Does the library allow membership from non-governmental users (be it researchers or non-researchers from outside the institute)?

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5. Comment on the library's sitting, shelving and office space.

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B. The information needs of researchers

6. Which category of researchers (the department or discipline in the institute) would you say frequent the library most?

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7. Which information do they need most?

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8. What information needs are you aware of that you cannot address?

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C. The information sources used by researchers

9. What type of material is mostly used and in which subject areas?

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10. Could you please comment on the type of materials held in the library?

- Number of books

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  ……
  ……
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- Number of journal titles

  ……
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- Research reports

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- Conference proceedings

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  ……

- Multimedia collection, etc.

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11. How current would you say the collection is?

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12. Any material/library collection held by the library of other languages that needs translations?

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13. If Yes, what step is the library taking to translate the materials/library collection into English?

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D. Factors affecting information seeking behaviour of researchers

14. What time/period is information mostly sought by researchers?

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15. How frequent do you assist researchers in searching for research information?

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E. Accessibility of information by researchers

16. Any alternative information access services provided by the institute's library?

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F. Library collections

17. What is the library's annual budget?

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18. How many titles do you add to the collection per year?

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19. Does the library receive donations of books and other materials?

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20. Who participates in the selection of library materials (books, journals etc)? Does the library have a Library Committee? If so, what is its membership?

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G. ICT infrastructure in the library

21. What role do ICTs play in communicating research information to researchers in the library?

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22. Which ICTs does the library have?

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23. Are the services fully automated?

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24. Does the library have Internet connection?

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25. What challenges do you have with the use of ICT infrastructure in the library as a librarian?

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26. Do you make use of Web 2.0 (social media) in communicating with researchers in terms of addressing their information needs?

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27. If Yes, how helpful is the social media in communication research information?

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28. Does the library have a webpage that gives adequate information to researchers in terms of their information needs?

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29. If Yes, what information is found on the webpage?

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30. How many computers are there in the library and how many are available to researchers?

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31. Does the library subscribe to electronic resources/journals (e.g. Africa journals online, Web of science citation indexes, Science citation index expanded)?

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32. If Yes, mention them.

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33. Does the library provide access to Open Source resources available on the Internet?

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34. If Yes, what has been the response of researchers to this?

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H. Information services/Partnership by institute's library

35. How would you say the library supports researchers of the institute?

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36. Does the library provide any current awareness services to researchers? (SDI, notice boards, RSS feeds, etc.)

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37. Does the library provide any user education programmes to researchers?

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38. Does the library collaborate with other libraries/information centres nationally and internationally?

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39. If Yes, state areas of collaboration.

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40. As the Central Library of the institute, what are your responsibilities with regards to other Ministry of Science and Technology libraries, including those of colleges/departments of science and technology?

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41. What information services and products do you currently provide to support the information needs of researchers?

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42. Would you say that researchers are satisfied with the level of services and resources provided by institute's library? Please explain.

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43. What recommendations would you propose in improving information service delivery to researchers?

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44. What would you say are the library's strengths and challenges?

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I. Skill acquisition and professional development

45. What skills or professional development initiatives (training/courses) did you attend in the last two years in preparation to provide support to researchers in terms of their information needs?

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Thank you very much for your co-operation and time.

APPENDIX C: OBSERVATION GUIDE OF FIIRO LIBRARY

Objective: To give a thorough assessment of the library in terms of: (Including ergonomics aspects)

1. Physical location of FIIRO Library (to include whether it is standalone building or attached?)

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2. Office space for library staff

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3. Lighting (to encourage usage in terms of illumination of library rooms) and size of FIIRO library

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4. Shelving and sitting space in the library

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5. Availability of computers and other ICTs for library users (including internet, printing facilities)

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6. Library guides for library users

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7. Collection outlook and usage of library materials. Browsing of date stamps will also be looked into to determine currency of library materials

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8. In addition, other facilities present within the research institute that pertain to information needs and information seeking behaviour of researchers as seen by the researcher as the research study progresses will also be observed and documented.

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APPENDIX D: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

6, Professor Tunji Bello Street
Ibeju Lekki
Lagos
25 August 2016

The Director General
Federal Institute of Industrial Research Oshodi
Lagos

Dear ma,

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT FIIRO

I hereby apply for a letter of consent to carry out my doctoral research work at FIIRO. I am Makinde, Olayinka Babayemi. A PhD student of the Department of Information Science, University of South Africa, Pretoria.

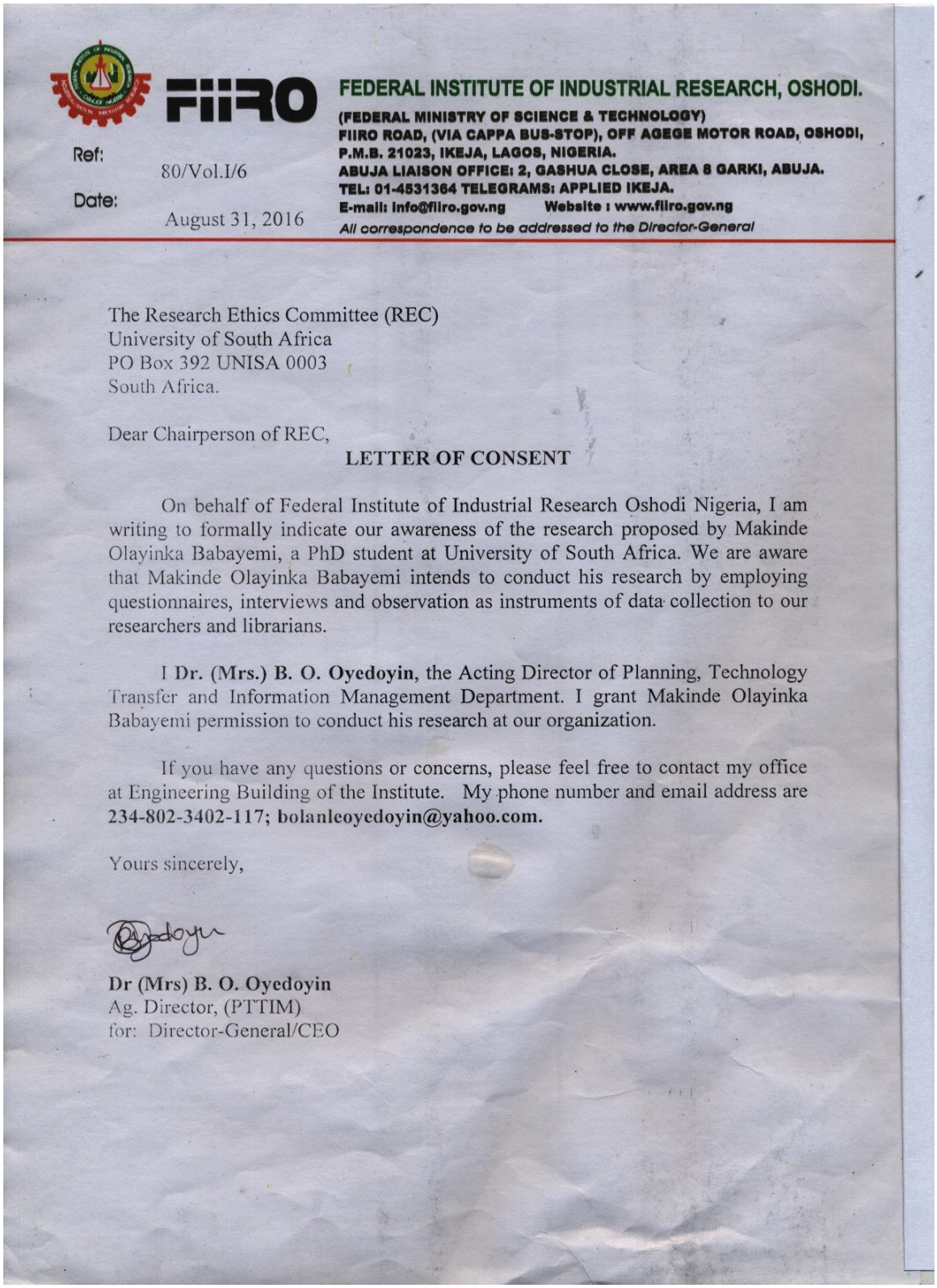
My research is based on the Information Needs and Information Seeking Behaviour of Researchers in an Industrial Research Institute in Nigeria. A survey research is going to be carried out with data being gathered from FIIRO researchers.

Attached is the template permission letter from University of South Africa. This is expected to be the format the permission letter will follow.

Thank you for your anticipated co-operation.

Yours faithfully
Olayinka Babayemi
Olayinka Makinde

APPENDIX E: CONSENT LETTER FROM THE INSTITUTE



FIIRO

FEDERAL INSTITUTE OF INDUSTRIAL RESEARCH, OSHODI.

(FEDERAL MINISTRY OF SCIENCE & TECHNOLOGY)
FIIRO ROAD, (VIA CAPPA BUS-STOP), OFF AGEGE MOTOR ROAD, OSHODI, P.M.B. 21023, IKEJA, LAGOS, NIGERIA.
ABUJA LIAISON OFFICE: 2, GASHUA CLOSE, AREA 8 GARKI, ABUJA.
TEL: 01-4531364 TELEGRAMS: APPLIED IKEJA.
E-mail: info@fiiro.gov.ng Website : www.fiiro.gov.ng
All correspondence to be addressed to the Director-General

Ref: 80/Vol.I/6

Date: August 31, 2016

The Research Ethics Committee (REC)
University of South Africa
PO Box 392 UNISA 0003
South Africa.

Dear Chairperson of REC,

LETTER OF CONSENT

On behalf of Federal Institute of Industrial Research Oshodi Nigeria, I am writing to formally indicate our awareness of the research proposed by Makinde Olayinka Babayemi, a PhD student at University of South Africa. We are aware that Makinde Olayinka Babayemi intends to conduct his research by employing questionnaires, interviews and observation as instruments of data collection to our researchers and librarians.

I **Dr. (Mrs.) B. O. Oyedoyin**, the Acting Director of Planning, Technology Transfer and Information Management Department. I grant Makinde Olayinka Babayemi permission to conduct his research at our organization.

If you have any questions or concerns, please feel free to contact my office at Engineering Building of the Institute. My phone number and email address are **234-802-3402-117; bolanleoyedoyin@yahoo.com.**

Yours sincerely,

Dr (Mrs) B. O. Oyedoyin
Ag. Director, (PTTIM)
for: Director-General/CEO

APPENDIX F: CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the <insert specific data collection method>.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..……