ACCESS AND UTILISATION OF KNOWLEDGE AND INFORMATION BY AQUACULTURE FARMERS IN NAMIBIA

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ABSTRACT

This study on access and utilisation of information and knowledge by aquaculture famers in Namibia investigated the knowledge gap that exists between information and aquaculture production by providing research based evidence on the nature and extent of information utilised by aquaculture farmers in Namibia. The study was driven by the main research question; what is the level of access and utilisation of knowledge and information by aquaculture farmers in Namibia?, and it was guided by two theories: Rogers' Diffusion of Innovations (DOI) theory that explained how a new innovation is adopted in society and Kuhlthau's Six Stage model of the Information Search. The mixed methods research design employed a concurrent triangulation approach, combining qualitative and quantitative research approaches. Data collection methods used for the quantitative research were surveys, and semi-structured interviews, observation and document analysis for the qualitative. The population comprised of all fish farmers and their managers in Namibia, and the fish farmers' database at the Ministry of Fisheries and Marine Resources was used as a sampling frame. The survey respondents were selected using a multi stage sampling technique, starting with a simple random sample as well as employing convenient sampling technique while key informants (managers) were selected using the purposive sampling technique. The key findings of the study revealed that fish farmers lacked the required information to fulfil their information needs. They needed the information for problem solving, performing tasks and decision making. The study also showed that fish farmers used different types of information which cuts across different disciplines and this information included agricultural information, health information, environmental information, technological information, business and trade information, and government policies and plans. Several information sources used by fish farmers were newspapers, Internet, textbooks, experts, etc. and they shared information on various topics amongst themselves such as fish markets and harvests, weather forecast, types of fish species, modern fishing methods, site of shoal, fish feeds, and fishing regulations and government policies. The study established that fish farmers could not attend information literacy and knowledge competencies training regularly, though this should not be interpreted to mean that they lacked information and knowledge on aquaculture production. The study proposes an information access and utilisation model (Integrated Aquaculture Information System) that can support aquaculture farmers as users of information, and also highlights the importance of information and knowledge for sustainable livelihoods amongst fish farmers.

Keywords:

Information need, Information use, Information seeking behaviour, Information and knowledge utilisation, Aquaculture information system, knowledge and information, Aquaculture farmers, Fish farmers

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ABBREVIATIONS AND ACRONYMS

AASA	Aquaculture Association of Southern Africa
AFGRP	Aquaculture and Fish Genetics Research Programme
AIIM	Association for Information and Image Management
ALCOM	Aquaculture for Local Community Development Programme
ANAF	Aquaculture Network for Africa
ATFALCO	The Ministerial Conference on Fisheries Cooperation among States Bordering the Atlantic Ocean
BEE	Black Economic Empowerment
CBO	Community Based Organisation
CTA	The Technical Centre for Agricultural and Rural Co-operation
DOI	Diffusion of Innovation
EBSCO	Elton B. Stephens Co.
FAO	Food and Agriculture Organisation
GRN	Government of Namibia
HINARI	Health Inter-Network Access to Research Initiative
ICLARM	International Center for Living Aquatic Resources Management
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IGI	Idea Group Publishing
ISP	Information Search Process
IPPR	Institute of Public Policy and Research
MARD	Ministry of Agriculture and Rural Development
MFMR	Ministry of Fisheries and Marine Resources
MICT	Ministry of Information and Communication Technology
MOARD	Ministry of Agriculture and Rural Development

NACA	Network for Aquaculture Centres in Asia-Pacific
NAERLS	National Agricultural Extension and Research Liaison Service (Nigeria)
NATMIRC	Namibia Marine Information and Resource Centre
NDP	National Development Plan
NGO	Non-Governmental Organisation
NPC	National Planning Commission
NSA	National Statistics Agency
NSSO	National Sample Survey Organisation
NYU	New York University
OP	Office of the President
OPM	Office of the Prime Minister
OARE	Online Access to Research in the Environment
PEAP	Poverty Eradication Action Plan
PMA	Plan for Modernisation of Agriculture
PRE	President
RADA	Rural and Agriculture Development Agency
RIP	Rest in Peace
SM	Sense Making
UNDP	United Nations Development Programme
WAS	World Aquaculture Society

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DEDICATION

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With lots of love to my kids, Sophia, Winnie and Willard, you need to take a leaf from this report. I have raised the bar high and this should be your yardstick, which you must all aim to aspire.

DECLARATION

I, Wilson Yule, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

I, Wilson Yule, grant The University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which The University of Namibia may deem fit.

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Name of Student	**Signature**	**Date**

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter includes an explanation of the area of the research and builds upon the context for the problem at hand. According to the Sacred Heart University (2019), the background of a study should also explain the problem that the study addresses and provides a brief account of the history of the problem mentioning whether it has been addressed in any form before, which then leads up to the research questions and the aims of the study. The outline of this chapter begins with the orientation of the study (1.2) which introduces the topic and shows that there is a symbiotic relationship between information and aquaculture production. The statement of the problem (1.3) highlights the missing link and leads into the research questions (1.4), which are critical tools to the research topic. The significance of the study (1.5) outlines the purpose and usefulness of the study to the disciplinary focus; and the limitations of the study (1.6), highlighting the major weaknesses of the study, which affected its findings, followed by the scope of the study (1.7) which shows the delimitations and the boundaries of the study. A summary of the methodology (1.8) is provided and organisation of the thesis (1.9) is also explained and the chapter concludes with a summary (1.10).

1.2 Orientation of the study

In Namibia, the emphasis on aquaculture is quite huge as noted by the former President, His Excellency Dr Sam Nujoma, who echoed that aquaculture development was a government priority and was in-line with the country's national development strategies with a significant role to play in enhancing food security and alleviating poverty and creating employment (Office of the President, 2004). However, in most African countries as indicated by Palamar (2002), a lack of government support in establishing a proper information infrastructure on aquaculture is seen as the underlying factor for the decline of information sharing and information services among aquaculture farmers. A study by FAO (2001) also noted that a lack of access to timely and accurate information has been identified as one of the constraints to the implementation of the 1995 Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries.

Information on aquaculture and fish farming technologies that are needed by fish farmers, according to Ofuoku, Emah and Itedjere (2008), include pond management and construction, breeds and spawning, weather patterns, disaster preparedness, etc. The challenges with accessing and utilising relevant and timely information on aquaculture were first tackled at the Conference on Aquaculture in the Third Millennium held in February 2000 in Bangkok. As a response to challenges faced on aquaculture information, the conference concluded by adopting a blue print named the Bangkok Declaration and Strategy for Aquaculture Development. The declaration identified and advanced a number of issues related to aquaculture information that needed to be addressed. These included poor understanding of the purpose of information and information activities, and lack of reliable information.

Namibia’s aquaculture strategic plan (MFMR, 2004), Vision 2030 and National Development Plan (NDPII), state that the aquaculture sector is expected to enhance food security, reduce poverty and increase investment. However, in all these blue-prints there is no mention of the role of information in nurturing and developing the aquaculture sector and yet it is a common fact (as pronounced by FAO and the Bangkok Declaration) that the development of the fishing industry in Namibia needs to be supported by proper and effective information infrastructure.

Despite the achievements being recorded and the priority accorded on the aquaculture sector, there is a lack of literature concerning access and utilisation of knowledge and information by aquaculture farmers in Namibia. The information provided is exclusively focused on policy makers, researchers, and those who manage policy decisions with little attention paid to the information needs of the targeted beneficiaries such as aquaculture farmers. To sustain this development, it becomes imperative that information on and for fish farmers be provided.

1.2.1 Conceptualisation of key terms

In this section, important key concepts are defined for the present study. As described in the introduction section, the study has a focus on concepts, such as; aquaculture, aquaculture farmers, information access information utilisation, aquaculture information and knowledge which are defined as follows:

FAO (1988) posits that aquaculture, also known as aqua-farming or fish farming is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming in this case, according to FAO (1988) implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. and it implies individual or corporate ownership of the stock being cultivated. On a technical level, aquaculture is defined in Namibia’s Aquaculture Act (no. 18 of 2002) as “the farming and ranching of aquatic organisms” (MFMR, 2004, p. 2). On a popular level, aquaculture is sometimes referred to as “fish farming”. For the purposes of this study, the term “aquaculture” includes all aspects of the technical definition such as aquatic organisms that are harvested by an individual or corporate body, which has owned them throughout their rearing period (Graham, 2001).

Aquaculture farmers are defined as farmers who raise fish and shellfish for the purposes of consumption, selling, population restocking, or for use as bait (Kramer, 2012). Kramer (2012) further explains that farmers are also responsible for feeding the fish, restocking, performing tests to ensure water quality and temperature, checking the health of the population, notifying veterinarians of any health concerns, and properly cleaning and maintaining ponds or tanks and sometimes these include technicians, supervisors and their managers working in fish farms. This study looked at the role of aquaculture farmers as people who are responsible for rearing fish and other aquatic livestock such as oysters, marron, crayfish and prawns. They may work in the open seas or in specially prepared areas such as tanks, dams or shallow rivers that contain cages. The farmers determine when to harvest their livestock, and oversee its harvesting, grading and transportation. They also organise the sale of their stock and manage the business side of their farm (FAO, 2002).

According to AIIM (2002), information access is the findability of information regardless of format, channel, or location. This definition is based on a growing recognition in the industry that what matters is not how searchable the information is, but how findable, which places the greatest emphasis on the success of the information management regimen and capacity to incorporate an effective user experience into the search process. Gartner (1999) on the other hand, defines information access as a collection of technologies to include and expand on what they previously called “enterprise search technology, that helps an individual to find information, such as; enterprise search, content classification, categorisation and clustering, fact and entity extraction, taxonomy creation and management and information presentation (for example visualisation). In the context of this study, “information access” includes receiving messages related to aquaculture production activity from different sources and extension methods such as mass media, extension service (advisory service, orientation about seasonal activities information, training, field days, demonstration, visits), on-farm research including its frequency (Swanson & Rajalahti, 2010).

Todd (1996, p. 16) posits that “information utilisation focuses on what people in a range of contexts do with information that they seek out or being provided to them”. Todd (1996) further notes that the study of information utilisation as an “act” or "doing" has focused particularly on two dimensions: (1) action, a behavioural "doing", and (2) thinking, a cognitive "doing". Underpinning this focus is the assumption that information has the potential to influence, to make a difference to the thoughts, actions and emotions of people. By information utilisation, one is interested in the outcomes of applying and working with information as perceived and experienced by aquaculture farmers. In the context of aquaculture farming, this is where-by the farmers perform aquaculture production or activities by using information and apply it into action.

Aquaculture information is operationally defined as the various sets of information and messages that are relevant to aquaculture production activities of farmers such as fish breeding, production and protection, fisheries production and management, and natural resource production and conservation (FAO, 2002). In the context of this study, aquaculture information does not include market information (Boyd & Rafferty, n. d.). Information, as suggested by Agbamu (2006), is defined as all published or unpublished knowledge in all aspects of subject discipline. Agbamu

(2006) further classified information into four categories namely, technical, commercial, socio-cultural and legal information. However, in this study fish farming information can be considered as all published or unpublished knowledge in all aspects of fish culture production (Ofuoku, Emah & Itedjere, 2008).

Unlike information, knowledge cannot be encapsulated in the form of messages. FAO (2009) suggests that information is what individuals and communities make of the information they receive and how they themselves process it. Individuals or communities do not acquire knowledge as something ready-made and packaged; “they build it within their culture and through the cultural exchanges and interactions in which they participate” (FAO, 2009, p. 23). Different people define the word knowledge in different ways. Knowledge is "information” combined with experience, context, interpretation, and reflection (FAO, 2009). It is a high-value form of information that is ready to apply to decisions and actions (Davenport et al., 1998). This study conceptualises knowledge is the human expertise stored in a person’s mind, gained through experience and interacts with the person’s environment.

1.3 Statement of the problem

Regardless of Namibia’s strong fishing industry due to the abundance of fish species, literature remains silent concerning the kind of information accessed and utilised by aquaculture farmers in nurturing, sustaining and developing their fish farms as has been revealed by FAO (2001). Studies by Mugwisi, Ocholla and Mostert (2012), Jorosi (2006), Mabhiza (2016), and Chiware (2008) conducted in the Southern African region particularly in Botswana, Namibia, South

Africa, Zambia and Zimbabwe, have focused primarily on information needs and information seeking behaviour of different specialist groups such as extension workers, veterinarians, engineers, and students, with almost no emphasis on access and utilisation of information by aquaculture farmers. Studies carried out in Nigeria by Ofuoku, Emah and Itedjere (2008) and in Ghana by Quagrainie, Amisah and Ngugi (2009), have shown that there is a symbiotic relationship between information support and aquaculture production. In the context of Namibian aquaculture production, the symbiotic relationship between information support and farmers is not known as evidenced by the studies above. This study therefore attempted to address this knowledge gap between information and aquaculture production by providing research based evidence on the nature and extent of information accessed and utilised by aquaculture farmers in Namibia.

1.4 Research questions

The main research question of this study was: What is the level of access, utilisation and sharing strategies of knowledge and information by aquaculture farmers in Namibia? This main research question was supported by the following sub-research questions:

- What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?
- What are the information and knowledge sources including sharing strategies of aquaculture farmers?
- What are the information literacy levels and knowledge competencies of aquaculture farmers?
- What are the policies governing information and aquaculture production in Namibia?

- What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?
- What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?

1.5 Significance of the study

Findings from this study could be used to inform and propose policy interventions, planning and decision making with regards to the role of information and knowledge utilisation in the aquaculture sector. The study also proposed an information access and utilisation model which can be adapted to benefit and used to understand the behaviour of aquaculture famers and other similar groups in their daily lives as users of information.

1.6 Limitations of the study

The sample size in terms of data collected through surveys was a limiting factor in the sense that the respondents were few since not every farmer in Namibia is involved in fish farming, and as a result it was difficult to find significant relationships from the data since statistical tests normally require large sample sizes to ensure representative distribution (Creswell, 2003) on which results should be generalised. The study did not look at access and the utilisation of information in the entire fisheries sector in general and therefore the findings should not be implied to represent it, except for the aquaculture sector (marine and freshwater).

1.7 Scope of the study

The study focused on access and utilisation of information and knowledge by aquaculture farmers in Namibia and this means that it did not focus on the information seeking behaviour in general but only looked on issues of access and utilisation of information and knowledge. The study also did not focus on the fisheries sector in its entirety except for the aquaculture sub sector (marine and freshwater). It neither focused on any area outside Namibia nor any of its jurisdictions outside its borders since the thrust of the study was only focused within the borders of Namibia. The specific information user group targeted in this study was fish farmers in Namibia, which therefore means that any other group of farmers was excluded from this study. The aquaculture sector in Namibia was selected since it was an emerging sector in Namibia and not much of its information support structures were known.

1.8 Research Methodology

A mixed methods research approach employing a concurrent triangulation design combining both qualitative and quantitative approaches was selected for this study. The benefit of employing a mixed methods approach was to ensure that there is a level of complementarity; that is, getting the best of both worlds, a point emphasised by Johnson, Onwuegbuzie and Turner (2007, p. 116), when they proffer that "… researchers should not be trapped in either quantitative or qualitative prisons when they can benefit from integrating the two approaches". The mixed methods approach enabled the researcher to get a fuller picture of the behaviour of aquaculture farmers as users of information; both from farmers' experiences and their managers' perspectives. The population included chief fisheries officers/ farm managers and extension workers as well as the entire fish farmers in the fourteen political regions of Namibia; that is

Erongo, Hardap, Karas, Kavango East, Kavango West, Khomas, Kunene, Ohangwena, Omaheke, Omusati, Oshana, Oshikoto, Otjozondjupa and Zambezi regions.

The major sampling frame was the aquaculture farmers' database at the Ministry of Fisheries and Marine Resources. This database was used as a pointer to various locations where fish farmers and producers were located. The researcher used a multistage sampling technique starting with a simple random sampling, which was used to gain access to the identified locations (catchment areas). From these identified locations, the survey respondents were selected using convenience or accidental sampling technique based on the availability of the respondent (Creswell, 2003). A total of 60 fish farmers including technicians who were working in the ponds (whose work according to the researcher was seen as equal to that of the fish farmers) were included in the survey. In addition, the key informants who in this case, known as managers were sampled purposefully and interviewed in their respective work stations. Nastasi (2004, p. 1) observed that qualitative studies tend to use more purposeful or criterion-based sampling, that is, "a sample that has the characteristics relevant to the research question(s)". The criteria used in selecting these key informants (managers) were based on their positions, which they hold in their institutions and their knowledge of the subject area. Two people were purposefully sampled inclusive of; one (1) chief fisheries officer/ fish farm manager and one (1) extension officer, were interviewed in each region (Kavango East and Kavango West, Zambezi, Omusati, Hardap and Erongo regions), which makes the total of 12 key informants. Institutional documents such as memorandums and minutes dealing with how farmers manage, access, use and share information and knowledge were selected and used for this study.

The qualitative data collection methods used were interviews, which were administered on key informants (12 chief fisheries officers/ fish farm managers and extension workers), document analysis, which was used to search for literature related to fish farming in Namibia, and observations which were conducted on Site A and Site B, which were fish cooperatives. The quantitative data collection method was a survey. The research instruments that were employed to collect qualitative data were semi structured interview guides (Annexure B), observational checklists (Annexure C), and secondary data sources while the quantitative data collection instrument was a semi structured questionnaire (Annexure A).

A procedure is a step by step process which the researcher ought to follow in order to gain access to the subjects (Creswell, 2002). The researcher wrote to the Permanent Secretary (PS), now referred to as Executive Director of the Ministry of Fisheries and Marine Resources, requesting authorisation to conduct the study, of which the authorisation was approved (Annexure E).

A pilot test on similar respondents with similar characteristics was conducted for both surveys and interviews so as to ensure clarity to remove ambiguity and prevent possible confusion from the questions (Bryman, 2008).

The quantitative data collected through the use of the survey instrument was analysed through spreadsheets to present descriptive and inferential statistical information. The analysis of data was descriptive in nature and frequency counts through the use of very often, often, sometimes and rarely which were used to measure access and usage of information and knowledge, and this was presented in graphs, pie charts and tables (See Chapter 5). The qualitative data was analysed using content analysis by checking on the repetitiveness of themes (Denzin & Lincoln, 2000) coming from the interviewees such as need, access and utilisation of information and knowledge. Data gathered through observations was also coded in themes and sub-themes derived from the research questions, and images of fish farmers were presented as they accessed and utilised information in their environments. However, the sample was analysed by combining the benefits of qualitative analysis with quantitative analysis since by integrating qualitative and quantitative analysis of verbal data the interpretation of the results became less subjective. All transcribed interviews including institutional documents were coded into meaningful categories (themes and sub themes) such as access, usage and sharing strategies using the qualitative data analysis software, Microsoft Word.

1.9 Organisation of the Thesis

This thesis is made up of seven (7) chapters in total. Chapter 1 introduces the study and explores an orientation of the study. It presents a statement of the problem, the research questions, the significance of the study, its limitations, research ethics and the scope of the study and a summary of research methodology used for the study. Chapter 1 also outlines the organisation of the thesis. Chapter 2 discusses the context of the study (setting the scene on the information environment and the fisheries sector in Namibia), while Chapter 3 presents the theoretical framework and literature review that guide the study. Chapter 4 discusses the methodology used for the study, while Chapter 5 presents the data analysis and presentation of findings. Chapter 6 is discussion and interpretation of findings. The researcher uses the findings to discuss with the literature in the study. Chapter 7 presents a summary of the findings, conclusions and recommendations. A model (Integrated Aquaculture Information System) was developed to support aquaculture farmers as users of information in Namibia.

1.10 Chapter summary

Chapter one provided the background of study and began with the orientation of the study by highlighting the role that information play in aquaculture production. The statement of the problem highlighted the gap and the symbiotic relationship between information support and aquaculture production. The research used literature to uncover the gap between information and aquaculture production in Namibia and noted that there was a symbiotic relationship between the two. This followed the main research question, which is a critical tool to the research topic: *What is the level of access, utilisation and sharing strategies of knowledge and information by aquaculture farmers in Namibia?* The significance of the study showed the purpose of the study: both in the field of study and its contributions to national development. The limitations of the study focused on the study weakness in relation to the size of sample which could not be generalisable to any fish farmer's community except for the areas under investigation. A brief methodology explaining the research design, population, data collection instruments, as well as reliability and validity considerations were also provided.

The next chapter (Chapter Two) deals with the context of the study.

CHAPTER TWO

CONTEXT OF STUDY

2.1 Introduction

This chapter sets the scene for the research by describing the context of the study and backing up the problem that motivated the research questions, particularly research question number four (4), which states; "*What are the policies governing information and aquaculture production in Namibia?"*. According to Phakisi (2008), the context of a study helps readers understand what they otherwise wouldn't be able to comprehend and this is where the reader is assisted to understand the situation as well as gain a background picture of where the topic emanated from. This chapter begins with outlining general information regarding the demographics of Namibia (2.2), followed by the fisheries industry in Namibia (2.3) and the mandate, functions and operational structure (2.4) of the Ministry of Fisheries and Marine Resources (MFMR). The chapter also provides a briefing of the aquaculture sector in Namibia (2.5) (mariculture and inland aquaculture) as well as a description of the functions of fisheries biologists (2.6) and the status of aquaculture farmers (2.7). The chapter further provides an account of current fisheries/ aquaculture information systems in Namibia (2.8) and concludes with a summary (2.9).

2.2 General information about the demographics of Namibia

The Republic of Namibia is located in the South-Western part of Africa, with an area covering 823,292 km² and has a coastline of 1,500 km (National Statistics Agency (NSA), 2015). According to the Population and Housing Census, the population statistics revealed that Namibia has 2,113,077 inhabitants with 32 percent of the population living in urban areas ((NSA, 2015). Inland water resources in Namibia are extremely scarce and the country experiences prolonged periods of drought, which occur regularly (FAO, 2019). Namibia lies along the South-Western coast of Africa, and is bordered by Angola in the north, Zambia and Zimbabwe in the North-East, Botswana to the east, South Africa in the south, and the Atlantic Ocean to the west. The country is divided into 14 political regions, which are (without any particular order), Oshikoto, Ohangwena, Omusati, Oshana, Kunene, Hardap, Erongo, Kavango East, Kavango West, Zambezi, Khomas, Otjozondjupa, Karas and Omaheke regions (NPC, 2018) (See Figure 2.1 below).

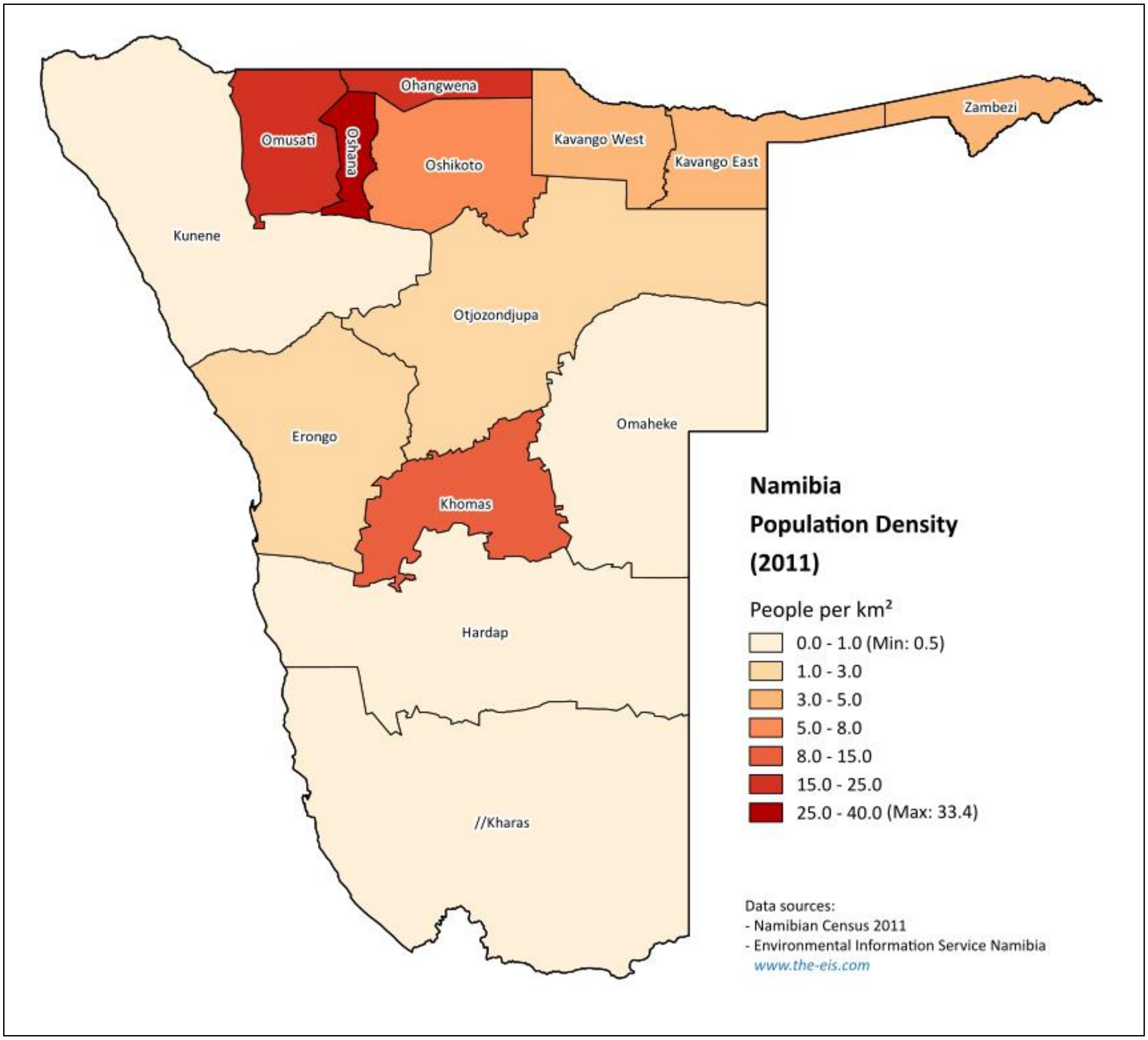


Figure 2.1: Namibia population density according to political regions

2.3 Fisheries industry in Namibia

Namibia is known because of its diversity in flora and fauna, with her contrasting beauty of natural resources found across the country. Namibia is endowed with one of the most productive fishing grounds in the world, based on the Benguela Current System, one of the four Eastern boundary upwelling systems in the world (The Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic Ocean (ATFALCO), 2012). The country regards aquaculture development a priority and it is in-line with Namibia's national strategies of enhancing food security, alleviating poverty and creating employment. The fishing sector in Namibia remains one of the biggest contributors to the local economy, while being the second most important foreign exchange earner for Namibia after mining. According to the Namibian Newspaper of 30 March 2017, the fisheries industry in 2016 provided roughly N$10 billion in foreign exchange. The sector also remains one of the biggest employment creators in the country as it currently sustains 16 800 jobs directly, according to the latest available statistics (MFMR, 2017).

Namibia has a long history of social injustices prior to Independence and in an effort to redress the inequities of the past; the policy of Namibianisation or Black Economic Empowerment (BEE) was adopted and introduced to many facets of life (Institute of Public Policy Research (IPPR), 2007). The fishing sector is a classic example of these inequalities and injustices, whereby prior to Independence the industry was largely owned and managed by foreigners, with some limited participation of white Namibians (Iitembu, 2005). The ATFALCO (2012) report notes that black Namibians that were part of the fisheries industry prior to independence held lowly paid jobs, worked mostly as seasonal workers in on-shore fish processing plants. As a consequence of Namibia's colonial past, the country inherited severely depleted fish resources at the time of Independence. The Namibianisation policy encouraged the participation of "previously-disadvantaged" Namibians in the fishing industry, both at the ownership and management levels and in the provision of jobs for workers, both on shore and at sea (ATFALCO, 2012).

The ATFALCO (2012) report also alludes to the fact that good governance is a prerequisite for sustainable fisheries. Namibia was perhaps even more aware of the necessity for good governance of fishing activities after it inherited fish stocks that had been systematically depleted. The FAO report of 2012 highlights that in terms of fisheries management; Namibia has since adopted an internationally accepted management legislature, with necessary adjustments relevant to the situation of the country. In contrast to many developing countries, the fishing industry is composed of a few large industrial companies and no artisanal fisheries (ATFALCO, 2012).

The participation of Namibians in the fisheries sector is promoted at all levels of the industry (GRN, 2015). As authored by the MFMR (2017), fishery licenses are issued preferentially to vessels that are owned and crewed by Namibians, and the largest quotas are given to companies that own vessels, process fish on land (thereby providing employment opportunities for Namibians) and support welfare and other social causes. In addition, rebates on catch levies are offered according to the level of Namibian involvement. These equate to 25, 50 or 75 percent of the levy depending on the level of Namibianisation and as such, form a strong incentive for companies to Namibianise. The strategy to Namibianise the fisheries sector has seen a major structural re-arrangement of the industry, which in itself has facilitated the introduction of new initiatives (ATFALCO, 2012). The following are fishing methods found in Namibia:

2.3.1 Artisanal fisheries

FAO (2018) defines artisanal fisheries as traditional fisheries involving fishing households (as opposed to commercial companies), using a relatively small amount of capital and energy, small fishing vessels (if any), making short fishing trips close to shore, mainly for local consumption. These are small-scale, low-technology, low-capital, fishing practices undertaken by individual fishing households as opposed to commercial fishing (ATFALCO, 2012). Namibia has a sizeable number of artisanal fisheries although FAO (2002) and ATFALCO (2012) allege the absence of artisanal or subsistence fisheries in Namibia, is a result of the harsh environmental conditions prevalent in the Namib dessert and its inhospitable nature. However, Sumaila (2000) and Roux and Shannon (2004) argue that traditional fishing communities existed in the past, which are currently shifting towards commercial fishing, such as the Topnaars community.

2.3.2 Inland fisheries

Namibia has no important natural freshwater bodies suitable for commercial exploitation and the perennial rivers are shared water courses on the borders among Angola, Zambia, Zimbabwe and Botswana. The shared watercourses such as Zambezi River and Okavango River in the Zambezi and Okavango regions respectively are used for limited fishing activities (MFMR, 2015).

There are no significant lakes in Namibia and the only permanent water bodies, being man-made dams and sinkhole lakes (FAO, 2012). Perennial rivers are found only in the Southern and

Northern border areas and provide over one million hectares of floodplain wetland with fisheries potential, varying by season between 6,000 and 8,000 tons per annum, comprising mostly of tilapia and tiger fish (MFMR, 2015). In the Okavango and Caprivi Regions, more than 100,000 people depend on fish resources for their daily protein needs (MFMR, 2015). Turpie et al. (1999, p. 346) observed that "freshwater fish consumption in the Caprivi Region ranks over beef, game and poultry and also has a significant economic value for the communities". Recreational fishery is also a major business sector in the Caprivi region and the importance of freshwater fish resources is emphasised especially during periods of drought, when the crop fails and people rely on fish catches from the river (FAO, 2012). The fish caught is partially consumed by the family members with the surplus sold at local markets.

2.3.3 Trawling

According to FAO (2018), trawling is a method of fishing that involves pulling fishing nets through the water behind one or more boats and the net that is used for trawling is called a trawl. FAO further explained that a trawl is constructed like a cone-shaped net that is towed (by one or two boats) on the bottom. Namibia uses different trawling methods, that is; midwater trawling, which is also known as pelagic trawling. Midwater trawling catches pelagic fish such as anchovies, shrimp, tuna and mackerel, whereas bottom trawling targets both bottom-living fish (ground fish) and semi-pelagic fish such as cod, halibut and rockfish (ATLAFCO, 2012). Other forms of trawling are demersal, midwater, and purse seine as shown below:

2.3.3.1 Demersal fisheries

Demersal fish live on or near the seabed and feed on bottom-living organisms and other fish (MFMR, 2015). According to MFMR (2015), Namibia has around 71 demersal trawlers (19-77m length), which are currently licensed. Their principal target species are hake *(Merluccius capensis and M. paradoxus)*, caught in deeper waters (trawling is not permitted in less than 200 m depth). Smaller trawlers fish inshore for monkfish *(Lophius spp.),* sole and kingklip. Eighteen demersal long-liners (19-55 m length range) also target hake, with smaller quantities of highly valuable kingklip and snoek.

Namibia's marine capture fisheries sector is exclusively industrial. The demersal fishery targets mainly hake in deep water and monkfish, sole, snoek and kingklip inshore. Other fisheries at the industrial level include tuna fishing, rock lobster fishing, deep-sea red crab fishing and line-fishing (kob and west steenbras) (MFMR, 2015).

2.3.3.2 Mid-water fishery

MFMR (2015) reports that a total number of 12 mid-water trawlers in the 62 to120m length range are licensed to fish for horse mackerels (*Trachurus capensis*). However, of these, at least 9 are wholly owned by Namibian nationals, but they retain foreign flag in order to facilitate work permits for the largely eastern-bloc sailing crew. The mid-water trawlers target horse mackerel, purse-seiners target pilchard, juvenile horse mackerel and anchovy.

2.3.3.3 Purse-seine fishery

Purse-seine fishery is a method of fishing that employs a fishing net called a “seine” that hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats (FAO, 2012). Purse-seines are used in the open ocean to target dense schools of single-species pelagic (midwater) fish like tuna and mackerel. Seine nets can be deployed from the shore as a beach seine, or from a boat (Marine Stewardship Council, 2018).

In Namibia, a fleet of 36 purse-seiners (21-47m length range) target pilchard *(Sardinops ocellatus)* for canning. Juvenile horse mackerel and anchovy *(Engraulis capensis),* which occur sporadically in Namibian waters, are also caught for fishmeal (MFMR, 2015).

2.4 Ministry of Fisheries and Marine Resources (MFMR), mandate, functions and operational structure

The Ministry of Fisheries and Marine Resources (MFMR, 2018) is the custodian of fisheries and marine resources. Namibia's fishing industry is well known for its world class capabilities, in handling, distributing and marketing of fish products. The mission of the MFMR is to strengthen Namibia's position as a leading fishing nation and contribute towards the achievement of economic, social and conservation goals for the benefit of all Namibians (MFMR, 2018).

The Ministry of Fisheries and Marine Resources (2017) defined its vision to be a leading fishing nation with a well-developed aquaculture industry. The manner in which this should be achieved will be through the MFMR mission that is, “to responsibly manage living aquatic resources to continuously ensure a conducive environment for the fishing and aquaculture sector to prosper" (MFMR, 2017, p. 6).

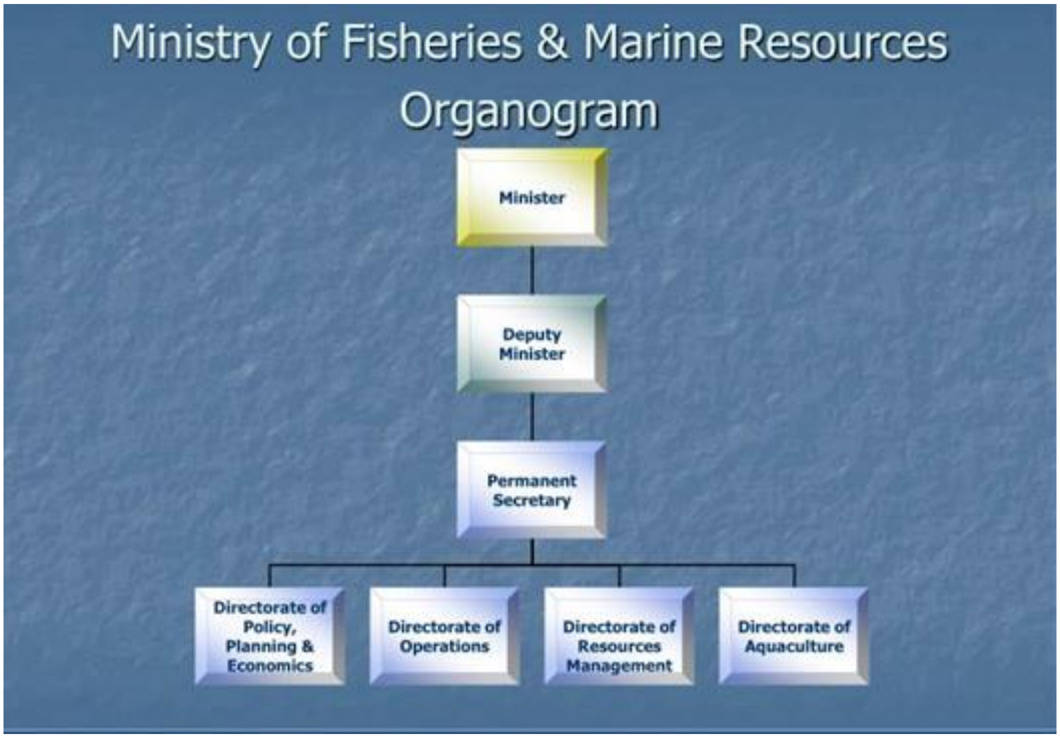
The Ministry's objective is to promote and regulate the optimal sustainable utilisation of living marine resources within the context of conserving marine ecosystems, establish a conducive environment in which the fishing industry can prosper and derive optimal income from marine resources, further Namibia's interests within the international fishing sector, provide professional, responsive and customer focused services, deliver services efficiently and effectively by providing best value for money and continuously invest in human resource development (MFMR, 2019).

The Minister of Fisheries and Marine Resources, Honourable Bernard Esau emphasised the point when introducing the five-year strategic plan 2018-2022 that, the development of fisheries in Namibia is in-line with national blueprints such as Vision 2030, Harambee Prosperity Plan (HPP) and National Development Plan (NDP5), which contribute to the national goal of poverty eradication in Namibia (MFMR, 2017).

The MFMR is responsible for the management and development of fisheries and aquaculture. The Ministry is headed by a Minister and deputised by the Deputy Minister. The Permanent Secretary, now known as Executive Director from January 2019 is the chief accounting officer responsible for the day to day operations of the Ministry (See Figure 2.2). The MFMR has four directorates which are namely, Directorate of Policy Planning and Economics, Directorate of Operations, Directorate of Resources Management and Directorate of Aquaculture (MFMR, 2017).

The Directorate of Resource Management is responsible for providing advice on the state of commercially important marine fish stocks and recommendations on their appropriate yields; and also responsible for research on fresh water fish resources in the interior of Namibia and provides advice on the conservation and management of those resources. The Directorate of Policy Planning and Economics co-ordinates the formulation and implementation of fisheries policies and legislation, carries out continuous policy and economic research and analyses, and is also responsible for the management of information services of the Ministry (MFMR, 2018).

The Directorate of Operations regulates fishing activities within the Namibian Exclusive Economic Zone (EEZ); monitors, controls and provides surveillance activities both at sea and onshore through the operation of fisheries patrol vessels, cars for coastal inspection, provides fisheries patrol aircraft by fisheries inspectors and enforces fisheries legislation.



Source: MFMR, 2015

Figure 2.2: Organogram for the Ministry of Fisheries and Marine Resources

2.5 The Aquaculture sector in Namibia

According to the strategic plan of the MFMR for 2018-2022, the Directorate of Aquaculture is responsible for ensuring responsible and sustainable development of aquaculture to achieve socio-economic benefits and environmental sustainability, facilitating an efficient, coordinated administrative and institutional framework for aquaculture as well as ensuring that the genetic diversity and integrity of the aquatic ecosystem is maintained and promoting responsible aquaculture production practices (MFMR, 2017).

2.5.1 Aquaculture legal and regulatory framework in Namibia

Namibia's initiative to develop an aquaculture policy and legislation has been the most comprehensive and it has sound institutional foundation for the aquaculture sector development. Aquaculture is specifically addressed as a development priority in Namibia's Second National Development Plan (NDP-2), Government's Vision 2030 and in the Harambee Prosperity Plan (HPP) document, wherein it is envisaged that by the year 2030 aquaculture will have grown to become a thriving industry (MFMR, 2017). Vision 2030 (Namibia, Office of the President, 2004, p. 5) also acknowledges that "Inland extensive and semi-intensive fresh water aquaculture systems will provide food, income and employment for rural communities" and seeks to achieve social and economic benefits for 90% of households living alongside the perennial rivers and seasonal rain-filled pans.

The Namibian Government has actively sought to create an "enabling environment" for aquaculture development, which has required specific policy, legislative and institutional interventions (MFMR, 2018). Namibia has been fortunate to benefit from international experience in aquaculture and its Aquaculture Policy and Aquaculture Act can be viewed as a synthesis of international best practice. The objective of Namibia's aquaculture policy is "the responsible and sustainable development of aquaculture to achieve socio-economic benefits for all Namibians and to secure environmental sustainability" (MFMR, 2015, p. 3). Namibia's Aquaculture Act was passed in 2003 and regulations to implement the Act have now been promulgated. Among the three Benguela Current Large Marine Ecosystem (BCLME) countries, Namibia is the first to translate its policy into a comprehensive deployment strategy articulated into "Namibia's Aquaculture Development Strategy" (ATFALCO, 2012). The strategy contextualises the opportunity for aquaculture in Namibia, outlines Namibia's aquaculture policy and Act and sets tentative production targets.

2.5.2 Mariculture in Namibia

Commercial marine aquaculture (mariculture) is currently dominated by oyster and abalone production in Walvisbay, Swakopmund and Luderitz (FAO, 2019). Both Pacific oyster *(Crassostrea gigas)* and European oyster *(Ostrea edulis)* are grown. Culture methods include baskets suspended from rafts and long lines and onshore raceways, at open sea and ponds. Currently there are eight companies involved in farming oysters in Namibia, which until 2006 was selling 70% of their production to South Africa. Total production has increased from 247 tons in 2004 to 302 tons in 2005 when new markets were discovered in Asia. It was projected that production could double in 2006 considering the growing demand for Namibian oysters in Asia (MFMR, 2015).

Huge potential to increase production exists in Namibia including the 1,500 km largely uninhabited coastline, unpolluted high quality marine waters, high natural primary productivity of the seawater, availability of inexpensive fish by-products from established fish processing sector for inclusion in wet aqua-feeds and well-established processing, packaging and marketing systems due to the marine capture fisheries that can be adopted for aquaculture purpose. However, lack of finances and lack of interest by financial institutions to finance fish farmers may hamper the further expansion and development of this sector (MFMR, 2018).

The MFMR (2015) also notes that besides the marine captured fisheries, Namibia also has a small but vibrant aquaculture sector. Marine aquaculture enterprises currently produce abalone, oysters, mussels and seaweed in Luderitz sea lagoons and salt-pond of Walvisbay and Swakopmund. Inland captured fisheries exist in the North East and North West of Namibia, where various types of tilapia species and catfish are harvested from rivers and flood plains. Commercial freshwater aquaculture of tilapia and catfish is also undertaken (MFMR, 2015).

2.5.3 Inland aquaculture in Namibia

Freshwater aquaculture in Namibia has been dominated by the catfish (*Clarias gariepinus*) and tilapia species (*Oreochromis niluticus and O. Mossambicus)*. The level of aquaculture production in Namibia is not known, but there is great potential for aquaculture development in the Okavango, Kunene, Orange and Zambezi, as well as in dams and reservoirs (Fishery and Aquaculture Department, 2009). The demand for fish as a substitute for high priced meat has encouraged the Government of Namibia (GRN) to include the promotion of continental aquaculture as a strategic sector. Namibia's aquaculture sector is in its infancy, although aquaculture activities are believed to have started in the late 1800's with the introduction of carps, bass and tilapia (Iitembu, 2005).

Earlier studies conducted by the Ministry of Fisheries and Marine Resources (2002) show that good freshwater aquaculture development potential exists along rivers such as the Okavango, Kunene, Orange and Zambezi, as well as in dams. Commercial freshwater aquaculture of tilapia and catfish is already undertaken in Hardap. In addition, the Ministry of fisheries and Marine

Resources and the Ministry of Trade and Industry have developed six community-based intensive freshwater aquaculture facilities in Omusati, Okavango and Caprivi region producing tilapia and catfish for local distribution. Fingerlings are also being produced and distributed to small scale farmers in the north for their own production (Iitembu, 2005).

The New Era newspaper of February 15, 2019 noted the speech by the Minister of Fisheries and Marine Resources when addressing his staff, Hon Bernard Esau stated that he has taken note of the ongoing monitoring programs, especially on shellfish water sanitation surveys, as well as training and extension services being offered to inland aquaculture farmers and was also quoted saying the following (para 3): https://neweralive.na/posts/esau-not-satisfied-with-national-aquaculture-coordination-activities_

> The Directorate of Aquaculture and Inland Fisheries needs to do more than you are doing at the moment – it is not sufficient. You need to develop and implement plans to eventually make Namibia a major aquaculture country globally. You must run our aquaculture stations sustainably, and as best practice demonstration farms, for the benefit of our aquaculture farmers.

The Hon Minister, Mr Bernard Esau has stated that because of the critical importance of inland aquaculture to food security in rural areas, he has mobilised resources to sustain feed supply, repairs and maintenance at inland aquaculture stations. He added that Namibia (para 4) "…must develop a roadmap on how we will ensure that our aquaculture does not remain in infancy, as is the case now".

The production of freshwater and brackish water species in the Oshikoto Region is also being considered for future development. The long-term strategy of this activity is to apply the lessons learnt to other regions. Local species already adapted to culture requirements shall be the first priority (e.g. *Oreochromis andersonii and Clarias gariepinus*) (MFMR, 2015).

The Ministry is also aiming to adopt a two-pronged approach for the development of fisheries sector. One is freshwater aquaculture, aimed at alleviating poverty, creating employment and satisfying local consumption needs. The second approach involves seawater aquaculture, which includes the culture of oysters and other molluscs for export (MFMR, 2015).

2.5.4 Fisheries biologists for marine and inland aquaculture

The Directorate of Aquaculture in the MFMR has positions of chief fisheries biologists, fisheries officers/ biologists and fisheries assistants. The fisheries biologist / fisheries officers are responsible for all aspects of aquatic plant and animal life (MFMR, 2015). Marine biologists study the distribution, abundance and life histories of animals and plants in the sea and the way in which these are governed by environmental factors. The Chief biologists / officers are supported by assistants to reach out to communities by providing extension services to aquaculture farmers in the regions. The development of aquaculture in Namibia can only become a huge success if people are empowered with enough resources.

2.5.5 The status of Aquaculture farmers in Namibia

To achieve the above, the Ministry has set up Inland Aquaculture Centres (IAC) and farms throughout the country and a fish-feed plant with an annual capacity of 1 200 tons, to support technical development (MFMR, 2018). Furthermore, a hatchery has been constructed to supply small scale fish farmers with fingerlings. Additional to the six community-based fish-farm projects established by the Government in the Kavango East and Caprivi regions (four of which are still operational), the Government is also presently busy with initiatives in the Karas and Omaheke regions. The tilapia species, *Oreochromis andersoni* and catfish, *Clarias gariepinus*, currently dominate the freshwater aquaculture initiatives in Namibia, though exotic species such as *Oreochromis niloticus and Oreochromis mossambicus* are farmed for commercial purposes at Hardap in the Karas Region (MFMR, 2018).

The mariculture and freshwater aquaculture subsectors are in different phases of development in Namibia. A small but progressive export orientated mariculture subsector exits, producing around 525 tonnes of shellfish, valued at N$35 million in 2011. By contrast, currently there is no meaningful production from freshwater or inland aquaculture. The GRN, however, has acknowledged this deficiency and as a first phase, the Ministry, has invested heavily this millennium to establish the required infrastructure to promote freshwater aquaculture across the regions (MFMR, 2015).

The inland aquaculture is being promoted by the Government and a total of 191 small scale fish farmers received fingerlings (tilapia and catfish) from the MFMR to grow and sell for their own income. The feed production averaged 124 tons. Fish farms are located in Caprivi, Kavango, Otjozondjupa, Hardap and Karas regions.

Aquaculture farmers are estimated to be 241 households practicing fish farming in the four political regions; that is, Ohangwena, Omusati, Oshikoto and Zambezi regions (NSA, 2015) as shown in Table 2.1 below:

Table 2. 1: Number of agricultural households who practice aquaculture by number of years and region

Region	Number of HHs reported	Agricultural HHs practising aquaculture		
		Since last 3 years	Since the last 5 years	Since last 10 years
Ohangwena	30	11	19	0
Omusati	122	105	0	17
Oshikoto	74	59	0	15
Zambezi	15	15	0	0
Total	**241**	**190**	**19**	**32**

Source: Namibia Statistics Agency (NSA), 2015

The aforementioned statistics do not however cover the other regions not stated in the report of the Namibia Census of Agriculture of 2015. This research covered six political regions; which are Hardap, Omusati, Erongo, Kavango East, Kavango West and Zambezi regions.

Mariculture sector is developing and have increased exports to China. The farms are located along the coast in Lüderitz, Swakopmund and Walvis Bay. In 2010, algae blooms devastated the oyster culture (MFMR, 2015). Comparing 2009 to 2010, farmers lost 50% of their export values. Licenses for Inland and Mariculture numbered 21 in 2010 and concern farming of the following species: Abalone, Scallop, Pacific Oyster, Clam, Seaweed, Crocodiles, Tilapia, Catfish, Sea Lettuce, Silver Cob, Kelp, Yellow Tail and Oyster (MFMR, 2015).

2.6 Fisheries / Aquaculture information systems in Namibia

Namibia has in place a number of national and international information Centres supporting information on fisheries and aquaculture. Amongst these Centres include the National Marine Information and Research Centre (NatMIRC), Namibia National Oceanographic Data Centre and other specialised libraries at Kamutjonga and MFMR headquarters.

2.6.1 National Marine Information and Research Centre (NatMIRC)

NatMIRC provides access to high quality information and knowledge necessary to support the individual researchers and academic programmes. It is a knowledge hub that underpins research and education. With emphasis on enhancing the quality of life for all Namibians, Vision 2030 calls for rapid economic growth to be accompanied by equitable social development. These twin goals of growth with equity are to be pursued within a broader strategic framework of transforming Namibia into a knowledge-based economy in which institutions of higher learning and NatMIRC are responsive to the skills and needs of the country (NATMIRC, 2018).

NatMIRC is a national support system for knowledge creation and knowledge management, providing access to relevant, appropriate and timely information in support of the mandate of the Ministry. Access to high quality and relevant information services and facilities will enhance effective utilisation of knowledge, resource-based learning, research and development, and rapid transfer of skills. The library thus underpins a knowledge-based economy (NatMIRC, 2018). The information Centre includes fisheries reports, monographs, databases, which also include expert databases, institutions databases and data products such as GIS, smart atlas, biodiversity data, etc.

2.6.2 The Kamutjonga Inland Fisheries Library

The Kamutjonga Inland Fisheries Library supports inland fisheries and aquaculture. The library has in its stock reports, monographs, documents and audiovisual materials on fisheries and aquaculture (MFMR, 2015).

2.6.3 Social media and blogs

Namibia has a number of blogs and social media sites promoting aquaculture and these include the MFMR official Facebook sites, Twitter, Fish site (https://thefishsite.com/country/na), FAO Website, and Blogs etc.

The MFMR website provides information on the publications produced by the Ministry, including policy documents and pieces of legislation related to marine and aquaculture resources. The Ministry is also visible on Facebook where it promotes dialogue with its stakeholders and general members of the public as well as a Twitter page.

The Fish Site has a national webpage on Namibia where information on fisheries and aquaculture is documented and indexed. This site includes articles and general statistics on fisheries and aquaculture (Fishsite, 2019).

The FAO website is very resourceful and contains general statistics and information on fisheries and aquaculture (FAO, 2018).

2.7 Chapter summary

This chapter sets the scene for the research by describing the context of the study and backing up the problem that motivated the research, which is underlined by the relationship between information provision and aquaculture production in Namibia. The chapter began with an outline of general information regarding the demographics of Namibia, followed by the fisheries industry in Namibia by showing the sub sectors in the industry such as inland fisheries and marine fisheries as well as types of fishing methods, which includes trawling, demersal, artisanal etc. The mandate, functions and operational structure of the Ministry of Fisheries and Marine Resources are also discussed with an illustrated organogram showing the organisational structure with particular emphasis on the top hierarchy. The chapter also provided a briefing of the aquaculture sector in Namibia (mariculture and inland aquaculture) as well as a description of the functions of fisheries biologists and the status of aquaculture farmers. The chapter concluded by giving an account of fisheries / aquaculture information systems in Namibia by looking at the roles of NATMIRC, social media and Blogs as well as the Kamutjonga Inland Fisheries Library.

The next chapter, (Chapter Three) reviews the available literature and discusses the theoretical framework.

CHAPTER THREE

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

3.1 Introduction

This chapter presents the theoretical framework (3.2) and the literature review (3.3) which provides the literature reviewed in the course of developing this study. The purpose of the review is to situate the focus of the study in relation to existing knowledge. Theories are formulated to explain, predict, and understand a problem at hand and, in many cases, to interrogate existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists. The chapter provides the appraisal of the chapter (3.4) and ends with a summary (3.5) which highlights important literature under different thematic areas.

3.2 Theoretical framework

A theoretical framework refers to that part of a research proposal or study that sets out to describe the research question (hypothesis) and the line of inquiry and methodology used to answer it (Ocholla & Le Roux, 2011). Drawn from the definition above one may come to the understanding that a theoretical framework thus refers to the agenda, outline, and theoretical construct of a research approach and normally comes in the literature review.

The marriage (or forced relationship) between the people-orientated and technological-orientated fields of library science and information science has led to the use of diverse theoretical models in library and information science (LIS) research (Minishi-Majanja, & Kiplangat, 2005),. These theories on information seeking behaviour include Kuhlthau's (2008), Havelock's (1971), Dervin's 1976), Rogers' (2003) amongst many others. In this section the study explores the information seeking and usage models (3.2.1), Broadly speaking, this study found the two models (Model of Information Search Process by Kuhlthau (3.2.2), and Diffusions of Innovation by Rogers (3.2.3) to be relevant and suitable in assisting to answer the last research questions raised "What is/are the relevant model(s.) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?"

3.2.1 Information seeking and usage models

A number of theorists have investigated on the information need, access and usage of information; chief proponents amongst these include, Wilson (1998; 2000), Dervin (1993; 1996), Kuhlthau (1991) and Case (1996). According to Wilson (1981), information behaviour is the totality of human behaviour in relation to sources and channels of information, including both active and passive information-seeking, and information use. Wilson (1981) adds that information seeking behaviour is the act of actively seeking information in order to answer a specific query, while information searching behaviour is the behaviour, which stems from the searcher interacting with the system in question. Accordingly, aquaculture farmers in this study participated in both information seeking, searching and utilisation processes.

Wilson's model (1998; 2000) suggests that information-seeking behaviour arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services, which result in success or failure to find relevant information. If successful, the individual then makes use of the information found and may either fully or partially satisfy the perceived need or, indeed, fail to satisfy the need and have to reiterate the search process. Wilson's model also shows that part of the information-seeking behaviour may involve other people through information exchange and that information perceived as useful may be passed to other people, as well as being used (or instead of being used) by the person himself or herself. In order to understand the relationship of information seeking behaviour to this study, one used the model to undertake an in-depth analysis of information seeking behaviour of fish farmers as well as the activities performed by an individual farmer in relation to acquisition of scientific information with regards to the improved cultivation and practices.

Dervin's Sense-Making theory (1993; 1996) posits that the model cannot be seen simply as a model of information-seeking behaviour: it is, rather, a set of assumptions, a theoretic perspective, a methodological approach, a set of research methods, and a practice' designed to cope with information perceived as a human tool designed for making sense of a reality assumed to be both chaotic and orderly. However, Sense-Making is implemented in terms of four constituent elements: 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 (e.g. uncertainty); an outcome, that is, the consequences of the Sense-Making (SM) process, and a bridge, that is, some means of closing the gap between situation and outcome. Dervin (1996) presents these elements in terms of a triangle: situation, gap/bridge, and outcome. The strength of Dervin's (1996) model lies partly in its methodological consequences, since, in relation to information behaviour, it can lead to a way of questioning that can reveal the nature of a problematic situation, the extent to which information serves to bridge the gap of uncertainty, confusion, and the nature of the outcomes from the use of information. The researcher further observed that rural farmers need agricultural information to enhance or boost their productivity and also to be informed of modern farming systems in order to meet up with challenges that may arise in their occupation and Dervin's (1996) model provided the answers on the extent to which information serves to close the gap of uncertainty and confusion.

Kuhlthau's (1991) work complements that of Dervin (1996) by attaching to stages of the 'information search process' the associated feelings, thoughts and actions, and the appropriate information tasks. This association of feelings, thoughts and actions clearly identify Kuhlthau's (1991) perspective as phenomenological, rather than cognitive. The stages of Kuhlthau's (1991) model are: Initiation, Selection, Exploration, Formulation, Collection and Presentation. As an example, the Initiation phase of the process is said to be characterised by feelings of uncertainty, vague and general thoughts about the problem area, and is associated with seeking background information: the 'appropriate task' at this point is simply to 'recognise' a need for information. The remaining appropriate tasks are: Identify, that is, fix the general topic of the search; Investigate, or search for information on that general topic; Formulate, focus on a more specific area within the topic; Collection, that is, gather relevant information on the focus; and Complete, end the information search. These stages were used in this study by this researcher to draw up instruments for data collection. It is of great value to this research to investigate the stages, which fish farmers undertake in order to solve their information needs and access problems.

3.2.2 Kuhlthau's Model of Information Search Process (ISP) and Roger's Diffusion of Innovation (DOI) Theory

Kuhlthau (2004) proposed a model comprising six stages of task initiation, selection, exploration, focus formulation, collection and presentation, which fall within three areas of experience - thinking, feeling and actions. These three areas of experience occur at each of the six stages. Kuhlthau’s (2004) Model of the Information Search Process that focuses on three different areas of the search experience: affective (feelings), cognitive (thoughts), and physical (actions) (See Figure 3.1) could assist in answering the major question, what is the level of access, utilisation and sharing strategies of knowledge and information by aquaculture farmers in Namibia?

Model of the Information Search Process

	Initiation	Selection	Exploration	Formulation	Collection	Presentation	Assessment
Feelings (Affective)	Uncertainty	Optimism	Confusion Frustration Doubt	Clarity	Sense of direction / Confidence	Satisfaction or Disappointment	Sense of accomplish-ment
Thoughts (Cognitive)	vague →			focused →	increased	interest	Increased self-awareness
Actions (Physical)	seeking	relevant Exploring →	information	seeking	pertinent Documenting	information	

Source: Kuhlthau, 2004, p. 82

Figure 3.1: Model of Information Search Process

Kuhlthau's (2004) model emphasised that uncertainty, which is central to the search process increases and decreases as the information seeker progresses through the stages. The model was used to answer specific questions addressed in research questions 1, 2 and 3. Kuhlthau’s (2004) model was used to study information usage and access behaviour of fish farmers. This model was relevant in that it accommodated the effective and cognitive processes involved in information searches, the research process involved in seeking information for effective task performance and factors influencing different stages in information search and usage.

Ongoing research by Broch (2000) and Branch (2003) reveal that the ISP model is a valid theoretical framework for the study of information behaviour irrespective of the information environment, whether print or online media. Broch (2000) emphasises that the search challenges, which are illuminated by the model may be more serious when searching the Web while Branch (2003) confirms that students experience the phases of the ISP even on the Web; for example, they experience confusion and frustration when they come across barriers in their search process.

Kuhlthau (2012) stresses the importance of technological tools as part of everyday life across the globe and that ICT tools help to interact, connect, and collaborate. These tools make information instantaneous due to real time access to information. However, Kuhlthau (2012) alerts one to the danger of everyone having a voice and access. Kuhlthau's (2012) concern is about the accuracy and reliability of information being communicated, which is a product of information literacy and it could therefore be discerned that Kuhlthau's (2012) ISP model was relevant to investigate the information access and usage patterns of fish farmers.

Apart from the strength afforded by Kuhlthau's (2012) ISP model, the model has also received criticisms from Orlu (2016), Kahlal (2011) and Kuhlthau, Heinstrom and Todd (2008). The ISP model, while confirmed in different settings, is also centred on a specific kind of research process, most often related to school assignments (Krub, Zinn & Hart, 2017). The model has not been applied to information needs and tasks, such as everyday life information seeking, which are less well-defined. Rather and Ganaie (2018) argue that the ISP model includes prescriptive elements that might limit its applicability to wide scope of information behaviour, such as less impact on systems design than on library services (Odoi, 2017). The immediacy of information, in addition to the sheer increase in the amount of information available, might affect both the cognitive and affective behaviours of users. Relevance judgments might be characterised by the increase in easily accessible information (Rather & Ganaie, 2017). Kuhlthau (2012) has suggested that electronic information has altered notions of what is “enough” information. New qualities of value and use in information, such as speed, convenience, readability, or portability (e.g. cut and paste) might also alter information choices and searching preferences.

Since the study tried to find out the knowledge sources, including access, usage and sharing strategies of aquaculture information, it was imperative that Kuhlthau’s (2012) ISP model was used to come up with answers to these questions. Viewing the ISP model in a holistic manner, this researcher suggested that the goal of this model was to develop knowledge on this topic on access and utilisation of information and knowledge by fish farmers. Thus, knowledge development was key to mastery of a subject. The more time the researcher was given to explore and truly "dig in" to the topic, the more one learned, and the more one appreciated the final result (Kuhlthau et al, 2007).

3.2.3 Rogers’ Diffusion of Innovation Model

The researcher used Rogers’ Diffusion of Innovation (DoI) theory to complement the Six Stage Model of the Information Search Process (see Figure 3.2). While Kuhlthau’s (2012) model was not able to answer questions especially those that seek to explain how, why, and at what rate new ideas and technology are spread through cultures, the DoI was used to come up with concrete answers on who, how, why and where the information literacy and knowledge competencies of aquaculture farmers together with solutions in addressing the spread of new innovations and technology.

According to Rogers (2003), innovation is defined as a first time perception of an opinion or application which has not been experienced in the past by an individual. Thus innovation is a subjective concept; that is everything seen, heard, experienced or perceived by an individual carries characteristics of innovation of that specific individual (2003). Ozcatalbas (2014) opines that subjects as wireless communication, biotechnology studies, sensitive agriculture applications and utilising Internet and information are recognised as innovations.

There are four main elements of the DOI theory. The first element is “Innovations”, which is an idea regarded as new by an individual; the second element is “Communication channels”, such as radios, television, newspapers, Internet, etc., that are as a means of informing an audience. The third element is “Time” which symbolises that innovations are not adopted by everyone at the same time; rather they are five adopter categories (Innovators, Early adopters, Early majority, Late majority and Laggards). The social system is the fourth element, which defines a set of inter-related units that are engaged in joint problem solving to accomplish a common goal (Rogers, 2003).

Ozcatalbas, Brumfield and Ozkan (2004) further argue that all agricultural innovation has material and information (intellectual or knowledge) dimension. Thus, one cannot talk about innovation without an information dimension since it is information, which contributes to the creation of knowledge. In this study the creation of knowledge is the one which is translated to aquaculture production and farming methods. Conceptually, adoption of innovation is mostly confused with decision making. Ozcatalbas, Brumfield and Ozkan (2003) wrote that the difference between adoption and decision making relates with existence of continuous application of an innovation. Thus, the period starting from the first time an individual hears about a novelty until the time he/she adopted this novelty is called the innovation adoption process (Kiplang'at & Ocholla, 2005). According to Rogers (1993), innovation adoption process is a five-step process for adoption which include awareness (having the information), interest, evaluation, trial and adoption. Ozcatalbas (2014) posits that the time required by each stage varies according to the characteristics of innovation, the way it is presented, individual characteristics (risk taker, brave, etc.), and who are open to innovation can skip some of these stages. Figure 3.2 exhibits characteristics of these stages.

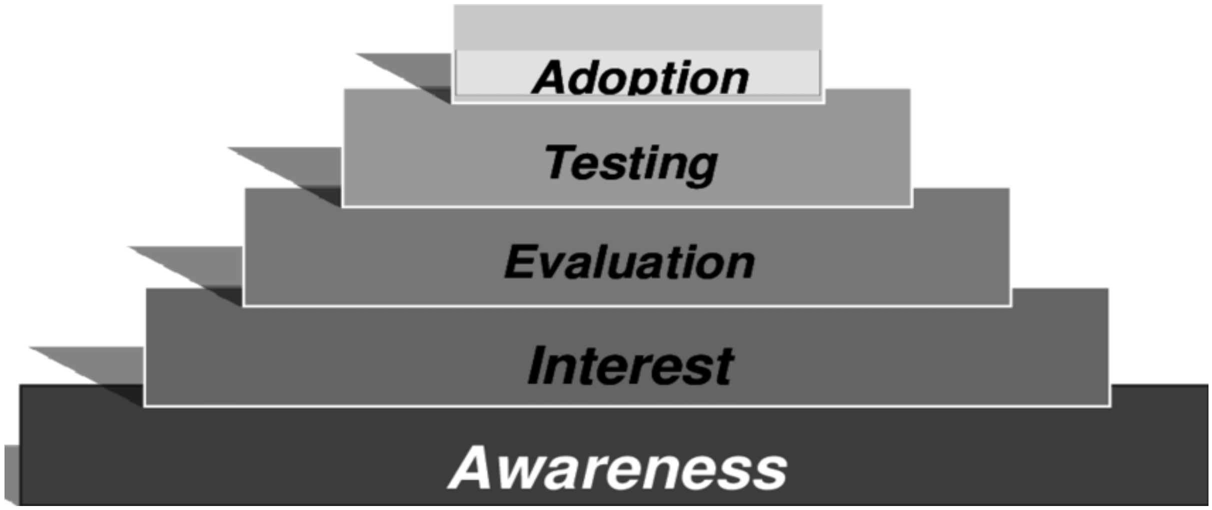
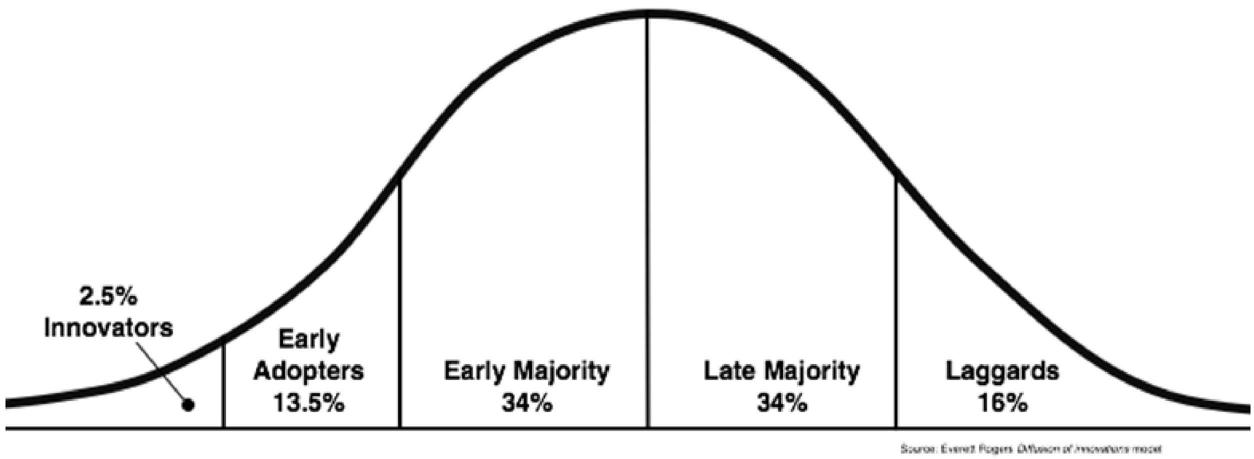


Figure 3.2: Stages in the Adoption Process

According to Rogers (2003), the first stage which is awareness, is when an individual becomes aware or informed about a new innovation, the second stage is when an individual generates interest or knowledge of an innovation, the third stage is when an individual evaluates an innovation, the fifth stage, this is when an individual test or tries an innovation and the process ends with the fifth stage when an individual makes a decision and adopts a new innovation.

It is not possible for members of the society to adopt a new innovation at the same time or react in the same way. According to Rogers (2003), the reason for this difference is that members of the society do not have the same characteristics, same opportunities and same conditions or think in the same way. Therefore, individuals in a society are categorised in different groups based on their adoption attitudes towards a novelty. Figure 3.3 shows five different segments based on individuals' propensity to adopt a specific innovation: innovators, early adopters, early majorities, late majorities and laggards.



Source: Everett M. Rogers (2003).

Figure 3.3: Diffusion of Innovation Theory

According to Rogers (2003), the adoption process begins with a tiny number of visionary, imaginative innovators (Figure 3.3). The second population segment is made up of “early adopters”. Rogers (2003) further mentions that once the benefits start to become apparent, early adopters leap in. They love getting an advantage over their peers and they have time and money to invest. The third population segment according to Rogers (2003), is the “early majority”. At this point when an innovation or product leaps the chasm, it may eventually reach majority audiences. Rogers (2003) further explains that the early majorities are pragmatists, comfortable with moderately progressive ideas, but won’t act without solid proof of benefits. The fourth population segment is the “late majority” According to Rogers (2003) this group of people are conservative pragmatists who hate risk and are uncomfortable with new ideas. The fifth and final segment of the population is made up of “Laggards” and this group holds out to the bitter end and sees a high risk in adopting a particular innovation or behaviour.

Factors affecting adoption process of individuals can be classified in different ways. These can be classified in socio-economic, personal factors and communication behaviours (Rogers, 2003; Tatidil, 1981). Studies and observations regarding extension of agricultural innovations into rural societies reveal that the same innovations have different extension pace in different societies (Ozcatalbas, Brumfield & Ozkan, 2004).

Despite the advantages of DOI and its contribution to research, the DOI theory has also shortcomings, Stephenson (2003), noted that the absence of critical viewpoints in the early development led to the challenges experienced in the long run. Minishi-Majanja and Kiplang’at (2004) identified four major criticism of diffusion research; firstly, that is its pro-innovation bias (which occurs when there is an economic benefit to adopt an innovation and when it is funded by an agency of change); secondly, the individual’s blame bias, which is a tendency to hold an individual accountable for his problems rather than the system for which he or she is part; thirdly, the recall problem, which may occur due to inaccuracies when respondents react to questions at the time of implementation and fourthly, the issue of equality in the diffusion process holds that socio-economic gaps often widen due to the spread of new ideas, which is a problem that often arises because researchers pay little attention to the consequences and outcomes of an innovation. Thus, the strengths and the weaknesses of the DOI model had been taken into account in this research in order not to fall into bias as explained above.

3.3 Literature Review

The review is guided by themes derived from the research questions as stated in Chapter 1, which are as follows:

- What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia? (3.3.1)

- What are the information and knowledge sources including sharing strategies of aquaculture farmers? (3.3.2)

- What are the information literacy levels and knowledge competencies of aquaculture farmers? (3.3.3)

- What are the policies governing information and aquaculture production in Namibia? (3.3.4)

The research question "What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?" is discussed separately earlier in this chapter under the Theoretical Framework section (3.2)

The last but not least research question which is "What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?" is discussed as a contribution to the study (7.4.3) in Chapter 7 where the study proposes a model on the "Integrated Aquaculture Information System" that can support aquaculture farmers as users of information.

The literature review discusses the following themes derived from the research questions; which are information and knowledge needs, access and usage of aquaculture farmers (3.3.1), Information and knowledge sources and sharing strategies among aquaculture farmers (3.3.2), information literacy and knowledge competencies of aquaculture farmers (3.3.3), and policies governing information and aquaculture production (3.3.4).

The main purpose of the literature review was to review previous studies on access and utilisation of knowledge and information by aquaculture farmers since each "…research study is part of an existing body of knowledge, building on the foundation of the past research and expanding that foundation for future research" (Gravetter & Forzano, 2012, p. 49). The literature search was done in order "to scope out the key data collection requirements for the primary research and it formed part of the emergent research design process" (Denscombe, 1998, p. 217).

An appreciation of previous literature in the area of information access and utilisation served three purposes. First, by providing direction in the preparation of data collection tools since it guarded against the risk of information-overload at the primary data collection stage. Second, working through the findings of the literature helped maintain thoroughness throughout the study and identify information gaps of the topic's perspective. Finally, this activity raised the opportunities for articulating a critical analysis of the actual "meaning" of the "data collected when the data analysis stages of the research were reached" (Hall, 2004, p. 3).

A range of secondary data sources served as the key tools for identifying relevant work for review. The most significant of these were the science databases. Personal recommendation by supervisors and experts in the subject area as well as citation analysis also led to a significant proportion of the publications selected for analysis in this review. Relevant publications were found in the literature of a number of academic domains including information access and utilisation, information exchange and sharing, information science, information systems, information architecture, aquaculture, marine and freshwater fisheries, research methodology and sociology. Most of these publications are in form of research articles.

This literature was also gathered through monographs obtained mainly from the University of Namibia (UNAM) library, the Internet and searching the e-resources such as; EBSCO, HINARI, OARE databases housed at the UNAM library. Other sources used were primary source documents such as reports, datasheets and factsheets downloaded from the Internet and some, which were obtained from the MFMR and Ministry of Agriculture libraries.

3.3.1 Information and knowledge needs, access and usage of aquaculture farmers

Agricultural information, according to Ofuoku et al. (2008), is all published knowledge in all aspects of agriculture and that the quality of such information depends on three attributes which are accuracy, timeliness and relevance. Access to adequate information is very essential to increase agricultural productivity (Emmanuel, 2012). To link this statement to this study, where the thrust is on fish farmers, it is therefore imperative to view aquaculture information as a resource like land, labour and capital. Aquaculture information is guided by the definition provided by Ofuoku et al. (2008), which is all published knowledge on aquaculture and meets the requirements in terms of accuracy, timeliness and relevance. It is also a resource which is expendable such as land, labour, capital etc., and fish farmers utilise information to improve their farming practices.

According to Rather and Ganaie (2018), an information need is the perception of a lack of information that provokes one to develop a need for it. The same sentiments were expressed by Rather and Ganaie (2018) who saw a need as the amount of information a user requires to fulfil the search intent. There is no agreed definition of information need (Nicholas & Herman, 2009, p. 2) and in this study an information need is the "need for information that individuals ought to have in order for them to perform their job effectively". It is often believed that information need may exist when there is a gap between the state of the present knowledge possessed by somebody and that which they need to deal with or solve some problems or handle a present situation.

Van den Ban (1998) discovered that farmers require a diverse range of information to support their farm enterprises. The researcher argued that information is needed not only on best practices and technologies for crop production, which the traditional public-sector extension system provided during the Green Revolution, but also information about postharvest aspects including processing, marketing, storage, and handling. Van den Ban (1998) added that farmers require information related to the following; most appropriate technology options, changing farming systems (mixed or diversification), collective action with other farmers, consumer and market demands, quality specifications for the produce, access to credit loans, sustainable resource management and coping with climate change. The information required will differ between categories of farmers and can be targeted to specific groups, based, for example, on landholding size or agro-climatic region (Rivera, 1996). In addition, these information needs of rural farmers according to Emmanuel (2012) may be grouped into five headings:

- agricultural inputs
- extension education
- agricultural technology
- agricultural credit
- marketing

Freeman and Hanfman (1989) wrote that because of the strong growth and potential of aquaculture throughout the world, the need for reliable information on the subject is in great demand. A planning workshop held by FAO/UNDP Aquaculture and Coordination Development Programme in 1988 identified the need for improvements in the collection and dissemination of four distinct types of information:

a) extension materials and services designed to transfer information and technology directly to those engaged in aquaculture at the community or farm level;

b) technical information, including library and information centres, databases and production of reports and translations;

c) market information concerning supplier, equipment and supplies, buyer, prices and the demands of different markets, and

d) aquaculture sectorial statistics needed for planning and decision making. The needs identified for aquaculture information were reiterated at the FAO (1985) Sub-Saharan symposium held in Zambia.

From the above findings by FAO/UNDP (1998) and Emmanuel (2012), which illustrate the type of information needed by farmers, without being judgmental, the researcher therefore used the literature and results obtained by these authors as a yardstick to measure the types of information needed by aquaculture farmers in Namibia.

Rural farmers need information to improve their farming practices and these information needs may relate to the use of fertilizers, pest and disease control, higher yield/agricultural production, planting at the right time, weed control, improved seeds, post-harvest losses/preservation techniques, agricultural credits, and agricultural cooperation (Emmanuel, 2012). Today, information has assumed greater importance because of the link between the provision of agricultural information and increased and sustained agricultural productivity (Ekoja, 2003). While Ozowa (1995) observed that no one can categorically claim to know all the information needs of farmers especially in an information dependent sector like agriculture where there are new and rather complex problems facing farmers every day. This review therefore provided the platform for the researcher to enquire about the intricacies of the technical nature of fish farming, which requires the knowledge and information of practitioners to be constantly updated (Saha & Devi, 2014).

According to AIIM (2002) information access is the findability of information regardless of format, channel, or location. Morville (2005) is credited for the popularisation of the term "findability" for the Web. In 2005, Morville defined findability as the ability of users to identify an appropriate Web site and navigate the pages of the site to discover and retrieve relevant information resources though it appears to have been first coined in a public context referring to the web and information retrieval by Alkis Papadopoullos in a 2005 article entitled *"Findability"*. It is from this development where scholars of information science (Papadopoullos, 2005; Morville, 2005) tried to connect the concept of information findability with information access.

Related studies on information access by Ugboma (2010), Ofuoku et al. (2008) and Ekoja (2003) reveal that access to information is very essential for increased productivity by fish farmers. In Nigeria agricultural information is available through NAERLS and its information services, (Ekoja, 2003). Agricultural information is also available in the many agricultural research institutes and school of agriculture in the universities (Adomi et al., 2003) as well as the government ministries of agriculture. Many previous studies confirm that the problem of farmers is access to agricultural information; and that even with the advent of information technologies which has succeeded in eliminating bottlenecks in information dissemination; constraints to access to information is still a real experience (Oladele, 2006).

The economic rationale for the farmers' access to information is to enable them manage risks and uncertainties regarding production and marketing of their produce (Parmar, Soni, Kuwornu

& Salin, 2019). Oladele (2006) posits that farmers access production and marketing information from various sources, which includes sources that utilise ICTs while others are non-ICT sources. The effect of age, education and farm characteristics on adoption of ICT has been extensively documented in the literature by Parmar et al. (2019), who argue that such characteristics influenced access to agricultural information. In a study carried out by Kumar and Roy (2014) in the western part of Rajasthan in India, the authors concluded that farmers' access to agricultural information was foreseen to be extremely poor, ill-timed, less credible, and not cost-effective due to low acceptance or adoption of mobile phones due to the fact that accessibility of mobile network was unreliable in the rural terrains.

Alfredo and Fagbenro (2006) studied how farmers in Nigeria accessed information and found that radio and television were the most used technologies by fish farmers. In addition, Ugboma (2010) notes that radio and television were by far the most popular platform of accessing information used by fish farmers. Ugboma (2010) further discovered that fish farmers accessed information from personal experience (which topped the list) followed by workshops and seminars, friends and neighbours, ministry officials, magazines, NGOs and newspapers (in that packing order). The study by Ugboma (2010) also revealed that fish farmers saw agricultural extension officers occasionally and where information from agricultural extension workers was available, the information was found not to be current since the information received could not answer their expectations and therefore not solving their immediate problems. The literature by Ugboma (2010) was important to the study when trying to establish the role of extension workers in support of aquaculture farmers.

Information utilisation, which is derived from information usage as defined by the IGI Global (2019) are actions that allow and draw upon available documents to increase knowledge, make decisions and generate new knowledge. Savolainen (2009) states that information scientists have paid inadequate attention to the concept of information use since this theoretical development in the research area has been very slow and interpreted in different ways. Savolainen (2009) further adds that the concept of *information use* has big terminological problems, because kindred expressions such as *knowledge use, information use, knowledge utilisation, information utilisation*, and *information processing* are synonymously used, and their meaning are often not clarified. Dervin (1992) views information use as concerned with understanding what information sources people choose and the ways in which people apply information to make sense of their lives and situations. In order to demystify the definition by Dervin (1993), *information use* can be instrumental (e.g., when a decision-maker uses data or information to make an informed decision), or it can be affective by influencing how people feel (e.g., a person may use information gathered during a conversation with a friend to feel more motivated or better satisfied). The reasons for why people create information may not be the same as the reasons which people use information. IGI Global (2019) posits that information is interpreted and used differently (and often in unintended ways) by different individuals and groups.

Kari (2010), after analysing different definitions from a number of authors such as Savolainen (2009), Limberg (1999), Kirk (2002) and Wilson (2000) concluded that information use as a functional process is made up of the following seven elements:

- information practices - almost any kind of human interaction with information;

- information search - the processes of *information seeking* and *information retrieval*;
- information processing - information is interpreted, analysed and modified;
- knowledge construction - mental constructs are shaped or designed to function as a basis for thinking;
- information production - creating an expression of knowledge, which others can also observe;
- applying information - information functions as a resource in some process;
- effects of information - changes brought about by information.

Thus in this study on access and utilisation of information and knowledge by aquaculture farmers in Namibia, the concept of information utilisation or information use could be achieved through studying the enhanced information seeking patterns of aquaculture farmers (Saha & Devi, 2014). It is understood, according to Kari (2010), that information utilisation starts with interaction with every kind of information (information practice); information search and retrieval; information processing and analysing; knowledge construction; information production; applying information and changes brought by information (effects of information). The use or utilisation of information by an individual farmer may lead to its storage/ preservation for future use and thereby creating an information cycle. Thus according to Sava and Devi, the uses to which people put information depend on such factors as their existing knowledge, their affective state (i.e., mood and motivation), their intellectual abilities, and their existing skills (e.g., literacy) or physical disabilities. The literature on information utilisation assisted the researcher to study the information usage patterns and to develop the data collection instruments particularly the questionnaire.

3.3.2 Information and knowledge sources and sharing strategies among aquaculture farmers

A number of initiatives which encourage aquaculture information exchange have been put in place and one such organisation is Aquaculture Network for Africa (ANAF). The responsibility of ANAF (2013) is to coordinate and facilitate the scientific and technical information exchange in aquaculture. The network facilitates and coordinates regional and sub-regional collaborative aquaculture research and development, while facilitating training of fish farmers and extension workers as well as technology transfer between countries. Its aim is to maximize and optimise utilisation of the scarce resources for aquaculture development in Africa. ANAF fosters sustainable aquaculture development in the region as a means to fight poverty, ensure food security, provide employment and ensure rural development (ANAF, 2013). The researcher used the ANAF model to understand and come up with questions on the information exchange and sharing strategies, which promotes sustainable aquaculture through information.

Collins (2013) argues that networks of libraries and information centres have for centuries shared the information and expertise of the individual units in order to provide better information services to their users. Developments in information and communication technologies (ICTs) are providing many new opportunities to share information online and to make it available globally to end users. One such new development is the Aquatic Commons, an Open Access digital repository for the aquatic sciences, including fisheries and aquaculture. The literature by Collins

(2013) was relevant to the researcher since the study tried to establish the forms of information networks, which existed in Namibia in support of aquaculture farmers.

Wilkinson (2013) proffers that the web has enabled organisations dealing with the sharing of aquaculture information such as Network for Aquaculture Centres in Asia-Pacific (NACA) to communicate with more people than ever before, which comprise to a larger extent new and potential traditional stakeholders. A large proportion of people that use the NACA website are not from NACA member states. Among the stakeholders, some groups have better access and capacity to use Internet resources than others, for example scientists are better represented than farmers, and countries where English is widely spoken are better represented than countries where it is not. Despite these disparities, the absolute number of stakeholders who access NACA's services via the web is much larger than the number of people the organisation can interact with by "traditional" means.

World-Fish Centre (2013) observes that social networks can be critical to the survival of both individuals and households in sharing aquaculture information. Networks can also exact costs as they may require individuals to meet various obligations. Membership to formal organisations, for instance, aquaculture associations or cooperatives, are more prevalent among men than women. The researcher was also of the opinion that whereas a number of farmers had embraced social networks, a grey area existed as to social networks were being exploited by fish farmers in Namibia and therefore this study tried to reveal the real situation on the ground.

A research undertaken by Quagrainie, Amisah and Ngugi (2009) on "Aquaculture information sources of small scale farmers in Ghana" identified a number of sources of information which include, extension farmers, technical reports, training and seminars. However, the study also mentions that usage of these information sources also relates well with the levels of education. Mitchell (2011) reveals that Information and Communication Technologies (ICTs) are becoming popular as sources of information with farmers in Jamaica. For instance, the use of mobile phones to send text messages to farmers by the Rural Agricultural Development Authority (RADA) in Jamaica is being used effectively to prepare for bad weather and preserving crops and livestock. CTA (2012) also suggests the use of posters, brochures, photographs, radio, television and the Internet as some of the sources of information that can be exploited by fish farmers when carrying out their work. An information gap has been identified in this area, where little is known about the use of ICTs amongst aquaculture farmers in Namibia, although revelations were made by experts at the Euroafrica-ICT Conference in Addis Ababa in 2013 where experts noted that integrating the right applications of Information and Communication Technology (ICT) in agricultural activities can help increase sustainable food production.

Information sharing according to Sam (n. d.), is about bringing together, creators, disseminators and recipients of information to collectively address common needs. Salanje (2005) identifies the types of information that is shared by farmers and other stakeholders, which include market for their fish harvests, daily weather forecasts, types of fish species, modern fishing methods, sites for fish shoal, fish feeds; just to mention a few. This study preludes to unlock and get to the intricacies of examining the types of information shared by Namibian aquacultures farmers.

According to a situation assessment survey by the National Sample Survey Organisation (NSSO) (2005), access to information from any source increased with larger farm size. Most farmers sought information on seed for cultivation, followed by veterinary care in animal husbandry, and then management and marketing in fisheries. The main information source was other farmers (16.7 percent), followed by input dealers (13.1 percent), radio (13 percent), TV (9.3 percent), and newspapers (7 percent). Public-sector extension was used for information by only 5.7 percent of survey respondents. In terms of differences in sources of information for the 40 percent of farmers who had accessed information, smallholder farmers relied primarily on other progressive farmers, input dealers, and radio for information, while medium-size and large-scale farmers equally used radio, TV, and newspapers. Contact with extension workers for medium-size and large-scale farmers was almost double that of smallholder farmers (Adhiguru, Birthal, & Kumar 2009). It is still not understood in the literature why marginal and smallholder farmers do not access information more frequently. This study therefore investigated and tried to ascertain why this is so, bearing in mind the following factors brought out by the literature: non availability of the information; information not being relevant; lack of incentives to access information on the part of the farmer; and farmers not having the means to use the information. If this could be the case, information that is supported by services and inputs could be highly relevant. As there have been few studies on the information needs of aquaculture farmers, research into this area like this study could help analysts understand the information-seeking behaviours of different types of farmers.

Glendenning, Babu and Asenso-Okyere (2010) observed that the success of an extension approach depended on how it enhances the information flow along the agriculture value chain, and whether this is done sustainably and effectively. Sustainability and effectiveness, in turn, are determined by four factors such as: the type of information provided, how and to whom the information is provided, the strength of feedback in each link, and the capacity of the approach to provide relevant information.

3.3.3 Information literacy levels and knowledge competencies of aquaculture farmers

Studies on information and knowledge competencies are closely tied with information literacy. Zurkowski (1974, p. 6) was the first person to use the word information literacy in which the writer referred to it as the "techniques and skills known by the information literate for utilising the wide range of information tools" as well as primary sources in moulding information solutions to their problems. Eisenberg and Berkowitz (2008) developed the big six stages of information literacy as highlighted below, namely to:

(1) Clarify and understand the requirements of the problem or task for which information is sought;

(2) Identify sources of information and find those resources;

(3) Examine the resources that were found;

(4) Organise and process - it is in this step that the information which has been selected is organized and processed so that knowledge and solutions are developed;

(5) Present - the information or solution is presented to the appropriate audience in an appropriate format and paper is written; and

(6) Evaluate - the final step in the information literacy strategy involves the critical evaluation of the completion of the task or the new understanding of the concept and reviewing whether the problem has been solved.

While there are no studies carried out on information literacy in aquaculture in Namibia, the researcher searched a number of information sources and found a study by Alfred and Fagbenro (2006), which interestingly revealed that information literacy programmes help farmers to assess themselves so as to be able to successfully determine the extent of information needed, access information effectively, evaluate critically and incorporate information into their knowledge basis and to use information effectively. Chrzastowsk and Joseph (2006), Jankowska et al. (2006) and Brown (1999) found that graduate students primarily used journal articles rather than books, whereas the general farmers according to Ugboma (2010) prefer to get their information from extension workers and different media such as television, radio, posters, pictures, and meetings. Also important is the study on knowledge competencies of fish farmers by FAO (2012), which explains that knowledge is a range of information gained from interaction and information combined with experience, and it is organised and interpreted by the human mind with confident understanding for the purpose of decisions making and actions. It is however, not clear what media is being used by aquaculture farmers in Namibia although an initiative exists with the prime purpose of assisting and supporting farmers in Omaheke Region with digital tools that can be used to empower and equip farmers with knowledge and skills in order to effectively manage their farms (National Planning Commission (NPC), 2015).

FAO (2012) states that there are various types of knowledge depending on the functions and carrier systems; such as, aquaculture knowledge, management knowledge, manager's knowledge etc. Knowledge varies depending on cultural, social, and economical factors. The type of knowledge people have depends on their age, sex, occupation, labour division within the family, enterprise or community, socio-economic status, experience, environment, history, etc. Knowledge can also be seen from the view point of coverage and degree of understanding of certain things such as: common knowledge, which is knowledge known by everyone or nearly everyone usually with reference to the community in which the term is used. For instance, an example of common knowledge could be that almost everyone knows how to cook a local staple food in a certain community whereas shared knowledge is knowledge, which is held by many, but not all community members; e.g. communities which are involved in fish farming will know more about basic fish breeding than those not involved in it. Specialised knowledge is knowledge held by a few people who might have had special training or an apprenticeship, for example, only few villagers will become healers, midwives, or blacksmiths (FAO, 2004). In the same vein, in this study, fish farmers can be categorised according to their roles; such as managers, supervisors, workers, etc., and expertise, for example breeders, biologist, etc., as well as by gender; that is male or female. These categories have a direct bearing and influence on their information needs, usage and sharing strategies.

Swanson (2008) argues that a holistic approach to agricultural extension today goes beyond technology transfer for major crop and livestock production systems. It also includes goals for human capital development, in terms of enhancing the management and technical skills of farm households relating to production and postharvest handling of high-value crops in different sectors such as livestock and fisheries, sustainable natural resource management, family health and nutrition (Swanson, 2008). As already discussed, agricultural extension facilitates problem solving; creates links to markets and other players in the agricultural value chain; and provides access to information, skills, and technologies (Glendenning et al., 2010).

A study carried out by Burns (2012) on “Networks, collectives, and social learning in aquaculture: Bridging the information to implementation gap”, it was revealed that shrimp farmers in Sri Lanka were grappling with the following challenges in order to sustain their fish farms: lack of capital and assets, lack of knowledge and information, not enough ‘knowledge’ exists, science, research, best management practices, lack of capital (computer, cell phone) can limit access to knowledge, failure of end users to access existing knowledge, and lack of knowledge that is applicable to local situations. Burns (2012) further explains that improved access to knowledge, that is, input and product prices can improve access to capital.

FAO (2011) recognises that knowledge competency is important for farmers to effectively respond to present day farming challenges. International Fund for Agricultural Development (IFAD) (2007) observed that since the 1950s, a central question in international development has been how knowledge can best be generated, mobilised, made available, applied and adapted to improve the human condition. The centrality of knowledge systems to development effectiveness comprised the theme of the World Bank’s World Development Report of 1998/99. The main argument in that report was that the development of poorer countries necessitated assigning the highest priority to building “knowledge-based economies”. Knowledge, as opposed to natural resources, the report stated, had become the most important factor for determining standards of living.

Nleya, Nyathi and Kokera (n. d.) wrote on how crop production can be enhanced through the use of Information and Communication Technologies, using a prototype Web based crop information system which implores Internet Web technologies to deliver information and services to users. The Web based information system empowers the resource poor farmers with up to date knowledge and information on crops and their varieties to be produced in each of the five farming regions by farmers. The system also provides information about agricultural technologies for crop improvement, pest control, soil and climatic requirements, best practices, markets, sources of finance and related inputs. The system thus improves the competency of the farmer by speeding up the circulation of agricultural information and affording easy access to systems of technology by the farmer. It also enhances production efficiency resulting in quality crops as well as access to national and international markets. A gap in literature exists regarding the Internet Web technologies for aquaculture farmers in Namibia and it was in the best interest of this research to explore whether these farmers use similar technologies, when communicating or sharing information and knowledge.

Kamarudin, Zaini, Aziz and Arif (2014) in their study of “Paady farmers in Selangor in Malaysia” observed that farmers working in the fields also required both formal and informal learning to discover and practice new skills. Farmers are aware that agriculture is a risky business, hence every decision made should be accurate and timely to facilitate decision making. The learning process is not just only limited to the classroom, seminar or workshop. Based on the case study conducted by Kamarudin et al. (2014), it was found that informal learning and training happen every day in order for farmers to acquire new knowledge.

The review examined the differences on access to each type of information, for example, agricultural, environmental, health, and marketing by fish farmers. Consequently, this study in addition to the type of information accessed by fish farmers, also examined the effect of information sought from ICT sources and information sought from Non-ICT sources. Magesa, Michael and Ko (2014) note that farmers access and use information differently depending on the type of information whether production or marketing. Magesa et al. (2014) and Parmar, Soni, Salin, and Kuwornu (2018) point out that there is a significant difference between ICT and Non-ICT users across their access to different types of information. Parmar et al. (2018) further argue that the predominant marketing information, that is, market place, market price, future price and transportation (types, sources and costs) were accessed by the farmers more than the other types of agricultural information. Consequently, these results suggest that ICT sources of marketing information play a crucial role on farmers' access to marketing information and that the male farmers have more access to marketing information than the female farmers as documented by previous studies (Parmar et al., 2018).

Ellis (1989) notes that different behaviours involved in information seeking is not set out as a diagrammatic model and makes no claims to the effect that the different behaviours constitute a single set of stages; indeed, the author further uses the term 'features' rather than 'stages'. These features are named as: starting, chaining, browsing, differentiating, monitoring, extracting, verifying and ending. Ellis (1989) notes that, "of the features" the detailed interrelation or interaction of the features in any individual information seeking pattern will depend on the unique circumstances of the information seeking activities of the person concerned at that particular point in time. However, it is clear that 'starting' must initiate a process and that 'ending' must end it. It also seems reasonable to suggest that 'verifying' is a penultimate stage in a process and that 'extracting' must follow on from a specific search behaviour such as 'browsing'. Indeed, drawing attention to this fact leads to the conclusion that 'extracting' is not an information behaviour of the same kind as 'browsing', or 'chaining' or 'monitoring', and Ellis (1989) suggests that 'differentiating' is also a different kind of behaviour: browsing, chaining and monitoring are search procedures, whereas differentiating is a filtering process and extracting may be seen as an action performed on the information sources.

This researcher is of the opinion that when seeking information at work, people rely on both other people and information repositories (e.g., documents and databases). However, according to Robinson (2010), the distribution of time among the constituent information seeking stages differs depending on the source. Robinson (2010) states that when consulting information from peers, the information seeker spends less time locating the source and information within that source. Similar time is spent when trying to understand the information, and Robinson (2010) argues that more time is spent on problem solving and decision making, than when consulting information repositories. Furthermore, Robinson (2010) found that people spend substantially more time receiving information passively (i.e., information that they have not requested) than actively (i.e., information that they have requested), and this pattern is also reflected when they provide others with information.

Jong-Ja (2001) argues that there is broad consensus throughout the aquaculture sector that informed policy and management decision-making call for improved data and information. This includes information from the aquafarm gates to the office of the minister responsible for planning and the management of the sector. Current decision-making on the role of aquaculture in sustainable fisheries is hampered by a lack of information and awareness of the nature and extent of the impacts of aquaculture on the economy, environment, food security, nutrition and rural development. Another factor hampering the growth of aquaculture is the significant knowledge gap and lack of clear documentation of the effects of any changes in aquaculture policies or management actions (Food and Agriculture Organisation/ Network of Aquaculture Centres in Asia and Pacific (FAO/NACA, 1998).

The Aquaculture and Fish Genetics Research Programme (AFGRP) (2013) confirmed that although aquaculture production is growing in many developing countries, poor information access constrains its ability to deliver widespread economic and livelihood benefits. This information deficit impinges most particularly on those already disadvantaged small-scale producers and supply networks in rural and peri-urban areas, and poorer consumers more generally. The steady supplementation and replacement of aquaculture products into aquatic food markets in domestic and international contexts also makes traditional information systems increasingly non-functional. While marketing is widely recognised to improve welfare within aquatic food value chains, constraints on making good marketing decisions have been relatively overlooked. A grassroots assessment of research and educational priorities identified lack of marketing alternatives as the key constraint to more sustainable agricultural systems (Worstell, 1995). Much of the marketing information that has been provided has focused almost exclusively on value-added and niche marketing as strategies to increase profits rather than enhance the overall sustainability of food systems (DeLind, 1994). It was imperative in this study to assess the levels of utilising marketing information on aquaculture products since studies, which have been done to this end gave little attention to the enhancement of aquaculture sustainability amongst farmers.

A study conducted by Kumaran, Vimala, Raja and Alagappan (2012) concluded that fishery extension personnel ought to be effective information seekers to perform their role as 'facilitators' for accessing farm inputs, advisory services and markets to the farming community. A study conducted among the fishery extension personnel of the Department of Fisheries in Tamil Nadu and Andhra Pradesh indicated that hardly 50% of them were information seekers and their information seeking frequency was totally insufficient and was rated below 50% (Kumaran et al., 2012). Extension workers cannot be efficient in their responsibilities to their clientele such as farmers if they are deficient in information dissemination resulting from not being adequately informed on some subjects (Yomi, Alfred & Odefadehan, 2007). Barriers that prevent farmers from seeking and getting information are also of great importance in understanding the information seeking behaviour of individuals and organisations.

Findings of a study carried out by Hagar (2010) on the foot-and-mouth disease outbreak in Cumbria, in the United Kingdom highlighted the importance of changes in information needs at different stages of the crisis; which are context in which information seeking took place; overlap of information and emotional needs; formal and informal channels of information seeking during the crisis and farmers as information providers as well as information seekers. In view of this study by Hagar (2010), the researcher used the literature by Hagar (2010) to find out whether fish farmers encounter any changes in information needs when working on their farms.

Barman et al. (2004) and Singh et al. (2003) found that the most important source of information on farm technology was state department of agriculture and the most important communication mode was staff specialists, while the least used mode was personal correspondence with researchers. It was reported that there was a significant relationship between age, level of education, experience and the worker's level of job-related information with information seeking behaviour (Mohammadi, 2002). The literature reviewed in this chapter shows that farmers trust specialists as providers of information. This study investigated whether this was the same situation or not with aquacultures farmers in Namibia. This follows Hagar's (2010) argument that decisions have to be made by farmers about which sources of information to trust and which information providers to trust.

A report by Glendenning et al. (2010) questioned the coverage and relevance of information provided to farmers through the agricultural extension system. While the observation by Glendenning et al. (2010) was partly due to inadequate contact by the extension services, which needed to reach a large and complex farming community, the report concluded that inappropriate or poor-quality information could also be a key hindrance to farmers' use of extension services. Glendenning et al. (2010) also revealed that the content of the information provided by agricultural extension approaches, and the information farmers needed, were not aligned. A similar study in India conducted in 2003 by the National Sample Survey Organisation (NSSO) found that despite the renewed interest and investment in agricultural extension in India, the coverage of such information services is inadequate. NSSO's survey showed that 60 percent of farmers had not accessed any source of information on modern technology to assist in their farming practices in the past year. Of those who had sourced information, 16 percent received it from other progressive farmers, followed by input dealers. Of those farmers who had accessed information, the major problem of extension services was found to be the practical relevance of the advice (NSSO, 2005). In this study the researcher explored whether what Glendenning et al. (2010) wrote hold any ground that farmers, in addition to needing different types of information; they will have different search behaviors and factors such as literacy levels or access to resources, will have a large impact on their information needs, searching behaviour, access, and use.

Swanson (2008) described various target groups of agricultural information to include rural and farm women, small and marginal subsistence farmers, medium-scale farmers, commercial farmers, and rural youth. In India for example, the information needs of the 360 million farmers (expected to rise to 600 million by 2020) who operate under rain-fed conditions and contribute 45 percent of production will be different from the needs of farmers in well-endowed irrigated areas (Farrington, Sulaiman & Pal, 1997; Sulaiman & Holt, 2002).

The Namibia, National Planning Commission (NPC) (2006) observed that information needs of resource-poor farmers and farmers operating under rain-fed conditions differ substantially from those of farmers who are able to enter the market economy. There is little opportunity to utilise new technologies in rain-fed areas because farmers lack the financial means, credit, and capacity to take risks, and consequently technology gaps are much wider in these areas compared to irrigated areas. Due to higher levels of poverty in rain-fed agriculture areas, improved access to information is essential to increase the productivity and profitability of these farmers. After observing the different needs, the researcher used the literature by Farrington, et al (1997); and Sulaiman and Holt (2002) to find out whether fish farmers in Namibia are users of technology as Hagar (2010, p. 40) argues that "…a range of technologies is needed to disseminate and communicate information, and different technological choices are needed to accommodate different user communities and user preferences". The study by Hagar (2010) and Dutta-Bergman (2004) provided some of the answers to questions raised regarding the types of technologies needed by aquaculture farmers.

Ofuoku, Emah and Itedjere (2008) in their study on information seeking behaviour of fish farmers revealed that the utilisation of information on fish farming technologies among farmers will always translate into efficiency in fish production and increased productivity. Yong-Ja (2001) further explained that a variety of aquaculture data and information bases are available, although their relevance and usefulness for policy-making, planning and management differ. Rapidly advancing Information and Communication Technologies provide powerful tools for aquaculture data and information management (Yong-Ja, 2001). A study carried out by Alfred and Fagbenro (2006) noted that radio and television were the most used technologies by the fish farmers in Nigeria and this led the study to investigate whether the situation in Namibia was the same.

Van der Mheen-Sluijer and Sen (1994) provided an insight on women's role in the utilisation of aquaculture information. The two researchers posit that information utilisation depends partly on the intra-household decision-making process. In some areas, men decide on who will carry out what tasks in the household. Decisions concerning the timing and quantity of fish to be harvested, the fish to be consumed by the household, the sale of fish, and the distribution of proceeds influence women's motivations to contribute to aquaculture production. The owner of the pond, usually a man, consults his wife on these matters, but he is the sole decision-maker. While it is clear from the above study that gender roles play a part on information utilisation, it is not ascertained whether Namibia fish farmers face similar challenges and hence the study revealed the gender roles in fish farming.

3.3.4 Policies governing information and aquaculture production

A study of this nature could not be complete without looking at the policies and legislation frameworks governing information and aquaculture production in Namibia. Literature such as the FAO (2014) report on policy and governance in aquaculture, the Strategic Plan for Aquaculture (MFMR, 2004), Vision 2030 (NPC, 2004), ICT Policy (MICT, 2001), and Inland Fisheries Resources Act 1 of 2003 (OPM, 2003), National Development Plans I, II and III (NPC) provided guidelines on the support systems to aquaculture production as they relate to information access and utilisation.

The FAO report (Hishamunda, Ridler & Martone, 2014, p. iv) on “Policy and governance in aquaculture: Lessons learned and way forward” has established the importance of policy frameworks on aquaculture as follows:

> Effective governance of modern aquaculture must reconcile ecological and human well-being so that the industry is sustainable over time. Without effective governance, there will be misallocation of resources and perhaps stagnation of the industry and irreversible environmental damage.

The report by Hishamunda et al. (2014) justifies the importance of information in aquaculture governance since without proper information there will be misallocation of resources and stagnation of the industry. Nguyen (2010) observes that information sharing on aquaculture is poor in Vietnam and proposes that the aquaculture policy should advocate and provide timely information through the upgraded Ministry of Agriculture and Rural Development (MARD) portal.

The Namibian Aquaculture Act, adopted in 2002, (the Act) is the primary legal framework for the aquaculture industry of Namibia, and provides for the establishment, administration and conduct of aquaculture in water and on land. The Act broadly applies to matters related to licensing, health management, and disease control, access to land and water, and environment protection. It is the responsibility of the Ministry of Fisheries and Marine Resources to manage the Act, which in itself vests regulatory and enforcement powers under the Ministry (Republic of Namibia, 2002). It was imperative to review this Act since it provided regulatory mechanism in which aquaculture farmers need to be aware of when exploiting information and carrying out their farm duties.

The Ministry of Fisheries and Marine Resources (MFMR) through its Strategic Plan for Aquaculture (2004) is spearheading the development of national aquaculture at the community level in order to empower rural communities to be self-sufficient in food production, and to derive income through fish production integrated with existing and potential agricultural practices wherever natural conditions permit. The plan showed that information plays a crucial role in the development of aquaculture in Namibia.

Namibia's Vision 2030 acknowledges the potential for aquaculture since it can contribute towards sustained food security, income and employment for many Namibians; if properly supported through proper management systems such as information and knowledge (National Planning Commission (2004). The Vision 2030 further explains that the modern world is moving from heavy industry to a knowledge-based economy-based on specialist services, specialised industries, communications, and information technologies. Namibia needs to fast track its development process, and springboard over the heavy industry development path taken by the industrialised countries and should put focus on high value-added services, specialised industries that are modest in their water requirements and information technology. To achieve this, the Vision 2030 argues that Namibia will have to transform into an innovative, knowledge-based society, supported by a dynamic, responsive and highly effective education and training system. It is against this background that one uses the Vision 2030 as a tool to argue that information and knowledge are important aspects, which can drive Namibia's economy to achieve its overall objective of being a knowledge-based economy.

Isyagi et al. (2009) in a study entitled *"*Assessment of National Aquaculture Policies and Programmes in Uganda*"*, note that Uganda has a fisheries policy, which outlines aquaculture in general terms but it also has institutional frameworks, plans and programmes under which aquaculture falls, notably; the Poverty Eradication Action Plan (PEAP) and the Plan for Modernization of Agriculture (PMA), which houses the National Agricultural Advisory Services.

The policy document presented to the Cabinet by the MFMR (2001) states that information, including research results, on coastal and freshwater aquaculture technology shall be centralised and contained in a dedicated library open to public access. This initiative will also assist and guide the private sector towards international sources of information and shall network with other aquaculture organizations and associations (e.g. FAO, Aquaculture for Local Community Development Programme - ALCOM, Network of Aquaculture Centres in Asia-Pacific, International Centre for Living Resource Management (ICLARM), World Aquaculture Society (WAS), Aquaculture Association of Southern Africa (AASA), etc.). Individual aquaculturists, aquaculture communities and producer organisations are to be encouraged to promote responsible aquaculture technology, management and community development projects (MFMR, 2001).

On the international scene, FAO (2001) also recognises the importance of information by keeping on-farm records on inputs, operational procedures, occurrence of disease and water quality problems, productivity, sales and farm economics for the benefit of the individual farming entity and the sector in general. This is in line with FAO's Fisheries and Aquaculture mandate, which is to exchange reliable information on all related subjects as an enabler for the responsible management of aquaculture. The FAO Portal is used by fisheries stakeholders including farmers and it has developed specific pages on aquaculture where users can consult relevant material on aquaculture at international, regional and national level. The MFMR argues that the timely submission of annual production statistics shall be made a condition of permits granting aquaculture rights (MFMR, 2001).

The Namibia aquaculture strategic plan by the Ministry of Marine Fisheries and Marine Resources (2004) cites that the public sector currently needs information regarding aquaculture operations and benefits. The strategic plan further argues that lack of information results in a negative attitude and a public perception of aquaculture. For inland (freshwater aquaculture) in particular, local communities will control aquaculture activities, but positive public support is needed for expansion of all aquaculture, both inland and coastal, which will encourage public-private partnerships in aquaculture to be very effective.

3.4 Appraisal of the chapter

The fundamental objective of this chapter is that it has helped to push the frontiers of knowledge beyond new horizons with the sole purpose to reveal something novel. Research in the field of information seeking behaviour is becoming increasingly popular as a result of the contributions made by Wilson (1998; 2000), Dervin (1993; 1996), Ellis, Kuhlthau (1991) and Case (1996), just to mention a few. The chapter explores the information seeking and usage models as discussed in section 3.2 and found the two models (Model of Information Search Process by Kuhlthau (3.2.1), and Diffusions of Innovation by Rogers (3.2.2) to be relevant and suitable in assisting to answer the last research questions raised “What is/are the relevant model(s.) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?”. The literature review in this chapter is informed by themes from the research questions and shows that farmers need agricultural information to enhance or boost their productivity and also to be informed of modern farming systems in order to meet up with challenges that may arise in their occupation. The review used literature to explore the gaps that exists on studies on access and utilisation of knowledge and information by aquaculture farmers. In the quest to keep with current trends, the researcher could not avoid reviewing historical literature since the subject on information seeking behaviour of aquaculture farmers was not popular in Namibia and hence a combination of outdated and current literature was used to support the research questions. A gap on literature exists regarding the Internet Web technologies for aquaculture farmers and it was in the best interest of this research to explore situations in different countries whether these farmers use similar technologies, when communicating or sharing information and knowledge. The study also used literature to study the policies and legislation frameworks in support of information and aquaculture production.

3.5 Chapter summary

This chapter reviewed literature on access and utilisation of information and knowledge by aquaculture farmers. The literature review was arranged according to topics and sub-themes derived from the research questions. The themes on information and knowledge needs, access and usage of aquaculture farmers features authors such as Savolainen (2009), Papadopoullos (2005), AIIM (2002), Rather and Ganaie (2018), that defined the concepts of information needs, information access and information utilisation The chapter also reviewed literature on information sources and sharing strategies among aquaculture farmers' studies by FAO and CTA, all of which highlight on the aspects of sharing information and knowledge. Dervin (1993; 1996) and Wilson (1996; 2000) provided a yardstick to measure information and knowledge competences of an information seeker as well as levels of access and utilisation of information and knowledge by aquaculture farmers. The study reviewed policies governing information and aquaculture production by using blue prints from FAO, Uganda, and Vietnam. A number of information seeking and usage models were also reviewed in trying to address the research questions and these included studies by Dervin (1983), Ellis (1989), Case (1996) and Kuhlthau (2012). The driver of the study, which is the theoretical framework was discussed and championed by Kuhlthau's Six Stage Model and Roger's Diffusion of Innovation theory.

The next chapter which is Chapter Four (4) deals with the Research Methodology.

CHAPTER FOUR
RESEARCH METHODOLOGY

4.1 Introduction

Research methodology is a systematic way to solve a problem and it is a science of studying how research is to be carried out. Rajasekar, Philominathan and Chinnathambi (2013) assert that research methodology encompasses the procedures by which researchers go about their work of describing, explaining and predicting phenomena. In this study, the researcher focused on research methodology as the method by which knowledge is gained and its aim is to give the work plan of research. Thus, according to Bryman (2012) the credibility of the research is grounded upon its methodology. Carcary (2009) argues that credibility can be established through prolonged engagement with informants, triangulation of data or getting data from a variety of sources (interviews, documents etc.), sharing with each participant the verbatim transcript of the individual interviews, and the emerging concepts and categories or respondent validation. Researchmethodology is a way to systematically solve the research problem and may be understood as a science of studying how research is done scientifically and outlining various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them.

This chapter provides an overview of the research philosophy (4.2), which shows the development of knowledge and the nature of knowledge; research design (4.3), which spells out the strategy and blueprint for the collection, measurement and analysis of data; population (4.4), which includes the totality of all the objects, subjects or members through which the research wishes to draw its conclusions; sampling (4.5), that is, individual units of the population studied; data collection instruments (4.6), which is the device used to collect data; procedure (4.7), which described actions taken to investigate a research problem; reliability and validity (4.8) data analysis (4.9), which is the process of describing and summarising data so as to identify relationships between variables and lastly, research ethics (4.10), which are general guidelines observed when people are involved in research; evaluation of methodology (4.11) and ends with the chapter summary (4.12).

4.2 Research philosophy

Research philosophy is an important part of research methodology and it is a belief about the way in which data of a phenomenon should be gathered, analysed and used (Bryman, 2012). Saunders, Lewis and Thornhill (2012) wrote that research philosophy is classified as ontology, epistemology and axiology. These philosophical approaches assisted in deciding, which approach should be adopted by the researcher and the reason why, which is also derived from the research questions or objectives (Saunders, Lewis, & Thornhill, 2009). According to Saunders, Lewis and Thornhill, (2012), **Ontology** is a construct of belief that reflects an individuals' interpretation about what constitutes a fact. The term **axiology** is the study of values and how those values come about in a society, while **epistemology** is what is known to be true as opposed to **doxology** (what is believed to be true) which, encompass the various philosophies of research approaches. Easterby-Smith et al. (2002) outline three benefits of having a research philosophy:

- Helps the researcher determine the most appropriate research method.

- Provides the researcher with an overview of methodologies and methods. (Early on the researcher may determine the limitations of each particular approach to avoid unnecessary work).
- Assists inexperienced researchers to select and adapt methods.

Ontology and epistemology are major branches in philosophy. Slevitch (2011) states that ontology (onto in Greek 'being' and logia 'science, study, theory') can be defined as the study of reality or things that comprise reality. The view of Guba and Lincoln (1994) is that the ontological consideration is the question of what is the form and nature of reality and therefore, what can be known about it, is how things really are, and how things really work.

Bryman and Bell (2007) mention that an epistemological issue concerns the question of what is (or should be regarded as acceptable knowledge or facts in a discipline. They also state that a particularly central issue in this context is the question of whether or not the social world can and should be studied according to the same principles, procedures and ethos as the natural sciences. Similarly, Allison and Hobbs (2006) mention that ontological consideration is about answering the question of what is the nature of the knowable, or what is the nature of reality and the epistemological consideration is about the nature of the relationship between the knower (the inquirer) and the known (or knowledge).

Several research philosophies have been identified in the Western tradition of science such as pragmatism, positivism, realism or interpretivism as discussed below. The choice between positivist and interpretivist research philosophies or between quantitative and qualitative research methods has traditionally represented a major point of debate (Saunders, Lewis & Thornhill, 2009). In part, the philosophy adopted is influenced by practical considerations and these assumptions are the ones used by the researcher to support the chosen research strategy and method. However, the main influence is likely to be the particular view of the relationship between knowledge and the process by which it is developed as spelt out below.

4.2.1 Positivists paradigm

The first positivist school or positivism dates back to the 19th century French philosopher August Comte and the 17th century British empiricist philosopher John Locke (Tashakkori & Teddlie, 1998). The positivists' school believes that there is a single reality. The relationship between the knower and what is known are dualist or independent. Thus, the researcher acts as an observer and reports on the reality that is discovered through this observation. In addition, learning is transferring what exists in reality to what is known by the learner. Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Levin, 1988), i.e. without interfering with the phenomena being studied. This school also applies deductive logic. There is general concern in arguing from the general to the particular (Tashakkori & Teddlie 1998) since the strategy of inquiry associated with this school is the quantitative approach (Pickard, 2007). This study on access and utilisation of information and knowledge by aquaculture farmers by its nature measured a number of relationships regarding the usage and access patterns of information and knowledge by aquaculture farmers and it was therefore imperative to employ the positivist paradigm.

4.2.2 Post positivists

The second post-positivist school or post-positivism refers to scientific knowledge. It evolved in the 19th century as a reaction to positivism (Pickard, 2007). The major differences distinguishing post-positivism from positivism are that “the knower and the known cannot be divorced, and hence the absence of a shared, single reality” (Pickard, 2007, p. 7). Therefore, post-positivism reflects "a deterministic philosophy", which investigates the relationship of causes and effects or outcomes. This is also "reductionist" because it focuses on dividing the idea into small, separate, sets of testable ideas (e.g. variables that form hypotheses and research questions). The knowledge that builds from a post-positivist approach is based on empirical observation and measurement of the objective reality of the "real world". Therefore, the principal features for the post-positivist approach are developing numeric measures of observations and studying the behaviour of individuals (Creswell et al., 2003). This study was also informed by the post positivists approach in that each research question was tested in order to obtain empirical evidence. The themes from the research questions were further refined in order to obtain small and separate sets of testable ideas. Thus observation as a data collection method was used to observe the behaviour of fish farmers and to gather the objective reality of the "real world".

4.2.3 Interpretivist paradigm

The constructive assumptions or social constructivism (i.e. interpretivism or naturalism) is the third major school (Tashakkori & Teddlie, 1998 & Creswell et al., 2003). It is based on the belief that individuals seek understanding of the world in which they live and work. Individuals develop varied subjective meanings of their experiences, which interpretivists claim that only through the subjective interpretation of and intervention in reality can that reality be fully understood on certain objects or things, which direct the researcher to look for a complexity of views rather than narrowing· meanings into a few categories or ideas. The strategy of inquiry associated with the school of interpretivism or naturalism is the qualitative approach. Therefore, the purpose of research relies as much as possible on the views of the participants of the situation being studied (Creswell et al., 2003); in this case, the fish farmers or aquaculture farmers as well as the key informants (managers and extension officers). Interpretivism targets to understand the current phenomena rather than focusing the problems related to empowerment of individuals and societies. Mack (2010) refers that this theoretical perspective implicitly neglects the issues of power and agency, which are features of our society. This specific shortcoming on the part of the interpretivism paradigm has potentially led to the role of critical inquiry or paradigm as discussed below in section 4.2.4.

4.2.4 Critical paradigm

Critical theory is a theoretical tradition developed most notably by Horkeimer, Adorno, Marcuse at the Frankfort School (Kellner, 1989). Their work is a critical response to the works of Marx, Kant, Hegel and Weber. Critical theoretical approaches also known as “transformative paradigm” tends to rely on dialogic methods; methods combining observation and interviewing with approaches that foster conversation and reflection. This reflective dialogic allows the researcher and the participants to question the 'natural' state and challenge the mechanisms for order maintenance. This is a way to reclaim conflict and tension. Critical theorists are not just trying to describe a situation from a particular vantage point or set of values (e.g. the need for greater autonomy or democracy in a particular setting), but they are trying to change the situation (Couzens & McCarthy, 1994). The present study used both interviews and observation as data collection methods, which therefore meant that the conversation afforded the opportunity to the interviewer to question the natural state of things in the research. The use of open ended questions (Annexure B) allowed the researcher to provide follow-up questions, which were not necessarily in the interview guide. Observation as a data collection method also provided in depth study of the phenomena in which the researcher observed fish farmers exploiting information resources in-situ.

4.2.5 Pragmatism

The fourth philosophical school is pragmatism. Its roots lie with some American scholars, particularly C.S. Peirce, William James, and John Dewey (Tashakkori & Teddlie, 1998). Bryant and Charmaz (2007, p. 609) stated that pragmatism is an "American philosophical tradition that views reality as characterised by indeterminacy and fluidity, and as open to multiple interpretations". Creswell (2003), mentions that the pragmatist school of science is positioned within a value framework that questions how we know something. Pragmatism is considered as the foundation of the mixed-method approach (Patton 2001; Tashakkori & Teddlie 1998, Creswell, 2003). In this study, the researcher used a mixed method approach which triangulates both qualitative and quantitative data collection approaches with the view of gathering rich data since the weakness of one approach was complimented by the other approach. In this way, the researcher used the qualitative approach (interviews, observation, document analysis) in order to provide an in depth study of a particular situation based on an in-depth investigation of a single group (in this case fish farmers) or event rather than a sweeping statistical survey. The quantitative (surveys) complimented the qualitative data in order to cover the gaps that were left by the surveys and thereby making the study to become open to multiple interpretations through triangulation.

4.2.6 Discussion and rationale of paradigm choice

The choice of a specific philosophy for a research paradigm is impacted by practical implications as what has been defined above (4.2.1 to 4.2.5). There are important philosophical differences between studies that focus on facts and numbers such as an analysis of the impact of foreign direct investment on the level of GDP growth and qualitative studies such as an analysis of leadership style on employee motivation in organisations.

It has been observed by Creswell (2003) that no single research methodology is intrinsically better than any other methodology, and researchers such as Creswell (2003) and Yin (1989) call for a combination of research methods in order to improve the quality of research. Hence, in this research, the researcher tried to avoid what may be characterised as methodological monism, i.e. the insistence of using a single research method. This is not due to an inability to decide between the various merits and demerits of the various alternatives; instead, it had more to do with strengthening the research with the belief that all methods are valuable if used appropriately by including both elements of positivist and interpretivist approaches (Teddlie, Charles, Tashakkori, & Abbas, 2003).

The most over-riding concern when carrying out research is that the research should address the research question and objectives as spelt out in Chapter One (1) so as to test its operationalisation. The researcher looked at the first research question, "what are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?" To answer this question the researcher used the positivist paradigm, which assumes people can know reality and use symbols to accurately describe and explain this objective reality. Positivism also assumes that we can rely on our perceptions of the world to provide us with accurate data (Creswell, 1988) and therefore descriptive data was generated to measure information and knowledge needs; access and usage of information.

In the present study, the researcher believed that an interpretivist philosophy, which is the cornerstone of qualitative approach was also used to understand how information and knowledge was shared amongst fish farmers and this information could only be understood by talking to fish farmers themselves and observing how they access and use information in their natural setting. This research involved understanding an element of technology transfer in which information as a resource is packaged in different platforms; some of which are accessed using ICT tools and in this study the researcher asked in depth questions to gather rich data from the knower. This thus required the researcher to play a part in the research process in order to meet the research objectives. It would have been impossible to gather the views of the fish farmers without the researcher being involved. Therefore, recognising the richness of the data that needed to be collected; the researcher adopted a pragmatist approach considered to be the backbone of a mixed method approach. The two schools; that is; positivism and interpretivism were important in this study and the researcher saw the need to use the pragmatic philosophy, which combines both the qualitative and quantitative research approaches.

Pragmatism tends to rely on a combination of qualitative and quantitative methods. Researches under these two approaches were conducted in more natural settings and more situational data was collected. Methods to elicit participants' ways of knowing and seeing (interview, observation, text) were used to collect data together with a survey.

4.3 Research design

Research design deals with a "logical problem and not a logistical problem" (Yin, 1989, p. 29). The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring effective address of the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data. Before a builder or architect can develop a work plan or order materials they must first establish the type of building required, its uses and the needs of the occupants. Similarly, in social research, the issues of sampling, method of data collection (e.g. questionnaire, observation, document analysis), design of questions are all subsidiary to the matter of what must be collected as evidence (Creswell, 1998). Research design is different from the method by which data are collected. Bryman (2012) argues that many research methods texts confuse research designs with methods. It is not uncommon to see research design treated as a mode of data collection rather than as a logical structure of the inquiry (New York University, n. d,). But there is nothing intrinsic about any research design that requires a particular method of data collection.

4.3.1 Justification on the choice of the research design

The function of a research design is to ensure that the evidence obtained enables the enquirer to effectively address the research problem as unambiguously as possible. In social sciences research, obtaining evidence relevant to the research problem generally entails specifying the type of evidence needed to test a theory, to evaluate a programme, or to accurately describe a phenomenon (Yin, 1989).

There are different research designs that are utilised in research, all with certain benefits and drawbacks and these include descriptive research, case study, historical research design, cross-sectional design, experimental, quasi experimental designs and mixed method research designs just to mention a few. Kothari (2004) argues that the choice of design the researcher employs, is dependent upon the goals of the study and the nature of the phenomenon. Universal Teacher (2018) posits that the choice of design is dependent on the following factors:

- Exactly what information is the researcher interested in? The objectives of the study.
- The type of the phenomenon – Is it possible to gather the data, and if so, will it be valid/ reliable?
- How trustworthy should the information be?
- Is it ethical to carry out the research?
- What is the expense of the design?
- Is there little or much existing scientific theory and materials on the subject?

The preparation of such a design facilitates research to be as efficient as possible yielding maximal information. In other words, the function of the research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money (Kothari, 2004).

A mixed methods research design employing a concurrent triangulation strategy combining both qualitative and quantitative data collection approaches was selected and used for this study. Concurrent triangulation is characterised by two or more methods used to confirm, cross-validate, or corroborate findings within a study (Creswell, 2007). The benefit of employing a mixed methods approach was to ensure that there was a level of complementarity; that is, getting the best of both worlds, a point emphasised by Johnson, Onwuegbuzie and Turner (2007, p. 116), when they wrote "… researchers should not be trapped in either quantitative or qualitative prisons when they can benefit from integrating the two approaches". The data collection methods for quantitative approach were surveys and the qualitative approach were semi-structured interviews, observations and documentation review. Tashakkori and Creswell (2007), as proponents of mixed methods, argue that the design encompasses more than simply combining qualitative and quantitative methods but, rather, reflects a new "third way" epistemological paradigm that occupies the conceptual space between positivism and interpretivism.

Creswell (2007, pp. 215-222) defines different designs for mixed methods studies which are; "sequential exploratory, sequential explanatory, concurrent triangulation, and concurrent nested strategies". The current study employed the concurrent triangulation where both qualitative and quantitative data collection approaches were implemented concurrently (as opposed to sequentially) and used to confirm or corroborate findings within a single study. The advantage of implementing the two data collection methods concurrently stemmed from the fact that the researcher visited six political regions in Namibia and therefore it was important to administer both data collection methods at the same time in order not to overwhelm the respondents as opposed to the situation where if it was to be administered at different times. According to Creswell (2003), the mixed method model generally uses separate quantitative and qualitative methods as a means to offset the weaknesses inherent within one method with the strengths of the other method.

The mixed method approach was suitable for this study since the narrative and non-textual information from observations and interviews added meaning to numeric data, while numeric data from the survey added precision to narrative and non-textual information. A case in point is that this study included interviews to gather information from chief fisheries officers/farm managers and extension workers to ascertain the information needs of fish farmers. The questionnaire was administered on fish farmers to measure their information needs, access and usage patterns. Equally important was that the research problem under study was investigated and the researcher was not constrained by using only one method and thereby each research data collection method provided the research with rich data that was used to overcome the inherent weaknesses of another method.

4.4 Population

A population encompasses the entire collection of cases or units from which the research wishes to draw its conclusions (Welman & Kruger, 2001). Polit and Hungler (1999) refer to a population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications. In other words, a population of a study is the entire entity on which the researcher is interested in basing a study.

The population of this study included chief fisheries officers/farm managers and extension workers as well as the entire fish farmers in the fourteen political regions of Namibia; that is Erongo, Hardap, ǁKaras, Kavango East, Kavango West, Khomas, Kunene, Ohangwena, Omaheke, Omusati, Oshana, Oshikoto, Otjozondjupa and Zambezi regions. The exact number of fish farmers was unknown and according to the report on Namibia Census of Agriculture 2013/14 produced in 2015, Namibia had 859 aquaculture workers and a total of 241 households in Ohangwena (30); Omusati (122); Oshikoto (74) and Zambezi (15) that were involved in aquaculture farming. It should be noted that the figure of 241 households practicing fish farming did not include the other five regions, which also formed part of this study.

4.4.1 The eligibility criteria of the population

The eligibility criteria formed the basis and specified the characteristics of people who were included in the population. Polit and Hungler (1999) argue that the population must possess an eligibility criteria in order to be included in the study. The eligibility criteria in this study were that the participants had to conform to one of the criteria as shown below:

- Be practicing aquaculture farmers
- Occupy a managerial/ supervisory role in aquaculture farms

- Responsible for extension work or supervising extension workers in their respective regions.

4.5 Sampling

Sampling, as it relates to research, refers to the selection of individuals, units, and/or settings to be studied (Patton, 2001). It is also the process of selecting units (e.g., people, organisations) from a population of interest so that by studying the sample the researcher may fairly generalise results back to the population from which they were chosen. The difference in sampling strategies between quantitative and qualitative studies is due to the different goals of each research approach. Typical quantitative research seeks to infer from a sample to a population (for example, a relationship or a treatment effect). In general, the goal of quantitative approaches according to Nastasi (2004, p.1.) can be stated as, “empirical generalisation to many”. Whereas, on one hand quantitative studies strive for random sampling, and on the other hand, Nastasi (2004, p.1.), observed that qualitative studies tend to use more purposeful or criterion-based sampling, that is, “a sample that has the characteristics relevant to the research question(s)”.

4.5.1 Sampling techniques used in qualitative approach

In qualitative research, there are various sampling techniques that one can use when recruiting participants (Creswell, 2003). The aim of the qualitative research is to understand, from within, the subjective reality of the study participants. This understanding of participants cannot be achieved through superficial knowledge about a large, representative sample of individuals. Rather, it is important to reach people within the study area who can share their unique experience of reality, so that each of the experiences put together can illustrate the range of variation within the study area.

Patton (2001) argues that the two most popular sampling techniques are purposeful and convenience sampling because they align the best across nearly all qualitative research designs. Sampling techniques can be used in conjunction with one another very easily or can be used alone within a qualitative dissertation.

Purposeful sampling also known as purposive or selective sampling is a sampling technique that qualitative researchers use to recruit participants who can provide in-depth and detailed information about the phenomenon under investigation (Nastasi, 2004). It is highly subjective and determined by the qualitative researcher generating the qualifying criteria each participant must meet to be considered for the research study.

Etikan, Musa and Alkassim (2016) explain that convenience sampling is a sampling technique that qualitative researchers use to recruit participants who are easily accessible and convenient to the researchers. Often times, this may include utilising geographic location and resources that make participant recruitment convenient. There are additional sampling techniques such as snowball and quota sampling, that qualitative researchers can use, but the majority of qualitative researchers utilise one of the sampling techniques described above.

The sample size of 60 respondents was achieved through the database, which was used as a sampling frame. Although old, this database was used to determine the sample size per region after using a randomised table. The sample size did not necessarily suffer as farmers were seasonal depending on the rainfall patterns. More so the number was drawn from the current practising farmers since the number varied from time to time. Due to these variations the ministry failed to maintain an updated list. This also became part of the weakness of the study under the evaluation of the methodology (4.11). The sampling technique used in the qualitative approach of this study was purposive sampling. The key informants were selected purposively and a criterion was used as mentioned below. These key informants included chief fisheries officers/extension workers and farm managers who had served in their capacity for a period not less than two years and were interviewed in their respective work stations. The criteria used in selecting these key informants (managers) were based on their positions, which they hold in their institutions and knowledge of the subject area. Two people inclusive of: one (1) chief fisheries officer and one (1) extension officer were interviewed in each region (Kavango East, Kavango West, Zambezi, Omusati, Hardap and Erongo regions). Instead of studying the whole of Namibia, the researcher also purposefully selected six regions; based on prior information gathered through discussions with the Director of Aquaculture in the Ministry of Fisheries and Marine Resources (MFMR). These six regions were chosen because of their nearness or proximity to large water bodies. For instance, Kavango, river justified the inclusion of Kavango East and Kavango West, the Zambezi and Kwando rivers motivated the selection of the Zambezi Region, Kunene river made the inclusion of the Omusati region possible, Hardap dam necessitated the inclusion of Hardap region and Erongo region was included because of the coastal and fishing activities along the Atlantic ocean. A study on aquaculture, like this one depended a lot on the availability of water resources and therefore it was necessary to only include areas which have perennial water bodies.

Institutional documents such as memoranda and minutes, dealing with how farmers manage, access, use and share information and knowledge were also purposefully selected in the six political regions. The researcher also used an observation checklist to purposefully observe materials used by aquaculture farmers, medium of communication used, availability and use of ICTs, photographs and description of information sharing strategies.

4.5.2 Sampling techniques used in quantitative approach

Quantitative research often is interested in being able to make generalisations about groups larger than their study samples (Bryman & Cramer, 1994). While there are certainly instances when quantitative researchers rely on nonprobability samples (e.g., when doing exploratory or evaluation research), quantitative researchers tend to rely on probability sampling techniques.

Probability sampling uses randomisation and takes steps to ensure all members of a population have a chance of being selected. There are several variations on this type of sampling and the following is a list of variations where probability sampling may occur:

- Random sampling – every member has an equal chance,
- Stratified sampling – population divided into subgroups (strata) and members are randomly selected from each group,
- Systematic sampling – uses a specific system to select members such as every 10th person on an alphabetised list,

- Cluster random sampling – divides the population into clusters, clusters are randomly selected and all members of the cluster selected are sampled, and
- Multi-stage random sampling – a combination of one or more of the above methods

The study under investigation besides using the purposive sampling technique for the qualitative approach (interviews), also used the multi stage sampling technique for the quantitative approach (surveys) starting with simple random technique (used to pick respondents from the database) in order to gain entry into the locations where fish farmers were based (catchments) and employing accidental or convenience sampling technique, which was based on the availability of respondents. A Randomised table was applied to select farmers from the database at regional offices. The sampling technique benefitted from both probability and non-probability sampling techniques, that is, simple random and accidental random sampling to achieve a multi layered/stage sampling technique. An accidental sample also known as convenience sample is a type of non-probability sampling method where the sample is taken from a group of people easy to contact or to reach (Creswell, 2013). Since fish farmers were located in sparsely populated areas, the extension or fisheries officers were used as the first contact points to locate practicing fish farmers who were easily accessible. The database for fish farmers at each of the MFMR regional office was used as a sampling frame and the researcher employed a simple random technique to gain entry in the catchment area. Once in the catchment area, the researcher utilised the convenience sampling technique to afford the opportunity of the respondents who were available to be included in the survey. According to data collected through interviews each region had the following approximate number of fish farmers: Hardap Region (30); Omusati Region (100); Kavango East Region (100); Kavango West Region (100); Zambezi Region

Region (100) and Erongo Region (50). The extension officers thus were the first point of contact since they possessed knowledge about people who were involved in fish farming in their respective regions and therefore referred the researcher to the fish farms. In some cases, the farmers were found working in their ponds whereas in other cases the farmers were followed to their places of residence for purposes of administering a survey questionnaire. A total of 60 fish farmers including technicians who were working in the ponds (whose work according to the researcher was seen as equal to that of the fish farmers) were included in the survey and these were workers who worked full –time on the fish farms and represented their bosses (farm owners) who had their full time jobs in town. In some cases, the owners of the fish ponds assumed the role of managers and left the day to day running of the pond to their technicians. These technicians were included in the study as fish farmers since their day to day duties were not different from those of bona fide fish farmers. These duties included the following: feeding the fish, restocking, performing tests to ensure water quality and temperature, checking the health of the population, notifying veterinarians of any health concerns, and properly cleaning and maintaining ponds or tanks.

4.6 Data collection methods

Data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes (Neuman, 2006). Neuman (2006) further states that data collection is a process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer queries, stated research questions, test hypotheses, and evaluate outcomes. The choice of the many methods for collecting data on access, and utilisation of knowledge of aquaculture information by fish farmers depended on the variables measured. Some of these variables which were measured included information needs, information access and information usage.

In many cases, there is a natural way to collect particular variables in a research study. There are a variety of methods of data collection in qualitative research, including observations, textual or visual analysis (e.g. from books or videos) and interviews (individual or group) (Creswell, 2002). However, the most common methods used, particularly in social science research, are interviews and focus groups.

Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection. This research being a mixed method approach required the researcher to use data collection methods, which are grounded in both qualitative and quantitative approaches.

4.6.1 Secondary data collection methods

Secondary data is a type of data that has already been published in books, newspapers, magazines, journals, and online portals (Johnson & Turner, 2003). Secondary data offer abundant data through different sources of information in a particular research, such as business studies or social science research area. Therefore, application of an appropriate set of criteria to select secondary data to be used in the study plays an important role in terms of increasing the levels of research validity and reliability. Johnson and Turner (2003) argue that this criterion include, but is not limited to date of publication, credentials of the author, reliability of the source, quality of discussions, depth of analyses, the extent of contribution of the text to the development of the research area etc. Thus, the study under review used document analysis to gather information regarding the policy issues of aquaculture in Namibia and to collect statistics and pieces of legislation that added value to the study.

4.6.2 Primary data collection methods

Primary data collection methods can be divided into two groups: quantitative and qualitative (Johnson & Turner, 2003). Quantitative data collection methods are based on mathematical calculations in various formats. Methods of quantitative data collection and analysis include questionnaires with closed-ended questions, methods of correlation and regression, mean, mode, median and others. Quantitative methods are cheaper to apply and they can be applied within a shorter duration of time compared to qualitative methods (Creswell, 2002). Moreover, due to a high level of standardisation of quantitative methods, it is easy to make comparisons of findings. Qualitative research methods, on the contrary, do not involve numbers or mathematical calculations. Qualitative research is closely associated with words, sounds, feeling, emotions, colours and other elements that are non-quantifiable (Creswell, 2002).

Qualitative studies aim to ensure greater level of depth of understanding and qualitative data collection methods include interviews, questionnaires with open-ended questions, focus groups, observation, game or role-playing, and case studies (Bryman, 2007).

The primary focus of this study was to gather rich data coupled with statistical inferences and thereby the researcher used the mixed method approach, which allowed triangulation of data collection methods. The primary data collection methods used for the qualitative approach were interviews, and observations. Surveys were also used as part of the quantitative approach to gather data from the fish farmers who were scattered around the regions, which were visited.

4.6.3 Data collection methods and instruments in mixed methods

The term “mixed methods” refers to an emergent methodology of research that advances the systematic integration, or “mixing,” of quantitative and qualitative data within a single investigation or sustained programme of inquiry (Creswell, 2002). The basic premise of this methodology is that such integration permits a more complete and synergistic utilisation of data than do separate quantitative and qualitative data collection and analysis.

Research instruments are the tools for data collection and they include questionnaire, interview guide, observation checklist and document review (Bryman, 2008). The researcher ensured that the instruments chosen were valid and reliable. Welman et al. (2005) posit that the validity and reliability of any research study depend to a large extent on the appropriateness of the instruments. Among the most used instruments in qualitative investigation are the observation checklist, interview guide, and document review checklist (Babbie & Mouton, 2001). In quantitative investigations, the most popular ones are the structured questionnaire and semi structured questionnaire.

Several data collection methods were employed to gather data for this research. The data collection methods together with their research instruments used are discussed below as follows:

4.6.3.1 Semi structured questionnaires

Quantitative research typically uses structured questionnaires in the form of a survey. Siniscalco and Auriat (2005) proffer that a formal standardised questionnaire is a survey instrument used to collect data from individuals about themselves, or about a social unit such as a household or a school and a questionnaire is said to be standardised when each respondent is to be exposed to the same questions and the same system of coding responses. The survey is probably the most commonly used research design in the social sciences (Siniscalco & Auriat, 2005). The survey is a flexible research approach used to investigate a wide range of topics. Surveys often employ the questionnaire as a tool for data collection.

Bryant and Charmaz (2007) note the advantages of questionnaires, which include increased speed of data collection, low or no cost requirements, and higher levels of objectivity compared to many alternative methods of primary data collection. However, questionnaires have certain disadvantages such as selection of random answer choices by respondents without properly reading the question. Moreover, there is usually no possibility for respondents to express their additional thoughts about the matter due to the absence of a relevant question.

Some mixed method researches use both structured questionnaire and semi structured as well as open ended questionnaire. A semi structured questionnaire is a mix of unstructured and structured questions. Some of the questions and their sequence are determined in advance, while others are open-ended so as to solicit the views, and feelings of the respondents (Welman & Kruger, 1998).

The present study utilised the semi structured questionnaire with the majority of structured questions and a few unstructured questions. The reasons for adopting the semi structured questionnaire were to obtain in-depth views of aquaculture farmers. The researcher also noticed that a semi structured questionnaire provided much room for the fish farmers to provide their views, opinions and feelings. It also limited long answers, which do not address the question.

Semi structured questionnaires were administered to 60 fish farmers in Hardap, Erongo, Kavango West, Kavango East, Omusati and Zambezi Regions. The semi structured questionnaire was divided into eight sections as follows:

- Section 1: Demographic characteristics of the information user
- Section 2: Information needs of aquaculture farmers
- Section 3: Information needs, access and usage
- Section 4: Frequency of the use of information sources
- Section 5: Information literacy levels
- Section 6: Policies governing information and aquaculture production
- Section 7: Information seeking
- Section 8: Other questions

The semi structured survey questionnaire, which was administered by the researcher (face to face), was employed in order to minimise the difficulties that the respondents were likely to encounter with the technical terms used in the field of information science and fisheries. The advantage observed when using the face to face semi structured questionnaire was that it was faster to cover a number of people and also the retain rate was assured to be 100 percent.

4.6.3.2 Semi-structured interviews with key informants

Interviews can be defined as a qualitative research technique, which involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program or situation (Kvale, 1996). Advantages of interviews include possibilities of collecting detailed information about research questions. Moreover, in this type of primary data collection, the researcher has direct control over the flow of process and has a chance to clarify certain issues during the process if needed. Disadvantages, on the other hand, include longer time requirements and difficulties associated with arranging appropriate times with perspective sample group members to conduct interviews (Adam, 2015).

Interviewing, as Dörnyei (2007, p. 140) argues, is 'a natural and socially acceptable' way of collecting data as it can be used in various situations covering a variety of topics. In line with this, as recommended by other researchers (e.g. Bell, 1987; Kvale, 1996; Berg, 2007), interviewing should be adopted as a tool for social research as it facilitates obtaining 'direct' explanations for human actions through a comprehensive speech interaction.

Interviews can take different forms; that is, face to face (FtF), telephonic and most recently electronic interviews through the Internet are also becoming very popular. Beside face-to-face (FtF) interview and telephone interview the use of new communication forms such as e-mail and MSN messenger opens new ways for qualitative research workers for data collection (Bryman, 2001). The type of interview technique chosen by the researcher can depend upon the advantages and disadvantages, which are linked to every interview technique.

According to Bryman (2001), face to face (FtF) interviews can be audio / voice recorded with the permission of the interviewee. Using a voice recorder has the advantage that the interview report is more accurate than writing out notes. However, voice recording also brings with it the danger of not taking any notes during the interview. Taking notes during the interview is important for the interviewer, even if the interview is voice recorded: (1) to check if all the questions have been answered, (2) in case of malfunctioning of the voice recorder, and (3) in case of malfunctioning of the interviewer. Another disadvantage of voice recording the interview is the time a transcription of the voice recording consumes. Bryman (2001) further suggests that one hour of tape takes five to six hours to transcribe.

An interview guide was used to collect data from twelve (12) key informants (made up of two from each of the six regions) (chief fisheries officers/ managers and extension officers) drawn from the Ministry of Fisheries and Marine Resources (MFMR) as well as government departments and organisations or companies involved with aquaculture programmes in Namibia. These included managers, cooperative chairpersons and MFMR officials. A semi-structured interview guide was preferred for this group because of its advantage to gather in-depth knowledge or views and the fact that they were very knowledgeable about the industry and issues of access and utilisation of knowledge and information by fish farmers in their daily lives. Semi structured interviews allowed flexibility and rephrasing where clarification was needed in data collection. Bryman (2007) argues that interviews facilitate adaptability of formulation of questions and terminology to suit the interviewee’s background and educational level. The researcher wrote notes while interviewing since a number of key informants were not willing to be recorded and a consent form was handed for signing before the interviews. The interview questions were divided into six sections as follows:

- Section A: Information and knowledge needs, access and usage
- Section B: Information and knowledge sources including sharing strategies
- Section C: Information literacy levels and knowledge competencies
- Section D: Policies governing information and aquaculture production
- Section E: Knowledge and information seeking models or theories
- Section F: Information infrastructure for aquaculture farmers in Namibia

All the sections were followed by sub-questions, which were either closed ended or open ended. These semi-structured interviews contained the components of both, structured and unstructured interviews and the researcher prepared the same set of questions to be answered by all interviewees. At the same time, additional questions were asked during interviews to clarify and/or further expand certain issues (see Annexure B).

4.6.3.3 Observation

Observation is a way of collecting data through observing (Creswell, 2002) and it is a data collection method, which is grounded in qualitative studies. It is classified as a participatory study, because the researcher has to be involved in the setting where his respondents are present, while at the same time taking notes and/or recording.

Welman, Kruger and Mitchell (2005) proffer that observation as a data collection method can be structured or unstructured. In structured or systematic observation, data collection is conducted using specific variables and according to a pre-defined schedule. Unstructured observation, on the other hand, is conducted in an open and free manner in a sense that there would be no pre-determined variables or objectives.

In this study, an observation checklist was employed to gather images and information on how farmers access and utilise their information and knowledge on aquaculture when carrying out their daily routine duties. The checklist was structured or systematic because there were predefined variables, which were measured. The observation checklist included the following variables, which were observed:

- Materials frequently used by aquaculture farmers (what materials, how often do they use them (through statistics obtained from borrowing materials if any))
- Availability of information sources (medium of communicating information)
- Availability of ICT gadgets
- Description of information sharing (who was involved, who said what, who initiated the exchange, did one or another information occur as a result, what type of emotions were attached to the information exchange?) The researcher visited Site A and B where meetings were held by cooperative members.
- Photographs

At the same time, the observation method also provided a number of disadvantages in the sense that there was a likelihood of modification of behaviour since participants were already informed by the researcher of the impending study. The challenge of modification of behaviour on the part of the participant entailed the researcher to assume the role of a participant observer. The researcher asked several questions (some not linked to the study) to the participants so as to create a natural environment and remove the feeling of being observed.

4.6.3.4 Secondary data sources/document analysis

Bearing in mind that reliance on information gathered through questionnaires, interviews and observations only, was not going to be enough as this could give a superficial account of the subject matter. The researcher used secondary documents of interest from specialised agencies working on issues relating to fisheries in the country such as; minutes, memoranda, reports, and policy documents. The documents covered in this study evolved around the following themes:

- Policy issues
- Legislation frameworks
- Annual reports from the Ministry of Fisheries and Marine Resources
- FAO/ International organisation reports
- Newspaper articles

These documents were analysed through content analysis to give an understanding of the perceived nature of challenges faced by aquaculture farmers in Namibia that are related to access and utilisation of knowledge and information.

4.7 Procedures

Procedure is a step by step process, which the researcher ought to do in order to gain access to his subjects (Creswell, 2002). The researcher wrote to the Permanent Secretary (PS) of the Ministry of Fisheries and Marine Resources requesting for authorisation to conduct a study of which the authorisation was approved (Annexure E).

Each region (i.e., Hardap, Erongo, Kavango West, Kavango East, Omusati and Zambezi Regions) was thereafter approached separately requesting for a date to conduct a study in their respective regions through the office of the chief fisheries officer. After the appointment was approved, the researcher travelled to the regions to conduct interviews with managers (fisheries officers) and administer a survey questionnaire and observation with aquaculture farmers in the region. Documents from libraries including organisations as well as the Internet dealing with aquaculture were also collected during the regional visits.

4.8 Reliability and validity

Researchers performing analysis on either quantitative or qualitative analyses should be aware of challenges to reliability and validity. For example, in the area of content analysis, Gottschalk (1995) identifies three factors that can affect the reliability of analysed data:

- stability, or the tendency for coders to consistently re-code the same data in the same way over a period of time
- reproducibility, or the tendency for a group of coders to classify categories membership in the same way

- accuracy, or the extent to which the classification of a text corresponds to a standard or norm statistically

The potential for compromising data integrity arises when researchers cannot consistently demonstrate stability, reproducibility, or accuracy of data analysis. A lot has been mentioned on reliability and validity such that the whole dissertation can be written about the two and only the relevant aspects were chosen for this study as discussed below:

4.8.1 Reliability

Reliability refers to the extent to which assessments are consistent (Welman, Kruger & Mitchell, 2005). Maree and Fraser (2004) define reliability as relating to how far the same test would produce the same results if it was administered to the same group under the same conditions. This means a test is seen as being reliable when it can be used by a number of different researchers under stable conditions, with consistent results and the results not varying. There are two types of reliability – internal and external reliability. Internal reliability refers to the extent to which a measure is consistent within itself, while external reliability refers to the extent to which a measure varies from one use to another (Moss, 1994; Neuman, 2003). The supervisors assisted in checking the reliability so as to ascertain whether the instruments were designed to measure what they were supposed to measure. The interview guide and the observation checklist were also scrutinised by the supervisors to ascertain whether the questions asked were in line with the research questions in order to provide the correct and reliable answers. A pre-test of both the questionnaire and interview guide was conducted at the Ministry of Agriculture and Water Resources to remove any ambiguity and ensure clarity on the instruments (4.8.3).

4.8.2 Validity

According to Bond (2003, p. 179), validity "…is foremost on the mind of those developing measures and that genuine scientific measurement is foremost in the minds of those who seek valid outcomes from assessment".

From the above quotation, validity can be seen as the backbone of any form of investigation or assessment that is trustworthy and accurate. Messicks (1989, p. 5) notes that "...what is to be validated is not the test or observation device but the inferences derived from the test scores or other indicators..." An inference can be seen as the interpretation made by a person about a test or assessments results and for this reason it would be incorrect to say that a test is valid since only inferences about the test can be valid or not. Welman, Kruger and Mitchell (2005) refer to validity as the accuracy of an assessment. Research validity can be divided into two groups which are internal and external. According to Pelissier (2008, p.12), "…internal validity refers to how the research findings match reality, while external validity refers to the extent to which the research findings can be replicated to other environments".

The questionnaire, interview guide and observation checklist were checked by the extension officers at the Ministry of Agriculture and Water Resources, to ascertain if they were addressing all the questions regarding need, access and utilisation of information by fish farmers. Thus, the instruments were considered valid because each individual question seemed to address specific and relevant aspects of information seeking behaviour of fish farmers. The other way of validating the data generated from the research was through the use of triangulation since the research used a mixed method data collection approach. The use of the semi structured questionnaire, interview guide and observation checklist enabled the instruments to complement each other and to cover the data gaps in areas where one instrument was rendered to be weak. This ensured that the research and the data gathered and generated were valid.

4.8.3 Pre-test of instruments

A pre-test of instruments on similar respondents with similar characteristics was conducted at the Ministry of Agriculture and Water Resources (MAWR) for both surveys and interviews so as to ensure clarity, remove ambiguity and prevent possible confusion from the questions. The researcher administered a survey questionnaire to 10 staff members at the Ministry of Agriculture and Water Resources (MAWR) to check on the reliability. A questionnaire was split into half for each of the respondents and the results were compared to check whether they were any discrepancies in order to ensure its reliability as a data collection tool. For instance, the 4 Point Likert Score was used in the survey questionnaire to measure consistently, the need, access, usage and sharing strategies of aquaculture information. This was one way of ascertaining whether the questionnaire was reliable. An interview scheduled was also pre-tested and the 3 chief extension officers were interviewed. The interview schedule was used to check consistency and accuracy. The data collected from both the questionnaire and the interview schedule were not included in the study and formed the basis for checking the reliability and validity of the instruments.

4.9 Data analysis

Data analysis is the process of extracting information from data (Bryman & Cramer, 1994). Data analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. According to Shamoo and Resnik (2003), various analytic procedures provide a way of drawing inductive inferences from data and distinguishing the phenomenon of interest from statistical fluctuations present in the data. While data analysis in qualitative research can include statistical procedures, many times analysis becomes an ongoing iterative process where data is continuously collected and analysed almost simultaneously. Researchers generally analyse for patterns in observations through the entire data collection phase (Silverman & Manson, 2003).

The form of the analysis is determined by the specific qualitative approach taken; whether field study, ethnography content analysis, oral history, biography, unobtrusive research and the form of the data (field notes, documents, audiotape, videotape). Data analysis involves multiple stages including establishing a data set, preparing the data for processing, applying models, identifying key findings and creating reports.

The quantitative data (generated through questionnaires) was analysed in the spreadsheets, SPSS to present descriptive and inferential statistical information. The analysis of data was descriptive in nature and frequency counts through mean, mode and median were calculated to measure access and usage of information and knowledge, which were presented in graphs and tables (see Chapter 5).

The qualitative data (generated from interview guide) and open ended questions in questionnaires were analysed using content analysis by checking on the repetitiveness of themes coming from the interviewees such as need, access and utilisation of information and knowledge. Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual material (Shamoo & Resnik, 2003). Data gathered through observations were also coded in themes, and images of fish farmers were presented as they access and utilise information in their environments. However, the data was analysed by combining the benefits of qualitative analysis with quantitative analysis since by integrating qualitative and quantitative analysis of verbal data the interpretation of the results became less subjective since data from both approaches was triangulated to measure its accuracy and validity.

All transcribed interviews including institutional documents were coded into meaningful categories (themes) such as access, usage and sharing strategies using the qualitative data analysis through content analysis. The application, Microsoft Word was chosen for coding qualitative data into categories because only 12 participants were interviewed and this meant that the data could be handled well by organising it in themes through content analysis using the word processing application, Microsoft Word.

4.10 Research ethics

Research ethics offer researchers with guidelines in terms of what is considered acceptable and unacceptable behaviour (Du Plooy-Cilliers, 2014). It is therefore, the researcher’s responsibility to make sure that all the ethical protocols are adhered to at all times. The researcher was issued with an ethical research certificate (Annexure F) which was used to prove that the research posed no harm to the subjects; that is both fish farmers and their managers/extension workers.

Informed consent refers to briefing the research participants about the purpose of the study. Louw (2014) advises that, with informed consent, the participants must know that they are part of the study. The researcher sought permission from farmers concerned in the study by asking them to sign a consent form and the confidentiality of information provided was observed. Participants were also informed about the benefits of this research prior to conducting the interviews and surveys of which they were allowed to express their willingness or unwillingness to participate without coercion.

Anonymity and confidentiality are considered important concerns for research participants. Confidentiality refers to the promise that "even though we will be able to match the participants' identities to their research responses, that information will be known only to the researcher and will be made available to no one else" (Louw, 2014, pp. 267-268). It is for this reason that the study used codes instead of the names of participants or institutions in order to hide and protect the identities of participants. Codes such as HA1& HA2 (Hardap), OM1 & OM2 (Omusati), KE1 & KE2 (Kavango East), KW1 & KW2 (Kavango West), ZA1 & ZA2 (Zambezi) and ER1 & ER2 (Erongo). Respondents were told not to provide their personal details or information on the questionnaire. Notes from interviews and completed questionnaires were kept under lock where they are only reachable to the researcher.

4.11 Evaluation of methodology

The evaluation of methodology helped the researcher to better understand the steps needed to do a quality evaluation (Baehr, 2004). In this section, the discussion of the use of methodology is geared towards the evaluation of the methodology. Wiggins and McTighe (1998) posit that the evaluation process reduces the occurrence of bias from evaluations and justifies decisions, even difficult decisions.

Mixed methods research (MMR) has not been exempted from criticism and has been criticized for its pragmatic approach to exploring research problems and should therefore not be regarded as a different and new research approach. In the present study, quantitative and qualitative research procedures were implemented concurrently for both the surveys and interviews due to the fact that fish farmers were spatially located in their respective regions. Opting for a sequential approach would have meant that the researcher was going to visit each region twice; which was going to be a situation, which could have overwhelmed the respondents and the contact people who were facilitating the research. Denzin and Lincoln (2011) argue that the sequential mixed methods research design involves a two-phase project in which the qualitative data help to explain in more detail some of the discrepancies deduced from the quantitative findings.

The concurrent approach has been criticised by Creswell (2014) because it does not allow the researcher to evaluate each phase of the data collection exercise in preparation for the next phase of data collection. Thus, to curb the weakness of the sequential approach used during data collection, the researcher used the questions on the interview guide and was also keen to ask further questions not reflected in the guide (if there was any need to elaborate). In this way, this meant that discrepancies deduced from the quantitative findings were curbed by further questions asked during interviews (qualitative findings) and thereby making the data reliable.

The technique used for sampling fish farmers was a simple random sampling technique, which was applied in all the regions visited. Convenience sampling is a specific type of non-probability sampling method that relies on data collection from population members who are conveniently available to participate in a study whereas, a simple random sample is a subset of a statistical population in which each member of the subset has an equal probability of being chosen (Welman & Kruger, 2001).

The researcher was aware that an accidental or convenience sampling technique could have been employed but opted for the simple random technique because of the nature of the research and the situation encountered on the ground as follows:

- The researcher used databases at regional offices to select fish farmers to be included in the survey. The researcher did not have any control in choosing the subjects and extension officers (who knew the area well) were responsible for choosing and in most cases their criteria was based on availability and accessibility.
- The sample size in each region was determined by the availability of the subjects and therefore it varied from region to region. The sample size could therefore not culminate to be a representation of the subset of the population.

On the other hand, opting for convenience sampling could have yielded disastrous consequences since the researcher was going to venture into the unknown area and hence depending on the local staff yielded positive results which resulted in the decision to opt for a multi stage sampling technique.

The study suffered a setback in the sense that the database which was used as a sampling frame was out dated since the Ministry could not maintain an updated list. This shortcoming was however countered by the fact that the study benefited from a multi stage sampling technique by applying both random and non-random sampling techniques. The sample size of 60 did not necessarily suffer and was perceived as adequate since fish farmers were seasonal depending on the rainfall patterns which resulted on the sample to be drawn from the current practising farmers since their numbers varied from time to time.

In mixed methods research, investigators use both quantitative and qualitative data because they work to provide the best understanding of a research problem. The researcher agrees with the pragmatists` philosophical worldviews that, knowledge is conjectural, absolute truth can never be found; thus knowledge found in research is always imperfect and fallible (Creswell, 2014) and thus this present study did not seek absolute truths, but provided a better understanding of the research phenomena.

4.12 Chapter summary

This chapter dealt with the road map in carrying out this study starting with the philosophical views of which the pragmatic paradigm was selected for this study because of its flexibility to accommodate both quantitative and qualitative approaches. A mixed methods approach was used to answer the research questions raised in this study. The population of the study included aquaculture farmers, fisheries officers/ managers, extension officers in the aquaculture industry in Namibia. The sample was made up of six regions (Hardap, Erongo, Kavango West, Kavango East, Omusati and Zambezi Regions) selected purposively and the survey included 60 fish farmers selected using a simple random sampling technique. The interviews were made up of two fisheries officials from each of the 6 regions mentioned above (1 x Chief fisheries officer/ manager and 1x Extension officer). The researcher observed the availability of information sources (medium of communicating information), photographs, etc., and ICT gadgets used by farmers when accessing information. Semi-structured questionnaires were used to collect quantitative and qualitative data, while semi structured interview guides, observation checklist and document analysis checklist were used to collect qualitative data. SPSS, software for calculating frequencies was used and this assisted to analyse data by grouping it into themes generated from the questionnaires. Content analysis was also used to analyse qualitative data, which was organised in themes in Microsoft Word. The chapter concludes by explaining how the researcher addressed ethical issues in the study and evaluation of methodology.

The next chapter (Chapter Five) is on data analysis and presentation.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1 Introduction

This chapter is on data analysis and presentation of findings for quantitative data (Part 1) and qualitative data (Part 2) as follows:

Chapter 5 is divided into two parts, that is, Part 1 (Data analysis and presentation of findings for quantitative data) and Part 2 (Data analysis and presentation of findings for qualitative data). Each part is arranged according to the research questions of the study and followed by sections which are derived from the themes emerging from research questions (excerpt for Section A: Demographic data). Section A (5.2) provides demographic characteristics of information users, while Section B (5.3) covers the types of information needed and used by aquaculture farmers, Section C (5.4) is a presentation of the specific types of information needed by aquaculture farmers, Section D (5.5) is a presentation of the medium of accessing information on aquaculture, Section E (5.6) is a presentation of the places for accessing aquaculture information by fish farmers, Section F (5.7) is a presentation of the problems encountered by fish farmers when accessing information, Section G (5.8) is a presentation of the frequency of usage of aquaculture information by respondents, Section H (5.9) is a presentation of the barriers to information access and use, Section I (5.10) is a presentation of prohibitive factors of using the Internet, Section J (5.11) is a presentation of frequency of use of information sources, Section K (5.12) is a presentation of most valuable information sources, Section L (5.13) is a presentation of frequency of sharing information, Section M (5.14) is a presentation of information sharing strategies for aquaculture farmers, Section N (5.15) is a presentation of usage of Internet technologies, Section O (5.16) is about the presentation of information literacy levels, and finally Section P (5.17) is the data analysis and presentation of the findings for the qualitative study.

The findings for the quantitative data in Part 1 were obtained through surveys from the study population group of all aquaculture farmers in the six political regions that were visited, which is made up of a sample of 60 fish farmers (Refer to 4.3). The findings of the qualitative data in Part 2 were obtained through interviews held with 4 chief fisheries officers and 2 manager of fish farm (categorised as managers) and 6 fisheries officers (categorised as extension workers), document analysis and observation. Both managers and fisheries extension officers were purposively selected and coded as Key Informants HA1& HA2 (Hardap), OM1 & OM2 (Omusati), KE1 & KE2 (Kavango East), KW1 & KW2 (Kavango West), ZA1 & ZA2 (Zambezi) and ER1 & ER2 (Erongo) as indicated in Table 5.1.1. According to the coding a “1” represented the chief fisheries officer / manager and a “2” represents fisheries officer who doubled his or her role as an extension officer/worker. Observations were carried out at two sites (Kavango East and Zambezi Regions) in which the researcher observed the information needs, access, utilisation and sharing strategies of fish farmers. Part 2 also includes data obtained through the observation checklist and document analysis.

Table 5.1.1: Codes used for the interviewees

Region	Code	Designation of the interviewee
Hardap	HA1	Chief fisheries officer / Manager
Hardap	HA2	Fisheries officer / Extension officer
Omusati	OM1	Chief fisheries officer / Manager
Omusati	OM2	Fisheries officer / Extension officer
Kavango East	KE1	Chief fisheries officer / Manager
Kavango East	KE2	Fisheries officer / Extension officer
Kavango West	KW1	Chief fisheries officer / Manager
Kavango West	KW2	Fisheries officer / Extension officer
Zambezi	ZA1	Chief fisheries officer / Manager
Zambezi	ZA2	Fisheries officer / Extension officer
Erongo	ER1	Chief fisheries officer / Manager
Erongo	ER2	Fisheries officer / Extension officer

Part 1: Findings for the quantitative part of the study

The sections in this part are arranged according to themes derived from research questions. The research questions addressed in Part 1 include "What are the information and knowledge needs, access and usage of information by aquaculture farmers?", which covers Sections B – H; "What are the information and knowledge sources including sharing strategies of aquaculture farmers?" which covers Sections J – N; and "What are the information literacy levels and knowledge competencies of aquaculture farmers?", which covers Section O. The other research questions; that is, Research Question 4, 5 and 6 were covered separately. The Research Question 4 on "What are the policies governing information and aquaculture production in Namibia?" is covered under 5.17.5 and Chapter 6, under section 6.10, and Research Question 5, "What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia" is presented in Chapter 3 under sections 3.2.1 and 3.2.2. The last Research Question on "What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia is covered as a contribution to the study in Chapter 7 under section 7.4.2.

5.2 Section A: Demographic data

Aquaculture farmers are estimated to be 241 households practicing fish farming in the Northern and Eastern parts of the country (NSA, 2015). These statistics does not cover all regions in Namibia as per the report of the Namibia Census of Agriculture of 2015. This research covered six political regions; which are Hardap, Omusati, Erongo, Kavango East, Kavango West and Zambezi regions. The respondents to the questionnaire were fish farmers who owned ponds (55) and technicians (whose work were deemed to be that of fish farmers) who worked in those ponds (5). In total, 60 fish farmers or aquaculture farmers responded to the survey questionnaire. The research sample was composed of 45 males and 15 females and the majority of fish farmers who participated in the survey were between the age group 31-45 (42) followed by 46-60 (18); 20-30 (16) and the least were 61-75(2). The highest qualifications of respondents were secondary education (27) followed by tertiary education (26), primary education (3) vocational education (3) and one (1) did not indicate his or her highest educational qualification.

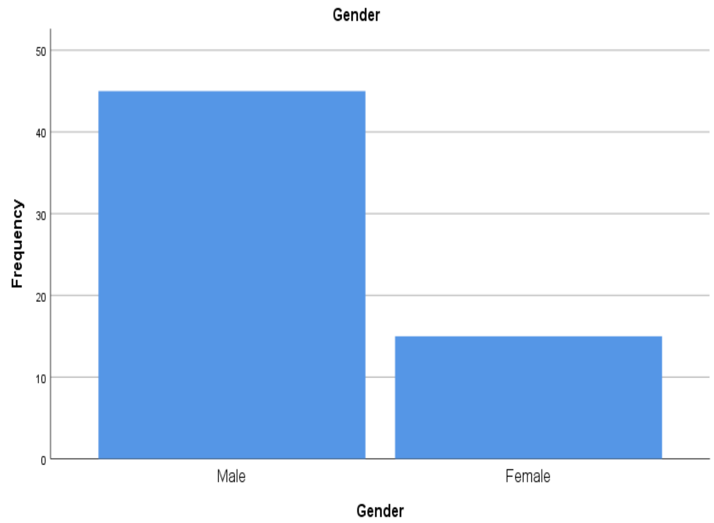


Figure 5.2.1: Gender of respondents

Figure 5.2.1 above indicates that 15 respondents were females and 45 were males. The study on fish farmers revealed that the sector was dominated by males.

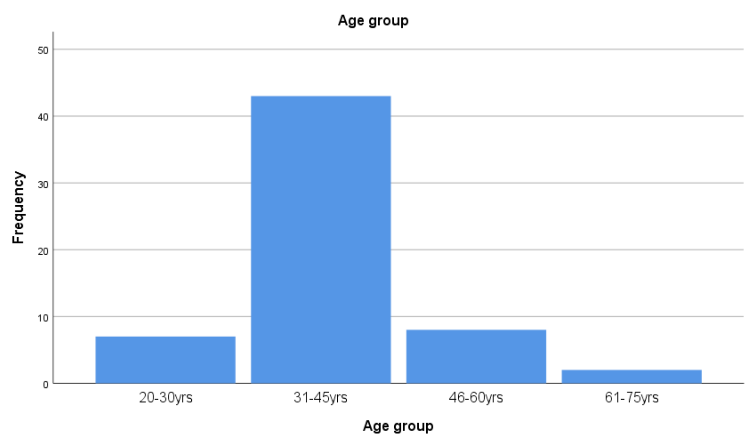


Figure 5.2.2: Age group

From Figure 5.2.2 above it can be observed that the majority of fish farmers who participated in the survey were between the age group 31-45 (73%) followed by 46-60 (10%); 20-30 (15%) and the least were 61-75(2%).

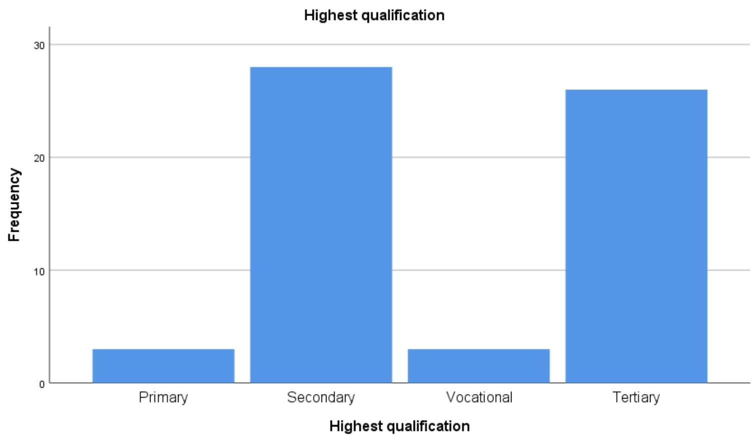


Figure 5.2.3: Highest qualification

In Figure 5.2.3 above, participants were asked to provide their highest qualifications and the majority, 28 (47%) were secondary education, followed by tertiary education, 27 (45%) and the least with 3 (5%) each were primary education and vocational education. Two (3%) did not reveal their highest educational qualifications.

Figure 5.2.4: Work experience in fish farming

The majority of fish farmers 39 (65%), had 1-10 years of experience followed by 21(35%) fish farmers who had 11-20 years of experience.

Research Question 1: What are the information and knowledge needs, access and usage of information by aquaculture farmers? (Sections B – H)

5.3 Section B: Types of information needed, used by aquaculture farmers

The majority (96.5%) of respondents revealed that they needed information for problem solving, 98% needed information for performing tasks and the same figure (98%) needed information for decision making. Eighty eight point three percent (88.3%) of the respondents mentioned that they spent 1-5 hours gathering information per week, while 6.7% spent 6-10 hours per week of their time gathering information and 5% spent 16 hours per week and above looking for information. Thirty six point seven percent (36.7%) often needed agricultural information, 43.3% often needed health information, 55% often needed environmental information, 36.7% often needed technological information, while 26.7% sometimes needed technological information, business and trade information was sometimes needed by 33.3% while 42.4% often needed government policies and plans.

Table 5.3.1: Information for emergency problem solving related to work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	55	91.7	96.5	96.5
	No	2	3.3	3.5	100.0
	Total	57	95.0	100.0	
Missing	System	3	5.0		
Total		60	100.0		

In Table 5.3.1 above, most (96.5%) fish farmers needed information for problem solving.

Table 5.3.2: Information for performing tasks on aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	58	96.7	98.3	98.3
	No	1	1.7	1.7	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Table 5.3.2 above shows that the majority (98%) of fish farmers needed information for performing aquaculture tasks.

Table 5.3.3: Information on decision making related to work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	51	85.0	98.1	98.1
	No	1	1.7	1.9	100.0
	Total	52	86.7	100.0	
Missing	System	8	13.3		
Total		60	100.0		

The Table 5.3.3 above shows that most (98%) farmers needed information for decision making.

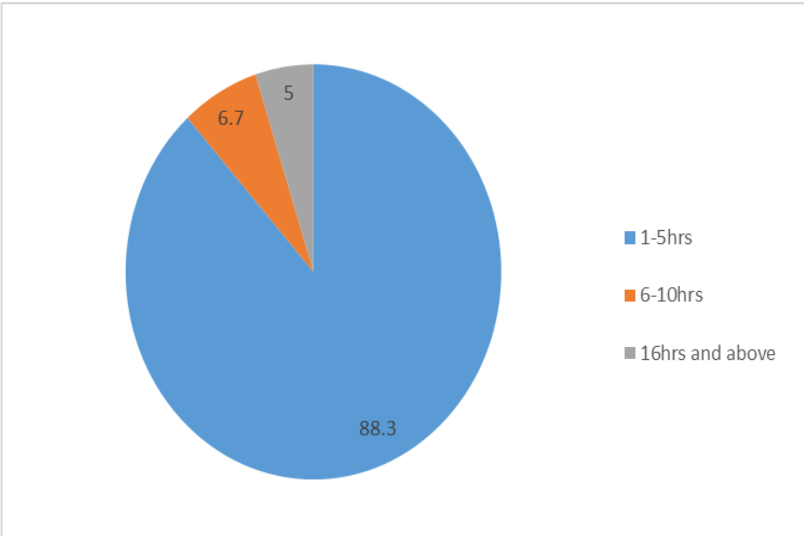


Figure 5.3.1: Time spent on gathering information

In the Figure 5.3.1 above, 88.3% of the respondents spent 1-5 hours gathering information per week; 6.7% spent 6-10 hours per week; 5% spent 16 hours per week and above gathering information. From this Figure 5.3.1 it is clear that fish farmers spent most of their time gathering information.

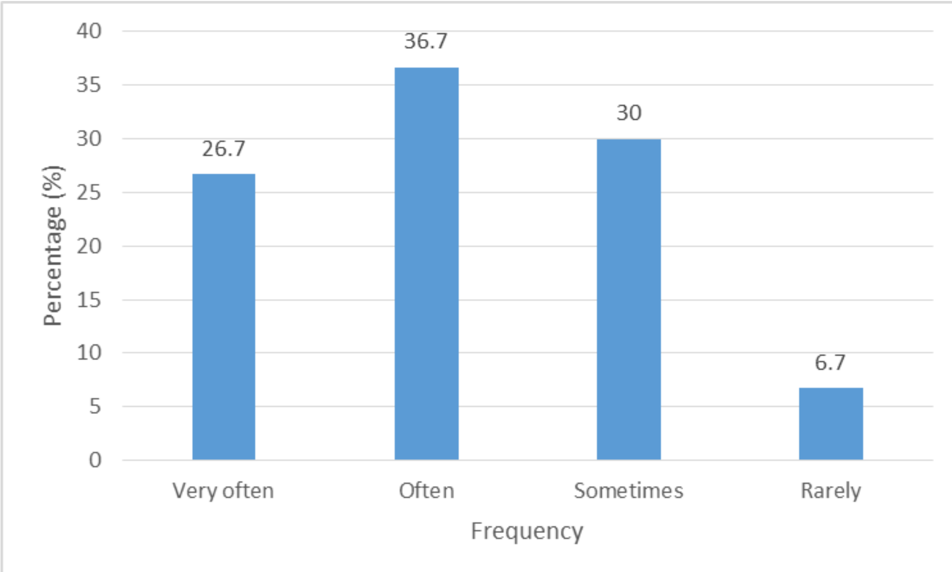


Figure 5.3.2: The need for agricultural information

From the Figure 5.3.2 above, 36.7% often needed agricultural information; 30% sometimes needed agricultural information; 26.7% very often needed agricultural information and 6.7% rarely needed information on agriculture. From this analysis, the figures in the Figure 5.3.2 show that agricultural information was important amongst fish farmers.

Table 5.3.4: The need for health information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	6	10.0	10.0	10.0
	Often	26	43.3	43.3	53.3
	Sometimes	21	35.0	35.0	88.3
	Rarely	7	11.7	11.7	100.0
	Total	60	100.0	100.0	

Participants were asked to rate how much they needed health information and 43.3% often needed health information; 35% sometimes needed health information; 11.7% rarely needed health information and the least (10%) needed health information very often. Table 5.3.6 shows that the majority of aquaculture farmers needed health information.

Table 5.3.5: The need for environmental information related to aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	13	21.7	21.7	21.7
	Often	33	55.0	55.0	76.7
	Sometimes	11	18.3	18.3	95.0
	Rarely	3	5.0	5.0	100.0
	Total	60	100.0	100.0	

In Table 5.3.5 above, fish farmers were asked to rate how much they needed environmental information in their work and the following answers were provided; 55% often needed; 21.7% very often needed, 18.3% sometimes needed and 5% rarely needed. From the statistics above, it is clear that environmental information was needed amongst fish farmers.

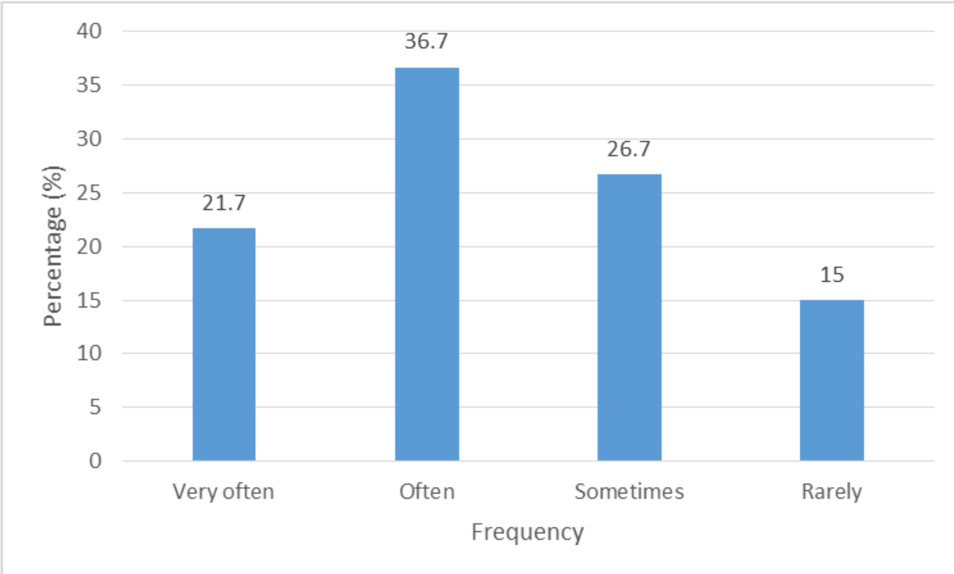


Figure 5.3.3: The need for technological information on aquaculture

Figure 5.3.3 shows that 36.7% of fish farmers often needed technological information and 26.7% sometimes needed technological information and this is followed by 21.7% very often needed technological information. The least in the Figure is 15% of fish farmers rarely needed technological information. The Figure 5.3.3 reveals that the need for technological information was very popular amongst aquaculture farmers.

Table 5.3.6: The need for fish business and trade information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	12	20.0	20.0	20.0
	Often	16	26.7	26.7	46.7
	Sometimes	20	33.3	33.3	80.0
	Rarely	12	20.0	20.0	100.0
	Total	60	100.0	100.0	

In Table 5.3.6, business and trade information is sometimes needed by 33.3% and often needed by 26.7%. The least in the table (20%) very often needed business and trade information and 20% rarely needed business and trade information.

Table 5.3.7: The need for information on government policies and plans on aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Often	3	5.0	5.1	5.1
	Often	25	41.7	42.4	47.5
	Sometimes	19	31.7	32.2	79.7
	Rarely	12	20.0	20.3	100.0
	Total	59	98.3	100.0	
Total		60	100.0		

Table 5.3.7 above shows the frequency of information needed on government policies and plans by aquaculture farmers. Forty two point four percent (42.4%) often needed information on government policies and plans followed by 32.2% who sometimes needed information on government policies and plans and 20.3% who rarely needed information on government policies and plans. The least in the table (5.1%) very often needed information on government policies and plans. The overall analysis of the above table shows that aquaculture farmers needed information on government policies and plans.

5.4 Section C: Specific types of information needed by aquaculture farmers

In this section respondents were asked for specific needs of information, eg., fish market information, weather conditions, fish post-harvest and storage, fish breeding, credit facilities, market trends, fish diseases and water management. The majority of the respondents (36.7%) in this section sometimes needed information on fish markets followed by (31.7%) that often needed market information. Forty five percent (45%) of respondents answered that they often needed information on weather conditions; 31.7% sometimes needed information on post-harvest and storage; 46.7% very often needed information on fish breeding; 33.3% rarely needed information on credit facilities; 45% % often needed information on diseases and pest management; 33.3% often needed information on fish markets, stock, pricing etc., and 45% very often needed information on soil and water management.

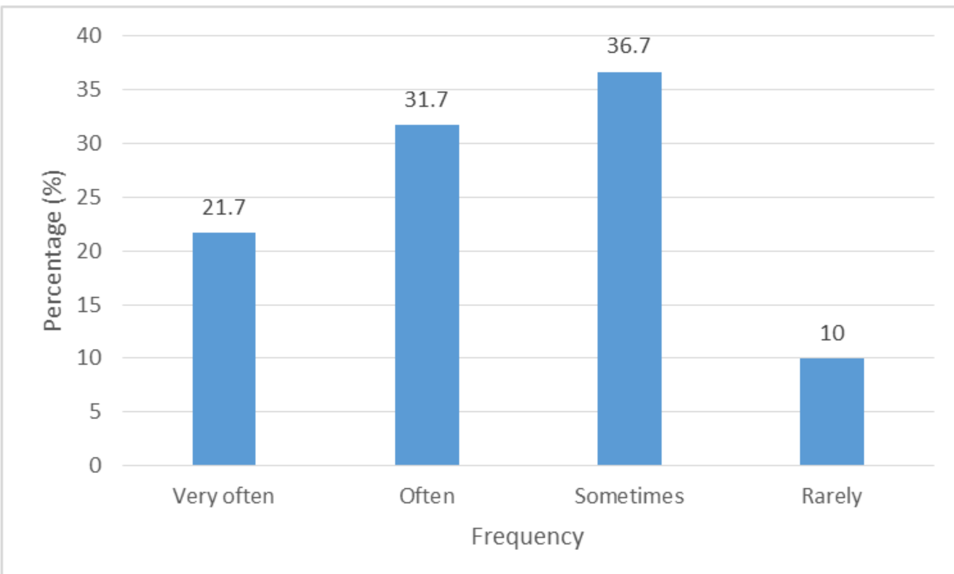


Figure 5.4.1: The need for fish market information

Respondents were asked to provide the frequency with which they needed market information as shown in Figure 5.4.1. The majority of the respondents (36.7%) sometimes needed; followed by 31.7% who often needed and 21.7% who very often needed the fish market information. The least in the Table answered that they rarely (10%) needed fish market information. The Table above reveals that the majority of aquaculture farmers needed market information so that they would know the market value of fish prices and where to sell their produce.

Table 5.4.1: The need for information on weather conditions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Often	22	36.7	36.7	36.7
	Often	27	45.0	45.0	81.7
	Sometimes	9	15.0	15.0	96.7
	Rarely	2	3.3	3.3	100.0
	Total	60	100.0	100.0	

Table 5.4.1 above shows that the majority of fish farmers (45%) often needed information on weather conditions, while 36.7% very often needed the same information. The Table above also shows 15% sometimes needed information on weather conditions and 3.3% rarely needed information on weather conditions. From the analysis above it is clear that information on weather conditions was needed by aquaculture farmers.

Table 5.4.2: The need for information on fish post-harvest and storage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Often	9	15.0	15.0	15.0
	Often	19	31.7	31.7	46.7
	Sometimes	26	43.3	43.3	90.0
	Rarely	6	10.0	10.0	100.0
	Total	60	100.0	100.0	

Respondents as shown in Table 5.4.2 revealed that they need information on post-harvest and storage. Forty three point three percent (43.3%) sometimes needed post-harvest information while 31.7% often needed information on post-harvest. The least of the figures in the Table shows 15% and 10% who very often and rarely needed post-harvest information respectively. The Table reveals that most fish farmers moderately needed information on post-harvest and storage.

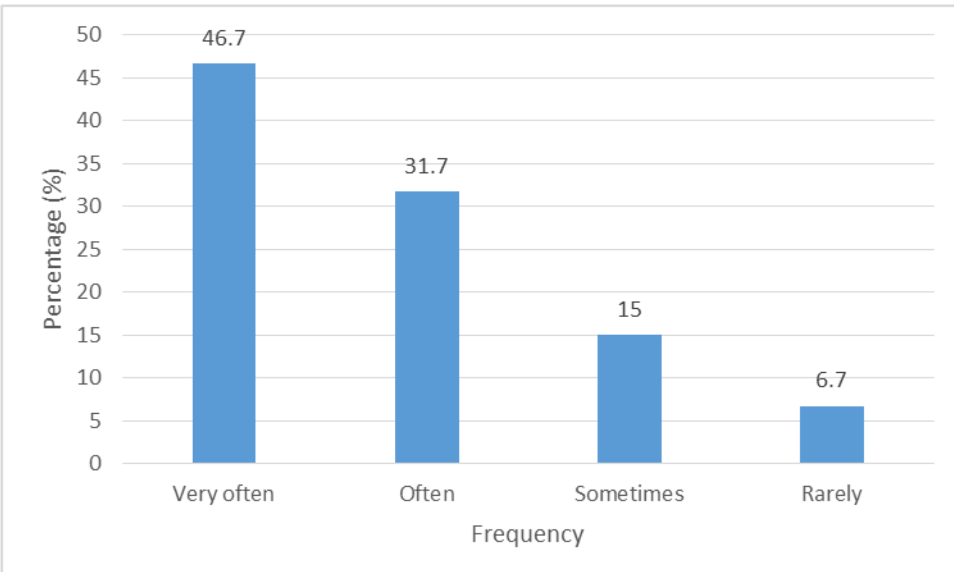


Figure 5.4.2: The need for information on fish breeding

Figure 5.4.2 above indicates the frequency at which fish farmers needed information on fish breeding. The following data is revealed in the Figure 5.4.2: 46.7% very often needed; 31.7% often needed; 15% sometimes needed and least but not last (6.7%) rarely needed information on fish breeding. The statistics above show that aquaculture farmers needed information on fish breeding to a large extent.

Table 5.4.3: The need to access information on credit facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	10	16.7	16.7	16.7
	Often	17	28.3	28.3	45.0
	Sometimes	13	21.7	21.7	66.7
	Rarely	20	33.3	33.3	100.0
	Total	60	100.0	100.0	

Table 5.4.3 above shows the statistics regarding the need for information to access credit facilities. The majority of fish farmers 33.3% rarely needed information on credit facilities; followed by 28.3% who often needed the information on credit facilities and 21.7% who sometimes needed information on credit facilities. The least (16.7%) very often needed information on credit facilities. From the Table above, it is apparent that information on credit facilities was not very popular with aquaculture farmers.

Table 5.4.4: The need for information on market trends, prices and stock etc.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	8	13.3	13.3	13.3
	Often	20	33.3	33.3	46.7
	Sometimes	18	30.0	30.0	76.7
	Rarely	14	23.3	23.3	100.0
	Total	60	100.0	100.0	

Table 5.4.4 above shows that aquaculture farmers needed information on market trends according to the following order: Thirty three point three percent (33.3%) often; 30% sometimes; 23.3% rarely and 13.3% very often. From the above figures, it is clear that fish farmers moderately needed information on market trends.

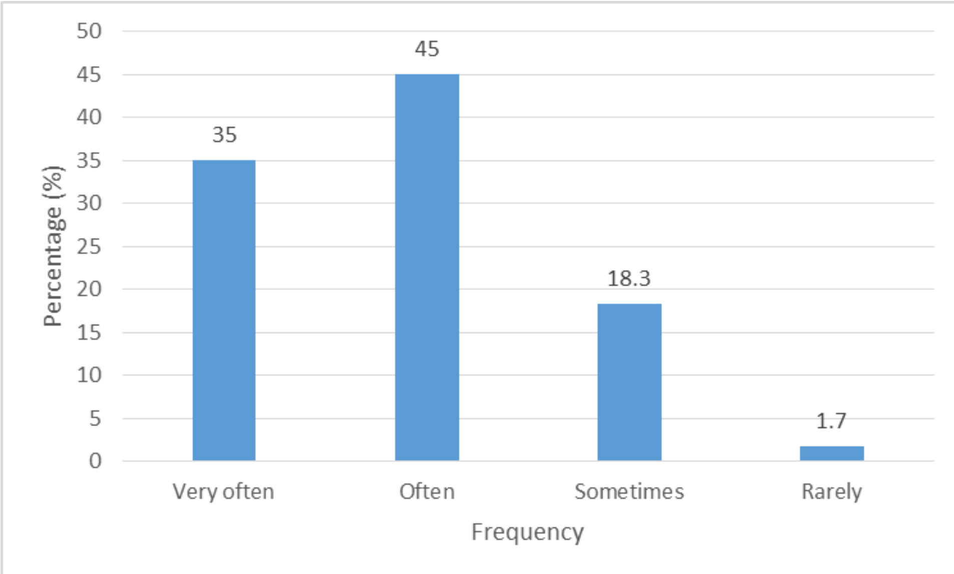


Figure 5.4.3: The need for information on fish diseases and pest management

Figure 5.4.3 reveals that 45% often needed information on diseases and pest management and 35% very often needed the same information on fish diseases and pest management. Eighteen point three percent (18.3%) sometimes needed and 1.7% rarely needed information on diseases and pest management. The figures above reveal that there was a need for information on fish diseases and pest management.

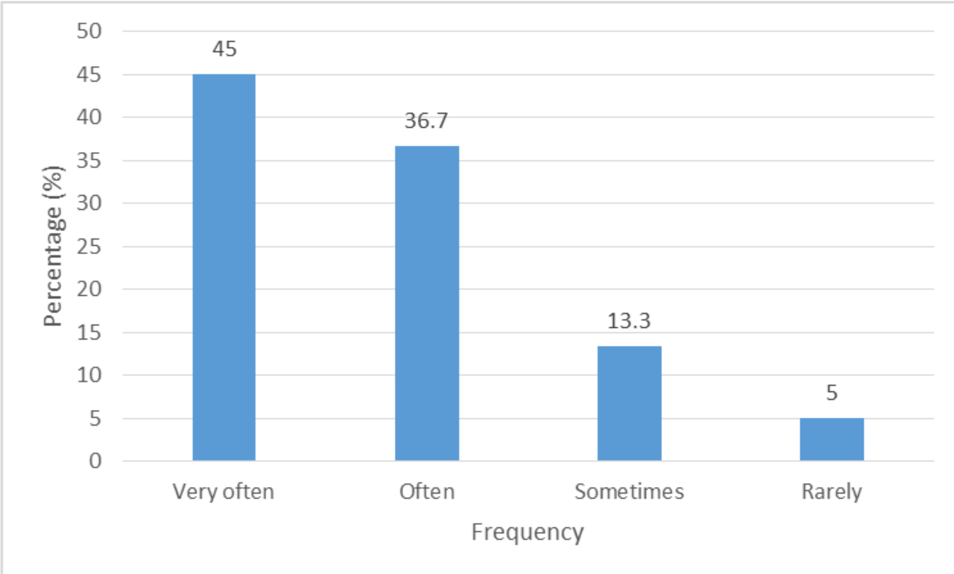


Figure 5.4.4: The need for information on soil and water management related to aquaculture

Figure 5.4.4 above shows that 45% very often needed information on soil and water management and the least (5%) rarely needed the same information on soil and water management. From the above figures, it is clear that the majority of aquaculture farmers needed information on soil and water management related to aquaculture.

5.5 Section D: Media / Channel of accessing information on aquaculture

Several media of accessing information were mentioned by respondents which include the following: 40% sometimes accessed information through newspapers, followed by 28% who rarely accessed information from newspapers; 33.3% sometimes accessed information through the radio, followed by 25% that very often accessed information through the radio; 33.3% often accessed information through television; followed by 30% who rarely viewed the television; 35% of farmers often accessed information through training or seminars, followed by 25% sometimes accessed information through training; 46.7% rarely used libraries to access information; 41.7% very often used colleagues to access information; 36.7% rarely used posters; 38.3% sometimes used textbooks, and 41.7% rarely used the Internet.

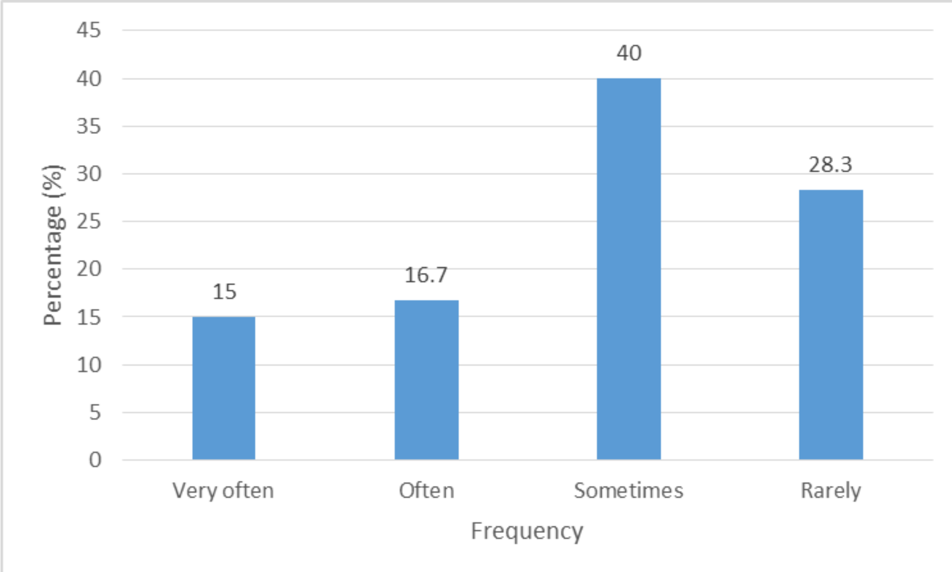


Figure 5.5.1: Newspapers as a media for accessing information

Figure 5.5.1 shows the frequency, with which fish farmers used the newspaper to access information. The majority of fish farmers 40% sometimes accessed information through newspapers followed by 28.3% who rarely used newspapers. 16.7% often used and 15% very often used newspapers.

Table 5.5.1: Radio as a medium of accessing information on aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	15	25.0	25.0	25.0
	Often	14	23.3	23.3	48.3
	Sometimes	20	33.3	33.3	81.7
	Rarely	11	18.3	18.3	100.0
	Total	60	100.0	100.0	

The figures of the radio as a media of accessing information as indicated in Table 5.5.1 shows that: Thirty three point three percent (33.3%) sometimes; followed by 25% very often and 23.3% often used radios as a medium of accessing information. The least figure shows (18.3%) rarely.

Radio as a media for accessing information was sometimes popular amongst fish farmers.

Table 5.5.2: Television as a medium of accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	6	10.0	10.0	10.0
	Often	20	33.3	33.3	43.3
	Sometimes	16	26.7	26.7	70.0
	Rarely	18	30.0	30.0	100.0
	Total	60	100.0	100.0	

Respondents were asked to rate how they used television for accessing information and the majority of respondents (33.3%) answered often; followed by 30% for rarely and 26.7% for sometimes. The minority answered (10%) very often. From the above responses, television is used moderately by aquaculture farmers as a media of accessing information.

Table 5.5.3: Training as a means of accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	13	21.7	21.7	21.7
	Often	21	35.0	35.0	56.7
	Sometimes	15	25.0	25.0	81.7
	Rarely	11	18.3	18.3	100.0
	Total	60	100.0	100.0	

As shown in Table 5.5.3 above, 35% of farmers often accessed information through training; followed by 25% who sometimes accessed information through training and 21.7% who very often accessed information through training. The least figure (18.3%) rarely accessed information through training. The figures above in Table 5.5.3 show that training was moderately used as a tool for accessing information.

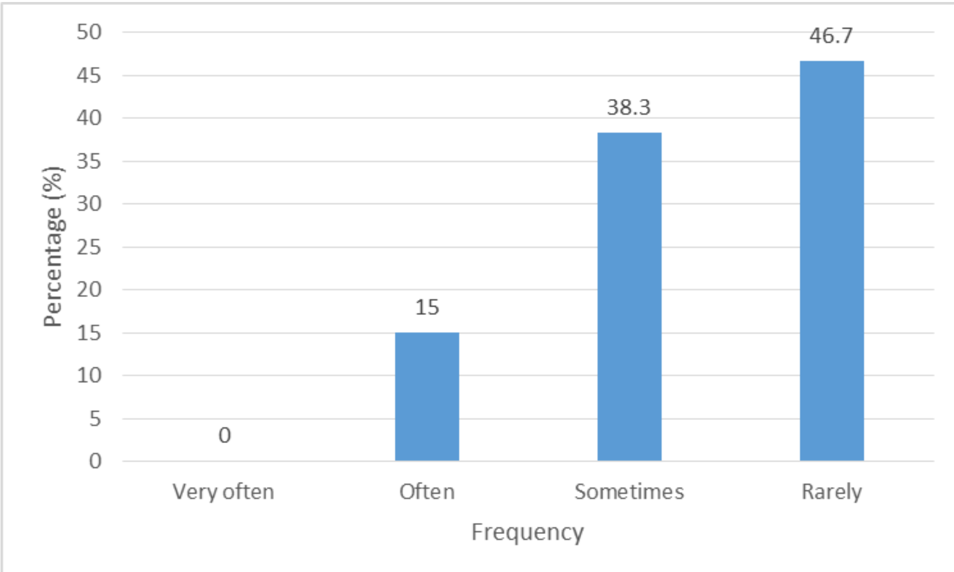


Figure 5.5.2: Library as a medium for accessing information

Figure 5.5.2 above reveals that the majority of fish farmers (46.7%) rarely used libraries to access information; followed by 38.3% sometimes used the libraries and 15% often used libraries. The figures above show that the library was not a popular tool as a media for accessing information by fish farmers.

Table 5.5.4: Professional colleagues as a media of accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	25	41.7	41.7	41.7
	Often	25	41.7	41.7	83.3
	Sometimes	6	10.0	10.0	93.3
	Rarely	4	6.7	6.7	100.0
	Total	60	100.0	100.0	

As shown in Table 5.5.4 above, the majority (41.7%) very often used colleagues to access information, whilst 41.7% often used colleagues to get information. Respondents also mentioned that they (10%) sometimes and (6.7%) rarely used professional colleagues to get information. These figures suggest that there was an overwhelming trust amongst fish farmers to get information from their professional colleagues.

Table 5.5.5: Posters as a media to access information on aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	9	15.0	15.0	15.0
	Often	13	21.7	21.7	36.7
	Sometimes	16	26.7	26.7	63.3
	Rarely	22	36.7	36.7	100.0
	Total	60	100.0	100.0	

Table 5.5.5 above shows that 36.7% of aquaculture farmers rarely used posters, 26.7% sometimes used posters, and 21.7% often used posters. The least (15%) represents fish farmers who very often used posters. These figures indicate a moderate usage of posters as a media for accessing information amongst fish farmers.

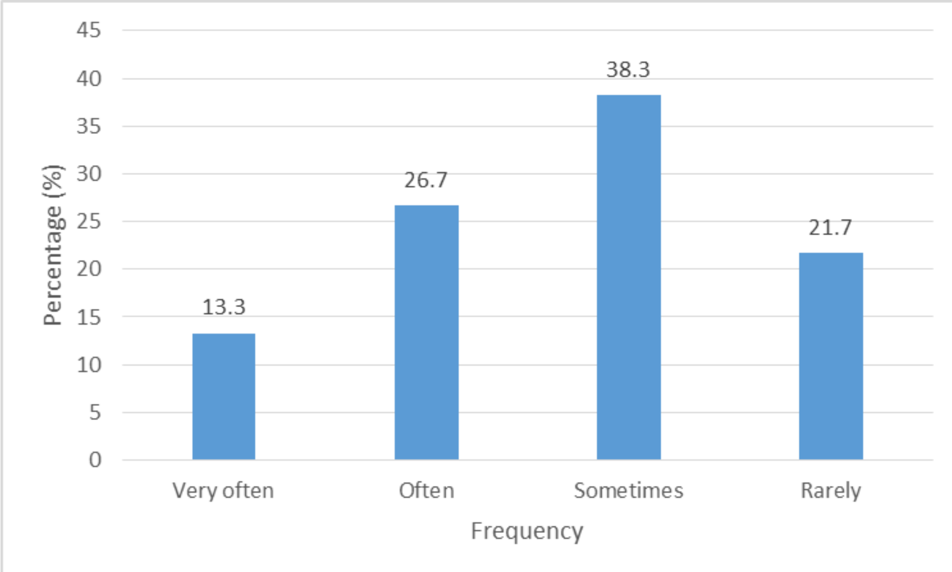


Figure 5.5.3: Textbooks as a tool of accessing information on aquaculture

Respondents were asked to rate the frequency at which they used textbooks as media of accessing information. Figure 5.5.3 above reveals that the majority (38.3%) sometimes used textbooks; followed by 26.7% who often used textbooks and 21.7% who rarely used textbooks. The least (13.3%) very often used textbooks. The findings show that textbooks were moderately used by fish farmers to access information.

Table 5.5.6: Internet as a tool for accessing information on aquaculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	19	31.7	31.7	31.7
	Often	7	11.7	11.7	43.3
	Sometimes	9	15.0	15.0	58.3
	Rarely	25	41.7	41.7	100.0
	Total	60	100.0	100.0	

Respondents were asked to rate how often they accessed the Internet for information on aquaculture. Table 5.5.6 above shows that the majority (41.7%) of the respondents rarely used the Internet, followed by 31.7% who very often used the Internet. Fifteen percent (15%) answered that they sometimes used the Internet and 11% often used the Internet. These findings show that the rate of using the Internet amongst fish farmers was average.

5.6 Section E: Places for accessing aquaculture information by fish farmers

Respondents revealed that they accessed information from the following places: 30% rarely accessed information at home; 40% often used information centres; 41.7% sometimes used non-governmental organisations (NGOs) and community based organisations (CBOs); 61.7% rarely used libraries, while 28.3% sometimes used libraries to access information to satisfy their information needs.

Table 5.6.1: Home as a place for accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	15	25.0	25.0	25.0
	Often	17	28.3	28.3	53.3
	Sometimes	10	16.7	16.7	70.0
	Rarely	18	30.0	30.0	100.0
	Total	60	100.0	100.0	

Respondents were asked how often they accessed information at their homes. Table 5.6.1 above shows that 30% answered rarely, followed by 28.3% answered often and 25% said they accessed information at their homes very often. The least (16.7%) answered that they sometimes accessed information at their homes. The figures above show that fish farmers preferred accessing information from the comfort of their homes.

Table 5.6.2: Government information centres as places of accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	14	23.3	23.3	23.3
	Often	24	40.0	40.0	63.3
	Sometimes	9	15.0	15.0	78.3
	Rarely	13	21.7	21.7	100.0
	Total	60	100.0	100.0	

In Table 5.6.2 above, 40% of respondents often used information centres, while 23.3% used information centres very often. The low figures which are 21.7% and 15% were recorded for farmers who used information centres rarely and sometimes respectively. From the above statistics, it is apparent that fish farmers relied on government information centres for their information needs.

Table: 5.6.3 Non-governmental organisations (NGOs) and Community Based Organisations (CBOs) as places of accessing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	2	3.3	3.3	3.3
	Often	15	25.0	25.0	28.3
	Sometimes	25	41.7	41.7	70.0
	Rarely	18	30.0	30.0	100.0
	Total	60	100.0	100.0	

Respondents were asked to rate how often they visited non-governmental organisations (NGOs) and community based organisations (CBOs) for their information needs. The responses are highlighted in Table 5.6.3 above. The majority (41.7%) of respondents answered "sometimes", followed by 30% who answered "rarely". Those who said often or very often were 25% and 3.3% respectively. The above figures suggest that NGOs and CBOs were moderately used by aquaculture farmers.

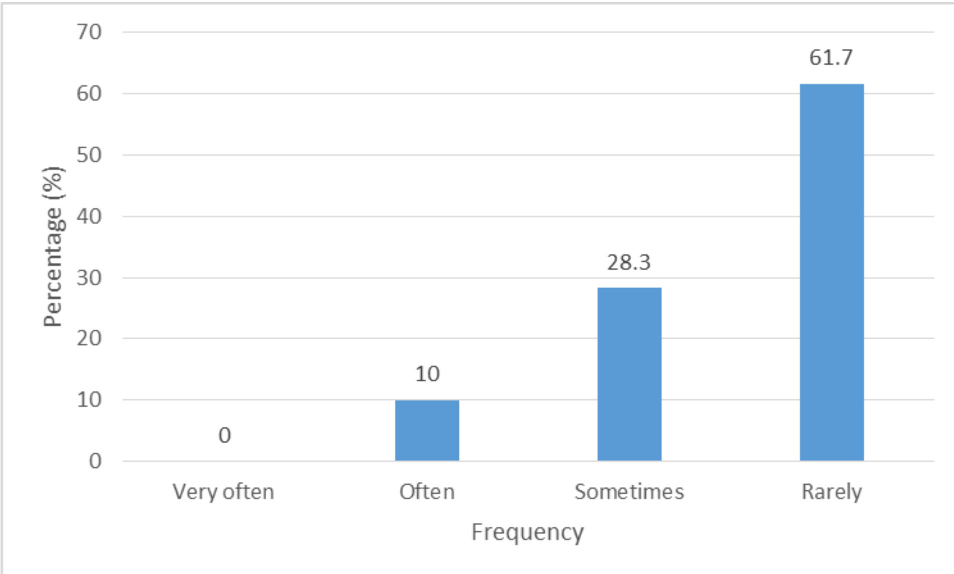


Figure: 5.6.1 Library as a place for accessing information

Figure 5.6.1 above shows that the majority (61.7%) of fish farmers who responded to the questionnaire used libraries rarely, followed by 28.3% who answered “sometimes”. From the above, it is clear that libraries were not popular among fish farmers as media for accessing information.

5.7 Section F: Problems encountered by fish farmers when accessing information

Respondents revealed problems which they encountered when accessing information, with 44.1% mentioning that they rarely lacked skills to use media tools; 91.5% were rarely illiterate (not illiterate) to use information; 40.7% were sometimes lacked transport facilities; 49.2% were rarely lacked extension support from extension workers; 62.7% were rarely lacked connection to rural electrification and 67.8% were rarely ignorant of government responsibility as far as aquaculture farming is concerned.

Table 5.7.1: Inability to use ICT media tools

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	15	25.0	25.4	25.4
	Often	6	10.0	10.2	35.6
	Sometimes	12	20.0	20.3	55.9
	Rarely	26	43.3	44.1	100.0
	Total	59	98.3	100.0	

Respondents were asked whether inability to use ICT media tools was a challenge when accessing information. The majority (44.1%) of the respondents indicated that they rarely faced challenges, followed by 25.4% who said very often, followed by those that indicated sometimes (20.3%) and the least indicated often (10.2%). The figures in Table 5.7.1 above show that aquaculture farmers moderately encountered problems in the use of ICT media tools when accessing information.

Table 5.7.2: Illiteracy as a challenge to use information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sometimes	5	8.3	8.5	8.5
	Rarely	54	90.0	91.5	100.0
	Total	59	98.3	100.0	
Missing	System	1	1.7		
Total		60	100.0		

Table 5.7.2 above shows that most fish farmers were rarely illiterate (not illiterate) to use aquaculture information and this figure is represented by 91.5% and only 8.5% answered sometimes. From the above it is clear that the majority of aquaculture farmers did not face challenges of illiteracy when using aquaculture information.

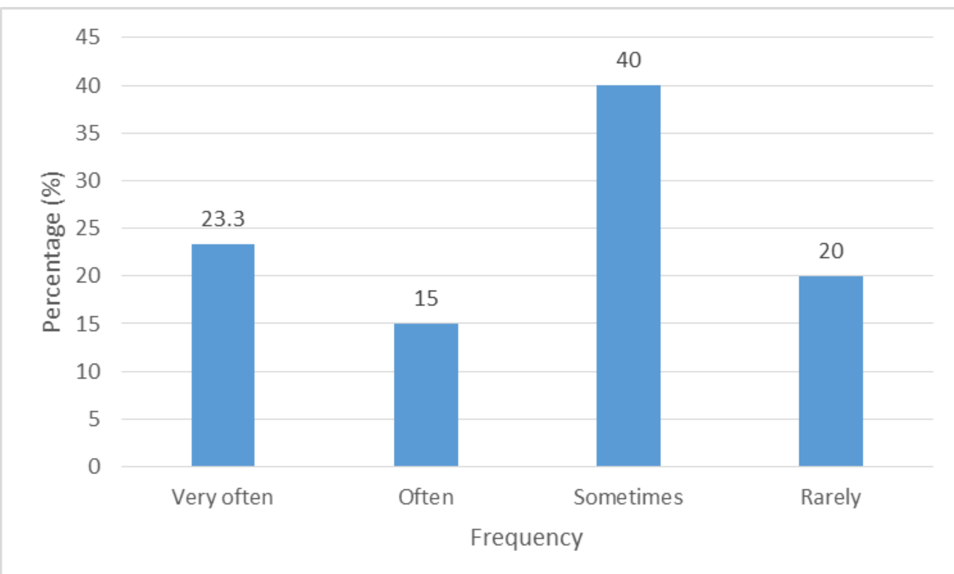


Figure 5.7.1: Inadequate transport facilities

Respondents were asked to rate how often they face problems regarding inadequate transport facilities. As indicated in Figure 5.7.1 above, the majority (40%) sometimes faced challenges of transport facilities followed by 23.3% who very often faced challenges of transport. Twenty percent (20%) rarely faced challenges of transport and 15% often faced problems of transport. These responses indicate that fish farmers moderately faced challenges regarding transport facilities.

Table 5.7.3: Inadequate extension workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	4	6.7	6.8	6.8
	Often	16	26.7	27.1	33.9
	Sometimes	10	16.7	16.9	50.8
	Rarely	29	48.3	49.2	100.0
	Total	59	98.3	100.0	
Total		60	100.0		

Table 5.7.3 above rates how frequent fish farmers faced inadequate extension workers. The majority (49.2%) said they rarely lacked support from extension workers, followed by 27.1% who answered “often”. Sixteen point nine percent (16.9%) answered “sometimes” and 6.8% said very often. These findings show that the majority of farmers rarely faced inadequate extension workers.

Table 5.7.4: Lack of rural electrification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	10	16.7	16.9	16.9
	Often	7	11.7	11.9	28.8
	Sometimes	5	8.3	8.5	37.3
	Rarely	37	61.7	62.7	100.0
	Total	59	98.3	100.0	
Total		60	100.0		

Table 5.7.4 above rates how aquaculture farmers lack rural electrification as a challenge to access information. The majority (62.7%) answered that they rarely lacked electrification in their homes, followed by 16.9% who said they very often lacked electrification. Eleven point nine percent (11.9%) answered that they often lacked electricity and 8.5% said they sometimes lacked rural electrification in their homes. The analysis shows that the majority of fish farmers did not face lack of rural electrification as a challenge to use information.

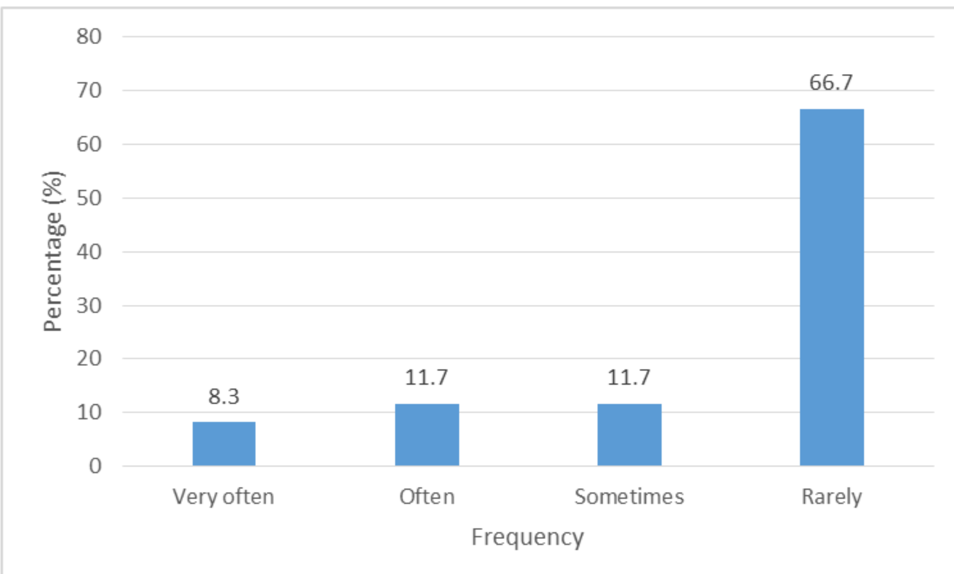


Figure 5.7.2: Ignorance of government responsibility

In Figure 5.7.2 above, the majority (66.7%) answered that they were rarely ignorant of government responsibility, followed by 11.7% who mentioned that they were sometimes ignorant. Eleven point seven percent (11.7%) also mentioned that they were often ignorant and 8.3% very often ignorant. The responses indicate that the majority of respondents were not ignorant of government responsibility in relation to their work as fish farmers.

5.8 Section G: Usage of aquaculture information by respondents

Respondents showed that their frequency of using aquaculture information was as follows: 44.1% very often used information on problem solving; 40.7% very often used information in performing tasks; 40.7% often used information in constructing new knowledge; 39% often used information for decision making; 50.8% very often shared information with other fish farmers and 50.8% very often used information to influence others.

Table 5.8.1: Information utilisation amongst fish farmers

Type of information	Very often	Often	Sometimes	Rarely
Problem solving	44.1%	35.6%	15.3%	5.1%
Performing tasks	40.7%	39%	18.6%	1.7%
Construction of new knowledge	37.3%	40.7%	6.7%	15.3%
Decision making	28.8%	39%	15.3%	16.9%
Sharing information amongst fish farmers	50.8%	32.2%	11.9%	5.1%
Influencing others through information	50.8%	32.2%	10.2%	6.8%

Table 5.8.1 above shows the frequency of usage of information for problem solving by fish farmers. The respondents rated the usage as follows: 44.1% very often, 35.6% often, 15.3% sometimes and lastly 5.1% rarely. The figures above show that the majority of aquaculture

farmers used information for problem solving.

Respondents were asked to rate the frequency at which they used information in performing tasks. As indicated in Table 5.8.1, the majority (40.7%) of the respondents used “very often,” followed by 39% who used “often” and 18.6% who answered “sometimes”. The least (1.7%) answered “rarely”. From the table above shows that the majority of fish farmers needed information for performing tasks.

Table 5.8.1 above also shows the frequency at which farmers use information in construction of new knowledge. The majority (40.7%) answered often, followed by 37.3% very often and 15.3% rarely. The least (6.7%) answered sometimes. These findings show that fish farmers used information in construction of new knowledge.

Table 5.8.1 above also shows the rate at which respondents used information for decision making. The majority (39%) answered often, followed by 28.8% very often and 16.9% rarely. The least (15.3%) answered sometimes. The above figures show that aquaculture farmers used information for decision making.

Moreover, Table 5.8.1 above shows the frequency of sharing information amongst aquaculture farmers. The majority (50.8%) of farmers shared information very often whilst 32.2% often shared information and 11.9% sometimes shared information. The least (5.1%) number of farmers rarely shared information. The figures suggest that the majority of aquaculture farmers shared information related to their work.

Respondents were asked to rate how they influenced others through information. Table 5.8.1, shows that the majority (50.8%) very often influenced others through information, followed by 32.2% who often influenced, 10.2% who sometimes influenced others and 6.8% who rarely influenced others. From these responses, it is clear that the majority of farmers used information to influence others.

5.9 Section H: Barriers to information access and use

Respondents cited the following as barriers to information access and use: 56.7% stated that the information that they needed for their work was not available; 1.7% complained about staff without good customer relations; 43.3% faced challenges of being provided or finding incomplete information sources; 15% did not have enough time to look for information, 18.3% had no knowledge of libraries, 50% mentioned that information was scattered in different sources and thereby not making it readily available; 53.3% found that information sources were far apart from each other; 20% confirmed that they did not know how to use the library catalogue when searching for information, 38.3% agreed that there was vast information on aquaculture and this posed as a challenge to use the information and 35% mentioned that information on aquaculture, which they came across was outdated.

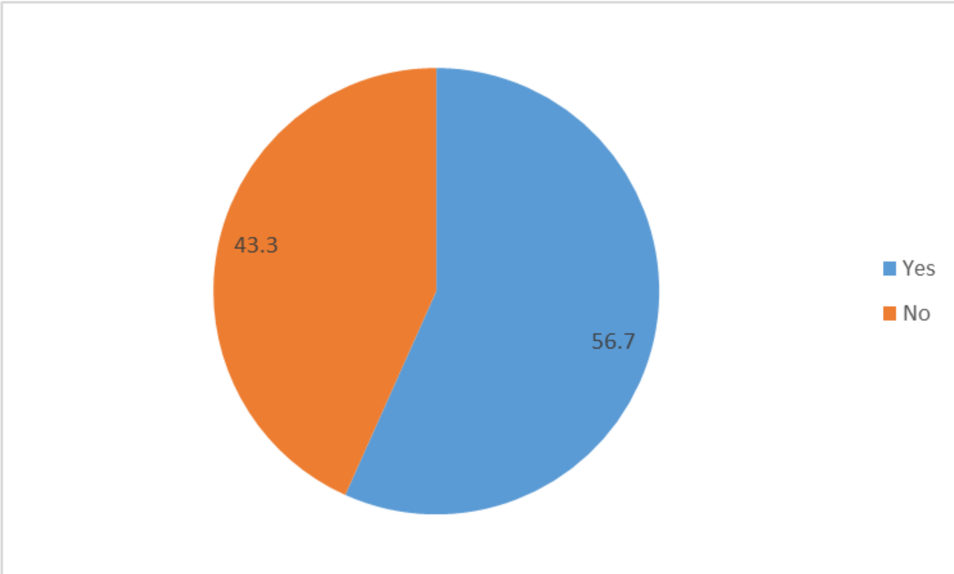


Figure 5.9.1: Required information not available

Figure 5.9.1 shows the figures representing the problem encountered by fish farmers relating to not finding the relevant information available. The majority of farmers (56.7%) found that the information that they needed for their work was not available, while 43.3% answered that they found the information that they needed.

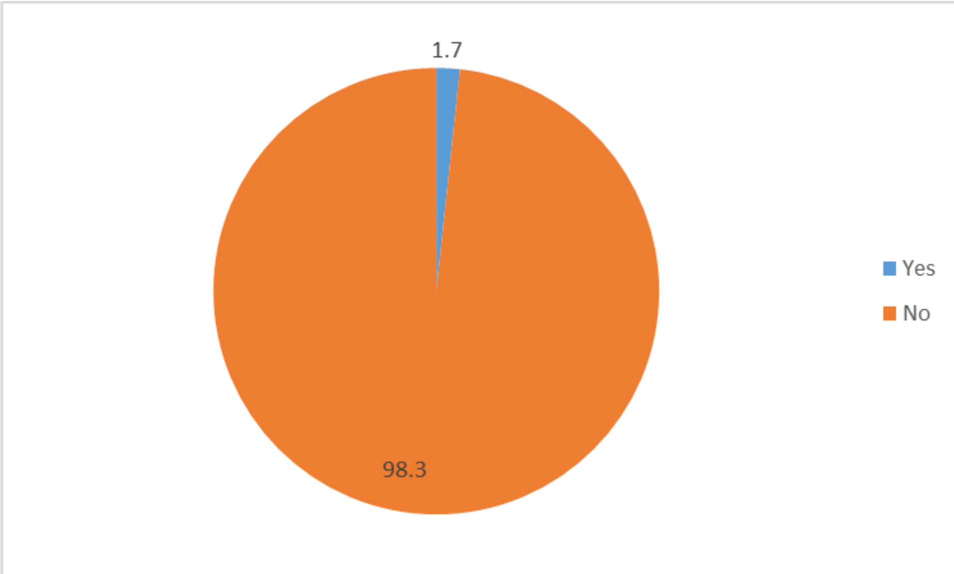


Figure 5.9.2: Library staff without good customer relations

Respondents in Figure 5.9.2 were asked whether they experienced problems of library staff with poor customer relations. The majority of participants (98.3%) answered “No” whilst 1.7% answered “Yes”. The above figures show that farmers did not face problems with library staff with poor customer relations. The main reason may be attributed to the fact that fish farmers had a low rate of using the library and therefore may not have been in any contact with library staff.

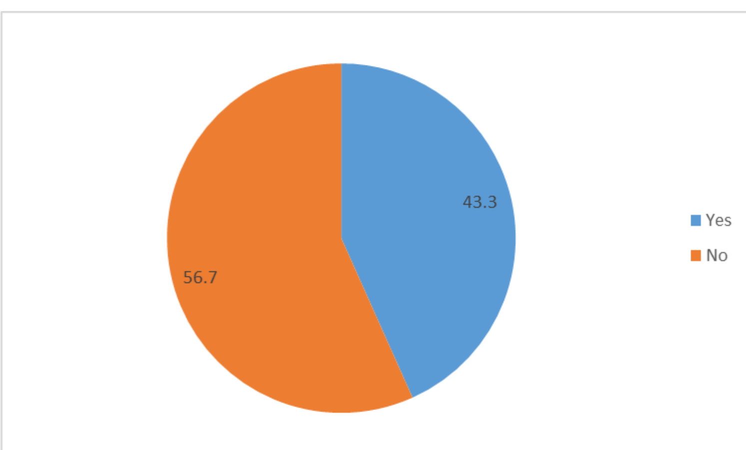


Figure 5.9.3: Incomplete information

Aquaculture farmers were asked if they faced any problems of using incomplete information when carrying out their daily duties. The above statistics show that 43.3% farmers faced challenges of being provided or using incomplete information sources and 56.7% mentioned that they did not have problem of using or being provided with incomplete information.

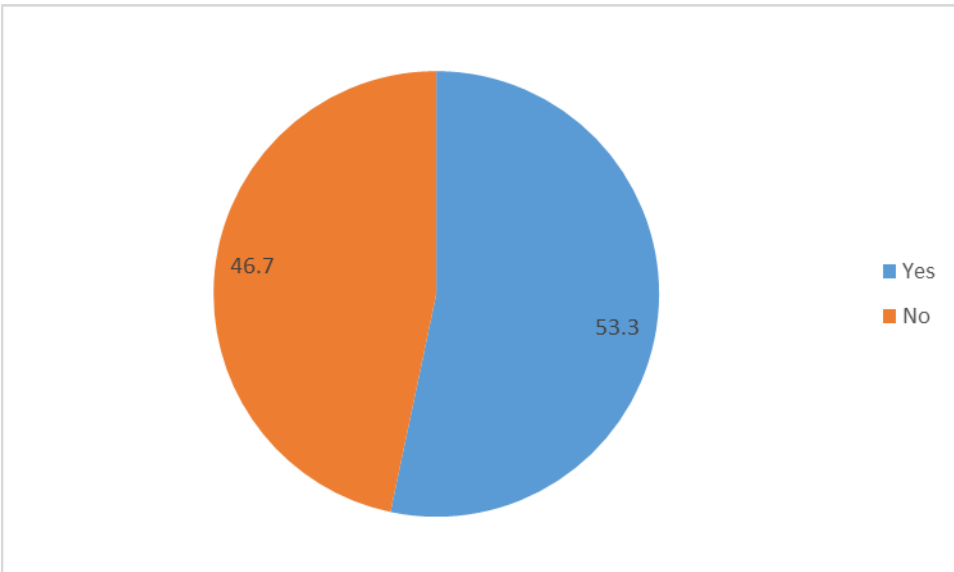


Figure 5.9.4: Information sources far apart from each other

In Figure 5.9.4 above, the figures show that 53.3% of respondents found that information sources were far apart from each other and 46.7% disagreed that information sources were far apart from each other.

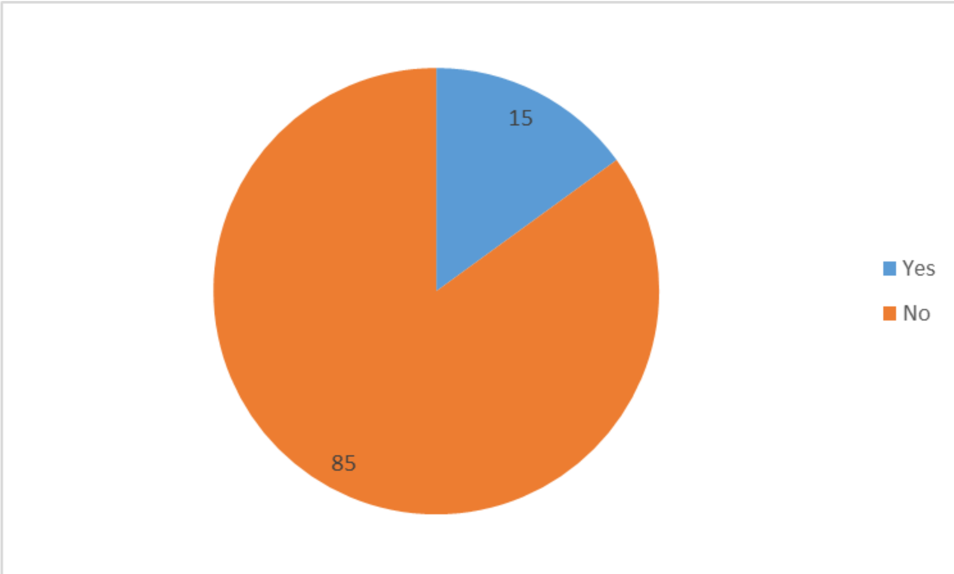


Figure 5.9.5: Not having enough time to look for information

Respondents were asked whether they did not have enough time to look for information and only 15% responded that they did not have enough time and 85% had enough time to look for information.

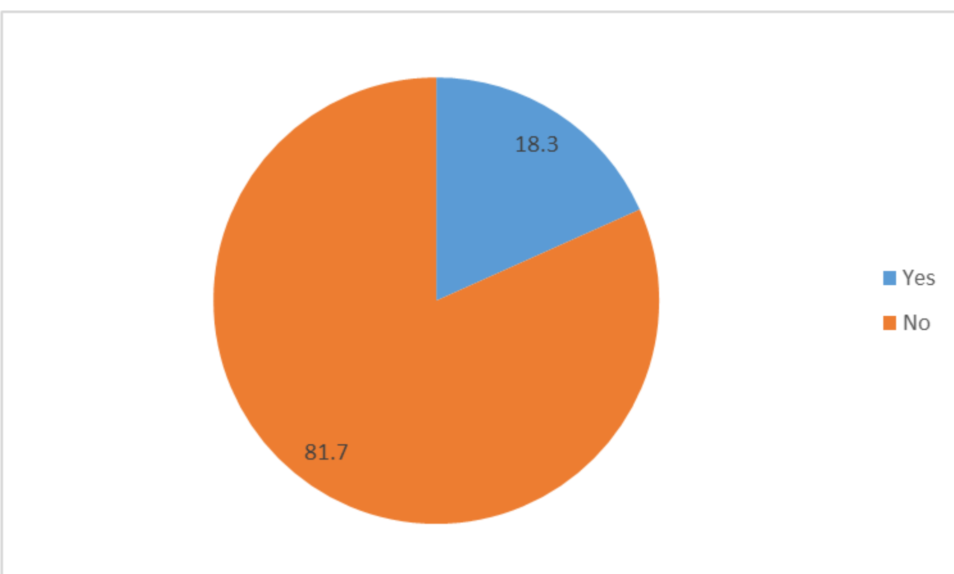


Figure 5.9.6: Don't have knowledge of libraries

Respondents were asked if they had knowledge of using libraries and 18.3% responded that they had no knowledge of libraries. This figure signifies that the majority (81.7%) of respondents had a good knowledge of using libraries. This knowledge of using libraries could have been acquired from their tertiary institutions that they attended.

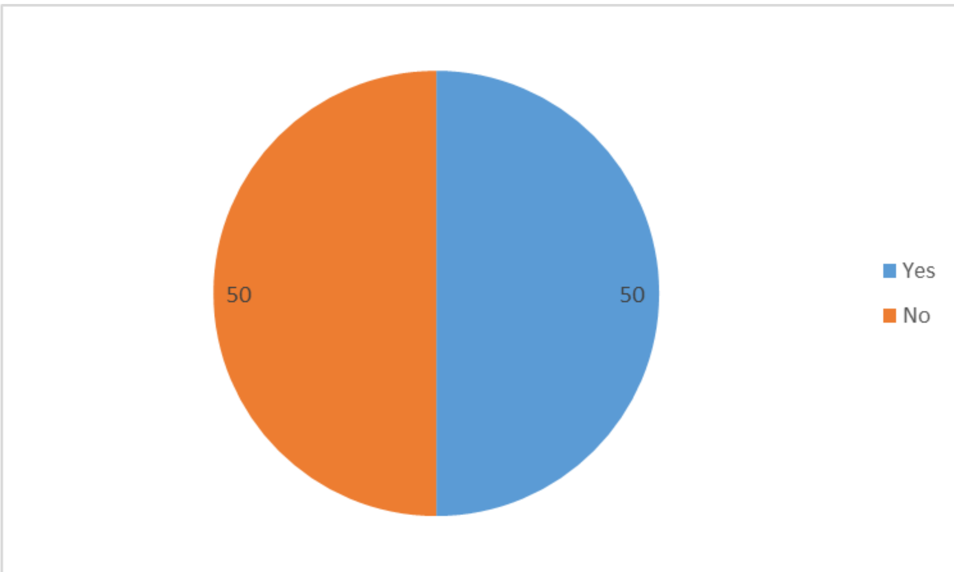


Figure 5.9.7: Information scattered in different sources

Figure 5.9.7 above shows that 50% of respondents agreed that information was scattered in different sources and thereby not making it readily available and the other half (50%) disagreed that information was scattered in different sources.

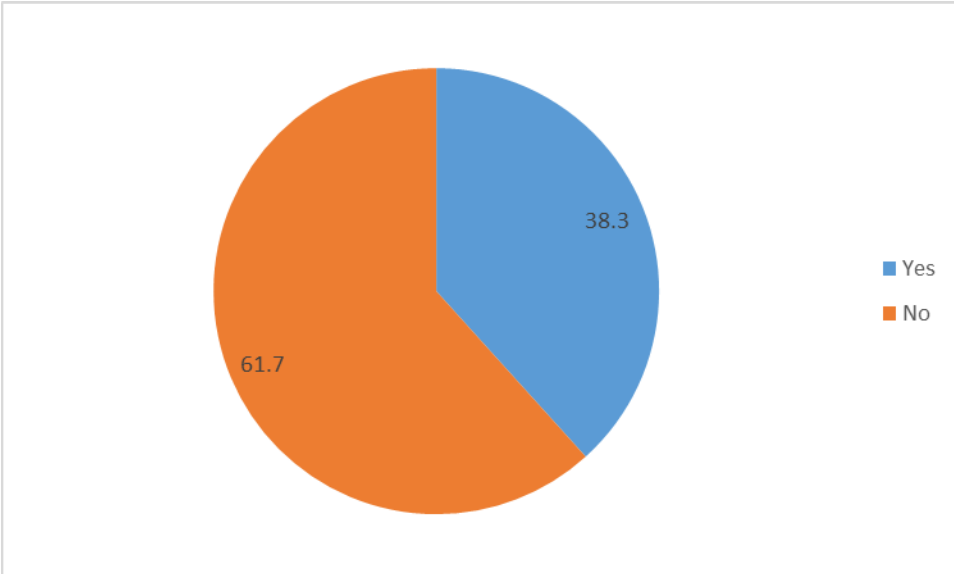


Figure 5.9.8: Information on the subject of aquaculture is too vast

Respondents were asked to state how they found information on aquaculture, whether there was too much information or too little information on this subject and 38.3% agreed that there was vast information on this topic, which posed as a challenge to use the information, while 61.7% disagreed that information on aquaculture was too vast.

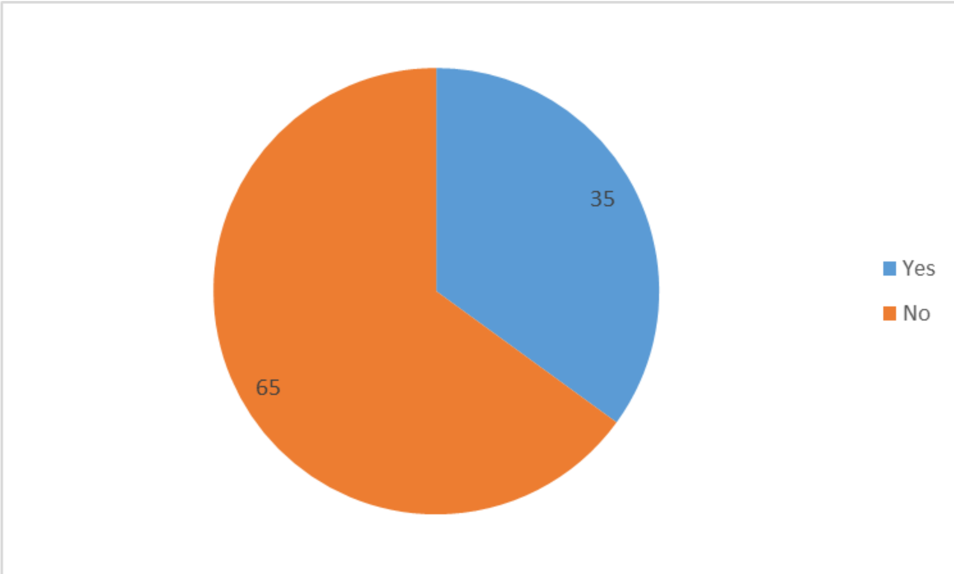


Figure 5.9.9: Information on aquaculture is outdated

Thirty five percent (35%) of respondents agreed that information on aquaculture, which they come across was outdated and 65% disagreed that the information on aquaculture, which they come across was out of date.

5.10 Section I: Prohibiting factors of using the Internet

The respondents mentioned the following as prohibitive factors of using the Internet: 16.7% agreed that the cost of hardware was prohibitive to use the Internet; 15% said that they found the cost of the Internet discouraging and hence not using the tool, while 10% agreed that they had limited knowledge of using the Internet as an information resource; 3.3% were not aware of the benefits of the Internet; 16.7% did not have access to a computer and as a result prohibiting them from using the Internet; 6.7% mentioned that information on the Internet was not trustworthy, 15% indicated that they had limited search skills and did not know how to search for information on the Internet and 23% agreed that they faced challenges of slow speed and download time when using the Internet.

Table 5.10.1: Prohibiting factors of using the Internet

	Prohibiting factors of using the Internet	Yes (%)	No (%)
a)	Cost of hardware prohibitive	16.7	83.3
b)	Cost of Internet discouraging	15	85
c)	Unaware of the benefits of the Internet	3.3	96.7
d)	Limited knowledge of using the Internet	10	90
e)	Not having access to a computer	16.7	83.3
f)	Not having access to a computer	15	85
g)	Information on the Internet is not trustworthy	6.7	93.3
h)	Limited Internet search skills	15	85
i)	Slow speed and download time on the Internet	23.3	76.7

In Table 5.10.1 above, respondents were presented with a number of statements (a-i) requiring a yes or no response regarding some prohibiting factors of using the Internet. (a) On whether the cost of hardware was prohibitive, 16.7% agreed and 83.3% disagreed. (b) On whether the cost of the Internet was discouraging; 15% of respondents agreed that it was discouraging and hence they did not use the tool as an information resource, while 85% disagreed. (c) In response to whether they were aware of the benefits of the Internet, 3.3% of respondents were not aware of the benefits of the Internet, while 96.7% were aware (d) On whether they had limited knowledge of using the Internet; 10% agreed and 90% disagreed. (e) Responding to whether they did not have access to a computer and prohibited them from using the Internet, 16.7% respondents agreed, while 83.3% disagreed. (f) The researcher asked respondents whether they had access to Internet and 15% showed that they did not have access to the Internet while 85% had access to the Internet. (g) In response to the statement that information on the Internet was not trustworthy, 6.7% agreed, while 93.3% disagreed. (h) The majority (85%) of fish farmers disagreed with the statement that they had limited searching skills when looking for information on the Internet while 15% agreed with the statement. (i) In response to whether they faced challenges of slow speed and downloading time on the Internet, the majority (76.7%) disagreed and 23.3% agreed.

Research Question 2: What are the information and knowledge sources including sharing strategies of aquaculture farmers? (Sections J – N)

5:11 Section J: Frequency of use of information sources

This section focuses and summarises the frequency of usage of information sources. The responses revealed that 40% very often used government officials as their sources of information; 43.3% very often relied on extension personnel as their sources of information; 63.3% relied very often on professional colleagues as sources of information; 46.7% rarely used teachers/ lecturers as their sources of information; 31.7% rarely consulted traditional leaders as their sources of information; 40% sometimes used textbooks to satisfy their information needs; 31.7% sometimes consulted newspapers as their sources of information, 45% rarely used leaflets, 45% rarely used television; 45% often used the radio; 35% rarely used the Internet; 50% very often used mobile phones; 31.7% often used workshops as a source of information and 63% rarely used the library as a source of information.

Table 5.11.1 Frequency of using information sources

	Frequency of using information sources	**Very Often**	**Often**	**Sometimes**	**Rarely**
a)	Government officials	40%	31.7%	16.7%	11.7%
b)	Extension workers	43.3%	28.3%	23.3%	5%
c)	Professional colleagues	63.3%	20%	6.7%	10%
d)	School teachers	5%	31.7%	16.7%	46.7%
e)	Community leaders	13.3%	28.3%	26.7%	31.7%
f)	Textbooks	15%	11.7%	40%	33.3%
g)	Newspapers	11.7%	26.7%	31.7%	30%
h)	Leaflets/ brochures	10%	28.3%	16.7%	45%
i)	Television	6.7%	30%	18.3%	45%
j)	Radio	18.3%	45%	16.7%	20%
k)	Internet	26.7%	21.7%	16.7%	35%
l)	Mobile phones	50%	15%	31.7%	3.3%
m)	Workshops and seminars	11.7%	31.7%	30%	26.7%
n)	Libraries	5%	10%	21.7%	63.3%

Table 5.11.1 presents information relating to when respondents were given several statements (a-n) which required them to rate the frequency of sources of information, which they used for their informational needs. The figures show that 40% of farmers very often used government officials as their sources of information, while 31.7% very often used government officials as sources of

information. These figures are followed by 16.7% who sometimes used government officials and 11.7% who used them rarely. From these responses, it is clear that the majority of farmers relied on government officials as their sources of information.

Respondents were also asked to rate the frequency with which they used extension personnel as sources of information. The majority (43.3%) mentioned that they very often relied on extension personnel as their sources of information, while 28.3% often relied on extension officers. Twenty three point three percent (23.3%) sometimes used extension officers and 5% rarely relied on extension officers as their sources of information. The above statistics show to a large extent that fish farmers' relied mostly on extension officers as their sources of information.

On whether respondents used professional colleagues as sources of information, the figures indicate that 63.3% of farmers relied very often on professional colleagues as sources of information, while 20% often consulted their colleagues for information. Ten percent (10%) rarely consulted their colleagues and 6.7% sometimes consulted their colleagues as sources of information. From these statistics it is clear that fish farmers trusted their professional colleagues as sources of information.

Fish farmers were asked to rate how often they used school teachers or lecturers as sources of information. The majority (46.7%) of farmers rarely used teachers / lecturers followed by 31.7% who often consulted lecturers / teachers as their sources of information. The remainder of respondents, that is, 16.7% sometimes consulted lecturers / teachers and 5% very often consulted teachers/ lecturers as sources of information. The figures above indicate that fish farmers moderately consulted teachers and lecturers as their sources of information.

Aquaculture farmers were asked to rate how often they relied on traditional leaders as their sources of information. The majority (31.7%) rarely consulted traditional leaders followed by 28.3% who often consulted traditional leaders. Twenty six point seven percent (26.7%) mentioned that they sometimes consulted traditional leaders and 13.3% also mentioned that they very often consulted traditional leaders as their sources of information.

Respondents were also asked to rate how often they used textbooks as their sources of information. 40% mentioned that they sometimes used textbooks, while 33.3% rarely used textbooks. Fifteen percent (15%) mentioned that they very often used textbooks and the least 11.7% mentioned that they often used textbooks as their sources of information on aquaculture.

Fish farmers also mentioned that they used newspapers as sources of information and the majority, (31.7%) mentioned that they sometimes consulted newspapers as their sources of information, while 30% rarely consulted newspapers. Twenty six point seven percent (26.7%) also mentioned that they often used newspapers and 11.7% mentioned that they very often used newspapers as their sources of information. These figures show that newspapers were moderately used by aquaculture farmers.

Fish farmers were asked to rate how often they used brochures and leaflets as their sources of information as indicated in Table 5.11.1. The majority (45%) of fish farmers rarely used leaflets / brochures, whilst 28.3% often use brochures and leaflets. Sixteen point seven percent (16.7%)

mentioned that they sometimes used leaflets and 10% very often used leaflets as their sources of information.

Forty five percent (45%) rarely used television as their source of information, followed by 30% who often used television. Table 5.11.1 further shows that 18.3% sometimes used television and 6.7% very often used television as a source of information.

Respondents were also asked to rate how often they used a radio as a source of information. Forty five percent (45%) mentioned that they often used the radio, followed by 20% who rarely used the gadget. Eighteen point three percent (18.3%) answered that they very often used the radio and 16.7% responded that they sometimes used the radio as a source of information.

In Table 5.11.1 above, the majority (35%) of fish farmers mentioned that they rarely used the Internet, while 26.7% very often used the Internet as their source of information. Twenty one point seven percent (21.7%) mentioned that they used the Internet often and 16.7% sometimes used the Internet as their source of information. The above figures suggest that fish farmers moderately used the Internet as their source of information.

Respondents also revealed that they used very often (50%) mobile phones, while 31.7% sometimes used mobile phones as their sources of information. Fifteen percent (15%) mentioned that they often used mobile phones and 3.3% rarely used mobile phones as their sources of information. The above statistics suggest that mobile phones were used by the majority as sources of information.

Table 5.11.1 provides the responses relating to how respondents often they used workshops and seminars as sources of information. The majority (31.7%) answered that they often used workshops, followed by 30% who answered sometimes. Twenty six point seven percent (26.7%) rarely used workshops and seminars and the least 11.7% answered that they very often used workshops as sources of information.

Respondents were asked to rate how often they used the library as a source of information. The majority (63.3%) rarely used the library as a source of information and the minority (5%) answered they very often used the library as an information source. Twenty one point seven percent (21.7%) answered that they sometimes used the library. while 10% answered that they often used the library. The figures above show that the library was not popular among fish farmers as a source of information.

5.12 Section K: Most valuable information sources

In this section, respondents were asked to identify the most valuable information sources and they revealed the following information: 40% rated a knowledgeable person/ expert as the **better** valuable information source; 50% rated the Internet as the **best** valuable source of information; 62% respondents rated **good** the guidelines/ manuals/ reports as sources of information and 52.4% respondents rated **best**, work colleagues as valuable sources of information.

Table 5.12.1: Most valuable information sources

	Most valuable information sources	Best	Better	Good	Poor
a)	Knowledgeable person/ expert	32.7%	40%	27%	0%
b)	Internet	50%	1.8%	31.3%	0%
c)	Textbooks	50%	50%	0%	0%
d)	Guidelines/ manuals and reports	13.3%	24.4%	62.2%	0%
e)	Work colleagues	52.4%	38.1%	9.5%	0%

Respondents were given the opportunity of multiple selection of sources to rate according to good, better best, or poor as valuable sources of information. These included an expert/ knowledgeable person/ Internet, textbooks, guidelines and manuals and work colleagues were the most valuable source of information. On whether a knowledgeable person was an important source of information, the majority (40%) of the participants rated **better**, while the lowest (27%) rated **good**. Those who rated **best** were 32.7%. From these figures fish farmers showed that they had confidence in experts or knowledgeable people as their sources of information.

The usefulness of the Internet as a source of information was rated best by 50%, followed by 31.3% who said **good** and lastly 1.8% mentioned that it was **better**. It is clear from these figures that the majority of respondents had confidence with the Internet as the most valuable source of information.

Regarding the rating of textbooks as sources of information, 50% answered **best**, while another 50% mentioned **better**. The figures show that textbooks were consulted as sources of information.

Respondents were also asked to rate guidelines/ manuals/ reports as sources of information and 13.3% answered **best,** while 24.4% responded **better** and 62.2% said they were **good**.

Respondents also rated their colleagues as sources of valuable information. As indicated in Table 5.12.1, 52.4% rated them as the **best** sources of information followed by 38.1% who rated their colleagues as **better** sources of information, while 9.5% mentioned that their colleagues were a **good** source of information. From these figures, it is clear that fish farmers trusted their fellow colleagues as valuable sources of information.

5.13 Section L: Frequency of sharing information

This section deals with the frequency of sharing different types of information. The respondents revealed the following: 38.3% often shared information on fish markets; 26.7% very often shared information on fish markets and 26.7% very often shared information on weather forecast; 45% often shared information on fish species, 43.3% often shared information on fishing methods; 31.7% often shared information on sites for fish shoal, 40% very often shared information on fish feeds; and 35% rarely shared information on government policies and regulations.

Table 5.13.1: Frequency of the type of information and knowledge shared

Frequency of the type of information and knowledge shared	Very often	Often	Sometimes	Rarely
Fish markets and harvests	26.7%	38.3%	16.7%	18.3%
Weather forecasts	26.7%	36.7%	21.7%	15%
Types of fish species	27.1%	45.8%	16.9%	10.2%
Modern fishing methods	15%	43.3%	18.3%	23.3%
Site of fish shoal	1.7%	31.7%	21.7%	45%
Fish feeds	40%	33.3%	13.3%	13.3%
Fishing regulations and government policy	18.3%	35%	23.3%	23.3%

Respondents rated the frequency at which they shared information on fish markets and harvests as shown in Table 5.13.1 above. The majority (38.3%) mentioned that they often shared such information followed by 26.7% who mentioned that they very often shared information on fish markets and harvests. Those who answered sometimes were 16.7% and others who answered “rarely” were 18.3%. From the above analysis, the figures show that the majority of fish farmers shared information on fish markets and harvests.

Information on weather forecast was shared often by the majority (36.7%) followed by 26.7% who answered very often and 21.7% who mentioned sometimes. The least 15% answered rarely. These figures suggest that fish farmers shared information on weather forecasts.

Table 5.13.1 shows how respondents answered when they were asked to rate how frequently they shared information on fish species. Forty five point eight percent (45.8%) answered often followed by 27.1% who answered very often and 16.9% who mentioned that they shared the information sometimes. The remainder 10.2% answered rarely. The figures above suggest that aquaculture farmers shared information on types of fish species to a greater extent.

Table 5.13.1 reveals that 43.3% of respondents often shared information on modern fishing methods followed by 23.3% who rarely shared such information and 18.3% who sometimes shared information on modern fishing methods. The least figure (15%), represents those who answered that they very often shared information on modern fishing methods. The figures above show that aquaculture farmers moderately shared information on modern fishing methods.

Respondents were asked to rate how they share information on sites for fish shoals. The majority 45% rarely shared information on fish shoals, followed by 31.7% who often shared such information. Respondents who answered sometimes were 21.7% and 1.7% answered very often. Figures in Table 4.13.1 suggest that aquaculture farmers moderately shared information on sites for fish shoals.

Respondents were asked to rate how often they shared information on fish feeds. The majority 40% responded that they shared information on fish feeds very often followed by 33.3% who often share such information. 13.3% answered sometimes and another 13.3% answered rarely. The figures in Table 5.13.1 suggest that to a larger extent fish farmers share information on fish feeds.

Table 5.13.1 also reveals that the majority (35%) of respondents rarely share information on government policies followed by 23.3% who said that they sometimes shared such information. The same figure of 23.3% also mentioned that they rarely shared information on government policies. The least figure of 18.3% represents those who very often shared information on fishing regulations and government policies. These responses suggest that fish farmers moderately share information on fishing regulations and government policies.

5.14 Section M: Information sharing strategies for aquaculture farmers

In this section, respondents were asked to rate the information sharing strategies and the following were the answers provided: 55% rarely used social media to share information; 25% very often shared information with associates and 25% often shared information to their associates and cooperatives as platforms of sharing information; 40% often shared information through meetings and seminars; 48.3% rarely used the Internet to share information, and 46.7% very often shared information through mobile phones.

Table 5.14.1: Social media as platforms for sharing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	10	16.7	16.7	16.7
	Often	11	18.3	18.3	35.0
	Sometimes	6	10.0	10.0	45.0
	Rarely	33	55.0	55.0	100.0
	Total	60	100.0	100.0	

Table 5.14.1 indicates the rating of social media as a platform for sharing information by aquaculture farmers. The majority (55%) rarely used social media followed by 18.3% who answered that they often used social media to share information and 16.7% mentioned they very often used such platforms. The least of the figures (10%) mentioned that they sometimes used social media to share information. The discrepancy in the figures shown in the above Table 5.14.1 suggests that fish farmers moderately used social media to share information.

Table 5.14.2: Associates and cooperatives as platforms of sharing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	15	25.0	25.0	25.0
	Often	15	25.0	25.0	50.0
	Sometimes	15	25.0	25.0	75.0
	Rarely	15	25.0	25.0	100.0
	Total	60	100.0	100.0	

In Table 5.14.2 above, respondents were asked how often they used cooperatives and associates to share information. An even figure of (25%) across very often, often, sometimes and rarely was recorded. These statistics show that fish farmers moderately shared information through cooperatives and associates.

Table 5.14.3: Seminars and meetings as platforms for sharing information

Seminars and meetings					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	16	26.7	26.7	26.7
	Often	24	40.0	40.0	66.7
	Sometimes	10	16.7	16.7	83.3
	Rarely	10	16.7	16.7	100.0
	Total	60	100.0	100.0	

In Table 5.14.3 above shows how often respondents shared information through seminars and meetings. The majority (40%) answered that they often shared information through meetings and seminars, followed by 26.7% who answered that they very often shared information using the same channels. An even figure of 16.7% each was recorded for those who rarely and sometimes used seminars and meetings to share information. The statistics above indicate that the majority of fish farmers shared information through seminars and meetings.

Table 5.14.4: Internet as a media for sharing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	16	26.7	26.7	26.7
	Often	6	10.0	10.0	36.7
	Sometimes	9	15.0	15.0	51.7
	Rarely	29	48.3	48.3	100.0
	Total	60	100.0	100.0	

Respondents were asked to rate the Internet as a media for sharing information and the majority (48.3%) answered that they rarely used the Internet to share information, followed by 26.7% who mentioned that they very often used the Internet to share information. Fifteen percent (15%) of the respondents answered that they sometimes shared information on the Internet and 10% often shared information through the Internet. These figures suggest that fish farmers moderately used the Internet to share information.

Table 5.14.5: Mobile phones as media of sharing information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	28	46.7	46.7	46.7
	Often	17	28.3	28.3	75.0
	Sometimes	8	13.3	13.3	88.3
	Rarely	7	11.7	11.7	100.0
	Total	60	100.0	100.0	

In Table 5.14.5 above, the figures show that the majority of respondents (46.7%) very often shared information through mobile phones, followed by 28.3% who answered that they often shared information using the same media. The lowest figures were recorded on those who sometimes (13.3%) and rarely (11.7%) shared information through mobile phones. The statistics above suggest that fish farmers used mobile phones for sharing information to a greater extent.

5.15 Section N: Usage of Internet technologies

In this section respondents were provided with statements, which they were supposed to rate and the following were the answers: 37% strongly agreed that the "*Internet enhances their abilities to access the latest information on aquaculture"*; 43% disagreed with the statement, *"The* *available information on the Internet confuses me"*; 43.3% agreed with the statement *"I mainly use the Internet to communicate"*; 55.6% agreed with the statement "*The Internet allows me to enjoy my job"*; 48.1% disagreed with the statement *"I feel overloaded with the information available on the Internet"*; 37% agreed with the statement *"I feel comfortable with the way I conduct information searches on the Internet"*; 61.7% agreed to the statement that *"I listen to the radio to get the information I need"*; 33.3% strongly agreed that they "*search on the Internet their information requirements"*; and 51.7% agreed with the statement that *"I view the television to access the information that I need"* as a summary of Table 5.15.1.

Table 5.15.1: Satisfaction on usage of Internet technologies

	Satisfaction on the usage of Internet technologies	Strongly Agree	Agree	Disagree	Don't know
a)	The Internet enhances my ability to access the latest information	37%	37%	5.6%	18%
b)	The available information on the Internet confuses me	11.1%	14.8%	43%	22.2%
c)	I mainly use the Internet to communicate	11.1%	43.3%	18.5%	22.2%
d)	The Internet allows me to enjoy my job	14.8%	55.6%	7.4%	22.2%
e)	I feel overloaded with the information available on the Internet	5.6%	14.8%	48.1%	27.8%
f)	I feel comfortable with the way I conduct information searches on the Internet	29.6%	37%	9.3%	24.1%
g)	I listen to the radio to get the information I need	15%	61.7%	23.3%	0%
h)	I use the Internet to search for the information I need	33.3%	31.7%	15%	10%
i)	I watch the television to get the information I need	8.3%	51.7%	28.3%	11.7%

Table 5.15.1 indicates the responses, which were obtained after respondents were asked to qualify a number of phrases by giving answers: strongly agree, agree, disagree or don't know. A question was posed to the respondents on how much they agreed with the statement that "*The Internet enhances my ability to access the latest information on aquaculture*". The majority of the respondents (37%) answered that they strongly agreed, followed by the same figure of (37%) who mentioned that they agreed and 18% mentioned that they did not know. The least of the figures (5.6%) represents those who disagreed that the Internet enhances their ability to search for the latest information. The responses suggest that the majority of Internet users confirmed the statement that the Internet enhances their abilities to access current information.

Respondents were also asked to confirm whether they agreed with the statement, "*The available information on the Internet confuses me"*. The majority (43%) of the respondents disagreed with the statement, while 22.2% mentioned that they did not know. The responses further show that 14.8% agreed and 11.1% strongly disagreed. The responses suggest that there was an average uptake of trusting information on the Internet amongst fish farmers.

The statement on whether respondents mainly used the Internet to communicate was meant to ascertain whether respondents agreed or disagreed with the statement. The majority of the respondents (43.3%) mentioned that they agreed, followed by 22.2% who said they did not know, while, 18.5% answered that they disagreed. The lowest figure (11.1%) represents those who strongly disagreed. These statistics suggest that there was a moderate usage of the Internet as a platform for communication.

Respondents were asked to confirm whether they agreed with the statement, *"The Internet allows me to enjoy my job"*. The majority (55.6%) of the respondents represented agreed, followed by 22.2% who said they did not know. The remainder: that is, 14.8% and 7.4% mentioned that they strongly agreed and disagreed respectively. The figures suggest a moderate response on whether the Internet allowed respondents to enjoy their job.

Table 5.15.1 shows the pattern in which respondents answered the question on whether they felt overloaded with the information on the Internet. Forty eight point one percent (48.1%) of the respondents disagreed with the above statement, followed by 27.8% who said they did not know. The lower figures represented by (14.8%) and (5.6%) represented that they agreed and strongly agreed respectively.

Respondents were also asked whether they agreed with the statement, *"I feel comfortable with the way I conduct information searches on the Internet"*. Thirty seven percent (37%) mentioned that they agreed, followed by 29.6% who answered that they strongly agreed. Twenty four point one percent (24.1%) answered that they did not know, and 9.3% disagreed. The statistics shown in Table 5.15.1 indicated that the majority of respondents were comfortable with the way they conducted information searches on the Internet.

The majority (61.7%) of the respondents agreed that they listened to the radio to get the information they needed, followed by 23.3% who mentioned that they disagreed, and 15% who strongly agreed that they listened to the radio to a greater extent for an update of their information requirements.

The majority of the respondents (33.3%) strongly agreed that they searched on the Internet for their information requirements, followed by 31.7% who also agreed that they also searched the Internet for information. The statistics shown in Table 5.15.1 above suggest that respondents searched for their information requirements on the Internet.

Table 5.15.1 also shows that 51.7% agreed with the statement that they "*viewed the television to access the information they needed"*, followed by 28.3% who mentioned that they disagreed and 11.7% who also mentioned that they did not know. The lower figure (8.3%) was of those who strongly agreed that the television provided them with the information they needed. These statistics show that the television was moderately used by respondents to access information.

Research Question 3: What are the information literacy levels and knowledge competencies of aquaculture farmers? (Section O)

5.16 Section O: Information literacy levels

In this section, respondents were asked a number of questions in order to ascertain their information literacy levels and the following answers were recorded: 48.3% rarely attended training sessions to upgrade their information literacy skills, while 31% attended once in three months. Seventeen point two percent (17.2%) mentioned that they attended training weekly and 3.4% also mentioned that they attended training on a monthly basis; 66.7% were satisfied with the information and knowledge on aquaculture; 47.9% consulted experts in order to cover the information and knowledge gap when they wanted to make up for their information requirements; 58.7% had not received training on how to use the library, 55% had not received training on information literacy and instruction; 51.7% had not received training on Internet searching skills; 98.3% answered that it was important to attend aquaculture conferences and seminars; 70% had never presented a paper at an aquaculture conference; 98.3% thought that it is important to share information and knowledge acquired at a conference or seminar; 95% mentioned that they had used information acquired to solve a problem; 88.3% had never published in a journal, newspaper or magazine; 80% of the respondents agreed that they would like to be consulted before an information program or system is put in place, and 76.7% did not receive any alerts or used any current awareness services.

Table 5.16.1: Frequency for attending training to upgrade information literacy skills and knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Weekly	10	16.7	17.2	17.2
	Monthly	2	3.3	3.4	20.7
	Once in 3 months	18	30.0	31.0	51.7
	Rarely get training	28	46.7	48.3	100.0
	Total	58	96.7	100.0	

The respondents were asked about the frequency of attending training sessions to upgrade their skills and 48.3% rarely attended training, while 31% attended once in three months. Seventeen point two percent (17.2%) mentioned that they attended training weekly and 3.4% said they attended training on a monthly basis. These figures suggest that the majority of fish farmers rarely attended training sessions to upgrade their skills and knowledge.

Table 5.16.2: Literacy levels of respondents on aquaculture information

Literacy levels	**Yes**	**No**
Do you feel satisfied with the information and knowledge you receive on aquaculture?	66.7	33.3
Have you ever received training on library/ user education?	43.3	56.7
Have you ever received training on information literacy instruction?	45	55
Have you ever received training on Internet searching skills?	48.3%	51.7%

In Table 5.16.2 above, respondents were asked whether they were satisfied with the information they received on aquaculture. The majority (66.7%) of fish farmers mentioned that they were satisfied with information and knowledge on aquaculture, while 33.3% were not satisfied with information and knowledge on aquaculture. Respondents were further asked if they had received any library training or user education. The majority (56.7%) of the respondents answered that they had not received training on library user education, while 43.3% had received library user education. The respondents were also asked whether they had received training on information literacy instruction. The majority of respondents (55%) mentioned that they had not received training on information literacy instruction, while 45% received such training. Most respondents (51.7%) had not received training on Internet searching skills, while 48.3% had received training on Internet searching skills.

Table 5.16.3: How do you make up for the gap in your information requirements?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Consult experts	23	38.3	47.9	47.9
	Ask colleague	18	30.0	37.5	85.4
	Search the internet/ Others	7	11.7	14.6	100.0
	Total	48	80.0	100.0	
Total		60	100.0		

Respondents were further asked in case if they were not satisfied with information provided to them – how they made up for the gap of their information requirements. The majority 47.9% mentioned that they consulted experts for their information requirements, while 37.5% asked a colleague. 14.6% of the respondents also mentioned that they searched the Internet and other sources for their information requirements.

Table 5.16.4: Knowledge competencies of respondents

Type of knowledge	Yes	No
Do you think it is important to attend aquaculture seminars to acquire new knowledge?	98.3%	1.7%
Have you ever used information to solve a problem at your work?	95%	5%
Have you ever shared your experiences at a workshop, seminar or conference?	30%	70%
Do you think it is important to share knowledge acquired at a conference seminar, radio programme, etc.?	98.3%	1.7%
Do you use current awareness alerts for any new information in your work	23.3%	76.7%
Do you think you should be consulted before an aquaculture information system is designed?	80%	20%
Do you think information is important in your work?	98.3%	1.7%

In Table 5.16.4 above, respondents were asked to rate their knowledge competencies on aquaculture. A question was asked as to whether they felt it was important to attend seminars and conferences on aquaculture; 98.3% of respondents answered yes, while 1.7% answered no. On the question on whether respondents had used information to solve a problem; the majority of respondents (95%) answered that they have used information acquired to solve a problem, while 5% mentioned that they have never used information to solve a problem. Respondents also mentioned as indicated in the above Table 5.16.4 that 70% had never presented a paper at an aquaculture conference, while 30% had presented a paper before. The majority of respondents (98.3%) thought that it was important to share information and knowledge acquired at a conference or seminar, while 1.7% believed that it was not important. Respondents were asked if they used current awareness services or alerts to help them know when new literature or information becomes available. Seventy six point seven percent (76.7%) responded that they had not received any alerts or current awareness services, while 23.3% mentioned that they had received. Respondents were asked whether they should be consulted when an aquaculture information system is designed and 80% of the respondents agreed that they would like to be consulted before an information programme or system is put in place, while 20% showed no interest.

In this section, respondents were also asked a number of questions and the following were the answers provided: 28.3% very often felt uncertain when they lacked information, 45% very often felt a sense of accomplishment when they used information to solve a problem and 100% felt that information was important in their work.

Table 5.16.5: Uncertainty when lacking information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	17	28.3	28.3	28.3
	Often	20	33.3	33.3	61.7
	Sometimes	17	28.3	28.3	90.0
	Rarely	6	10.0	10.0	100.0
	Total	60	100.0	100.0	

Respondents were asked how often they felt uncertain when lacking information. The majority (33.3%) responded that they often felt uncertain followed by 28.3% who mentioned that they very often felt uncertain and 28.3% mentioned that they sometimes felt uncertain. Ten percent

(10%) of the respondents replied that they rarely felt uncertain. From the analysis of the above figures, it was evident that the majority of respondents felt uncertain when they lacked information.

Table 5.16.6: How often do use the information acquired to solve problems?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	23	38.3	38.3	38.3
	Often	26	43.3	43.3	81.7
	Sometimes	11	18.3	18.3	100.0
	Total	60	100.0	100.0	

Table 5.16.6 above shows the rating in terms of the frequency which respondents use information to solve problems. The majority (43.3%) used information often, followed by 38.3% who mentioned that they used the information very often to solve problems and 18.3% sometimes used the information. The figures suggest that respondents used information to solve their problems they encountered when carrying out their duties.

Table 5.16.7: Do you have a sense of accomplishment when you use information?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very often	27	45.0	45.0	45.0
	Often	23	38.3	38.3	83.3
	Sometimes	10	16.7	16.7	100.0
	Total	60	100.0	100.0	

Aquaculture farmers were asked whether they felt that they had achieved and were satisfied when they used information to solve a problem. Table 5.16.7 above shows that 45% of the respondents very often felt a sense of accomplishment when they used information to solve a problem, while 38.3% often felt a sense of accomplishment when they used information.

Respondents (16.7%) sometimes felt a sense of accomplishment when they found and used the information they needed. The figures suggest that respondents felt satisfied when they sought and found information they needed.

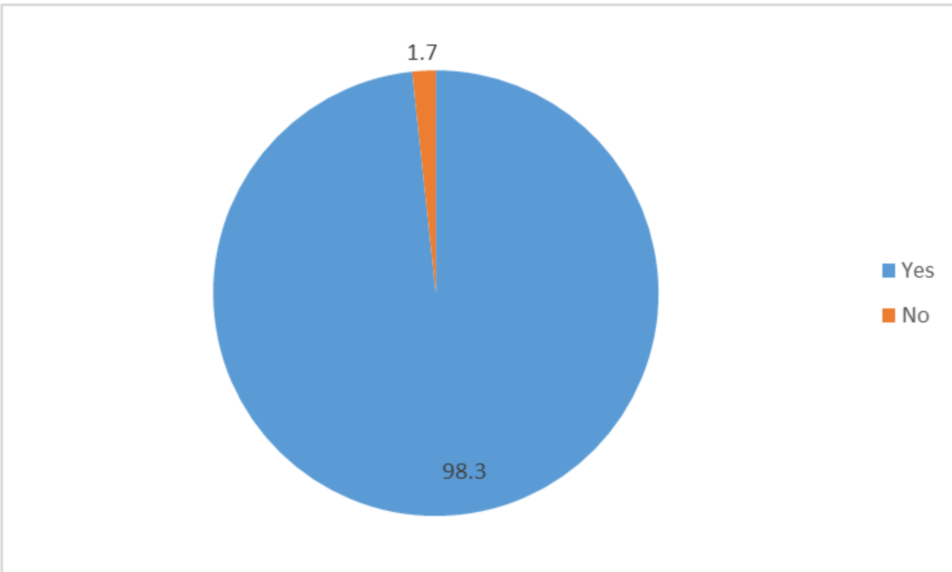


Figure 5.16.1: Do you think information is important in your work?

Respondents were asked whether information was important in their work. The majority (98.3%) answered that it was important, while 1.7% disagreed. This figure suggests that respondents were aware of the importance of information in their work.

5.17 Part 2 (Two): Data analysis and presentation of the findings for the qualitative study

The sections in this part are arranged according to themes derived from research questions. The research questions addressed in Part 2 include "What are the information and knowledge needs, access and usage of information by aquaculture farmers?" presented in section 5.17.1; "What are the information and knowledge sources including sharing strategies of aquaculture farmers?" presented under section 5.17.3; "What are the information literacy levels and knowledge competencies of aquaculture farmers?" presented in section 5.17.3; and "What are policies governing information and aquaculture production in Namibia" presented under section 5.17.5. The other research questions; that is, Research Question 5 and 6 were covered separately. The Research Question 5 "What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia" is presented in Chapter 3 under sections 3.2.1 and 3.2.2. The last Research Question "What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia is presented as a contribution to the study in Chapter 7 under section 7.4.2.

5.17.1 Introduction

The study held interviews with the 12 purposively selected key informants and also generated qualitative data through open ended questions from the semi structured questionnaire. The reasons for gathering qualitative data through interviews and open ended questions from questionnaires were as follows: firstly it was important to get an in depth understanding of information seeking behaviour of fish farmers to explain in detail the what, where, how, when and why?, and secondly, the study wanted to validate the missing data from the questionnaire (quantitative data) and compliment it with the answers provided from the interviews and open ended questions (qualitative data) and thereby complying with the requirements of the mixed methods approach for purposes of triangulating the two approaches (quantitative and qualitative approaches) as a way of validating data. The qualitative data in this study covers data from interviews, semi structured questionnaire (open ended questions) observations and document analysis.

All 12 key informants occupied senior managerial positions in aquaculture divisions and were considered to be experienced and knowledgeable in the field of fish farming and dealing with aquaculture farmers. They had the advantage of understanding the policy issues and had clear understanding of the purpose of study and the benefits, which the study will contribute to the aquaculture sector. These key informants were based in the regions and had good understanding of aquaculture issues and how information was used to support the fish farmers. For purposes of protecting their identity, the researcher used codes (Table 5.1.1) in which they are referred to as Key Informant HA1& HA2 (Hardap), OM1 & OM2 (Omusati), KE1 & KE2 (Kavango East), KW1 &KW2 (Kavango West), ZA1 & ZA2 (Zambezi) and ER1 & ER2 (Erongo). According to the coding, a "1" represents the chief fisheries officer/ manager and a "2" represents fisheries officer who doubles his or her role as an extension officer/ worker (See 4.3).

Research Question 1: What are the information and knowledge needs, access and usage of information by aquaculture farmers? (5.17.2)

5.17.2: Information and knowledge needs, access and usage of information

All key informants (HA1, HA2, OM1, OM2, KE1, KE2, KW1, KW2, ZA1, ZA2, ER1 and ER2) agreed that fish farmers had specific information, which they required when performing their duties and the information, which they needed included the following: weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on general agriculture and the environment. They also explained that they used the above mentioned information for emergency problem solving, performing tasks, decision-making and keeping abreast with current trends in fish farming. Key informant OM1 said:

> *Aquaculture is a way of farming which is new to this part of the world and therefore, it is important that fish farmers become users of information. We always encourage them to read about fish farming and where they need help; we tell them to contact us for assistance.*

In support, key informant HA1 alluded to the fact that information is of paramount importance to every fish farmer but they had a few cases in which some farmers did not have a reading culture. However, they still relied for their information needs on Ministry officials or colleagues. A case in point mentioned by HA1 was that in some commercial fish farms, the workers in the ponds relied mostly for their information needs on their supervisors. These supervisors were well trained and had knowledge and experience of fish farming. It was also noted that some fish farms had failed because of poor farming methods, which occurred as a result of lack of information.

KE1 added in a separate interview that the information which was mostly sought was for problem solving and every fish farmer in one way or the other encountered problems which needed to be solved by using information. These problems included diseases, flooding, and predators etc, and as a result they found themselves looking for information from different sources.

The key informants (KE1, KE2, OM1 and ZA1) mentioned that the frequency with which fish farmers looked for information varied from daily to occasionally and this was mainly influenced by a number of factors such as their level of education, problems encountered in their work, eagerness to learn so as to acquire new skills and knowledge. According to key informant KE2:

> *Fish farmers consult information depending on the problems which they would like to address and the frequency for consulting information varies. It is really impossible to find a fish farmer who does not understand the value of information in their work.*

Respondents were asked how the information acquired or sought by fish farmers helped the farmers in their work. The answers provided showed that fish farmers used environmental information to understand the soil type, making decisions based on the information provided and using information for administration and planning; agricultural information was needed on rainfall patterns and general information on fish species and types was also needed. Key informant OM2 had this to say when asked what fish farmers did with the information they looked for:

> *Fish farmers look for information depending on the task and they are not limited to maps to find out about the vegetation type and environmental issues. Information on new technology used for fish farming, is needed by fish farmers in order to stay abreast with new technology.*

The key informants (KW1, KW2, OM1, ZA2 and ZA1) also mentioned that aquaculture farmers accessed their information from different media depending on the media within reach to them since some of them stayed in remote areas. The media used to access information includes but it is not limited to television, radios, Internet, seminars and meetings, textbooks, radios, newspapers, libraries, posters and information centres as well as extension officers who visit them on a regular basis.

The issue of radio as a source of information was emphasized by ZA2 who mentioned that most fish farmers had access to radios and in most cases they always found it as an easier and quickest method when they wanted to inform or create awareness to fish farmers on impending drought or floods. The local NBC Silozi Radio Station was used to reach out to farmers whenever there was some information which they needed to communicate with them. ZA1 mentioned the following as a disadvantage of using the television as a source of information:

> *Most farmers in this region have a television set either powered by electricity or solar but the problem is that it cannot be used as an effective tool to communicate with fish farmers since the programming is always prior arranged and if you look at the current programming it favours mini-series and current news. For news on fish farming, the national television only broadcasts such information as part of the news item which is a disadvantage since the farmers need to be constantly informed of good farming practices.*

The key informants (KE2 and KW2) were asked if fish farmers encountered situations where they lacked information and some agreed, while some disagreed. Key informant KE2 mentioned that sometimes fish farmers encountered problems relating to the lack of information caused as a result of information which was not properly coordinated since information on aquaculture was fragmented in different ministries; that is, Ministry of Agriculture, Water and Forestry (MAWF), Ministry of Environment and Tourism (MET) and Ministry of Fisheries and Marine Resources

(MFMR). This lack of coordination amongst ministries in the provision of information resulted in knowledge gaps amongst fish farmers. KW2 added by saying the following:

> *…for instance, when a farmer wants to dig ponds to start fish farming, s/he has to seek authority from the ministries of lands, environment, etc. The environment ministry is consulted because there is a need to do an environmental impact assessment and sometimes the ministry of agriculture is also consulted to look at the soil type. The parent ministry of fisheries provides extension services and all these ministries involved at every stage of planning and implementing a fisheries project poses a big challenge to the farmer since information is likely to be uncoordinated which may result to miscommunication. Though it should be encouraged for ministries to work together but this may become a disadvantage where the same information can be communicated differently and this may end up confusing the farmer.*

Key informant OM1 disagreed that fish farmers lacked information and was quoted saying the following:

> *Since fish farmers depended a lot on extension workers and fisheries officials, it was highly unlikely that they faced problems of lack of information, whenever, they have problems at their farms regarding fish farming they are free to walk into the offices of extension workers or call them on their mobile phones with their queries. Our office practices an open door policy and we can help the farmers 24/7.*

The above was also supported by ER1 who mentioned the following:

Most fish farmers who practice fish farming along the ocean are advanced in terms of how they access and exploit information. They are well resourced and can afford to employ experts who are able to provide the most current information on fishing practices. The Ministry is always available to support them with information on the water quality, recording diseases, collecting statistics, etc.

Key informant OM2 mentioned the following when asked whether fish farmers feel overloaded with information:

There is need for user profiling in terms of the information accessed by fish farmers since most of the information is written in technical jargon and therefore it is not easily accessible. Information overload on the part of the fish farmer can arise as a result of the information which is not properly packaged to suit some of the fish farmers. The majority of farmers lack understanding of technical jargon and therefore it is important if publishers of information can simplify aquaculture information in order to become easily accessible to the intended audience.

Key informants (OM2, OM1 and KW2) were asked a follow up question on how fish farmers use the information they obtain from extension workers and other sources of information. The answer to this question showed that fish farmers mainly use the information to solve problems and make strategic decisions regarding their farms. Key informant OM2 noted that fish farmers use information on environmental assessment to make informed decisions;

Information helps farmers to plan for the sites for the dams and carry out an environmental impact assessment before starting the aquaculture project. It is only through the availability of information that an aquaculture project can be successful.

Another follow up question was asked regarding the rate of adoption and use of information among fish farmers and key informant KW2 answered that:

Fish farming unlike other farming practices in Namibia; it requires the farmer to use information and any farmer who does not use information risks poor yields and production. It is highly unlikely to find a fish farmer who does not use information.

The researcher also wanted to find out the approximate statistics regarding the adoption of fish farming as a new farming method and KW1 responded by saying that:

The interest which is generated from the beginning when the farming practice is introduced differs from when farmers discover that aquaculture farming is labour intensive and requires a lot of capital. The initial meetings are attended by almost everyone in the community and the interest fades away when farmers notice that aquaculture farming requires a huge investment in terms of capital. The early implementers of the fish farming project are always below twenty percent (20%).

Research Question 2: What are the information and knowledge sources including sharing strategies of aquaculture farmers? (15.17.3)

5.17.3: Information and knowledge sources including sharing strategies of aquaculture farmers

Key informants (KW1, KE1, ER1 and OM1) mentioned that aquaculture farmers used a variety of information sources to gather information and these sources included; atlases, Internet, textbooks, journal articles, conferences papers, workshops reports, experiments from the laboratories and government officials (orally through meetings) (see Figure 5.17.1). Most of the sources of information were either communicated through printed media (documents, reports, etc.) or orally (meetings and seminars) and telephonically. Electronic media was also used to communicate information and this also included television, radio, e-mail, Blogs, WhatsApp and various other social media platforms.

Key informant KW2 mentioned the following when asked why farmers would use some of the sources of information such as atlases, textbooks and journal articles:

> *…atlases are used by fish farmers when siting the location of the ponds to see whether the place lies on the flood plain or not, checking the soil type and making sure that the area is suitable for fish farming. Textbooks on the other hand are also used because as sources of information since they contain biological information about diseases and types of fish species.*

Figure 5.17.1: Fish farmers sharing information at a meeting

The key informants also noted that aquaculture farmers used different platforms to share knowledge and information. These platforms included the following (See Table 4.17.1):

- Radio, workshops and community presentations with headmen
- Email, cellphones, visits, etc.,
- Orally, meetings, seminars, brochures, posters,
- Radio – talk about fish farming, and
- Share information with the colleagues and listen to what they say during meetings (See Figure 4.18.1).

Upon being asked about what kind of information was shared by fish farmers during their meetings, all key informants had varied answers which were related in that the radio was used to disseminate awareness information about diseases, the next meetings, visits by extension workers and weather conditions. Meetings were also used to discuss catches, diseases, fish harvests and markets and extension workers or ministry officials used them to disseminate information on fish production. Cellphones were used by fish farmers to communicate with each other and also to communicate with ministry officials. Sometimes fish farmers are located far away and during times of floods, cellphones were used as a way of communication as noted by key information ZA2.

Key informant OM2 informed the interviewer that posters were used and are preferred because they were easier to carry when visiting farmers. Such posters contained important information on types of fishes (fish species), diseases and general information on the Ministry of Fisheries and Marine Resources (MFMR). The interviewer had an opportunity to be shown these posters by key informant OM2 who showed posters for fish species, brochures on aquaculture showing responsible people who should be contacted in case of emergency.

The following table (Table 5.17.1) shows the information sources often used by aquaculture farmers to share information as observed on Site A and Site B:

Table 5.17.1: Information sources used by aquaculture farmers to share information

Information source	Site A	Site B
Internet	√	√
Social media	√	x
E-mails	√	√
Oral communication	√	√
Posters	√	√
Books	√	x
Meetings	√	√
Cellphones	√	√

In Table 5.17.1 above, the researcher went to two sites and observed the types of information sources available, which were used by fish farmers. At Site A, the researcher noticed that Internet, social media, emails, oral communication, posters, books, meetings and cellphone communication were used as sources of information whereas in Site B, Internet, emails, oral communication Posters, Meetings and cellphones except for books and social media were used as sources of information. It was not clear why social media was not used as a source of information but it was noted that books were not used because most of the fish farmers relied mostly on ministry officials for their information needs since they were experts in their various fields.

Research Question 3: What are the information literacy levels and knowledge competencies of aquaculture farmers? (5.17.4)

5.17.4: Information literacy levels and knowledge competencies of aquaculture farmers

According to key informants (ZA1, ZA2, KE1, and KE2), the three most popular sources of information consulted by fish farmers were colleagues, government officials (extension workers) and reports. Colleagues were preferred over the other sources because they were readily available to share their knowledge and these included their supervisors or fellow colleagues. It was noted by informant ER2 that besides the advantage of colleagues being readily available; aquaculture farmers found it easier to share information with their colleagues since they are familiar with the situation and problems faced in their farms.

Informant ZA2 added that:

> *Government employees or extension workers are the second preferred since these are knowledgeable people and are consulted because of their expertise in fish farming* (See Figure 5.18.2).

The third preferred source of information as mentioned by KA2 was technical reports and these included; FAO reports, ministry of fisheries reports, etc. These reports were consulted because they are written by experts and include important information on fish farming. This information from reports covered guidelines, policies and fishing practices as well as training workshops held in different regions.

Figure 5.17.2: Extension officers regularly visit farmers to share information

The question on whether fish farmers ever shared information about their work was answered as follows:

Key informant OM1 mentioned:

> *We normally have regular meetings with fish farmers and it is through these platforms that fish farmers share information and new knowledge regarding their farming practices….these meetings are important since they facilitate a two way process in the sense that we also learn from what they are doing,*

While Key Informant KE2 answered:

> *We haven't organised a seminar or a meeting in a long time since the government does not have enough money but we always try to make ourselves available for each individual farmer whenever s/he experiences problems at his or her farm. In other words we are saying in as much as we understand how important meetings are but most of our farmers*

have not met in a long time so that they can share information through seminars and conferences. This is becoming a setback in our work since the interest initially generated by fish farmers are slowly fading.

Key Informant ZA2 also answered:

Fish farmers share information and knowledge through meetings and as you can see, we have a meeting today for the fishing cooperative.

Similarly, Key Informant ER1 responded by saying:

We would love to see our fish farmers sharing information through seminars and workshops but when such opportunities arise to attend conferences and workshops; they are quickly grabbed by government officials and high ranking officials who are not farmers". Key Informant HA1 also noted that – "Fish farmers attend meetings and conferences but I am not sure whether they do present at the conferences

Key Informant KE1 also mentioned: "Yes fish farmers have presented at the conference and they normally have regular meetings with fisheries officials".

The information shared at meetings by fish farmers included the following:

- Culturable fish species,
- Fish farming and information related to all areas of aquaculture,
- Extension services, how to start the distribution of fingerlings,
- Ministry organises workshops on production, fish feed and growth of Tilapia,
- Fish diseases,
- Weather information e.g., floods and drought,

- Environmental issues (soil types, etc.), and
- General agricultural information

Fish farmers become knowledgeable with experience and in the initial stages they relied so much on fisheries officials from the ministry. Informant OM2 explained that fish farming was a complex activity and it was very difficult to say that fish farmers can become knowledgeable without using information. All the key informants agreed that information was very important in fish farming and there is no way a farmer can start farming with fish without using information.

On whether fish farmers felt satisfied when using information, the key informants (HA1, HA2, ER1, ER2, OM1, KW1 and KW2) explained that the majority of fish farmers knew how to use information. Key informant HA2 said:

> *It is common knowledge that one feels satisfied if s/he finds the information that s/he needs and unsatisfied when an individual fails to find the relevant information. A sense of accomplishment develops when one uses information to solve the problem no matter which source or sources of information were consulted or used.*

The Interviewees (KW1, KW2, OM1, ZA1 and KE1) gathered that the following information is mostly used by fish farmers and all key informants mentioned them in one way or another:

- Information about transporting fingerlings to farms, advice on how to regulate or control fish diseases, e.g., fungi,

- Vision 2030, annual plans NDP reports,
- FAO training manuals concerning fish husbandry, and
- Workers rely mostly in getting information from their supervisors on fish feed, water quality, etc.

The following table shows the availability of ICT gadgets used by aquaculture farmers to share information as observed on Site A and Site B:

Table 5.17.2: availability of ICT and electrical gadgets/ facilities used by aquaculture farmers

ICT Gadgets	Site A	Site B
Cellphones	√	√
Telephone (Landline)	X	X
Computers/ Desktops or Laptops	X	X
Printers	X	X
Electricity	√	√
Radio	√	√
Television	X	X
Photocopying machines	X	X

Observation was carried out at Site A and Site B to ascertain the availability of ICT gadgets found at both sites and the findings are highlighted in Table 5.17.2 above. The ICT gadgets found at Site A and Site B included cellphones, electricity, and radio; whereas telephone (landline), computers printers, television and photocopying machines were not available at both Sites A and B.

Research Question 4: What are policies governing information and aquaculture production in Namibia (5.17.5)

5.17.5: Policies governing information and aquaculture production

All key informants showed mixed reactions when asked whether aquaculture farmers were aware of policies governing information and aquaculture production. It was noted that fish farmers although they might not have access to policy documents such as the Vision 2030, Aquaculture Act, National Policy on Aquaculture, etc., but extension officers and government officials through their meetings with farmers they always tried to talk about and unpack the information from these documents. These documents were useful to the farmers and outlined the importance of the aquaculture sector in Namibia.

Key informant KE1 was asked whether farmers consulted policy and legislative documents and answered the following:

> *The Aquaculture Act of 2002 was mainly consulted in the initial phases when the farmer was starting on the aquaculture farming. This document was important to the farmer since it provided the sound pillars through which aquaculture laws were firmly grounded. These pillars included access to prudent strategies to ensure proper control and production of aquaculture development.*

KW2 mentioned that the strategic plan was also consulted by stating the following:

> *The Strategic Plan on Aquaculture like the Aquaculture Act was also consulted occasionally by aquaculture farmers since it represented the foundation for addressing the complex, multifaceted issues associated with aquaculture and represented a planning process that transformed the Aquaculture Act into real actions, so that it continued to build a long-term structure for aquaculture development.*

ZA1 mentioned that Aquaculture Strategic Plan recommended on the importance of information to support farmers by quoting the document as follows (GRN, 2004, p. 14):

> *"A user-friendly "Aquaculture Regulatory Handbook" will be produced. This Handbook will outline the permit requirements, review time frames, jurisdictional authorities, application fees, contact persons, necessary licence application documentation and materials, and review processes for the different types of aquaculture. This handbook will guide prospective aquaculturists, financial institutions, and other stakeholders. The Handbook will be available on the Ministry's website".*

It was also noted that aquaculture farmers also understood and read other blueprints including the Vision 2030 and National Development Plans (NDPs). Key informant KA1 stated:

> *…it is their duty as government officials to create awareness on government plans and to create awareness about these blue prints.*

When asked about whether aquaculture farmers were aware of the government policies towards aquaculture farming, key informant KW2 responded as follows:

Most fish farmers were interested in aquaculture production for financial benefit since they saw an opportunity to get rich very quick. However, the majority of fish farmers were aware that the growth of aquaculture industry could improve food security, reduce poverty, create employment and increase inward investment to the country.

5.18 Chapter summary

The results presented in Part 1 (Quantitative study) above show that a total of 60 respondents in the 6 regions that were visited (Hardap, Omusati, Kavango East, Kavango West and Zambezi and Erongo regions) completed the questionnaire. The respondents to the questionnaire were fish farmers who owned ponds and technicians (whose work were deemed to be that of fish farmers) who worked in those ponds. The research sample was composed of 45 males and 15 females and the majority of fish farmers who participated in the survey were between the age group 31-45 (42) followed by 46-60 (18); 20-30 (16) and the least were 61-75(2). The highest qualifications of respondents were secondary education (27) followed by tertiary education (26), primary education (3) and vocational education (3).

The majority of respondents revealed that they needed information for problem solving, performing tasks and decision making. The respondents (88.3%) mentioned that they spent 1-5 hours gathering information, while 6.7% spend 6-10 hours of their time gathering information and 5% spent 16 hours and above looking for information. The respondents needed agricultural information, health information, environmental information, technological information, business and trade information, and government policies and plans. Several media of accessing information were mentioned by respondents, which included the following: newspapers, radio television, training or seminars, libraries, colleagues, textbooks, and the Internet. The respondents revealed that they accessed information from the following places: home, non-governmental organisations (NGOs) and community based organisations (CBOs), and libraries to access information. The fish farmers also revealed problems, which they encountered when accessing information, which were as follows: lack of skills to use media tools, lack of transport facilities, and lack of connection to rural electrification. Fish farmers cited the following as barriers to information access and use: information that they needed for their work was not readily available, staff without good customer relations, challenges of being provided or finding incomplete information sources, not having enough time to look for information, no knowledge of libraries, information was scattered in different sources and thereby not making it readily available, information sources were far apart from each other, did not know how to use the library catalogue when searching for information, there was vast information on aquaculture and this posed a challenge to use the information on aquaculture, which they came across with, was outdated. The findings presented in this section (4.19.2 - 4.19.5) in Part 2 (Qualitative study) provided useful information and covered gaps identified in Part 1 (Quantitative study) through an in-depth analysis of the study. The data under this section was collected using interviews, observations and document analysis. The key informants provided more information on the following themes: Information and knowledge needs, access and usage of information; information and knowledge sources including sharing strategies of aquaculture farmers; information literacy levels and knowledge competencies of aquaculture farmers; and policies governing information and aquaculture production. The key informants revealed that fish farmers had specific information needs which they required when performing their duties and the information needs included the following information: weather forecasts, fish breeding, fish types and species, water quality, fish markets. It was also noted in the study that respondents used a variety of information sources, which they used to gather information and these sources included; atlases, Internet, textbooks, journal articles, conferences papers, workshops reports, experiments from the laboratories and government officials (orally through meetings). The key informants had mixed feelings on whether fish farmers were aware of policies governing information and aquaculture production. It was noted that fish farmers although they might not have access to policy documents such as the Vision 2030, Aquaculture Act, National Policy on Aquaculture, etc., but extension officers and government officials through their meetings with farmers, they always try to talk about information contained in these documents. The data gathered through the qualitative study helped to compliment the data gathered through the quantitative study (Part 1) in that the researcher was able to observe the usage and sharing strategies of information and knowledge by aquaculture farmers.

The next chapter (Chapter Six) presents the discussion of the findings and is organised according to themes derived from research questions.

CHAPTER SIX

DISCUSSION AND INTEPRETATION OF FINDINGS

6.1 Introduction

The main purpose of this chapter is to provide a discussion of findings on access and utilisation of information and knowledge by aquaculture farmers in Namibia. This chapter focuses on an analyses of the data generated and presented in Chapter 5 and relates or compares the data with the literature from Chapter 3. The chapter provides a discussion of findings and answers the research questions of the study under thematic areas, such as; Social and economic characteristics of aquaculture farmers (6.2), Information and knowledge needs of aquaculture farmers (6.3), Information and knowledge access by aquaculture farmers (6.4), Information and knowledge utilisation by aquaculture farmers (6.5), Information sources and sharing strategies among aquaculture farmers (6.6), Level of access of information and knowledge by aquaculture famers(6.7), Levels of utilisation of information and knowledge by aquaculture farmers (6.8), Information literacy of aquaculture farmers (6.9), Fish farmers and policies governing aquaculture governing information and aquaculture production in Namibia (6.10), Contribution of Kuhlthau's Six Stage Model of Information Search Process to the study (6.11), and Contribution of Diffusion of Innovation (DOI) Model to the study (6.11.1). These findings are discussed in respect of the research questions which are as follows:

- What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?

- What are the information and knowledge sources including sharing strategies of aquaculture farmers?
- What are the information literacy levels and knowledge competencies of aquaculture farmers?
- What are the policies governing information and aquaculture production in Namibia?
- What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?
- What is/ are the relevant model(s) or theory(ies) which can be employed to support the information infrastructure for aquaculture farmers in Namibia?

The chapter ends with a summary where a brief synopsis of the research findings is provided.

6.2 Social and economic characteristics of aquaculture farmers

The socio economic characteristics of aquaculture farmers investigated in this research study included age groups, gender, highest qualifications and years of experience. Gopi, Narmatha, Sakthivel, Uma and Jothilakshmi (2016) in their study on *Socio-economic characteristics and its relationship with information seeking patterns of dairy farmers in Tamilnadu, India* discovered that the attitude of the farmers change fast with new demands and preferences viz. quality, quantity and cost. In most cases, farmers differ in their individual characteristics, access to and utilisation of information from different sources. Such diversity among farmers could be related to various personal, socio-economical, or institutional factors. The researcher opined it was imperative to understand and study socio-economic characteristics of fish farmers in order to develop appropriate methods for transferring information and analysing the information system used by these farmers and to strengthen the information process. With the above background, this study also collected information through a survey questionnaire to identify the socio-economic characteristics of aquaculture farmers and its effect on their information seeking behaviour.

In Figure 5.2.2, the majority of fish farmers who participated in the survey were between the age group 31-45 years (73%), followed by 46-60 years (10%); 20-30 (15%) and the least was 61-75(2%). The oldest respondents (2%) were aged 61-75, while the youngest (15%) were aged 20-30 years. The figures showed that the majority (98%) of the respondents were below 61 years of age. This age distribution of respondents as studied by Adefalu, Aderinoye-Abdulwahab, Bello, Olorunfemi and Oba (2013) is important when researching the information needs of fish farmers since age categories may give an indication and more leverage in fish farming since the practice requires some strength to work in the ponds. The majority of respondents showed that they were still within their active and more productive years.

The study considered the gender disparity amongst respondents and Figure 5.2.1 showed that they were 15 females and 45 males, hence revealed that there were more males involved in fish farming than their female counterparts. The small number of females in the study involved in fish farming could be as a result of the nature of fish farming roles which involved a lot of tasks, requiring more physical and mental coordination. A study on fish farmers' information needs may reveal that the gender of an individual can influence the type and quality of work carried out by the individual (Ofuoku, Emah & Itedjere, 2008). Van der Mheen-Sluijer and Sen (1994) provided an insight on women's role in the utilisation of aquaculture information and concluded that different roles were played between females and males in fish farming. Van der Mheen-Sluijer and Sen (1994) added that females occupied themselves with less physical work whereas males were involved with tasks requiring more physical and mental input.

The educational qualifications amongst respondents were studied and Figure 5.2.3 showed the highest qualifications of respondents. The majority of respondents were secondary education (27) tertiary education (26) primary education (3), vocational education (3) and one (1) did not reveal his or her highest educational qualification. These figures however, showed that the majority of the fish farmers had secondary or tertiary education and were predominantly literate. Adefalu et al. (2013) argue that a farmer's level of education is expected to influence his or her innovativeness and ability to make decisions on various aspects of farming. It is important for a study on information needs to look at the level of education of fish farmers since education is highly important for sustainable aquaculture growth and development (FAO, 2012) as well as access and utilisation of information and knowledge. Since the majority of the respondents in the study had some form of education; it therefore implied that the respondents were not likely to have much difficulty in understanding and adopting modern agricultural information technologies and innovation. Farming experience and level of education generally resonate with acquisition of improved skills in agricultural production (Adefalu et al., 2013). In the same breath, education in this case is viewed as an enabler which allows the farmer to increase knowledge in order to use and exploit information and knowledge sources (Ofuoku et al., 2008).

Figure 5.2.4 shows that the majority (39) of the respondents had 1-10 years of experience in fish farming followed by (21) fish farmers who had 11-20 years of experience. The study revealed that the majority of fish farmers had some reasonable years of fish farming experience which might have facilitated their acquisition of some good skills and knowledge in fish farming production. This result is in conformity with the findings of Gopi et al. (2016), who observed that literacy and experience are important factors to all farmers for purposes of good farming methods and increasing agricultural productivity. Adewumi (2003) identified farmers as one of the six categories of agricultural information users; in the category, which included policy makers and planners, researchers, extension educators and students, agro-based industries and service staff. In this study, although fish farmers appeared to have enough experience in fish farming, they still needed to be provided with information so as to increase their productivity (Adewumi, 2003).

6.3 Information and knowledge needs of aquaculture farmers

The findings in this section address the issues on information and knowledge needs raised in the research question number one, *what are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?* According to Rather and Ganaie (2018) an information need is the perception of a lack of information that provokes one to develop a need for it. The same sentiments were mentioned by Rather and Ganaie (2018) who regarded a need as the amount of information a user requires to fulfil the search intent. It is often believed that an information need may exist when there is a gap between the state of the present knowledge possessed by somebody and that which they need to deal with to solve some problems or handle a present situation. In this study, aquaculture farmers revealed that they lacked information and required information to fulfil their information needs and this need symbolises the gap between information and the action they ought to take to correct a situation. The majority of respondents

(96.5%) revealed that they needed information for problem solving, 98% needed information for performing tasks and the same figure (98%) needed information for decision making. This need of information is inherent in an individual as suggested by Wilson's model (1998; 2000) that sees an information need as a behaviour, which arises as a consequence of a need perceived by an information user. This observation by Wilson interfaces with the definition by Nicholas and Herman (2009) who concludes that an information need is the need for information that individuals ought to have in order for them to perform their job effectively. The findings of the study revealed that fish farmers had information needs and these needs can be described as needs for information which may exist when there is a gap between the state of the present knowledge possessed by the individual farmer and that which each farmer needs to solve some problems or handle a difficult situation at his or her farm.

In the study as indicated in the Table 5.3.4, 88.3% of the respondents mentioned that they spent 1-5 hours gathering information per week, while 6.7% spent 6-10 hours per week of their time gathering information and 5% spent 16 hours per week and above looking for information. The frequency of time spent by these respondents looking for information suggested that aquaculture farmers needed information for their work. Van den Ban (1998) posits that farmers require information related to the following; most appropriate technology options, changing farming systems (mixed or diversification), collective action with other farmers, consumer and market demands, quality specifications for the produce, access to credit loans, sustainable resource management and coping with climate change.

The type of information needed by fish farmers varied from agricultural, health, environmental, technological to business and trade information. Respondents rated their need for each category of information on a 4 point Likert Scale using very often, often, sometimes and rarely (See Figures and Tables 5.4.1 to 5.4. 4). The highest scores showed that 26.7% very often needed agricultural information and 36.7% often needed agricultural information, 10% very often needed health information and 43.3% often needed health information, 21.7% very often needed environmental information and 55% often needed environmental information, 21.7% very often needed technological information and 36.7% often needed technological information, while 26.7% sometimes needed technological information, business and trade information was sometimes needed by 33.3% while 42.4% often needed government policies and plans. These high figures signify that Namibia's fish farmers in one way or the other need information just like other farmers, who require diverse information to support their farm enterprises (Ofuoku et al., 2008). Ofuoku et al. (2008) further argue that information is needed not only on best practices and technologies for crop production, which the traditional public-sector extension system provided during the Green Revolution, but also information about postharvest aspects including processing, marketing, storage, and handling. These researchers added that farmers require information related to the following: most appropriate technology options, changing farming systems (mixed or diversification), collective action with other farmers, consumer and market demands, quality specifications for the produce, access to credit loans, sustainable resource management and coping with climate change. The information required differed between categories of farmers and can be targeted to specific groups, based, for example, on landholding size or agro-climatic region (Rivera, 1996).

FAO (2001) proffers that because of the strong growth and potential of aquaculture throughout the world, the need for reliable information on the subject was in great demand. A planning workshop held by FAO/UNDP Aquaculture and Coordination Development Programme in 1988 identified the need for improvements in the collection and dissemination of four distinct types of information:

a) extension materials and services designed to transfer information and technology directly to those engaged in aquaculture at the community or farm level;
b) technical information, including library and information centres, databases and production of reports and translations;
c) market information concerning supplier, equipment and supplies, buyer, prices and the demands of different markets, and
d) aquaculture sectorial statistics needed for planning and decision making. The needs identified for aquaculture information were reiterated at the FAO (1985) Sub-Saharan symposium held in Zambia.

From the above literature by FAO/UNDP (1998), it can be argued that the types of information needed by fish farmers in Namibia are many and encompass different types of information, which included agricultural information, health information, environmental information, technological information, business and trade information and government policies and plans.

During the interviews all key informants (HA1, HA2, OM1, OM2, KE1, KE2, KW1, KW2, ZA1, ZA2, ER1 and ER2) agreed that fish farmers had specific information needs, and the information needs included the following information: weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on general agriculture and the environment. The key informants also explained that fish farmers used the above mentioned information for emergency problem solving, performing tasks, decision-making and keeping abreast with current trends in fish farming. The quantitative study also revealed that fish farmers had specific needs of information which included, 36.7% sometimes needed information on fish markets, 31.7% often needed market information, 45% often needed information on weather conditions, 31.7% sometimes needed information on post-harvest and storage, 46.7% very often needed information on fish breeding, 33.3% rarely needed information on credit facilities, 45% often needed information on diseases and pest management, 33.3% often needed information on fish markets, stock, pricing etc., and 45% very often needed information on soil and water management. The implication of the respondents' high demand for information on weather forecast, fish breeding, fish types and species, water quality and fish markets revealed that farmers were not sufficiently knowledgeable in these areas. This could make farmers susceptible to poor fish farming practices, which might hinder their level of profit increases in fish farming production. The study is in tandem with Adefalu et al. (2013) who studied the information needs of fish farmers in Kwara State, Nigeria and found that the farmers' information needs include fish marketing, fish processing and fish preservation as they ranked these needs 1st, 2nd, and 3rd respectively, while the respondents moderately needed training on water quality management, brood stock selection and record keeping which were ranked 4th, 5th, and 6th respectively.

By looking at these specific information needs by fish farmers in Namibia, one would agree with Wilson's model (1998; 2000), which suggests that information-seeking behaviour arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services, which result in success or failure to find relevant information. Wilson adds that if successful, the individual then makes use of the information found and may either fully or partially satisfy the perceived need or, indeed, fail to satisfy the need and have to reiterate the search process.

The respondents were asked if they felt uncertain when they lacked information and 100% mentioned that they felt uncertain when they lacked information. A further question was asked to rate the frequency of feeling uncertain when the respondents lacked information and the response were provided on a Likert Scale as shown in Table 5.17.1 The majority 33.3% answered that they often felt uncertain followed by 28.3% who mentioned that they very often felt uncertain and 28.3%, who also said they sometimes felt uncertain and 10% replied that they rarely felt uncertain. From the analysis of the above figures, it is clear that the majority of respondents felt uncertain when they lacked information. It is this information gap or lacuna that arises as a result of feelings, thoughts and actions, which prompts the fish farmers to require information as noted by Kuhlthau (1991, p.13-18). Kuhlthau (1991) attaches the stages of the 'information search process' to be associated with feelings, thoughts and actions, and the appropriate information tasks. This association of feelings, thoughts and actions clearly identifies Kuhlthau's (1991) perspective as phenomenological, rather than cognitive. The stages of Kuhlthau's (1991) model are: Initiation, Selection, Exploration, Formulation, Collection and Presentation. As an example, the Initiation phase of the process is said to be characterised by feelings of uncertainty, vague and general thoughts about the problem area and is also associated with seeking background information: the 'appropriate task' at this point is simply to 'recognise' a need for information.

6.4 Knowledge and information access by aquaculture farmers

The findings in this section addresses the issues on knowledge and information access raised in the research question number one, *what are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?* According to AIIM (2002), information access is the findability of information regardless of format, channel, or location. This study revealed that aquaculture farmers accessed information from the following places: 30% answered they rarely accessed information at home, 40% of respondents often used information centres to access information, 41.7% answered they sometimes used Non-governmental organisations (NGOs) and Community Based Organisations (CBOs) as places of accessing information, and 61.7% rarely used libraries to access information, while 28.3% sometimes used libraries to access information to satisfy their information needs. These figures confirm that respondents were active users of information and they accessed information from a plethora of places. Swanson and Rajalahti (2010) agree that aquaculture farmers access information related to aquaculture production activity from different sources through extension methods such as mass media, extension service (advisory service, orientation about seasonal activities information, training, field days, demonstration, visits), and on-farm research. Agricultural information is also made accessible in the many agricultural research institutes and school of agriculture in the Universities (Adomi et al., 2003) as well as the federal and state Ministries of Agriculture.

The study also revealed the three most important media of accessing information, which were namely, professional colleagues, seminars and training, and radios. The responses were provided in a Likert Scale in which respondents mentioned as indicated in Table 5.5.6 that 41.7% very often used colleagues to access information, similarly 41.7% often used colleagues to get information. The study also recorded 10% and 6.7% representing sometimes and rarely used professional colleagues to access information respectively. Table 5.5.4 shows that 35% of respondents often accessed information through training and seminars; followed by 25% sometimes accessed information through training and 21.7% very often accessed information through training. The figure of 18.3% is for those who rarely accessed information through training. The radio in Table 5.5.2 is represented by 33.3% sometimes used the radio to access information, followed by 25% very often used and 23.3% often used the radio to access information. The least figure of 18.3% indicates those who rarely used the radio to access information. Radio as a media for accessing information was sometimes popular amongst fish farmers as shown in the figures above. The other media used as shown by the study included are television, newspapers, posters, text books and libraries. The findings of this study were somehow similar to discoveries by Alfred and Fagbenro (n.d.) who revealed that radio and television were the most used technologies by the fish farmers in Nigeria. The slight difference between the two studies might be that the use of television is not very popular in the Namibian context because of connectivity problems since most of the fish farms are located in villages and remote areas. The few who could use television have access to alternative sources of electricity such as solar power or generators. It is instructive to note that a study by Ugboma (2010) also points out to radio and television as media platforms where farmers access information. In the

Namibian context, respondents also pointed out to programmes broadcasted on radio where farmers are educated about fish production. These programmes still run today, however key informant KA1 noted that these programmes covered a wide range of agricultural issues and thereby not having regular slots on fish farming programmes on television and radio. Key informants even claimed a lack of electricity as a prohibiting factor to watch or listen to these programmes on television and radio.

Respondents were asked about the places, which they preferred to use when accessing information such as home, government information centres, non-governmental organisations and CBOs and libraries. Table 5.6.1 shows that 30% rarely used their homes as places to access information followed by 28.3% that answered they often accessed information from their homes and 25% accessed information at their homes very often. The least (16.7%) answered that they sometimes used their homes to access information. The figures suggested that fish farmers feel comfortable to access information from their homes since they may not want to leave their farms unattended. Table 5.6.2 shows that 40% of respondents often used information centres, while 23.3% used information centres very often. The lowest figures: 21.7% and 15% were recorded by farmers who used information centres rarely and sometimes respectively. These statistics may insinuate that fish farmers trusted and relied on information emanating from government information centres for their information needs. Table 5.6.3 shows the frequency with which respondents visited non-governmental organisations (NGOs) and Community Based Organisations (CBOs) for their information needs. The majority (41.7%) of respondents answered sometimes, followed by 30% who answered rarely. These figures suggest that NGOs and CBOs were moderately used by aquaculture farmers and the reason could be that there were few NGOs and CBOs involved in aquaculture production in Namibia. Table 5.6.4 showed that the majority (61.7%) of respondents used libraries rarely and followed by 28.3% who answered that they sometimes used libraries. From the above analysis, it was clear that libraries were not popular among fish farmers as places for accessing information partly for the reason that most of these libraries were found in towns and if ever they were available nearby, they did not comprehensively cover the information needs of fish farmers. The findings of this study were however similar to the study by Ugboma (2010) which found out that fish farmers access their information from personal experience, which topped the list, 63%, followed by workshop/seminar 50.6%. Friends and neighbours accounted for 42.6%, Ministry of Agriculture 29.6%, Magazines 17.6%, Extension Officers and NGOs account for 12.6% respectively; and Newspapers 9.3%.Very few farmers (7%) accessed information through local government offices. The striking difference on the less reliance of government offices on the part of the Nigerian respondents as compared to the Namibian study could be because Namibia's aquaculture farmers are still gaining experience whereas in Nigeria, the industry has developed and the farmers have gained a lot of knowledge through experience and therefore do not want to rely on the government offices.

The respondents revealed problems, which they encountered when accessing information. These problems included lack of skills to use media tools; illiteracy to use information, lack of transport facilities, lack of extension support from extension workers, lack of connection to rural electrification and lack of awareness of government responsibility as far as aquaculture farming is concerned. It was also mentioned in an interview by ZA2 that the frequency with which farmers looked for information varied from daily to occasionally and this was mainly influenced by a number of factors such as the level of education, problems encountered in their work, and eagerness to learn in order to acquire new skills.

The respondents were asked whether inability to use ICT media tools is a challenge when accessing information. As indicated in Table 5.7.1, the majority (44.1%) of the respondents responded that they rarely encountered challenges of using ICT media tools followed by 25.5% very often faced challenges to use ICT media tools. The least of the figures 20.3% and 10.2% indicate those who answered that they sometimes faced challenges to use ICT media tools and often faced challenges to use media tools respectively. These figures show that aquaculture farmers moderately encountered problems to use ICT media tools when accessing information. In Table 5.7.2 the results show that most fish farmers were rarely illiterate to access aquaculture information and this figure is represented by 91.5% and only 8.5% answered sometimes were illiterate to access aquaculture information. It can therefore be implied that the majority of respondents were information literate and knew how to access aquaculture information. In contrast, a study by Oladele (2006) noted that a wealth of information is not readily accessible because of many impeding variables among fish farmers which are; insufficient agricultural extension officers, lack of use of media, language barrier and the unreliable nature of electricity in Nigeria.

Table 5.7.4 reveals the rate with which respondents got supported by extension workers. The majority (49.2%) rarely lacked support from extension workers followed by 27.1% that often lacked support from extension officers, 16.9% sometimes lacked support from extension officers and 6.8% very often lacked support from extension officers. These figures show that the majority of farmers in Namibia rarely lacked support from extension workers. The findings of this study contrast with findings of a Nigerian study by Ugboma (2010) which found that fish farmers saw agricultural extension officers occasionally. Fish farmers in Nigeria indicated that where information from agricultural extension officers was available, the information was found to be not current as the information received did not answer to their agitations and therefore could not solve some of their problems. Ugboma's (2010) study further reveals that farmers often fell prey to extension workers who sought bribes in order to make them visit their farms.

Table 5.7.6 revealed the rate of lack of awareness in terms of understanding government responsibility on the part of respondents. The majority (67.8%) were rarely ignorant of the government's responsibilities followed by 11.9% sometimes ignorant of government responsibilities. The results showed that the majority of respondents were not ignorant of government responsibility in relation to their work as fish farmers. The Nigerian study by Ugboma (2010) showed that some fish farmers were ignorant of their government's responsibility and hence ended up losing a lot of money to pay or bribe extension workers to visit their farms and these results contrast sharply with the current study where the majority of farmers were aware of the government responsibility and information support systems rendered to aquaculture farmers. Morville (2005) defined findability as the ability of users to discover and retrieve relevant information resources. The findings revealed that Namibian farmers were aware of where to find information as compared to a study by Ugboma (2010) which revealed that Nigerian farmers were ignorant of their government responsibilities and ended up losing money through bribes in order to find the information they needed.

6.5 Information and knowledge utilisation by aquaculture farmers

The findings in this section address the issues on knowledge and information utilisation raised in the research question number one, *what are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?* Cole (2015) defines information use as the modification of the user's knowledge structure. This definition by Cole is extrapolated from the user or cognitive perspective, whereas Duchess and Chengalur-Smith (2008) perceived information use as competency to access and use data and information. The study showed that 88.3% spent 1-5 hours using information per week, while 6.7% spent 6-10 hours using information per week and 5% spent 16 hours and above using information per week. The findings of the study revealed that most fish farmers use information frequently in order to improve their farming methods and these findings confirms the study by Ofuoku, Emah and Itedjere (2008) which found that the utilisation of information on fish farming technologies among farmers will always translate into efficiency in fish production and increased productivity.

Through discussions with key informants (OM1, KE2, and KE1), the study revealed that fish farmers used different types of information which cut across different disciplines and this information included; agricultural information, health information, environmental information, technological information, business and trade information, and government policies and plans. This information was used for different reasons such as problem solving, performing tasks, constructing new knowledge, decision making, and share information with other fish farmers and to influence others (Table 6.1). These findings were similar to the findings of Ofuoku, Emah and Itedjere (2008), which noted that 90% of the fish farmers in the Central Agricultural Zone of Delta State, Nigeria utilised information on all fish farming operations, while 10% did not. In contrast, the current study done in Namibia revealed that all respondents who responded to the questionnaire in Namibia were users of information in one way or another.

The frequency of utilising information as indicated in Table 6.8.1 shows that fish farmers use information to a greater extent. Most fish farmers used information to influence others and to share with their fellow colleagues so as to increase their productivity. Table 6.8.1 also shows that respondents used information for problem solving, decision making, performing tasks and constructing new knowledge. From this view point, one would discern that the type of information used by aquaculture farmers was not different from the information they needed or required. Similar to these findings Ofuoku, Emah and Itedjere (2008, p. 563) observed that "…fish farmers related better with each other and exchanged visits to their respective farms where they got information". Fish farmers identified with each other and were able to trust each other than they did with others in the society since they were involved and shared the same needs and interests (Ugboma, 2010).

In a study carried out by Alfred and Fagbenro (2006), the findings revealed that radio and television were the most used technologies by the fish farmers in Nigeria. This however, compares well with the Namibian situation in which key informant KA1 stated that radio and television were utilised to gather information for problem solving. These problems included how to solve problems of diseases, flooding, predators etc., and as a result they found themselves looking for information from different sources. In addition, in a separate interview OM1 noted the following:

> *…aquaculture is a way of farming which is new to this part of the world and therefore, it is important that fish farmers become users of information. We always encouraged them to read about fish farming and where they need help; we tell them to contact us for assistance or send their questions through the farmers' programme on radio*.

In as much as the study revealed that fish farmers were users of information, Van der Mheen-Sluijer and Sen (1994) provide an insight on women's role in the utilisation of aquaculture information. The two researchers argue that information utilisation depends partly on the context of information and intra-household decision-making process. This study however found gender related issues on the use of information though it could not delve deeper on gender roles in utilisation of aquaculture information since the main concern was to find out whether fish farmers were users of information.

Findings of a study carried out by Hagar (2010), which explored the multiple information needs that faced the Cumbrian farming community in the north-west of England during the 2001 UK foot-and-mouth disease outbreak, highlighted the importance of: changes in information needs and utilisation at different stages of the crisis, context in which information seeking took place, overlap of information and emotional needs, formal and informal channels of information seeking during the crisis, farmers as information providers as well as information seekers. In view of this study, the researcher came to the conclusion that farmers should not only be information seekers and users in times of crisis, especially when they encountered problems of fish diseases but should sustain the information seeking behaviour to improve production.

6.6 Information sources and sharing strategies among aquaculture farmers

This section discusses and answers the research question number two, *what are the information and knowledge sources including the sharing strategies of aquaculture farmers?* An information source is a source of information where information is obtained; that is, anything that might inform a person about something or provide knowledge to somebody (Ashikuzzaman, 2018). Traditionally speaking, information sources would include secondary sources such as books, periodicals and newspapers, experts and extension workers etc., and primary sources, which are based on first-hand information. However, the number and forms of sources of information are continuously increasing with each passing day because of the rapid changes in technology. Arora (2019) wrote that once it is decided what type of information is needed, the next step is to select a source that will likely have the information or plan a search strategy that will include several types of information sources. Several sources of accessing information were mentioned by aquaculture farmers, which included the following: 40% sometimes accessed information through newspapers followed by 28% rarely accessed newspapers, 33.3% sometimes accessed information through the radio followed by 25% that very often accessed information through the radio, 33.3% often accessed information through television, followed by 30% who rarely viewed the television, 35% of farmers often accessed information through training or seminars followed by 25% sometimes accessed information through training, 46.7% rarely used libraries to accessed information, 41.7% very often used colleagues to access information, 36.7% rarely used posters, 38.3% sometimes accessed information from textbooks, and 41.7% rarely accessed information from the Internet. A research undertaken by Quagrainie, Amisah and Ngugi (2009) on *Aquaculture information sources of small scale farmers in Ghana* identified a number of sources of information which included extension farmers, technical reports, training and seminars. Moroever, the study by Quagrainie, Amisah and Ngugi (2009) also mentioned that the usage of these information sources was also related well with the levels of education. In this study, respondents showed that they were able to consult sources of information in one way or another maybe because of their levels of education (tertiary, vocational and secondary education), which enabled them to articulate issues and utilise sources of information.

Mitchell (2011) revealed that Information and Communication Technologies (ICTs) were becoming popular as sources of information used by farmers in Jamaica. For instance, extension officers from Rural Agricultural Development Authority (RADA) used mobile phones to send text messages to farmers, to prepare for bad weather and preserving crops and livestock. This study revealed that respondents used information technology gadgets such as mobile phones, radio and television. CTA (2012) also suggested the use of posters, brochures, photographs, radio, television and the Internet as some of the sources of information that can be exploited by fish farmers when carrying out their work. The study by CTA also resonates with the findings in this study, which showed that aquaculture farmers used a variety of information sources to gather information such as; government officials, extension workers, professional colleagues, school teachers, community leaders, textbooks, newspapers, leaflets/brochures, television, radio, Internet, mobile phones, and workshops and seminars as shown in Table 5.11.1.

Key informants (ZA1, ER1 and OM1) mentioned that aquaculture farmers used a variety of information sources, to gather information on fish farming such as libraries atlases, Internet, textbooks, journal articles, conferences papers, workshops reports, experiments from the laboratories and government officials (orally through meetings) (see 5.19.13). Most of the sources of information were either communicated through printed media (documents, reports, etc.) or orally (meetings and seminars) and telephonically. Electronic media was also used to share information and this also amplifies the use of television, radio, e-mail, Blogs, WhatsApp and various other social media platforms as sources of information. Collins (2013) argued that networks of libraries and information centres have for centuries shared the information and expertise of the individual units in order to provide better information services to their users. Developments in Information and Communication Technologies (ICTs) are providing many new opportunities to share information online and to make it available globally to end users (Ugboma, 2010). One such new development is the Aquatic Commons (2019), an open access digital repository for the Aquatic Sciences, including fisheries and aquaculture, which is used as a vital source of information.

The study showed that the most valuable information sources as indicated in Table 5.12.1 were: work colleagues, textbooks, Internet, knowledgeable person/expert and guidelines/manuals/reports (in that packing order). In contrast, the research done by Ugboma (2010) showed that the most valuable sources of information were personal experience which topped the list (63%), followed by workshop/seminars (50.6%), friends and neighbours (42.6%), Ministry of Agriculture (29.6%), magazines (17.6%), extension officers and NGOs (12.6%) and (10%) respectively; while newspapers (9.3%) used newspapers and very few got information through local government offices (7%). The difference between Ugboma's (2010) study, which was done in Nigeria from the current study may be that in the Nigerian study, fish farmers relied so much on their personal experiences since the industry has a lot of players as opposed to the Namibian industry, which is still young and still facing teething problems.

Key informant KA2 mentioned the following when asked why farmers would use some of the sources of information such as atlases, textbooks and journal articles:

> *…atlases are used by fish farmers when citing the location of the ponds to see whether the place lies on the floodplain or not, checking the soil type and making sure that the area is suitable for fish farming. Textbooks on the other hand are also used as sources of information since they contain biological information about diseases and types of fish species.*

The findings as noted above can be linked to the findings by Quagrainie, Amisah and Ngugi (2009) who came to the conclusion that maps and textbooks were used by fish farmers in Nigeria. Quagrainie, Amisah and Ngugi (2009) also added that the current government services in the form of extension information services, research technologies and technical assistance for the aquaculture industry should be continued, and would even be better if it was well-coordinated and supported by technically competent aquaculture extension services.

The findings also noted that least valuable sources of information as shown in Table 5.12.1 were guidelines, manuals and reports and this may be because of the technical jargons which are used in packaging and communicating the contents in these information sources. Barman et al. (2004) and Singh et al. (2003) found that the most important source of information on farm technology was state department of agriculture and the most important communication mode was staff specialists, while the least used mode was personal correspondence with researchers. The study also discovered that farmers were unlikely to use materials, which were technical and beyond their comprehension. The findings in this research showed that farmers trusted specialists as providers of information and thus a conclusion can be drawn that fish farmers in Namibia trusted information provided to them by experts. This follows Hagar's (2010) argument that decisions have to be made by farmers about which sources of information to trust and also which information providers to trust.

A report by Glendenning et al. (2010) questions the coverage and relevance of information provided to farmers through the agricultural extension system. While this may be partly due to inadequate contact by the extension services, which need to reach a large and complex farming community, the report concluded that inappropriate or poor-quality information could also be a key hindrance to farmers' use of extension services. This study also revealed that content of the information provided by agricultural extension services, and the farmers' information needs, were not aligned. A similar study in India conducted in 2003 published by the National Sample Survey Organisation (NSSO) noted that despite the renewed interest and investment in agricultural extension in India, the coverage of such information services remained and was still inadequate. Thus a gap will always exist between what is provided and what is expected by the farmer, and hence justifying the need for extension workers (Glendenning et al, 2010).

6.6.1 Information and knowledge sharing strategies among fish farmers

This section discusses and answers aspects of the research question number two, *what are the information and knowledge sources including the sharing strategies of aquaculture farmers?* Information sharing according to Paulin and Suneson (2012) is about bringing together, creators, disseminators and recipients in order to share information to collectively address common needs. Salanje (2005) identified the types of information that is shared by farmers and other stakeholders, which include market for their fish harvests, daily weather forecasts, types of fish species, modern fishing methods, sites for fish shoal, fish feeds; just to mention a few. This study showed that fish farmers shared information on various topics amongst themselves, such as, fish markets and harvests, weather forecast, types of fish species, modern fishing methods, site of shoal, fish feeds, and fishing regulations and government policies.

Respondents were asked to rate the frequency with which they shared different types of information as shown in Table 5.13.1 and the majority (49%) indicated that they very often shared information on fish feeds, followed by fish types 27.1%, weather forecast 26.7%, fish markets and fish harvests 26.7%, fishing regulations and government policy 18.3%, modern fishing methods 15% and bottom of the list was site of fish shoal. The findings of the study showed that fish farmers in Namibia frequently shared information and knowledge on various topics. Respondents were also aware that information opens windows of sharing experiences, best practices in fish farming production, sources of financial aids and new markets (Benard, Dulle & Lamtane, 2018). The study by Soyemi and Haliso (2015), although it did not single out the frequency with which certain information was shared, the study discovered that fish farmers in Tanzania shared information and knowledge pertaining to awareness on various improved fish farming technologies; awareness on improved fish breeds, fish feeds and fish feeding and increased productivity. It is for this reason that fish farmers need to be kept up to date with current information in order to improve their fish farming management practices. The World-Fish Centre (2013) observed that social networks can be critical to the survival of both individuals and households in sharing aquaculture information. Networks can also be expensive to maintain as they may require individuals to meet various obligations, for example, subscription costs, etc. Membership to formal organisations for instance, aquaculture associations or cooperatives is more prevalent among men than women (World-Fish Centre, 2013).

The findings of the study revealed that respondents used different platforms to share information and the statistics indicated that 55% rarely used social media to share information, 25% very often used social media and 25% often shared information to their associates and cooperatives as platforms of sharing information, 40% often shared information through meetings and seminars, 48.3% rarely used the Internet to share information, and 46.7% very often shared information through mobile phones. The study showed that there was a very moderate use of the Internet and mobile phones as platforms of sharing information. The most notable platforms mostly used by respondents were social media (WhatsApp), meetings and seminars as well as associates and cooperatives. Judging on the trends of the moderately used platform and the most used platforms, the researcher conjectured that farmers preferred trusted information disseminated by experts through meetings and seminars as opposed to the Internet where the accuracy of such information would be difficult to verify. Barguma and Ndaghu (2014) argue that unlike the traditional agricultural information dissemination methods, ICT tools have the benefit of offering a cheaper way of communicating and sharing knowledge and information to fish farmers in the fastest way; delivering training and education modules to farmers; and improving farmers' access to markets and aquaculture credit. Moreover, ICT tools empower fish farmers to negotiate better prices and facilitate and strengthen networking among fish farmers (Barghuma & Ndaghu, 2014). In addition, Barghuma and Ndaghu (2014) also argue that fish farmers can apply ICT tools to increase farm productivity by matching cropping practices to climatic trends, use inputs and resources optimally, and ensure good fish farming practices through improved breeds, feeds and pond management. Likewise, Akinbile and Alabi (2010) point out that the enhancement of fish farming production can be achieved by improving the capacity in terms of enhancing access to information, which can be achieved through enhanced information seeking behaviour by the use of information and communication technologies (ICTs).

All key informants confirmed that electronic media was also used to communicate and share information and these included television, radio, e-mail, Blogs, WhatsApp and various other social media platforms. Radios were used to share best practices of fish farming through programmes aired and talks about fish farming. The Namibia Broadcasting Corporation (NBC), Television Services, sometimes had programmes on fish farming though the programmes were not aired regularly as radio programmes. It was also mentioned that the Ministry of Fisheries and Marine Resources tried to maintain its visibility on the Internet by sharing various information through a Blog managed by one aquaculture expert. The Blog contained discussions and articles on fish farming in order to create a network or awareness of fishing practices. Wilkinson (2013) wrote that the web has enabled organisations dealing with sharing of aquaculture information such as Network for Aquaculture Centres in Asia-Pacific (NACA) to communicate with more people than ever before, which comprise to a larger extent new and different audience to traditional stakeholders since a large proportion of people that use the NACA website are not from NACA member states. Of the stakeholders that use the Website, it was discovered that some groups had better access and capacity to use Internet resources than others. For example, scientists are better represented than farmers, and countries where English is widely spoken are better represented than countries where it is not. Despite these disparities, the absolute number of stakeholders who access NACA's services via the Web is much larger than the number of people the organisation can interact with by "traditional" means.

Key informants (KW2, KE2, OM2, ZA2, ER2 and HA2) also noted that aquaculture farmers used different platforms to share knowledge and information. These platforms included the following (see Table 4.19.1):

- Radio, workshops and community presentations with headmen,
- Email, cellphones, visits, etc.,
- Orally, meetings, seminars, brochures, posters,
- Radio – talk about fish farming, and

- Share information with the colleagues and listen to what they say during meetings (Figure 5.19.1).

Collins (2013) argues that developments on Information and Communication Technologies (ICTs) are providing many new opportunities to share information online and to make it available globally to end users. Glendenning et al. (2010) observed that the success of an extension approach depended on how it enhances the information flow along the agriculture value chain. Sustainability and effectiveness, in turn, are determined by the four factors such as: the type of information provided, how and to whom the information is provided, the strength of feedback in each link, and the capacity of the approach to provide relevant information. Entry points can be identified for improving information flow and content by using ICT tools, and for strengthening the capacity of the entities within the system and of the approach as a whole to meet farmers' needs.

Key informants (KE1, ZA1, KE1 and ER1) had varied answers when they were asked to elaborate the type of information shared through each of the media and it was noted that the radio was used to disseminate awareness information about diseases and visits by extension workers were used to share information on weather conditions. Meetings were used to discuss catches, diseases, fish harvests and markets and were also used by extension workers or ministry officials to disseminate information on fish production. Cellphones were also used by fish farmers to communicate with each other about a plethora of different issues including diseases, breeding, feed, etc., and also to communicate with ministry officials. Sometimes fish farmers were located far away and during times of floods, cellphones were used as a way of communication as noted by key informant ZA2. The findings of the study revealed that each media of disseminating information had a role to play regarding the information shared and to whom. Key informant OM2 informed the interviewer that posters were used and are easier to carry when they are visiting farmers. Such posters contained important information on types of fishes (fish species), diseases and general information on the Ministry of Fisheries and Marine Resources (MFMR). These findings are similar to the discoveries of Glendenning et al. (2010) that highlighted about the agricultural value chain, which is made up of the type of information provided, how and to whom the information is provided, the strength of feedback in each link, and the capacity of the approach to provide relevant information. In the case of the feedback in the current study, the farmers showed that they were knowledgeable about the problem that they wanted to address and they also knew where to find information to solve their immediate problems.

6.7 Levels of access of information and knowledge by aquaculture farmers

This section discusses and partly answers the research question number three, *what are the information literacy levels and knowledge competencies of aquaculture farmers?* Webster (2002) contends that the development of an information infrastructure, since the industrial revolution, has entailed access to and provision of information. Information access has been defined as the findability of information (Ugboma, 2008; Oltmann, 2009). The two phrases, access to information and information access, should be seen as functionally equivalent and interchangeable, as demonstrated by several scholars who use both interchangeably (e.g., Burnett, Jaeger & Thompson, 2008; Jaeger & Burnett, 2005). The findings of this study revealed that fish farmers were at different levels in terms of information access and therefore faced a lot of challenges. As has already been mentioned, the study showed that information accessed by fish farmers ranged from agricultural information, health information, environmental information, technological information, business and trade information and government policies and plans. This however reflected that farmers were aware of the importance of information and the fact that adequate information was very essential to increased agricultural productivity. The above findings are comparable to Haruna, Obaroh, Yahaya, and Muhd (2015) who noted that fish farmers accessed information on fish farming or fish farming technologies including: pond construction and management, breeds and spawning, fish processing and value addition, storage, and marketing.

Fish farmers noted that they encountered problems with accessing information and these problems included lack of skills to use media tools, information illiteracy, lack of transport facilities, lack of extension support from extension workers, lack of connection to rural electrification and lack of awareness on government responsibility as far as aquaculture farming is concerned. The findings revealed that the majority (62.7%) of fish farmers rarely lacked electrification in their homes followed by 16.9% that mostly lacked electrification. The remainder 11.9%, often lacked electrification and 8.5% sometimes lacked rural electrification in their homes. The analysis shows that the majority of fish farmers did not lack rural electrification and also could not see it as a challenge to use information. In contrast, a study carried out in Nigeria which cited unreliable nature of electricity in Nigeria (Ugboma, 2010) as a big challenge and impacted on the farmers' usage of information. This difference could be as a result that

Namibian farmers have adapted to use alternative energy such as diesel and solar power as mentioned by one of the key informants (KW2).

Ugboma (2010) also noted that most fish farmers faced challenges of insufficient agricultural extension officers. These findings of the study in Nigeria by Ugboma differ from the results of this study, which confirmed that the majority of respondents (49.2%) rarely lacked support from extension workers, followed by 27.1% often lacked support from extension officers. 16.9% sometimes lacked support and 6.8% very often lacked support from extension officers. The study showed that the majority of respondents rarely faced inadequate support from extension workers and this could be the reason why all key informants mentioned that they supported their fish farmers with information and their doors were wide open to accommodate them in case they had any queries.

The study showed that the majority (44.1%) of the respondents responded that they rarely faced challenges of using ICT media tools followed by 25.5% who very often faced challenges to use ICT media tools. Of the respondents, 20.3% and 10.2% sometimes faced challenges to use ICT media tools and often faced challenges to use ICT media tools respectively. These figures showed that aquaculture farmers in Namibia moderately encounter problems to use media tools when accessing information and these findings could be equated to the studies by Ugboma (2010), Haruna, Obaroh, Yahaya, and Muhd (2015), Aina, Kaniki and Ojiambo (1995) and Mchombu (2006), which acknowledge that farmers encountered problems of using media tools such as ICT gadgets, and Internet. The reason could be that with the current study, fish farmers in Namibia were well supported by the government and most of which were well resourced financially had the means to equip themselves with ICT skills, unlike other studies by Aina, Kaniki and Ojiambo (1995) and Mchombu (2006), which showed that farmers lacked ICT skills due to rapid technological changes that were affecting them and making them fail to keep pace with this technological advancement (Chisenga, 2015). The National Planning Commission (2006) reports that information needs of resource-poor farmers operating under rain-fed conditions differ substantially from those of farmers in irrigated areas who are able to enter the market economy. National Planning Commission further notes that there is little opportunity to utilise new technologies in rain-fed areas because farmers lacked the financial means, credit, and capacity to take risks, and consequently technology gaps are much wider in these areas compared to irrigated areas. Due to higher levels of poverty in rain-fed agriculture areas, improved access to information is essential to increase the productivity and profitability of these farmers.

Respondents showed that they were literate to access aquaculture information and were represented by 91.5% whilst 8.5% were sometimes illiterate to use aquaculture information. From the above figures it was clear that the majority of aquaculture farmers did not face challenges of illiteracy when using aquaculture information and this could be backed up by the fact that most respondents were graduates from tertiary institutions, vocational colleges and secondary school graduates who might have information literacy skills. This was also confirmed by one key informant (KA2) who mentioned that:

…unlike other places, in Namibia fish farming is mostly practiced by people who have a certain level of education since many people are aware of the risks that come along with fish production.

The findings of this study are similar to the findings by Ugboma (2010, p. 3) who wrote that:

> …it is interesting to note that majority of the respondents were educated. Respondents with B.A/B.Sc degrees account for 47.3%, HND/ND certificates accounts for 19.3% while N.C.E. /T.C. 2 accounts for 7.3%. This implies that majority of the fish farmers had one form of tertiary education or the other.

The study revealed that respondents faced problems regarding inadequate transport facilities and the majority (40.7%) sometimes faced challenges of transport facilities followed by 23.7% very often faced challenges of transport facilities. A total of 20.3% rarely faced challenges of transport and 15.3% often faced problems of transport. These figures showed that respondents moderately faced challenges of transport facilities since many of these farmers had their means of transportation as noted by one key informant (ZA2). Ugboma (2010) also cited lack of transport facilities as a challenge faced by fish farmers in Nigeria.

6.8 Levels of utilisation of information and knowledge by aquaculture farmers

This section discusses and answers the research question number three, *what are the information literacy levels and knowledge competencies of aquaculture farmers?* Information use or information utilisation is the competency to access and use data and information (IGI Global, 2019). The findings of this study showed that respondents were at different levels of utilising information. Some of the areas noted were that the information that they needed for their work was not always available because of challenges of being provided or finding incomplete information sources, not having enough time to look for information, no knowledge of libraries, information was scattered in different sources and thereby not making it readily available and information sources were far apart from each other, not knowing how to use the library catalogue when searching for information, and that there was vast information on aquaculture, which compounded the respondents' challenges to use information on aquaculture, which they came across with, and that some of the information was outdated.

Respondents of the study showed that they encountered problems of not finding the relevant information available and the majority (56.7%) of farmers could not find information that they needed for their work available, while 43.3% found the information they needed. These figures indicated that the majority could not find the information they needed and information on aquaculture was not readily available. The reason could be that the respondents faced challenges of using the Internet, which would not be accessible to them whenever they needed information due to problems of connectivity. Ijatuyi, Abiolu and Olaniyi (2016) recommend that fish farmers should be trained and provided with skills on information literacy including searching the Internet. Ijatuyi et al. (2016), further pointed out that discouraging factors in the use of the Internet may be cost subscription or data bundles, which might not be affordable by the majority of the rural folk. It was also noted that other sources could not be utilised since they were accorded less importance for instance libraries were ranked as the least useful source of information and fellow colleagues and extension officers as the most useful source of information, which is in tandem with the findings of Ogunremi et al. (2013), which recognised that the highest source of information utilised by fish farmers were extension agents. Extension agents were also ranked the highest source of information utilised by fish farmers in the study by Olaoye et al. (2014).

Respondents noted that they faced problems of using incomplete information when carrying out their daily duties and 43.3% farmers faced challenges of being provided or using incomplete information sources and 56.7% did not have problems of using or being provided with incomplete information. By looking at these figures one is inclined to think that the majority of respondents were aware of their information needs and inadequacies, which culminated into information gaps of incomplete information in their process of utilising information. The respondents also mentioned that information sources were far apart from each other, in which case 53.3% found that information sources were far apart from each other and 46.7% disagreed that information sources were far apart from each other. The dispersing of information from each other was cited by the key informant (KE2) as a problem area, which makes it difficult for the information to be effectively accessed and utilised. A case in point was the reason supplied by a key informant (KE2) that aquaculture information in Namibia was found and housed under different Ministries or departments such as Agriculture, Water, Fisheries, Lands, National Planning Commission, etc. It was further mentioned by an interviewee that information on aquaculture was fragmented in different ministries; that is, Ministry of Agriculture, Water and Forestry (MAWF), Ministry of Environment and Tourism (MET) and Ministry of Fisheries and Marine Resources (MFMR), Ministry of Land and Resettlement etc., and this lack of coordination amongst ministries in the provision of information resulted in knowledge gaps amongst fish farmers.

The findings revealed that there was too much information on the topic of aquaculture and 38.3% agreed that there was vast information on this topic, which was a challenge in itself to use the information, while 61.7% disagreed that information on aquaculture was too vast. These figures however, showed that the majority of respondents did not find information on aquaculture to be too vast and confusing. This pattern of fish farmers not having problems in using or selecting the information they need can be attributed to their levels of education. The educational pattern of respondents was similar to that of Ogboma (2010) whose respondents were also majorly educated and hence could not find information on aquaculture confusing. Respondents also agreed that information on aquaculture, which they came across, was outdated 35% while 65% disagreed that the information on aquaculture, which they came across was out of date. The study confirmed the study by Ijatuyi et al. (2016), which recommend that farmers need to be provided with up to date and relevant information in order to increase productivity. The down side of the findings of this study, which showed that farmers were faced with challenges of too much information can be summed up by the fact that information overload is becoming an issue with increasing access to mass communications and Information and Communication Technologies (CTA, 2006). The Centre for Tropical Agriculture (CTA) further points out that, in terms of relevant, timely, well-adapted and adequately delivered information for agricultural and rural development, there is certainly a big gap in most developing countries.

The findings showed that respondents faced prohibiting factors of using the Internet. On the question on whether the cost of hardware is prohibitive, 16.7% agreed that the cost of hardware was prohibitive to use the Internet while 83.3% disagreed that the cost of hardware was prohibitive to use the Internet. A similar question was asked to find out whether the cost of the Internet was discouraging; 15% of respondents found the cost of the Internet discouraging and hence not using the tool as an information resource, while 85% refused that that the cost of Internet was discouraging. The findings contrast with the study on agricultural information and Information Communication Technologies, which cited that the cost of hardware was a prohibiting factor on the usage of the Internet (Chisenga, 2015; Mchombu, 2006). Mishra and Williams (2006) on a different note, suggest that the propensity for a farm household to adopt the Internet is positively related to a number of variables, including age and educational level of the operator. This could also be important factors in the study that the majority of respondents did not find the cost of using hardware prohibitive on using the Internet since most of them were having a good level of education plus their age groups fell within their active and more productive years where they would want to experiment with different technologies.

In the findings of this study 3.3% were not aware of the benefits of the Internet while 96.7% were aware of the benefits of the Internet. In addition, respondents were asked whether they had limited knowledge of using the Internet and 10% agreed that they had limited knowledge of using the Internet and 90% disagreed that they had limited knowledge of using the Internet. It was also important to note that 16.7% did not have access to a computer and as a result prohibiting them from using the Internet, while 83.3% disagreed that they did not have access to a computer. As the Internet has spread throughout the world, Internet tools and techniques have been employed in the aquaculture sector with the hope that they will eventually improve agricultural productivity, quality and values. The findings of the current study projects the finding of Karnka's (2006) study, which revealed that most farmers had positive attitudes toward the use of Internet for supporting their learning activities.

The study showed that 6.7% did not trust information on the Internet, while 93.3% disagreed with the statement that information on the Internet was not trustworthy. These findings regarded the Internet as not only a useful information source but also as a more credible information provider (OAE, 2009). Fish farmers were asked whether they had limited searching skills when looking for information on the Internet and 15% indicated that they had limited searching skills and did not know how to search for information on the Internet while, 85% disagreed that they had limited Internet searching skills. It is important to note that these findings could be linked to a study by Kadzamira, Ngwira and Salanje (2004) which explains that the most popular ways of searching for information on fisheries were search engines, browsing various fisheries institutional websites, newsgroups and referencing through e-mails. E-mails were preferred because they are cheap and fast and the lowest level of Internet usage was 20% in government institutions due to lack of good Internet facilities (Kadzamira et al., 2004).

6.9 Information literacy of aquaculture farmers

This section discusses and answers the research question, *what are the information literacy levels and knowledge competencies of aquaculture farmers?* Information literacy also known as information competency or information fluency is defined in the original ACRL/ALA (2018) report on information literacy in the digital age as a set of abilities requiring individuals to recognise when information is needed and have the ability to locate, evaluate, and use effectively the needed information. Respondents rated themselves in areas such as information literacy levels, levels of satisfaction on aquaculture information, frequency of attending training on information literacy, levels of Internet searching skills, presentation and information sharing skills.

The study rated the frequency of attending training sessions by respondents in order to upgrade their information literacy skills and knowledge competencies and the majority (48.3%) rarely attended training on information literacy and knowledge competencies, while 31% attended once in three months, followed by 17.2% that attended training weekly and 3.4% that attended training on information literacy and knowledge competencies on a monthly basis. In this study the majority of respondents showed that they did not attend information literacy and knowledge competencies training regularly though this could not be translated to mean that they lacked knowledge on aquaculture production or utilisation of information sources. As has been mentioned already, it was noted that the respondents were regular users of information and most of them knew what to do when they were overloaded with information. The finding of this study contrasted with the recommendations of the study by Sokoya, Alabi and Fagbola (2014) on farmers' information literacy skills, which discovered that most farmers were not information literate, and suggested that they should attend information literacy training in order to boost their knowledge thereby addressing their information needs through the Internet and reading books. The main reason why this Namibian study showed that respondents were information literate could be that aquaculture farming is still at experimental stage and hence the group of "early majority" do not want to take risks in fish farming and thereby becoming effective users of information.

Respondents showed that they were satisfied with information on aquaculture, which they obtained from various sources. The majority (66.7%) were satisfied with information and knowledge on aquaculture, while 33.3% were not satisfied with information and knowledge on aquaculture. In addition, the study revealed that the majority of respondents (55%) have not received training on information literacy instructions, while 45% received such training. This however, confirms the findings by Naveed and Anwar (2013) in which respondents were asked to indicate their level of satisfaction with the agricultural information they used. Naveed and Anwar's (2013) study registered that 26.1% of the respondents were highly satisfied whereas the majority of the respondents 58.3% were somewhat satisfied and 15.5% of farmers were dissatisfied with agricultural information which they used. The majority of the farmers complained that sometimes they failed to get information from the sources that they used and most of the time they did not get information on time. According to Naveed and Anwar (2013), the fact that all of the farmers expressed their opinion either positive or negative in terms of their level of satisfaction with the information that they used, it meant that they were aware of the type, level, and scope of information that they needed.

The findings showed that most (51.7%) respondents had not received training on Internet searching skills, while 48.3% had received training on Internet searching skills. These findings however suggested that farmers needed to be properly trained so that they are able to search and retrieve information on their own (Kadzamira et al., 2004). The study further indicated that the majority (98.3%) thought it was important to share information and knowledge acquired at a conference or seminar, while 1.7% thought that it was not important to share information and knowledge acquired at a conference or seminar. From what was gathered through key informants (ZA1, ZA2, KE2, ER1 and OM1), the farmers were in support of sharing information, which they had obtained from seminars or workshops because there was enough evidence already, which indicated that they shared information regularly amongst themselves. Naveed and Anwar (2013) observed that though the majority of the farmers depended upon their personal experience relating to farming practices to a larger extent, they relied on information which they shared with other farmers, friends and neighbours.

6.9.1 Knowledge competencies of aquaculture farmers

This section partly discusses and answers the research question, *what are the information literacy levels and knowledge competencies of aquaculture farmers?* A definition of knowledge competencies by FAO (2012) explains that knowledge is a range of information gained from interaction and information combined with experience, and it is organised and interpreted by the human mind with confident understanding for the purpose of decision making and actions. FAO continues to say that there are various types of knowledge depending on its functions and its carrier systems, for example, aquaculture knowledge, management knowledge, manager's knowledge etc. Knowledge varies depending on cultural, social, and economical factors. The type of knowledge people have depends on their age, sex, occupation, labour division within the family, enterprise or community, socio-economic status, experience, environment, and history (FAO, 2012). Related to this study, respondents showed that they needed and utilise different types of information in order to gain knowledge in areas such as fish breeding, types of fish species, fish trade and markers, diseases, etc. In a study carried out by Burns (2012), the researcher reveals that shrimp farmers in Sri Lanka are grappling with the following challenges in order to sustain their fish farms;, lack of capital and assets, lack of knowledge and information (not enough 'knowledge' exists in science, research, best management practices), lack of capital (computer, cellphone) can limit access to knowledge, failure of end users to access existing knowledge, and lack of knowledge that is applicable to local situations. The author explains that improved access to knowledge; that is, input and product prices can improve access to capital.

Respondents were asked if they were not satisfied with information provided to them and also how they made up for the gap in their information requirements. The majority (47.9%) consulted experts for their information requirements, while 37.5% asked a colleague for their information requirements. 14% of the respondents also mentioned that they searched the Internet and other sources for their information requirements. A study conducted by Kumaran et al. (2012) points out that fishery extension personnel ought to be effective information seekers to perform their role as 'facilitators' for accessing farm inputs, advisory services and markets to the farming community. A study conducted among the fishery extension personnel of the Department of Fisheries in Tamil Nadu and Andhra Pradesh indicated that hardly, 50% of them were information seekers and their information seeking frequency (<50%) was totally insufficient and hence lacked knowledge on certain fishing practices. Extension workers cannot be efficient in their responsibilities to their clientele such as farmers if they themselves are deficient in information dissemination resulting from not having sufficient knowledge and adequately informed on some subjects (Yomi, Alfred & Odefadehan, 2007). Barriers to lack of knowledge on the part of extension officers prevent farmers from seeking and getting relevant information, which is also of great importance in understanding the information seeking behaviour of individuals and organisations.

The findings also showed that colleagues are important sources of information and knowledge although Naveed and Anwar (2013) warned that obtaining information through interpersonal relationships and informal information networks raises questions about accuracy, relevancy, and currency of information. These sources of information could not always provide timely, accurate, relevant, and current information (Naveed & Anwar, 2013).

The use of the Internet was also pointed out by respondents as an important source of knowledge and information. Chisita and Malapela (2014) wrote in their research paper that crop production can be enhanced by using Information and Communication Technologies and employing a prototype Web based crop information system which implores Internet Web technologies to deliver information and services to users. The authors further argue that the Web based information system empowers the resource poor farmers with up to date knowledge and information on crops and their varieties produced by farmers. Farrington, Sulaiman and Pal (1997) posit that the system also provides information about agricultural technologies for crop improvement, pest control, soil and climatic requirements, best practices, markets, sources of finance and related inputs. The system thus improves the knowledge competency of the farmer by affording easy access to systems of technology, production efficiency resulting in a quality crop as well as access to national and international markets.

This study revealed that 98.3% of respondents thought it was important to attend aquaculture conferences and seminars while 1.7% thought it was not important to attend training or seminars (See Table 5.16.7). This however, brings to the question on the frequency of which workshops and seminars were held on fish farming. A key informant (KE2) mentioned that they normally had regular meetings with fish farmers. Apart from these regular meetings, fish farmers could not be afforded a chance to attend workshops or seminars since when such opportunities arose; they were quickly grabbed by government officials and high ranking officials who were not farmers. The findings differ with those of a study by Ogunremi, Faturoti and Oladele (2011), which found out that there was a high turnout of attendance of seminars and workshops by fish farmers in Oyo State. The authors further explained that his high turnout may be attributed to the fact that fish farmers wanted to be free to rub their minds with their counterparts and share knowledge amongst themselves. Agbamu (2000) affirms that a participatory approach or a farmer-led extension services should be encouraged since fish farmers would learn directly and gain knowledge from their counterparts and researchers through these workshops and seminars.

The study also showed that 70% had never shared their experiences at a workshops or seminar whereas 30% confirmed sharing their knowledge and experiences at a workshop or seminar. FAO (2017) noted that it was essential for small scale farmers to be organised and attend workshops and seminars where they can present and share their own experiences since this was beneficial on both technical and management aspects for effective participation in the value chain. FAO further argues that the resilient value chain makes small scale fish farmers knowledgeable and resilient to risks.

The findings also showed that 98.3% felt it was important to share information and knowledge acquired at a conference or seminar, while 1.7 % did not see any need of sharing information, which they acquired from seminars and workshops. Kamarudin et al. (2014) in their study of *Paady farmers in Selangor in Malaysia* observed that farmers working in the field also required both formal and informal learning to discover and practice new skills. Farmers are aware that agriculture is a risky business, which requires one to be knowledgeable, hence every decision made should be backed by accurate and timely information to facilitate good decision making. The authors further explained that the learning process is not just only limited to the classroom, seminar or workshop. Based on the findings of the study above, it was found that informal learning and training happened every day among peers, colleagues and neighbours through sharing ideas and knowledge in order for farmers to acquire new knowledge.

The study revealed that 95% used information acquired to solve a problem, whereas 5% did not use information to solve any problem. These figures show that information is important to farmers for problem solving. This is confirmed by a study carried out by FAO (2011) on *Farm business school: training of farmer's programme in South Asia,* which projects that knowledge competency, is important for farmers to effectively respond to present day farming challenges. Farm management advice helps farmers to make the right choice and solve farming challenges, which they encounter according to individual levels of financial, labour and land endowments and at their level of risk adversity. IFAD (2007) observed that since the 1950s, a central question in international development has been how knowledge can best be generated, mobilised, made available, applied and adapted to improve the human condition. The centrality of knowledge systems to development comprised the theme of the World Bank's World Development Report of 1998/99. The main argument in that report was that the development of poorer countries necessitated assigning the highest priority to building “knowledge-based economies”. Knowledge, as opposed to natural resources, the report also mentioned that, it had become the most important factor for determining the standard of living. Hagar (2010, p. 40) argues that “…a range of technologies is needed to disseminate and communicate information, and different technological choices are needed to accommodate different user communities and user preferences”. This study adds to Dutta-Bergman’s (2004) argument that farmers need a mix of technologies to meet their information and knowledge needs and to provide more channels of communication (both traditional and new media) to accommodate user’s preferred choice of technology. All these arguments provided by Hagar (2010) and Dutta-Bergman’s (2004) prove and draw from the same conclusion with the findings of fish farmers in Namibia that knowledge and information were needed to solve aquaculture problems as highlighted by the majority of the respondents.

The respondents (80%) mentioned that they would like to be consulted before an information programme or system on aquaculture is put in place, while 30% would not want to be consulted before an information system is put in place. Aquaculture information system or aquaculture informatics can be described as the scientific application of information technology in fisheries that enhance the productivity and economic viability. According to Inbakandan et al. (2009, p. 36);

> …the application may be in the form of precision farming, analysing aquaculture information, developing database for aquaculture research, analysing genetic information, transfer of technology, and qua-business etc.

Various aquaculture informatics based tools like Decision Support Systems (DSS), Remote sensing, Farmer Information System (FIS), Management Information System (MIS), Geographical Information System (GIS), Farm management software and aquaculture databases can provide effective and timely solutions to many problems in aquaculture (Inbakandan et al., 2009). A key informant (KA1) reported that an aquaculture information system would be ideal in the Namibian context to enhance and promote the availability of aquaculture information and knowledge.

The study showed that 76.7% of respondents did not receive any alerts or use any current awareness services, while 23.3% received alerts and current awareness. The majority of respondents were aware of how crucial information plays a role in their livelihoods. A study by Inbakandan et al. (2009) supports the use of different technologies where a farmer can get all the aquaculture related information regarding various fish crops, aqua feed details, market information, credit details, transport details and more, on a single platform so that he or she can plan each and every stage of his fish husbandry and improve the yield.

6.10 Fish farmers and policies governing information and aquaculture production in Namibia

This section discusses and answers the research question number three, “What is/ are the legislative and policies governing information and aquaculture production in Namibia. The findings revealed that a number of blue prints, policies and legislative frameworks governing information and aquaculture production in Namibia exist to support fish farming. Key amongst the documents were the Aquaculture Act no. 18 of 2002, Inland Fisheries Resources Act 1 of 2003, Strategic Plan for Aquaculture (MFMR, 2004), Vision 2030 (NPC, 2004), ICT Policy (MICT, 2001), and the National Development Plans I, II and III, IV and V. (NPC) which provided guidelines on the support systems to aquaculture production as they relate to information access and utilisation.

The Aquaculture Act, adopted in 2002, is the primary legal framework for the aquaculture industry of Namibia, and provides for the establishment, administration and conduct of aquaculture in water and on land. The Act broadly applies to matters related to licensing, health management, and diseases control, access to land and water, and environment protection. It is the responsibility of the Ministry of Fisheries to manage the Act, which in itself vests regulatory and enforcement powers in the Ministry (Republic of Namibia, 2002). It was imperative that one looked at this Act since it provided regulatory mechanism of which aquaculture farmers needed to be aware of, when exploiting information and carrying out their farm duties.

The Ministry of Fisheries and Marine Resources (MFMR) through its Strategic Plan for Aquaculture (2004) is spearheading the development of national aquaculture at the community level in order to empower rural communities to be self-sufficient in food production, and to derive income through fish production integrated with existing and potential agricultural practices wherever natural conditions permit. The plan showed that information plays a crucial role in the development of aquaculture in Namibia and encourages the establishment of information resources centres in the regions.

The National Planning Commission (2004) through the Vision 2030 document acknowledged the potential for aquaculture since it can contribute towards sustained food security, income and employment for many Namibians. The Vision provided a road map for attaining the knowledge based economy and noted that aquaculture has potential to thrive if properly supported by proper management systems such as information and knowledge. The Vision further explained that the modern world is moving from heavy industry to knowledge-based economies which are based on specialist services, specialised industries, communications, and information technologies. The Vision mentions that Namibia needs to fast track its development process, and springboard over the heavy industry development path taken by the industrialised countries and should put focus on high value-added services, specialised industries that are modest in their water requirements and information technology. To achieve this, the Vision argued that Namibia has a potential to transform into an innovative, knowledge-based society, supported by a dynamic, responsive and highly effective education and training system. It is against this background that one uses the Vision 2030 as a tool to argue that information and knowledge are important aspects which can drive Namibia's economy to achieve overall objective of developing aquaculture farmers.

The policy document presented to the cabinet by the MFMR (2001) stated that information, including research results, on coastal and freshwater aquaculture technology shall be centralised and contained in a dedicated library that is open to public access. This initiative could assist and guide the private sector towards international sources of information and would network with other aquaculture organisations and associations (e.g. FAO, Aquaculture for Local Community Development Programme (ALCOM), Network of Aquaculture Centres in Asia-Pacific, International Centre for Living Resource Management (ICLARM) World Aquaculture Society, Aquaculture Association of Southern Africa, etc.). The Ministry of Fisheries and Marine Resources ((MFMR), (2001) reported that aquaculture communities and producer organisations are to be encouraged to promote responsible aquaculture technology, management and community development projects.

On the international scene, The Food and Agriculture Organisation of the United Nations (FAO) (2001) recognised the importance of information in areas such as keeping of on-farm records on inputs, operational procedures, occurrence of disease and water quality problems, productivity, sales and farm economics for the benefit of the individual farming entity and the sector in general. This is in line with FAO’s Fisheries and Aquaculture mandate which is to exchange reliable information on all related subjects as an enabler for the responsible management of aquaculture. The FAO Portal is used by fisheries stakeholders including farmers and it has developed specific pages on aquaculture where users can consult relevant material on aquaculture at international, regional and national level.

The Namibia aquaculture strategic plan by the Ministry of Marine Fisheries and Marine Resources (2004) reported that the public sector needed information regarding aquaculture operations and benefits. The strategic plan further argued that lack of information results in a negative attitude and public perception of aquaculture. For inland fisheries (freshwater aquaculture), in particular the local communities controlled aquaculture activities needed positive public support for expansion of all aquaculture, both inland and coastal which would encourage public-private partnerships in aquaculture. With all these blue prints and policy documents, one would argue that provision of aquaculture information is fully supported in Namibia as has been cited in the national and international documents in the discussion above.

6.11 Implications of Kuhlthau's Six Stage Model of Information Search Process to the study

This section tries to answer the fifth research question of the study "*What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia".* In this study the Kuhlthau's model of the Information Search Process was used to interrogate the access and utilisation of information and knowledge by fish farmers in Namibia. Kuhlthau's Information Search Process model was developed in the 1980s and refined in the 1990s. From the time of its conceptualisation and development, the model has been used as a framework and diagnostic tool for understanding the information seeking behaviour. The model provided the framework within which to prosecute the study.

According to Kuhlthau (2004) the stages of information process starts with Stage 1, which deals with Task Initiation, Stage 2 – Topic Selection, Stage 3 – Pre-focus Exploration, Stage 4 – Focus

Formulation, Stage 5 – Information collection and Stage 6 – Search Closure (see Figure 3.1). It is important to note that at every stage of the search process, an information searcher encounters different areas of search experience such as thoughts (cognitive), feelings (affective), and physical (actions).

The first stage, according to Kuhlthau (2008) starts with Task Initiation whereby the searcher prepares for the decision of selecting or choosing a topic. The findings of the study revealed that respondents encountered a situation where they lacked information because of a plethora of varied reasons. Some of the reasons could be the need for information of problem solving, decision making and or performing a task. This need of information is inherent as suggested by Wilson's model (1998; 2000) that an information need is a behaviour, which arises as a consequence of a need perceived by an information user. This need arises as a result of the information gap and hence the respondents showed that it is this information gap, which prompted them to initiate the search process. It has been mentioned in the findings that respondents were always worried about improving their productivity (thoughts), and hence the feeling of looking for information for problem solving, decision making, constructing new knowledge, etc. The study also revealed that fish farmers experienced doubts, confusions, and frustrations, which were evident at all stages of Kuhlthau's (2008) model. In the initiation phase, fish farmers reported about their ability to use information though they had doubts of understanding information on aquaculture. They also lacked experience in the farming practice and feared risking their capital. It can be inferred that fear of failure and doubts encountered by fish farmers activated them to take the initial necessary action by identifying the need for information in order to solve a problem or take a decision as has been noted in the study that fish farmers required diverse information on environment, weather, fish feed, fish harvests and markets, etc.

The second stage of the Information Search Process is dominated by deciding on the topic for research, which is known as "topic selection". The study showed that the respondents in their quest for the need for information, they also refined their topics. The information which they required when performing their duties included: weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on agriculture in general and the environment. According to Kuhlthau (2004), this is where the searcher weighs a topic against an area of personal interest and chooses a topic with potential for success. However, at this stage respondents reported that they select their topics based on the problems they faced on their farms and shared their problems with their colleagues or extension workers. The fish farmers also reported that they often chose their topics based on the estimated availability of information and became frustrated when information was not easily found, which are findings similar to those of Bilal (2002), Branch (2003), Kracker and Wang (2002), and Whitmire (2003). At this stage, the availability of the information used by fish farmers depended on the environment and they used the most available source of information such as colleagues, neighbours or extension workers. Cieszynsk (2017) noted that when a selection is delayed or postponed, feelings of anxiety are likely to intensify until the choice is made. At this point the respondents noted that they also experienced doubt and confusion as well as frustrations in terms of refining their topics and trying to relate with the problem at hand. For example, farmers got confused since they were not experts when browsing through a mass of aquaculture information which, in most cases was closely related to each other (topic-wise). This was when a number of factors played a crucial role on the part of the farmer when refining a search process and these factors included, experience, level of education and seeking for assistance from a colleague or an expert.

The third stage of the Information Search Process deals with pre-focus exploration. According to Kuhlthau (2004), this stage focuses on information with the intent of finding a focus. Based on their experiences, the respondents highlighted their level of education, which ranged from secondary education, with the majority having received tertiary and vocational education. It could be through this level of education that respondents were somehow able to refine and focus on general topics in aquaculture. At this stage respondents, revealed that they read to learn about the topic or listened to the radio, and watched television. The findings of this study support earlier findings by Holliday and Li (2004), which showed that users of information tend to conceptualise information as something easily available and feel frustrated when the process is not as seamless as they expect.

The fourth stage of the Information Search Process deals with Focus formulation. It is at this stage that the searcher is involved in formulating focus on the information encountered. The findings of the study showed that respondents chose their sources of information carefully depending on which sources of information they trusted. The study revealed that they used radio, television, books, Internet, Blogs, colleagues, libraries, academics, extension workers, community based organisations as their sources of information. The study also noted that respondents trusted colleagues, extension personnel and the Internet as their sources of information. The fact that the respondents trusted the Internet as a source of information could also be evident that respondents were aware of identifying their information needs and wants amongst a pool of other topics. The respondents also seemed to be aware of increased frustration and anxiety to be expected mid-way through the knowledge construction process by avoiding untrusted information sources. The respondents also reported that frustrations could also result if they were inundated with a number of sources of information, which may result in confusion and failure to get the correct information due to information overload. Kracker (2002) posits that it is important for information providers to understand the needs of the searcher who in this case is the fish farmer through the information inquiry process to be ready to intervene in helpful ways.

The fifth stage is the information collection stage, which deals with gathering information that defines, extends and supports focus. The findings showed that respondents were involved in information collection and gathering. The findings showed that information was gathered through various sources such as Internet, extension workers, information centres, government departments, colleagues, etc., and such information was used for problem solving, decision making, constructing new knowledge or ideas. Generally, the purpose of gathering this information was to improve their productivity and farming methods. As was explained by Kuhlthau (2004), the description of the stages of affective, cognitive and physical experience of users continued to be found at this stage whereby the fish farmer builds confidence to complete the task and used the relevant sources of information such as maps, atlases, databases, Websites, etc. or even requesting for assistance from a colleague or expert in the field to complete the task.

The sixth stage, according to Kuhlthau (2004) is the search closure, which concludes the information search process. The findings of the study could not ascertain whether respondents needed any additional information after reaching this stage but what is clear from the findings was that respondents increased their knowledge and skills on fish production where they felt some sense of relief, satisfaction and accomplishments by finding relevant information sources. Sometimes disappointment could arise at this stage, which may require the respondent to restart or redefine his information search process. According to Kuhlthau et al. (2008) the information search process model describes feelings, thoughts and actions in an information seeking task with a discreet beginning and end, where considerable construction of knowledge takes place. The findings also revealed that respondents working on digital environments such as the Internet tended to get confused in the search process stages when they tried to build knowledge of their topics, but the easy availability of information encouraged them to skip certain stages and thus ended up with superficial descriptive conceptions of their topics. The description of the stages of affective, cognitive and physical experience of users continued to be found on the last phase of the study and the results indicated that the model was relevant and useful as a theoretical framework (Kuhlthau et al. 2008) to explain access and utilisation of information and knowledge by fish farmers in Namibia. Kuhlthau's (2004) Information Search Process model remains a useful research tool for designing, framing and analysing the investigation of information seeking behaviour in complex tasks and also continues to be useful for designing user centred information services and systems for any information user group in the information search inquiry process (Kuhlthau et al., 2008).

6.11.1 Implications of the Diffusion of Innovation (DOI) Model to the study

Apart from the Six Stage Search Process model by Kuhlthau (2004), the study also used the Diffusion of Innovation Theory by Roger (2003) in trying to answer the fifth research question of the study "*What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?*" According to Rogers (2003), innovation is theorising about the diffusion of new ideas, beliefs, practices, knowledge, programmes and technologies, while diffusion is the process through which an innovation is communicated through certain channels over time amongst members of the social system.

Rogers (2003) identified four elements of the DOI theory. The first element is "Innovation", which is an idea regarded as new by an individual; the second element is "Communication channels" such as radio, television, Internet, etc., which are used to inform an audience. The third element is "Time", which symbolises that innovations are adopted by individuals at different times (Innovators, Early adopters, Early Majority, Late majority and Laggard). The social system is the fourth element, which defines a set of inter-related units to accomplish a common goal (Rogers, 2003).

The study on access and utilisation of information and knowledge by aquaculture farmers revealed that fish farming was an Innovation in Namibia. This also meant that information access and utilisation for fish farming was an Innovation amongst fish farmers. Ozcatalbas (2014) opines that an innovation is a subjective concept and new idea, object or practice such as, agricultural practices, application of ICTs and biotechnologies studies, etc. The DOI theory has been used as a theoretical basis for a number of information systems projects (Rogers & Scott, 1999). The findings of the study showed that aquaculture information is an innovation which can be exploited by the respondents, in this case, fish farmers. Further to that, it was revealed in an interview with one key informant that aquaculture was a new way of farming in Namibia and therefore, it was important that fish farmers become users of information and this was the reason why farmers were encouraged to read about fish farming and to contact the extension officers for any assistance. The study revealed that the level of education of the majority of respondents ranged from secondary education, tertiary education and vocational education and hence were literate and enabled them to interact with information on aquaculture. The findings also showed that fish farming was mostly practiced by people who have attained a certain level of education since many people were aware of the risks that came along with fish production. Thus the exploitation of aquaculture information required someone to have acquired a certain level of education in order to be functional and able to use the information needed. The DOI theory spells out that education level is an important factor in the adoption of an innovation since the higher the level of education means that it is easier for an individual to adopt a novelty (Ozcatalbas, 2014).

The study also investigated the communication channels by which the Innovation was communicated and the data revealed that radios, television, Internet, extension workers, colleagues, government officers, and community leaders were all used as communication channels through which the Innovation was communicated.

According to Rogers (2003), the first time when an individual hears about a novelty until the time he or she adopts this novelty is called innovation adoption process. Innovation process is a five step process, which include awareness, interest, evaluation and adoption (Talug & Tatlidil, 1993). The findings of the study revealed that fish farmers in Namibia went through the stages of innovation adoption process as exhibited in Table 6.1 below:

Table 6.1: Stages of Adoption Process on aquaculture farming and aquaculture information utilisation

STAGES	EXAMPLE SCENARIO Innovation 1: Aquaculture Farming practices	EXAMPLE SCENARIO Innovation 2: Use of Aquaculture Information
1. Awareness/ Getting Informed	Government and extension officers • Farmers obtain information on aquaculture farming • Additional income on the part of the farmer.	• Government and extension officers inform farmers about aquaculture.
2. Interest (Knowledge)	• Farmer meets with friends, extension workers, suppliers and research institutions.	• The search for information on aquaculture starts. • There is need to listen to other people, reading documents and leaning about aquaculture.
3. Evaluation	• Farmer finds out whether he or she has the right tools and equipment to farm with fish. • Farmer asks whether he or she will have problems with the market. • Opportunity for the farmer to realise extra income.	• Acquired general knowledge on aquaculture is developed for application.
4. Trial (Testing)	• Farming with fish on a smaller scale. • Follow other farmer's trials.	• Use information on trial and error basis
5. Adoption	• The decision is made.	• Application on the

	• New farming practice (aquaculture) has yielded positive results. • A new farming method (aquaculture) is started to be applied totally and continuously	usage of information has yielded positive results. • Information and knowledge used continuously to sustain aquaculture production.

In Table 6.1 above, the findings revealed that fish farmers went through different stages of the innovation adoption process. The findings of the study showed that the adoption of information usage as an innovation by fish farmers started with awareness. This awareness of information was created by government officials and extension workers as well as other experts in aquaculture farming. Hence the study revealed that their main sources of information are experts and extension workers. The Ministry of Agriculture and Rural Development (MOARD) (1997) in Kenya, observed information deficits due to ineffective agricultural information systems, which resulted to low agricultural productivity. MOARD recommended an information system, which facilitates communication of agricultural information to all actors in the agricultural sectors. Similar to the Kenyan study the agenda setting on usage and utilisation of aquaculture information in Namibia was set by government officials and extension workers as was revealed by this study.

Fish farmers also went through the second stage, which is awareness when using information. The study revealed that fish farmers obtain aquaculture information from different sources, which included colleagues, reading documents and learning about aquaculture. Rogers (2003) argues that the time required by each stage varies according to the characteristics of innovation, the way it is presented and personality of the individual. In some cases, risk takers can skip some of the stages (Ozcatalbas, 2014). The third stage is whereby the farmer evaluates the information provided to him or her. The study revealed that fish farmers attended meetings and trusted information provided to them by experts. The fourth stage is when the farmer tries to apply the information that he or she has obtained and the study revealed that aquaculture farmers felt satisfied when they obtained positive results after they used information gathered from various sources and felt dissatisfied when they could not obtain positive results. According to Rogers (2003), the innovation adoption process ends with adoption. The findings also revealed that aquaculture farmers adopted the usage of information as an innovation in order to boost productivity in their fish farms. Thus, the DOI's application to utilisation as an innovation made it the most appropriate theory for the innovation adoption process of aquaculture farmers.

Diffusion researchers like Rogers (2003) and Tatlidil (1993) believe that a population can be broken down into five different segments, based on their propensity to adopt a specific innovation: innovators, early adopters, early majorities, late majorities and laggards (Figure 3.3).

According to Rogers (2003), the adoption process begins with a tiny number of visionary, imaginative innovators (Figure 3.2). The findings of the study revealed that the innovators in this case were the government departments, community leaders, NGOs, CBOs and international organisations such as FAO and SADC. The government through its national development plans, policies and vision statements developed ideas on how to alleviate poverty and promote economic development amongst rural livelihoods. These organisations spent their time, energy and creativity on developing new ideas and gadgets (Rogers, 2003) in order to promote fish farming as a new innovation. In the same breath, the study focused on aquaculture information as an innovation, which could be exploited by fish farmers so that they could improve their fishing practices. These innovators worked with their first followers and provided them with support and publicity for their ideas. In the case of this study, government departments worked with extension workers to get support from the respondents or fish farmers to create awareness on aquaculture farming. According to Rogers (2003), innovators constitute a small population of 2.5% as indicated in Figure 3.2.

The second population segment is made up of “early adopters”. According to Rogers (2003), once the benefits start to become apparent, early adopters leap in. They love getting an advantage over their peers and they have time and money to invest. The study revealed that the majority of fish farmers needed information to work in their ponds and this information varied according to their needs such as problem solving, decision making, creating new knowledge etc. Early adopters tended to be more economically successful, well connected and well informed and hence more socially respected (Rogers, 2003). Similar to this study, respondents revealed that they had a certain level of education, which necessitated them to be able to utilise aquaculture information and grow fish in their ponds. However, contrary to Rogers findings that the early adopters constitute 13.5% of the population, the current study showed that the need for information on aquaculture by respondents was pegged at 90%. The situation could be like this because fish farmers in Namibia were aware of the risks and challenges of fish farming that without information, there wouldn’t be any fish farming to talk about. As a new innovation at this stage, aquaculture information seemingly had a large following of users of information whereas fish farming itself as an innovation could be regarded as a farming practice of the elite, and hence constituted a small population of 13.5%. Kainga (2016) discovered that a greater proportion (40.6%) of the farmers adopted fish pond construction. This is linked with the fact that good fish pond construction is necessary for increased production, and this supports the findings of Nwachukwu and Onuegbu (2007) who indicated that about half of the respondents adopted pond construction practice as improved fish production technology in Imo State, Nigeria. According to Rogers (2003), early adopters like to talk about their successes and they don't need much persuading because they are on the lookout for anything that could give them a social or economic edge. The findings of this Namibian study revealed that apart from their regular meetings, which they attended with Ministry officials; they felt they also needed to attend conferences and workshops in order to share information and success stories. Rogers further mentions that an important characteristic of early adopters is that when a public meeting is called to discuss new farming practices, they are the ones who come along and are eager to share their success stories. Working with early adopters requires face to face support in order to promote new ideas and the study revealed that extension workers should be readily available to support the needs of early adopters. The other interesting area in the study showed that early adopters needed training so as to improve their yields and farming practices. However, Rogers (2003) points that early adopters have a crucial role to play since they can also be recruited and trained as peer educators as an incentive. This argument by Rogers (2003) could fit well with the findings of this study where respondents showed that they were likely to seek and share information from their peers whom they trusted.

The third population segment according to Rogers (2003) is the "early majority". At this point when an innovation or product leaps the chasm, it may eventually reach majority audiences. Rogers (2003) further explains that the early majorities are pragmatists, comfortable with moderately progressive ideas, but won’t act without solid proof of benefits. In the findings of the study, it was revealed that some respondents found it difficult to use ICT gadgets and some had also problems of getting too much information from the Internet to solve their information needs. These were some of the challenges that were faced by the early majorities in their quest to use aquaculture information. In this study, early majorities were viewed as those information users who needed minimum disruptions, cost and time when using information. Rogers explains that early majorities require minimum disruption, minimum commitment of time, minimum learning, and either cost neutrality or rapid payback periods and, hence they hate complexity. In view of the findings, it was noted by one key informant (ZA1) that information on aquaculture needed to be simplified and repackaged so that it could fit well with its users. Sometimes the platforms for accessing such information were not easy to use and it was therefore important to disseminate aquaculture information on platforms and gadgets that were easy to use. A case in point could be the use of radio and television where regular programmes could be aired for the benefit of fish farmers. It was also important to note that information on fish farming, which is currently scattered in different offices and departments, could also be made available on a central platform for easy access. This could be important as it would create a one stop shop for information users and thereby attracting the population segment of the early majorities. It was also mentioned in an interview by one key informant (OM1) that the frequency with which farmers looked for information varied from daily to occasionally and this was mainly due to a number of factors such as the level of education, problems encountered in their work, and eagerness to learn in order to acquire new skills. According to Ndah (2014), the DOI theory helps to clarify the fact that not all potential farmers can adopt innovations at the same time as well as not every member of the society might even find some innovations worth adopting. The findings of this study showed that while some farmers found the adoption of using aquaculture information attractive to them at different stages in the course of the diffusion process with varied reasons responsible for their behaviour; some could not find it attractive at all and thereby resorting to access their information from extension workers.

The fourth population segment is the “late majority” According to Rogers (2003), this group of people are conservative pragmatists who hate risk and are uncomfortable with new ideas. Rogers adds that their only driver is the fear of not fitting in; hence they will follow mainstream fashions and established standards and are often influenced by the fears and opinions of laggards. In the study, as noted by one key informant (KE2) that understanding social norms played a pivotal role in trying to convince one to be involved in fish farming practices, let alone becoming a user of aquaculture information. Regardless of support provided by extension workers and the government departments, some communities could not see the benefit of fish farming because of environmental factors. According to Rogers (2003), working with the late majority can be complex and requires one to emphasise on the risk of being left behind. The use of information has so many benefits for a farmer since information is a key to creation of knowledge. The study identified a few people who faced challenges in exploiting information and were information illiterate. However, the economic benefit, which came as a result of practicing in fish farming, meant that the majority of farmers were information literate. Minish-Majanja and Kiplang’at (2004) identified weaknesses in the DOI theory, that it is, pro-innovation bias, which occurs when there is an economic reason to adopt an innovation. The study also showed that fish farming as a practice is engaged by farmers because of its potential benefit to raise more income. The findings however, could not come up with conclusive characteristics of fish farmers who were in the late majority segment apart from singling out of the aspect of information illiteracy since the majority of them were users of information in one way or the other.

The fifth and final segment of the population is made up of “Laggards”. According to Rogers (2003), the laggards hold out to the bitter end and they see a high risk in adopting a particular innovation or behaviour. Rogers (2003) further argues that sometimes they are not really laggards at all, but innovators of ideas that are so new and can challenge any new paradigm. In this study, the laggards were viewed as those who neither used information nor practiced fish farming. The whole narrative of exploiting aquaculture information as mentioned by one key informant (KE2) was viewed as a farming practice of the elite because of amount of inputs that were required to set up a fish project. In a way, this was a catch used by laggards to instil fear into the late majorities. The study revealed that working with laggards required the Ministry (innovators) to address their criticisms, because late majorities shared many of their fears and maximised their familiarity with new innovation or practices, while expecting them to change their behaviour. Those that fell in this category included the traditional, lower social class in the society (Rogers, 2003) and this confirmed the findings, which showed that fish farming in Namibia is a farming practice of the rich and elite. The study recommended that extension workers through the Ministry of Fisheries and Marine Resources (MFMR) should visit fish farmers regularly and provide them with support on aquaculture information in order to minimise their fears of adopting a new innovation.

Rogers (2003) argues that the economic capabilities of an individual affects his or social environment as an external factor of adopting an innovation. This assertion is also supported by Ozcatalbas (2014), that economically and educationally privileged individuals are likely to easily adopt a new innovation. Based on the findings of this study, the level of education was one of the factors which necessitated the adoption of information utilisation amongst fish farmers. The majority of fish farmers in Namibia had attained a good level of education and hence they could use information (See Figure 5.2.2). Ozcatalbas (2014) posits that socio-economic factors such as quality of learning and high social status are effective in the innovation process. The study also revealed that aquaculture farming practice in Namibia is a farming method which is practiced by the elite because of the amount of investment which is needed to start an aquaculture farm as was mentioned by key informant KE2. According to the findings, it was revealed that early adopters had a higher level of education compared to laggards.

6.12 Chapter summary

The Chapter started with defining "information need" and revealed that respondents lacked information and required information to fulfil their information needs. The majority of respondents needed information for problem solving, performing tasks and information and decision making. This need of information is inherent within an individual as a behaviour which arises as a result of a need to solve a problem. The section also looked at the three most important sources of information used by aquaculture farmers which were namely, professional colleagues, seminars and training, and radios. The study revealed that fish farmers used different types of information, which cut across different disciplines and this information included; agricultural information, health information, environmental information, technological information, business and trade information, and government policies and plans. Several sources of accessing information were newspapers, Internet, textbooks, experts, etc., and that fish farmers shared information on various topics amongst themselves, such as, fish markets and harvests, weather forecast, types of fish species, modern fishing methods, site of shoal, fish feeds, and fishing regulations and government policy. It was also revealed that fish farmers could not attend information literacy and knowledge competencies training regularly though this should not be translated to their lack of information and knowledge on aquaculture production. The finding suggested that fish farmers should continue attending information literacy training in order to boost their knowledge thereby addressing their information needs through the Internet and reading books. Namibia is one country in the sub-region, which had done a lot to support aquaculture farming as evidenced by a number of blue prints such as the Aquaculture Act no. 18 of 2002, Inland Fisheries Resources Act 1 of 2003, Strategic Plan for Aquaculture (MFMR, 2004), Vision 2030 (NPC, 2004), ICT Policy (MICT, 2001), and the National Development Plans I, II and III, IV and V. (NPC) which provided guidelines on the support systems to aquaculture production as they related to information access and utilisation. The study used the Information Search Process model to investigate the search process of aquaculture farmers. The model confirmed that farmers encountered a situation where they lacked information as a result of many and varied reasons. Roger’s DOI theory was also used to measure how utilisation of aquaculture information has been adopted by fish farmers in Namibia and the findings showed that aquaculture information is an innovation which is new to farmers in Namibia and aquaculture as a way of practice was new in Namibia and therefore, it was important that fish farmers were served with relevant information.

The next chapter (Chapter 7) presents a summary of the findings, conclusion and recommendations.

CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATONS

7.1 Introduction

This final chapter presents a summary of the findings, conclusions and recommendations of the study. The section on the summary of findings is organised according to themes and sub sub-themes derived from the research questions as follows: Information and knowledge needs, Information and knowledge access, Information and knowledge utilisation, Information and knowledge sources, Information and knowledge sharing strategies among aquaculture farmers, Levels of access and utilisation of information and knowledge by aquaculture farmers, Information and knowledge competencies of aquaculture farmers, Policies governing information and aquaculture production in Namibia, Contribution of DoI, Model to the study, and Contribution of the Information Search Process to the study. The chapter also highlights conclusions based on the research questions: What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia? ; What are the information and knowledge sources including sharing strategies of aquaculture farmers?; What are the information literacy levels and knowledge competencies of aquaculture farmers?; What are the policies governing information and aquaculture production in Namibia?; What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia? and What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?. The chapter also presents recommendations, areas for further study and the conclusion.

7.2 Summary of findings

The summary of findings (7.2) is organised according to themes and sub sub-themes derived from the research questions as follows: Information and knowledge needs (7.2.1), Information and knowledge access (7.2.2), Information and knowledge utilisation (7.2.3), Information and knowledge sources (7.2.4), Information and knowledge sharing strategies among aquaculture farmers (7.2.5), Levels of access and utilisation of information and knowledge by aquaculture farmers (7.2.6), Information and knowledge competencies of aquaculture farmers (7.2.7), Policies governing information and aquaculture production in Namibia (7.2.8), Contribution of the DoI model to the study (7.2.9), and Contribution of the Six Stage Search Process to the study (7.2.10). The Chapter ends with Conclusion (7.3), Recommendations (7.4) and Final Conclusion (7.5).

7.2.1 Information and knowledge needs of fish farmers

It is evident from the study that aquaculture farmers lacked information and required information to fulfil their information needs. The majority of respondents revealed that they needed information in one way or the other, to perform their duties and this information included information for problem solving, performing tasks, decision making and a plethora of other needs such as informational, educational, increasing their knowledge etc. This study showed that the need for information is inherent within an individual and it can be summed up as a behaviour which arises as a result of a need to solve a problem, make a decision or to perform a task. The findings of the study indicated that the majority of fish farmers spent 1-5 hours gathering information per week. The short frequency of time spent by these farmers gathering information reflects that these farmers need information on a regular basis to support their farming activities.

The specific types of information needed by fish farmers varied from agricultural, health, environmental, technological to business and trade information, government policies and plans etc. Other specific information needs for performing their duties on their farms were identified and included the following: weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on general agriculture and the environment. The study also revealed that fish farmers used the above mentioned information for emergency problem solving, and keeping abreast with current trends in fish farming. The implication of respondents' high demand for information on the weather forecast, fish breeding, fish types and species, water quality and fish markets revealed that the farmers were not sufficiently knowledgeable in these areas and their reliance on information could mean that they did not want to be susceptible to poor fish farming practices, which might hinder their level of profit increases in fish production. The findings also showed that fish farmers felt uncertain when they lacked or did not have access to information. It is this information gap or lacuna that arises as a result of feelings, thoughts and actions which prompted them to search for information and hence aroused their need for information.

7.2.2 Information and knowledge access by fish farmers

The study revealed that the three most important media of accessing information were namely, professional colleagues, seminars and training, and radios. Radio as a media for accessing information was rated somewhat popular amongst fish farmers due to programming which was irregular in covering issues on aquaculture. The other media used as shown by the study included television, newspapers, posters, text books and libraries. Respondents preferred accessing information from places such as homes, government information centres, non-governmental organisations and community based organisations (CBOs) and libraries. The figures suggested that fish farmers felt comfortable to access information from their homes since they may not want to leave their farms unattended. The findings also revealed that aquaculture farming required the farmer to be on site on a full time basis. It was evident that farmers moderately used information centres in government institutions such as libraries. The usage of information centres perhaps suggested that farmers trusted and relied on information emanating from government information centres for their information needs. It was also discovered that in as much as libraries were used by fish farmers, these were not very popular as places for accessing information due to the fact that most of these libraries were found in towns and if ever they were available near their farms, they could not comprehensively cover the information needs of fish farmers (see Figure 5.6.1).

The study revealed problems, which were encountered by farmers when accessing information and these problems included lack of skills to use media tools, illiteracy to use information, lack of transport facilities, lack of extension support from extension workers, lack of connection to rural electrification and ignorance of government responsibility as far as aquaculture farming was concerned. It was also mentioned in an interview by one key informant (ZA2) that the frequency with which farmers searched for information varied from daily to occasionally and this was mainly influenced by a number of factors such as the level of education, problems encountered in their work, and eagerness to learn in order to acquire new skills.

It was evident in the study that the majority of respondents 44.1% rarely faced challenges of using ICT media tools followed by 25.5% who very often faced challenges to use ICT media tools. These figures showed that aquaculture farmers moderately encounter problems to use ICT media tools when accessing information. The findings showed that most fish farmers were barely illiterate to access aquaculture information and knew how to access aquaculture information. The reason to support this assertion could be that fish farming is a specialised area in Namibia, which required a farmer to attain a certain level of education in order to understand the farming practices. The majority of farmers were satisfied with the support they received from extension workers and findings revealed that they rarely lacked support from extension officers. The study also showed that some fish farmers (in the minority) often lacked support from extension workers and this could be as a result of the fact that the study was carried out during the time when most government departments were facing the impact of the financial deficit, which was prevailing at that particular time. At that time, when the field study was conducted the Government of the Republic of Namibia (GRN) was trying to cut expenditure, hence extension work was severely affected. The findings showed that the majority of fish farmers were rarely ignorant of the government's responsibilities in relation to their work as fish farmers and this could be as a result that the majority of these farmers were having the financial means (as the early majority) and understood the role of the government well in fish farming.

7.2.3 Information and knowledge utilisation by fish farmers

The study revealed that fish farmers used different types of information which cut across different disciplines and this information included; agricultural information, health information, environmental information, technological information, business and trade information, and government policies and plans. It was also evident in the study that the information needs of aquaculture farmers matched the type of information they utilised. Thus, the information assembled or gathered was used for different reasons such as problem solving, performing tasks, constructing new knowledge, decision making, and sharing information with other fish farmers and to influence others. The study also revealed that all respondents were users of information, though at different levels depending on the prevailing environmental factors. The study also showed that environmental factors were important for utilisation of information and this ranged from level of education, and availability of resources. Most fish farmers used information to influence others and to share with their fellow colleagues so as to increase their productivity. The study also revealed according to key informant KA1 that the information, which was mostly used was for problem solving and every fish farmer in one way or another encountered problems, which needed to be solved by using information. These problems included diseases, flooding and predators, and as such, the farmers found themselves utilising information which they obtained from different sources.

7.2.4 Information and knowledge sources of aquaculture farmers

In this study, respondents showed that they were able to consult sources of information in one way or the other, maybe because of their levels of education (tertiary, vocational and secondary education), which enabled them to articulate issues and utilise sources of information. The findings of the study revealed that respondents used a number of sources such as information technology gadgets (such as mobile phones, Internet, radio and television). The study observed the use of posters, brochures, photographs, radio, television and the Internet as some of the sources of information that were consulted by fish farmers when carrying out their work. It was also mentioned that apart from the ICT media tools, aquaculture farmers used a variety of information sources to gather information such as; government officials, extension workers, professional colleagues, school teachers, community leaders, textbooks, newspapers, leaflets/ brochures. Some of these sources of information were identified as atlases, Internet, textbooks, journal articles, conferences papers, workshops reports, experiments from the laboratories and government officials (orally through meetings). Most of these sources of information were either communicated through printed media (documents, reports, etc.) or orally (meetings and seminars). Electronic media was also used to communicate information and this also included television, radio, Internet, e-mail, Blogs, WhatsApp, and various other social media platforms. The study also revealed that networks of libraries and information centres have for centuries shared the information and expertise of the individual units in order to provide better information services to their users and new developments in Information and Communication Technologies (ICTs) were providing many new opportunities, to share information online and to make it available globally to end users.

The study showed that the most valuable information sources were as follows: work colleagues, textbooks, Internet, knowledgeable person/ expert and guidelines/ manuals/ reports (in that packing order). The findings also highlighted the fact that the small holder fish farming in Namibia was still young and faced teething problems; hence some of the farmers relied heavily on the information support they received from extension workers and the government. It was noted that the least valuable sources of information used were guidelines, manuals and reports, may be because of the technical jargon, which was used in packaging and communicating the contents in these information sources. The researcher also discovered that farmers were unlikely to use materials, which were technical and beyond their comprehension. The findings in this research showed that farmers trusted specialists as their providers of information and, thus one is likely to conclude that fish farmers in Namibia trusted information provided to them by experts.

7.2.5 Information sharing strategies among aquaculture farmers

The study showed that fish farmers shared information on various topics amongst themselves, such as, fish markets and harvests, weather forecast, types of fish species, modern fishing methods, site of shoal, fish feeds, and fishing regulations and government policy. The findings of the study showed that fish farmers in Namibia frequently shared information and knowledge on various topics. Respondents were also aware that information also opened windows for sharing experiences, best practices in fish farming, sources of financial aid and new markets. The research discovered that respondents used different platforms to share information through the following media: social media associates and cooperatives, meetings and seminars, Internet and mobile phones. However, there appeared to be a very moderate use of Internet and mobile phones as platforms of sharing information. The notable platforms used by respondents were social media (WhatsApp), meetings and seminars as well as associates and cooperatives. Judging on the trends of the moderately used platforms and the most used platforms, the researcher was of the opinion that farmers preferred the trusted information disseminated by experts through meetings and seminars as opposed to the Internet, where such information would be difficult to verify its credibility.

All key informants confirmed that electronic media was also used to communicate and share information and these included television, radio, e-mail, Blogs, WhatsApp and various other social media platforms. Radios were used to share best practices of fish farming through programmes aired and talks about fish farming. The national television had programmes on farming which they used to broadcast occasionally, and these were not broadcasted as regularly as radio programmes. It was also mentioned that the Ministry of Fisheries and Marine Resources tried to maintain its visibility on the Internet by sharing various information through a Blog. The Blog contained discussions and articles on fish farming in order to create a network or awareness of fishing practices. Interviewees had varied answers when they were asked to elaborate on the type of information shared through each of the media and it was noted that the radio was used to disseminate awareness information about fish diseases, the next meetings, visits by extension workers and weather conditions. Meetings were used to discuss catches, diseases, fish harvests and markets, and they were also used by extension workers or ministry officials to disseminate information on fish production. Cellphones were also used by fish farmers to communicate with each other and to communicate with ministry officials. Sometimes fish farmers were located far away and during times of floods, cellphones were used as a way of communicating as noted by key informant ZA2. The findings of the study revealed that each media of disseminating information had a role to play depending on the information being shared, and to whom. Information sources such as posters contained important information on types of fishes (fish species), diseases and general information on the Ministry of Fisheries and Marine Resources (MFMR) and extension workers used posters to share important information with the farmers.

7.2.6 Levels of access and utilisation of information and knowledge by aquaculture farmers

The majority of farmers could not find the information they needed readily available. The reason could be that the Internet would not be readily accessible to them unless they had Internet connectivity either by subscribing or by going to a cyber café. A discouraging factor on the use of the Internet was the cost of subscription or data bundles, which was unaffordable to the rural folk. Other sources were accorded less importance for instance libraries were ranked as the least useful to access sources of information, with fellow colleagues and extension officers as the most useful sources of information.

Respondents also noted that they faced problems of using incomplete information when carrying out their daily duties. The study showed that the majority of respondents were aware of their information needs and therefore were able to realise gaps of incomplete information in their quest of utilising information. The respondents also mentioned that information sources were far apart from each other. The dispersing of information from each other was cited by ZA1 in the research as a problem area, which made it difficult for the information to be effectively accessed and utilised. A case in point, was the reason supplied by interviewees that aquaculture information in Namibia was currently found and housed under different Ministries or departments such as Agriculture, Water, Fisheries, Lands, and the National Planning Commission, which caused a lot of confusion to information searchers and users. It was further mentioned by KW1 that information on aquaculture was fragmented in different ministries; that is, Ministry of Agriculture, Water and Forestry (MAWF), Ministry of Environment and Tourism (MET) and Ministry of Fisheries and Marine Resources (MFMR and this lack of coordination amongst ministries in the provision of information resulted in knowledge gaps amongst fish farmers.

The findings also revealed that few fish farmers encountered challenges of finding too much information on aquaculture, which posed as a big challenge to use the information meaningfully while a few others cited that information on aquaculture was too vast and confusing. This implies that the majority did not encounter such problems and this trend by fish farmers of not having problems in using or selecting the information they needed could be attributed to their high levels of education. The study confirmed that aquaculture farmers needed up to date and relevant information in order to increase productivity.

The respondents faced prohibiting factors of using the Internet, which were attached to the cost of hardware and data bundles to access the Internet. This study however, revealed that the majority of farmers could not find the skills to use of technology or gadgets to access the Internet prohibitive since most of them were having a good level of education plus their age groups fell within their active and more productive years as they were so keen on experimenting new technologies.

As the Internet has spread throughout the world, Internet tools and techniques have been employed in the aquaculture sector with the hope that they can eventually improve agricultural productivity, quality and values. The findings projected that most farmers had positive attitudes towards the use of the Internet for supporting their learning activities.

The findings showed the Internet as not only a useful information source but also as a more reliable information provider. The most popular ways of searching for information on fisheries were search engines, browsing various fisheries institutional websites, newsgroups and referencing through e-mails. E-mails were preferred because they were cheap and fast.

7.2.7 Information and knowledge competencies of aquaculture farmers

In this study, the majority of respondents showed that they could not attend information literacy and knowledge competencies training regularly, though this could not be translated to mean that they lacked knowledge on aquaculture production. As has been mentioned already, it was noted that the respondents were users of information and most of them knew what to do when they were overloaded with information.

Respondents showed that they were satisfied with information on aquaculture which they obtained from various sources. It was interesting to note that all of the fish farmers were aware of their information needs as they embarked on their search journeys for information.

The findings of the study showed that most respondents had not received training on Internet searching skills. These findings however, suggested that farmers needed to be properly trained so that they could search and retrieve information on their own. The study further indicated that the majority of respondents thought it was important to share information and knowledge acquired at conferences or seminars. From what was gathered, it was imperative that respondents were in support of sharing information, which they obtained from seminars or workshops because there was already evidence that they shared information regularly amongst themselves. It was also revealed that though the majority of the farmers depended upon their personal experience relating to farming practices but to a larger extent, they relied on information, which they shared with other farmers, friends and neighbours.

7.2.8 Policies governing information and aquaculture production in Namibia

The findings revealed that a number of blue prints, policies and legislation frameworks governing information and aquaculture production in Namibia existed to support fish farming. Key amongst the documents were the Aquaculture Act no. 18 of 2002, Inland Fisheries Resources Act 1 of 2003, Strategic Plan for Aquaculture (MFMR, 2004), Vision 2030 (NPC, 2004), ICT Policy (MICT, 2001), and the National Development Plans I, II and III, IV and V. (NPC), which provided guidelines on the support systems to aquaculture production as they related to information access and utilisation. A detailed discussion on the literature gathered in support of policies governing information on aquaculture production is provided in Chapter 3 under section 3.6.

7.2.9 Contribution of the Information Search Process Model to the study

The study used Kuhlthau's Information Search Process model, which is characterised by the following stages: Stage 1- Task Initiation, Stage 2 – Topic Selection, Stage 3 – Pre-focus

Exploration, Stage 4 – Focus Formulation, Stage 5 – Information collection and Stage 6 – Search Closure. The model was used to confirm or refute the search process encountered by respondents when searching for information. The findings of the study revealed that respondents encountered a situation in the initiation phase where they lacked information as a result of many and varied reasons. Some of the reasons were the need for information on problem solving, decision making and or performing a task. The need for information was inherent amongst fish farmers and prompted them to search for information whenever they encountered problems.

The study showed that the second stage of the Information Search Process (ISP) is dominated by deciding on the topic for research and respondents in their quest for the need for information; they also refined their searches or topics. The information which was required by respondents when performing their duties included weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on general agriculture and the environment. However, at this stage respondents also acknowledged that they shared their problems and information with their colleagues or extension workers.

The third stage of the Information Search Process deals with pre-focus exploration. Based on the respondents' experience, the study highlighted their level of education which ranged from secondary education, with the majority having received tertiary and vocational education. It could be through this level of education that respondents showed that they were well informed and found it easier to refine and focus on general topics in aquaculture while searching for information. At this stage, respondents revealed that they read to learn about the topic or listened to the radio, and watched television. The findings also showed that respondents tended to conceptualise information as something easily available and felt frustrated when the search process was not as seamless as they expected and often chose their topics based on estimated availability of information; which caused them to become frustrated when information was not easily found.

The fourth stage showed that respondents were involved in formulating search strategies and focused on the information encountered. The findings of the study showed that respondents chose their sources of information carefully depending on which sources of information they trusted. The study revealed that they used radio, television, books, Internet, Blogs, colleagues, libraries, academics, extension workers, community based organisations as their sources of information. The study also noted that respondents trusted colleagues, extension personnel and the Internet as their preferred sources of information. The respondents also seemed to be aware of increased frustration and anxiety to be expected mid-way through the knowledge construction process by avoiding untrusted information sources.

The fifth stage showed that respondents were involved in information collection and gathering. The information was gathered from various sources, such as Internet, extension workers, information centres, the Internet, government departments, and colleagues, and such information was used for problem solving, decision making, and constructing new knowledge or ideas.

The sixth stage concluded the information search process. The findings of the study did not reveal whether respondents needed any additional information after reaching this stage but what was clear from the findings was that respondents increased their knowledge and skills on fish production where they felt some sense of relief, satisfaction and accomplishments to find relevant information sources. Sometimes disappointment would arise at this stage (when the farmer could not find the information needed), which required the respondent to restart or redefine his or her information search process. The findings also revealed that respondents working on digital environments such as the Internet tended to get confused in the search process stages to build knowledge of their topics (because of the overwhelming search results), but the easy availability of information encouraged them to skip stages and thus ended up with superficial descriptive conceptions of their topics.

7.2.10 Contribution of the DOI Model to the study

Besides the Information Search Process model by Kuhlthau (2004), the study also used the Diffusion of Innovation Theory by Roger (1957) to confirm or refute the findings. Rogers (2003) identified four elements of the DOI model. The first element is “Innovation”, which is an idea regarded as new by an individual; the second element is “Communication channels” such as radio, television, Internet, etc., which are used to inform an audience. The third element is “Time”, which symbolises that innovations are adopted by individuals at different times (Innovators, Early adopters, Early Majority, Late majority and Laggard). The social system is the fourth element, which defines a set of inter-related units to accomplish a common goal (Rogers, 2003).

This study on access and utilisation of information and knowledge by aquaculture farmers revealed that fish farming was an Innovation in Namibia. This also meant that information access and utilisation was also an Innovation amongst fish farmers in Namibia. The findings of the study showed that aquaculture information was an innovation which could be exploited by the respondents, in this case, fish farmers. Further to that, the study revealed that aquaculture was a new way of farming in Namibia and therefore, it was important that fish farmers became users of information and this was the reason why farmers were encouraged to read about fish farming and to contact the extension officers for any assistance. The findings revealed that fish farming was mostly practiced by people who had attained a certain level of education since people were aware of the risks that came along with fish production. Thus the exploitation of aquaculture information required someone to have acquired a certain level of education in order to be functional and able to use the information needed.

The study investigated on the communication channels through which the Innovation was communicated to fish farmers and the data revealed that radios, television, Internet, extension workers, colleagues, government officers, and community leaders were all used as communication channels through which the Innovation was communicated. The findings of the study also revealed that fish farmers in Namibia went through the stages of innovation adoption process, which include awareness, interest, evaluation and adoption. The findings of the study showed that the adoption of information usage as an innovation by fish farmers started with awareness. This awareness of information was created by government officials and extension workers as well as other experts in aquaculture farming. The findings of this study hence fit well with the assumption of Rogers (2003) who states that awareness (information) is created when a novelty is being introduced. The study revealed that the main sources of information among aquaculture farmers were experts and extension workers. The third stage according to Rogers (2003) is evaluation and the study showed that farmers evaluate the information provided to them by asking colleagues and experts. The fourth stage according to Rogers (2003) is adoption when the farmer tries to apply the information that he or she has obtained and the study revealed that aquaculture farmers felt satisfied when they obtained positive results after they used information gathered from various sources and felt dissatisfied when they could not obtain positive results. The findings also revealed that aquaculture farmers adopted the usage of information as an innovation in order to boost productivity in their fish farms. Thus, The DOI's application to access and utilisation of aquaculture information as an innovation made is the most appropriate theory for the innovation adoption process of aquaculture farmers.

The investigation concluded that population segments of aquaculture farmers in Namibia can be broken down into five different segments of adoption, based on the premise of Rogers (2003) which were: innovators, early adopters, early majorities, late majorities and laggards. The findings of the study showed that aquaculture information is an innovation, which is new to farmers in Namibia and could be exploited by the respondents, in this case, fish farmers. Further to that, it was revealed that aquaculture as a way of farming was new in Namibia and therefore, it was important that fish farmers became users of information and this was the reason why farmers were encouraged to read about fish farming and to contact the extension officers for any assistance.

According to Rogers (2003), the adoption process begins with a tiny number of visionary, imaginative innovators. The findings of the study revealed that the innovators were government departments, community leaders, NGOs, CBOs and international organisations such as FAO, SADC, etc. In the case of this study, government departments worked with extension workers to get support from the respondents or fish farmers to create awareness of aquaculture farming.

The second population segment was made up of “early adopters”. The study revealed that the majority of fish farmers needed information to work in their ponds and this information varied according to their needs such as problem solving, decision making, and creating new knowledge. Based on Rogers’s (2003) characteristics of early adopters; they tended to be more economically successful, well connected and well informed and hence more socially respected (Roger, 2003). Fish farmers in Namibia were aware of the risks and challenges of fish farming and reasoned that without information, there wouldn’t be any fish farming to talk about. As a new innovation at this stage, aquaculture information seemingly had large following of users of information whereas fish farming itself as an innovation could be regarded as a farming practice of the elite, and hence constituting a small population of early adopters. Working with early adopters requires face to face support in order to promote new ideas and the study revealed that extension workers and government were readily available to support the needs of early adopters. The other interesting area in the study showed that early adopters needed continuous training to improve their yields and farming practices. However, Rogers (2003) points that early adopters have a crucial role to play since they can also be recruited and trained as peer educators as an incentive. This argument by Rogers (2003) could fit well with the findings of this study where respondents showed that they were likely to seek and share information from their peers whom they trusted.

The third population segment according to Rogers (2003) is the "early majority". As per the findings of the study, it was revealed that some respondents found it difficult to use ICT gadgets and some also had problems of getting too much information from the Internet to solve their information needs. These were some of the challenges that were faced by the early majorities in their quest to use aquaculture information. In view of the findings, it was noted by KE1 that information on aquaculture needed to be simplified and repackaged so that it could be understood by all its users. These findings about fish farmers in Namibia fit well with Rogers's (2003) characteristics of early majorities who were regarded as practical with moderately progressive ideas and would not act without solid proof. It was also important to note that information on fish farming which was currently scattered in different offices and departments or sources could also be made available on a central platform for easy access. This would be important as it could create a one stop shop for information users, thereby attracting the population segment of the early majorities.

The fourth population segment is the "late majority", and this group of people is conservative pragmatists who hate risk and are uncomfortable with new ideas. The study discovered that understanding social norms played a pivotal role in trying to convince one to be involved in fish farming or to use information. The study showed that regardless of support provided by extension workers and the government departments, some communities could not see the benefit of fish farming because of environmental and cultural factors. A small percentage could not see the value of using information in their work as compared to the majority who often used information and discovered that it had many benefits for a farmer since information is key to creation of knowledge.

The fifth and final segment of the population is made up of "Laggards" and this group holds out to the bitter end and sees a high risk in adopting a particular innovation or behaviour. Sometimes they are not really laggards at all, but innovators of ideas that are so new and can challenge any new paradigm. In this study, it was not clear how the laggards viewed the whole narrative of exploiting aquaculture information but an observation was made whereby fish farming had been viewed as a farming practice of the elite because of the amount of inputs that are required to set up a fish project. Further to that, the study found that laggards did not have any motivation to start a fish project and let alone to use aquaculture information. In a way, this was a catch used by laggards to instil fear into the late majorities.

7.3 Conclusions

This section outlines the conclusions of the study based on the research questions, which read as follows: What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia? (7.3.1); What are the information and knowledge sources including sharing strategies of aquaculture farmers? (7.3.2); What are the information literacy levels and knowledge competencies of aquaculture farmers? (7.3.3); What are the policies governing information and aquaculture production in Namibia? (7.3.4); What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?

(7.3.5) and What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia? (7.3.6)

7.3.1 What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?

This research question was useful when answering the question on access and utilisation patterns of information and knowledge by aquaculture farmers. The assumptions of the research question were that (i) fish farmers needed specific information; (ii) fish farmers accessed information from different sources; (iii) fish farmers used information to increase their knowledge and improve their farming production. These assumptions were proved correct and the findings of the study revealed that farmers needed information in one way or the other to perform their duties and this information included information for problem solving, performing tasks, decision making and a plethora of other needs such as informational, educational, and general information to increase their knowledge etc. The specific types of information needed by fish farmers varied from agricultural, health, environmental, technological to business and trade information, technological information, and government policies and plans. Other specific information needs included the following: weather forecasts, fish breeding, fish types and species, water quality, fish markets, aquaculture farming methods, current affairs and political situation, policy and legislative issues as well as other information on general agriculture and the environment. The study revealed that the three most important media of accessing information were namely, professional colleagues, seminars and training, and radios. The media used to access information by farmers were television, newspapers, posters, text books and libraries. Respondents preferred accessing information from places such as homes, government information centres, non-governmental organisations and community based organisations (CBOs) and libraries. It was also evident in the study that the information needs of aquaculture farmers matched the type of information they utilised. Thus, the information assembled or gathered was used for different reasons such as problem solving, performing tasks, constructing new knowledge, decision making, and share information with other fish farmers and to influence others. Contrary to the researcher's expectations, the researcher was proved wrong on the following assumptions that: (i) fish farmers did not know the value of information on their work; and (ii) farmers were not using ICT to access information. The findings were evident that farmers were users of information and knew the value of information in aquaculture farming. The study also showed that the majority of farmers used ICTs to access information and they used the Internet and accessed information from Blogs, Whatsapp as well as radio and television.

7.3.2 What are the information and knowledge sources including sharing strategies of aquaculture farmers?

This question was asked to ascertain the information and knowledge sources including the sharing strategies of aquaculture farmers. The assumptions regarding this research question were that (i) fish farmers may not discern information and knowledge sources and (ii) fish farmers did not share information amongst themselves apart from the information shared to them by extension workers and government officials. The study showed that the most valuable information sources were as follows: work colleagues, textbooks, Internet, knowledgeable person/ expert and guidelines/ manuals/ reports (in that packing order). The findings also highlighted the fact the small holder fish farming in Namibia is still young and it is faced with teething problems, hence some of the farmers relied heavily on the support they received from extension workers and the government. The researcher also discovered that farmers were unlikely to use materials which were technical and beyond their comprehension. The findings in this research showed that farmers trusted specialists as their providers of information and thus the research concluded that fish farmers in Namibia trusted information provided to them by experts. The assumption by the researcher was proved wrong in that fish farmers shared information amongst themselves as well as the information shared by government officials. Contrary to the assumption, the study showed that fish farmers shared information on various topics amongst themselves, such as, fish markets and harvests, weather forecast, types of fish species, modern fishing methods, site of shoal, fish feeds, and fishing regulations and government policy. The findings of the study showed that fish farmers in Namibia frequently shared information and knowledge on various topics. The Blog contained discussions and articles on fish farming in order to create a network or awareness of fishing practices. It appeared that each of the media types had specific information shared and it was noted that the radio was used to disseminate awareness information about fish diseases, the next meetings, visits by extension workers and weather conditions. Meetings were used to discuss catches, diseases, fish harvests and markets and were also used by extension workers or ministry officials to disseminate information on fish production. Cellphones were also used by fish farmers to communicate with each other and also to communicate with ministry officials. The findings of the study revealed that each medium of disseminating information had a role to play depending on the information being shared, and to whom. Information sources such as posters contained important information on types of fishes (fish species), diseases and general information on the Ministry of Fisheries and Marine Resources (MFMR) and extension workers used posters to share important information with the farmers because they were packaged in a language which was easy to understand.

7.3.3 What are the information literacy levels and knowledge competencies of aquaculture farmers?

This question intended to measure the literacy and knowledge competences of aquaculture farmers and was supported by the following assumptions: (i) fish farmers were not information literate; (ii) farmers were not competent to use aquaculture information; and (iii) farmers lacked knowledge on aquaculture. The assumption was proven wrong that fish farmers were not information literate, and instead it was discovered that most farmers used information to solve problems on their farms. It was noted that most farmers knew what to do when they were overloaded with information though the findings suggested that they needed to be properly trained so that they would be able to search and retrieve information on their own. The other assumption which was confirmed by this study was that farmers were sometimes not competent to use aquaculture information. This was evident in the study that farmers faced the challenges of information overload and lacked skills of discerning which information was reliable or not reliable. The assumption was also proven wrong that fish farmers lacked knowledge on aquaculture and the study revealed that they were satisfied with information on aquaculture, which they collected from different sources though they preferred to get information from an expert or a knowledgeable person.

7.3.4 What are the policies governing information and aquaculture production in Namibia?

The research question sought to find answers establishing if aquaculture information is supported by policies and or any blue prints in Namibia. The assumption of the study was that the Namibian aquaculture information sector was not supported by any policies. This assumption was however, proven wrong since the study revealed that a number of blue prints, policies and legislation frameworks governing information and aquaculture production in Namibia existed to support fish farming. Key amongst the documents were the Aquaculture Act no. 18 of 2002, Inland Fisheries Resources Act 1 of 2003, Strategic Plan for Aquaculture (MFMR, 2004), Vision 2030 (NPC, 2004), ICT Policy (MICT, 2001), and the National Development Plans I, II and III, IV and V. (NPC), which provided guidelines on the support systems to aquaculture production as they relate to information access and utilisation. A write up on these policies and guidelines on fish production in Namibia is provided in Sections (2.5.1), (3.6) and (6.10). However a gap existed on the delays to implement the aquaculture strategic plan so as to strengthen the role information in the sector.

7.3.5 What are the knowledge and information seeking models or theories that are suitable for aquaculture farmers in Namibia?

The two information seeking models used for aquaculture farmers in Namibia were the Information Search Process model for information seeking by Kuhlthau (2004) and Diffusion of Innovation theory by Rogers (2003). The contribution of two models to information seeking models by aquaculture farmers are summarised under 7.3.5.1 and 7.3.5.2:

7.3.5.1 Contribution of Kuhlthau's Model of the Information Search Process to the study

In this study the Kuhlthau's (2004) model of the Information Search Process was used to interrogate the access and utilisation of information and knowledge by fish farmers in Namibia. The model was used to confirm or refute the search process encountered by respondents when searching for information. The findings of the study revealed that just like Kuhlthau's (2004) assumption of the initiation stage, respondents encountered a situation where they lacked information as a result of many and varied reasons. The study showed that during the second stage of the Information Search Process, fish farmers were dominated by deciding on the topic for research and in their quest for the need for information; they also refined their searches or topics. The third stage of the Information Search Process deals with pre-focus exploration. The study highlighted that through the farmers' level of education; they were well informed and found it easier to refine and focus on general topics in aquaculture. Farmers felt frustrated when the search process was not as seamless as they expected and often chose their topics based on estimated availability of information. The fourth stage showed that respondents were involved in formulating search strategies and focused on the information encountered. The findings of the study showed that fish farmers chose their sources of information carefully depending on which sources of information they trusted. The fact that the respondents trusted the Internet as a source of information could also provide evidence that respondents were aware of identifying their information needs and wants amongst a pool of other topics. The fifth stage showed that respondents were involved in information collection and gathering. The information was gathered from various sources, such as the Internet, extension workers, information centres, the Internet, government departments, and colleagues, and such information was used for problem solving, decision making, and constructing new knowledge or ideas. The sixth stage concluded the information search process. The findings of the study could not ascertain whether respondents needed any additional information after reaching this stage but what was clear from the findings was that respondents increased their knowledge and skills on fish production where they felt some sense of relief, satisfaction and accomplishments to find relevant information sources. Sometimes disappointment would arise at this stage, which required the respondent to restart or redefine his or her information search process. The findings also revealed that respondents working on digital environments such as the Internet tended to get confused in the search process stages to build knowledge of their topics.

7.3.5.2 Contribution of Roger's Model of the Diffusion of Innovation (DOI) to the study

The study used the Diffusion of Innovation Theory by Roger (2003) to confirm or refute the findings. The DOI theory has been used as a theoretical basis for a number of information systems projects and the findings of the study showed that aquaculture information is an innovation, which can be exploited by the respondents, in this case, fish farmers. Further to that, it was revealed that aquaculture was a new way of farming in Namibia and therefore, it was important that fish farmers become users of information and this was the reason why farmers were encouraged to read about fish farming and to contact the extension officers for any assistance.

The study revealed that the adoption of information usage as an innovation by fish farmers started with awareness. This awareness of information was created by government officials and extension workers as well as other experts in aquaculture farming. The third stage according to Rogers (2003) is evaluation and the study showed that farmers evaluate the information provided to them by asking colleagues and experts. The fourth stage according to Rogers (2003) is adoption when the farmer tries to apply the information that he or she has obtained and the study revealed that aquaculture farmers felt satisfied when they obtained positive results after they used information gathered from various sources and felt dissatisfied when they could not obtain positive results.

The study investigated whether access and utilisation of aquaculture information fitted into the five different segments, based on Rogers's (2003) assumption: innovators, early adopters, early majorities, late majorities and laggards. The findings of the study showed that aquaculture information is an innovation, which is new to farmers in Namibia and could be exploited by the respondents, in this case, fish farmers. The findings of the study revealed that the innovators in this case were government departments, community leaders, NGOs, CBOs and international organisations such as FAO and SADC. The third population segment according to Roger is the "early majority". The early majorities are pragmatists, comfortable with moderately progressive ideas, but won't act without solid proof of benefits. In the findings of the study, it was revealed that some respondents found it difficult to use ICT gadgets and some also had a problem of getting too much information from the Internet to solve their information needs. The fourth population segment is the "late majority", and this group of people is conservative pragmatists who hate risk and are uncomfortable with new ideas. The study discovered that understanding social norms played a pivotal role in trying to convince one to be involved in fish farming or to use information. Regardless of support provided by extension workers and the government departments, some communities could not see the benefit of fish farming because of environmental factors.

The fifth and final segment of the population is made up of "laggards" and this group holds out to the bitter end and sees a high risk in adopting a particular innovation or behaviour. In this study, it was not clear how the laggards viewed the whole narrative of exploiting aquaculture information but an observation was made whereby fish farming was viewed as a farming practice of the elite because of the amount of inputs that are required to set up a fish project. In a way, this was a catch used by laggards to instil fear into the late majorities or anyone wanting to be involved in fish farming.

7.3.6 What is/ are the relevant model(s) or theory(ies), which can be employed to support the information infrastructure for aquaculture farmers in Namibia?

The study required that a proposed model for supporting the aquaculture information infrastructure be developed as proposed by the last research question. The proposed aquaculture information system was derived out of the model by Inbakandan et al. (2009) with some modifications to suit the Namibian situation. Inbakandan et al. (2009) used information technology as a great enabler and calls the application of ICT technology in the provision of aquaculture information as aquaculture informatics. At the centre of the information system is the ***Integrated Aquaculture Information System*** as shown in Figure 7.1, which supports farming practices, analyses aquaculture information, develops aquaculture databases for research and development, analyses genetic information, technology transfer and aqua-business. The proposed system uses various aquaculture informatics based tools such as Remote Sensing (RS), Farmer Information System (FIS), Management Information System (MIS), Geographical Information System (GIS), Farm Management Software and aquaculture databases to provide effective and timely solutions to any problems faced by fish farmers. The study suggested that fish farmers should be able to get information delivered to them at a time, place and source of their choice since this would be beneficial for farmers to realise productivity gains from the adoption of new farming practices and mitigate losses.

7.4 Recommendations

In this section, the study outlines recommendations of the study. The recommendations came as a result of the gaps between the literature and the findings. The study also came up with a recommendation in form a proposed model to support the information infrastructure for aquaculture farmers in Namibia (7.4.3).

7.4.1 Specific Recommendations

The study identified low usage of libraries and barriers to effective use of information such as; low levels of ICT skills, low levels of information literacy skills, low levels of understanding the subject matter and aquaculture farming practices, information sources scattered in different ministries, agencies or offices and information overload as a result of not being able to access information from the Internet. The research therefore recommends the following:

i) The Ministry of Fisheries and Marine Resources (MFMR) should consider adopting the Information Search Process model when designing, framing and implementing the proposed model to support the information infrastructure for aquaculture farmers in Namibia. The Information Search Model should be viewed as a tool to be used when designing user centred information services and systems for any information user group in the information search inquiry process.

ii) The Aquaculture Directorate in the Ministry of Fisheries and Marine Resources (MFMR) should consider adopting the DOI theory when implementing aquaculture farming as a new farming practice in Namibia. It is imperative for extension workers to be aware that an innovation will not be adopted by individuals at the same time and should also consider different categories of the DOI stages.

iii) The Ministry of Fisheries and Marine Resources should continuously provide training to all fish farmers in the region. This training should be in the form of continuing education for farmers where they are provided training on aquaculture and the problems that are encountered in fish farming such as fish diseases, water quality, and fish feeds.

iv) The Ministry of Fisheries and Marine Resources should work in conjunction with other ministries such as Ministry of Information and Communication Technologies and Ministry of Education through the directorate of Namibia Library and Archives Services (NLAS) in order to provide computer literacy skills. Public libraries in the regions are equipped with computer labs which are accessible to all and can be used for imparting computer literacy skills for fish farmers.

v) The Ministry of Fisheries and Marine Resources should collaborate with the Ministry of Education and Culture through the directorate of Namibia Library and Archives Services (NLAS) to provide training to farmers on information literacy; which covers areas such as retrieval of aquaculture information from online databases and the Internet, evaluating information sources and applying information to solve their daily information needs.

vi) The Ministry of Fisheries and Marine Resources should further develop their existing Portal to become a one stop shop for information access so as to enhance easy access and retrieval of information from the databases held by partner organisations and related ministries on aquaculture production.

vii) The government should accelerate the rural electrification project in Namibia as this will be the only way to accelerate the adoption and use of ICTs especially among rural farmers. This will pave way to accelerated exchange of information among farmers and extension workers as well as effective application of ICT tools. It has been observed by Ajit (2003) that linear information flows are being replaced by pluralistic information flows where new actors are emerging to form community information spaces.

viii) Networking amongst aquaculture organisations and farmers should be improved so that Internet and email facilities are available to all farmers. Individual farmers and researchers should be encouraged to join Internet or social media discussion groups and post their best practices on the Internet. This will allow a wider dissemination of aquaculture information.

ix) The Ministry of Fisheries and Marine Resources should coordinate with all Ministries and departments as well as institutions dealing with aquaculture to support easy accessibility of information.

x) The Directorate of Aquaculture in the Ministry of Fisheries and Marine Resources (MFMR) should consider keeping the database up to date of practising fish farmers.

xi) The study revealed that there is a shortage of materials on fish farming written in local languages (vernacular) since most of the materials are written in English which is the language of the elite. The Ministry should consider repackaging information on aquaculture farming in the local languages so that that the materials are accessible to the majority of practicing and potential fish farmers.

The researcher envisions that the above recommendations if properly implemented may yield optimum and effective utilisation of aquaculture information amongst fish farmers in Namibia. The study identified that despite the constraints and challenges encountered by fish farmers when accessing and utilising information, a wide range of information utilisation tools and sources had been adopted to facilitate aquaculture information sharing and exchange among extension workers and farmers.

7.4.2 Contribution of the study

The major contribution of this study, the first of its kind in Namibia to facilitate access and utilisation of information and knowledge by aquaculture farmers, is the proposed model to support the information infrastructure for aquaculture in Namibia (See 7.4.3). This study acts as a future reference point for studies on information seeking behaviour of aquaculture farmers as well as different categories of farmers (cattle, goats, mahangu or millet) in Namibia. The study is also important in facilitating the rate of adoption regarding aquaculture information use and aquaculture as a farming practice.

7.4.3 Contribution of the proposed model to support the information infrastructure for aquaculture farmers in Namibia

The last research question of the study, *"What is/ are the relevant model(s) or theory(ies) which can be employed to support the information infrastructure for aquaculture farmers in Namibia?"* required that a proposed model for supporting the aquaculture information infrastructure be developed. The aquaculture information infrastructure can be supported by information technology, which is becoming more relevant in terms of how aquaculture information is exploited. This information infrastructure can be equated to an aquaculture information system which can be defined as a system, in which aquaculture information is generated, transformed, transferred, consolidated, received and fed-back in such a manner that these processes function synergistically to underpin knowledge utilisation by fish producers (Röling, 1988; Inbakandan et al., 2009).

Figure 7.1 below shows the proposed information and knowledge management system in Namibia (which is represented as a “spoke wheel”. The representation of a “spoke wheel” shows the dynamism of the integrated information system in case there could be new developments which can be added or outdated ideas which can be subtracted. The proposed aquaculture information system was derived out of the model by Inbakandan et al. (2009) with some modifications to suit the Namibian situation. Inbakandan et al. (2009) used information technology as a great enabler and called for the application of ICT technology in the provision of aquaculture information as aquaculture informatics.

Figure 7.1: Concept map for aquaculture information and knowledge system in Namibia

At the centre of the information system is the ***Integrated Aquaculture Information System*** as shown in Figure 7.1.; which supports farming practices, analyses aquaculture information, develops aquaculture databases for research and development, analyses genetic information, technology transfer and aqua-business. The proposed system uses various aquaculture informatics based tools such as Remote Sensing (RS), Farmer Information System (FIS), Management Information System (MIS), Geographical Information System (GIS), Farm Management Software and aquaculture databases to provide effective and timely solutions to any problems faced by fish farmers. An integrated aquaculture system would facilitate easy access to different information systems including databases and portals, management information system, business information system, farmers' information system, decision support system, geographical information system, technological support system and environmental management system. However, it is imperative that the government equips the regions in Namibia with ICT tools in order to make the integrated information system a success since the study observed that most governments offices in the regions are not fully equipped with up to date information and communication gadgets such as computers and communication facilities, Internet facilities and telephones as well as the fact that some of the farmers were not familiar with ICT based tools. The study showed that there was a growing awareness on the importance of aquaculture information and its use amongst the farming community. It is suggested that fish farmers should be able to get information delivered to them at a time, place and source of their choice since this would be beneficial for farmers to "…realise productivity gains from the adoption of new farming practices and mitigate losses" (Bachhav, 2012, p. 10).

The integrated aquaculture information system will be made up of the ***Business Information System***. This is where information on e-commerce, pricing, buyers/middleman, including profit management will be available. The findings of the current study showed that fish farmers lacked information on the markets, such as pricing, buyers and it will be imperative if the integrated information system could also provide business and e-commerce information for the benefit of the farmers.

According to the Figure 7.1, the ***Farmers' Information System*** will provide information on feed availability, brood stock (fingerlings) and the status of the market demand. The findings of the study showed that fish farmers were in constant need of information on feed availability, brood stock (fingerlings), etc., and therefore the farmers' information system will answer questions on where to find different types of feed stock for fish as well as fingerlings. This system could also link farmers to fish farmers' associations and clubs as well as cooperatives.

Decision making is a critical for the successful fish production, and the study showed that farmers relied on aquaculture specialists to assist with expert knowledge. In most cases these specialists are not always available since most of them are located away from farming areas as was observed in the study. In trying to solve this problem, the study recommends the establishment of a ***Decision Support System (DSS***) which can be made up of aquaculture experts drawn from government (MFMR), academic institutions (UNAM, NUST, etc.), Non-government organisations etc., and this could also be referred to as the Expert System. According to Röling (1988), the expert system is a special computer program designed to capture the knowledge generated by aquaculture and agricultural specialists in order to help fish farmers and extension workers in making the required decisions for raising fish successfully. A case in point is the strengthening of and improving the Blog on Inland Fisheries on Aquaculture in Namibia (http://aquaculturenamibia.blogspot.com/feeds/posts/default?alt=rss) developed by a fish biologist, which has a lot of information resources regarding projects on aquaculture in Namibia. The expert system will be designed to answer questions entered on the computer on diverse topics on aquaculture. For instance, a Tilapia Advisor/ Expert will answer any questions on Tilapia and a Catfish Expert can relatively answer all questions on catfish farming. These experts can also be responsible for answering all questions raised by fish farmers.

The ***Geographical Information System*** is also another important area in the integrated information system whereby information on land and water resources, soil and water quality, pond position/ elevation can also be made available to fish farmers. Currently such activities seem to be implemented separately under different line ministries in Namibia and information sharing should be encouraged. Geographical information systems and remote sensing technologies have become useful tools for scientists, planners and administrators to obtain accurate information on various aspects of fish species, soil and water land use (Inbakandan et al., 2009). Remote sensed data or information will help fish farmers to make informed decisions when choosing sites to position their ponds and also to determine soil type, weather conditions etc., and such information will only become accessible when it can be housed under a central location, which is coordinated by the integrated aquaculture information system. The Geographical information system will facilitate useful information for planning purposes and fish farmers will also find this information useful when planning their fish farming activities.

The study also recommends the establishment of the ***Technological Scientific Support System*** which will be a platform within the integrated aquaculture information system. The technological Scientific Support System will provide technological transfer, research and development with the assistance of specialised research institutions such as UNAM's SANUMARC and the Ministry of Fisheries and Marine Resources department of scientific research. The study revealed that most fish farmers were users of information and had received some form of education at tertiary level and vocational level and it will therefore be important to unpack scientific information (which include current status on aquaculture, disease diagnostics, etc.) at the level which they can understand so that they can use the information to develop their farms.

The findings of the study showed that farmers used the Internet for their information needs and Inbakandan et al. (2009) recommend the ***Databases and Portals*** to support farmers with quick information available on the Internet such as Fish Experts Database, Fish Database, Short Messages Services (SMS), Aquaculture Portals and Aquaculture links within Namibia and outside Namibia. The ***Environmental Management Information System*** will include information on pollution as well as environmental authorities, disposal and pond affluent, drought management and weather forecasts. This kind of information could be relevant and useful to fish farmers when managing their environment. In addition, The ***Management Information System*** could also provide information to the farmer on water quality management, disease management, feed management and post-harvest management.

Agricultural information is generated from a variety of sources, such as universities, research institutions, the FAO, etc., and is then disseminated to farmers and those in agricultural areas by the extension officers of the MFMR so that it could reach all agricultural stakeholders including farmer organisations. An important issue for Namibian fish farmers is their need for increased availability of sources of information, which would be particularly welcome and highly effective with regard to helping them make decisions and choices about aquaculture production. Advances in the production and distribution of information technologies (Kiplang'at & Ochola, 2005) are a potential, untapped driver, which could increase the availability of sources of information in this area. Farmer participation is especially valuable, since better communication between scientists and farmers would increase the utility and reliability of information reaching farmers. Research projects must intentionally incorporate farmers as sources of knowledge from the outset, rather than seeing them as passive receivers of information (Saver, 1990; Kloppenburg, 1991). It is recommended that all media of communication, which facilitates transfer of information from the scientist to the farmer be enhanced, such as radio television, newspapers in order to communicate information on different topics on aquaculture.

The integrated aquaculture information system is therefore recommended to assist fish farmers to access and utilise information and knowledge on aquaculture. The integrated information system will enable aquaculture information to be freely available as a one “stop shop” or platform where fish farmers can search, retrieve and send queries regarding aquaculture farming.

7.4.4 Recommendations for further research

The study on access and utilisation of information and knowledge by aquaculture farmers in Namibia has shown through its findings some important trends regarding the information seeking behaviour amongst farmers. However, further studies can look at the exploitation and adoption of ICT tools amongst fish farmers, which this study has opened the doors for further investigation. More emphasis is needed to investigate the rate of adoption of ICT tools amongst fish farmers. An important area worth to be investigated will be the information seeking behaviour of aquaculture extension workers or fish biologists since these are important and key people in the aquaculture industry and it is imperative to research on their information needs, access and utilisation. Effective access and utilisation of aquaculture information by this user-group can improve how aquaculture information is being collected, generated, packaged and disseminated to the farmers. In the current knowledge economy, it could also be important to interrogate how farmers as well as extension workers are using social media tools to access and disseminate information on aquaculture.

7.5 Final conclusion

This study on access and utilisation of information and knowledge by aquaculture farmers has revealed that aquaculture farmers needed information on various topics that could assist them with sustaining and developing their fish farms. The study showed that farmers were users of information and needed to be supported by information in their fish farming practices. The study also showed that the majority of farmers used ICTs to access information although they faced a number of challenges; such as low levels of ICT skills, low levels of information literacy skills, low levels of understanding the subject matter and aquaculture farming practices, information sources scattered in different ministries, agencies or offices and information overload as a result of not being able to access information from the Internet. The challenges faced by aquaculture farmers when using information enabled the study to recommend the adoption of an Integrated Aquaculture Information System (IAIS). The study has added knowledge to the field of aquaculture and information utilisation, which will open debate and act a as a reference point for further investigations.

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ANNEXURE A: QUESTIONNAIRE

Annexure1: Aquaculture Farmers

Thank you for voluntarily agreeing to participate in this questionnaire survey on "*Access and utilisation of information and knowledge by aquaculture farmers in Namibia"*

Purpose

The purpose of this study is to determine the information needs, information seeking behaviours, information use and sharing strategies of aquaculture or fish farmers in Namibia. For this reason, the researcher has prepared this structured questionnaire with a few additional open ended questions to be completed by fish farmers as they carry out their daily routine. Respondents will be requested to complete a 20-minute survey. If you are willing to participate, the survey will ask questions about your background (age, gender, education, job title) as well as your role in the fish farming industry, how you look for information and the types of resources you may use to locate information and sharing strategies. The survey aims to establish the information seeking patterns and a better understanding of the information needs and information seeking behavior of fish farmers in Namibia. This survey is being carried out in order to fulfil the requirements of a Doctor of Philosophy degree in Information Science, Faculty of Humanities and Social Sciences (FHSS) at UNAM. The results will be used to develop a model characterising the information needs and seeking behaviours of aquaculture farmers in Namibia.

There are no foreseeable risks associated with this study, nor are there any direct benefits to you. This is an entirely anonymous survey; no responses will be identifiable in any way. Your participation is voluntary, and you may withdraw from completing the survey at any time.

Rights to participate

Your participation in this survey is strictly voluntary. You may discontinue participation at any time without penalty. For questions about research participants` rights, please contact the supervisor of this research, Dr Beukes-Amiss at (061) 206 3001 0r e-mail cmbeukes@unam.na Centre for Open, Distance and eLearning, University of Namibia or Prof J. K. Mchombu Pro Vice Chancellor, International University of Management (IUM), email: k.mchombu@ium.edu.na Tel (061) 4336000. All information received through this survey will be kept strictly confidential and will be seen only by authorized UNAM officials.

Data gathered from the study will be summarized in the aggregate, excluding all references to any individual responses. The aggregated results of this survey will be used to inform other data sets to help answer the research questions concerning "*Access and utilisation of information and knowledge by aquaculture farmers in Namibia"*.

Appendix 1: Aquaculture Farmers Survey Questionnaire June 2016

Thank you for voluntarily agreeing to participate in this questionnaire survey on access and utilization of knowledge and information by aquaculture farmers in Namibia.

No.	SECTION 1: DEMOGRAPHIC CHARACTERISTICS OF THE INFORMATION USER	
1	What is your Gender?	☐ Male ☐ Female
2	Select your Age category:	☐ 20-30 yrs ☐ 31-45 yrs ☐ 46-60 yrs ☐ 61-75 yrs
3	What is your highest qualification (award) in your field of study?	☐ Primary ☐ Secondary ☐ Vocational ☐ Tertiary
4	What is your Job designation/title?	
5	What is your work experience? (total number of years)	☐ 1-10 years ☐ 11-20 yrs ☐ 21-30 yrs ☐ 31-40 yrs
No.	**SECTION 2: INFORMATION NEEDS OF AQUACULTURE FARMERS**	
1	What circumstances necessitate you to engage in information gathering activities at work? (Tick any which is relevant)	☐ Emergency problem solving, e.g., aquaculture management, etc ☐ Performing tasks ☐ Decision making Any other, please specify
2	How much time do you spend on information gathering activities per week, i.e., reading and looking for information	☐ 1-5 hrs. ☐ 6-10 hrs. ☐ 11-15 hrs. ☐ 16 hrs.

SECTION 3: INFORMATION NEEDS, ACCESS AND USAGE

No.	**SUB-SECTION A: Information Needs**				
	Statement	**Very Often**	**Often**	**Sometimes**	**Rarely**
1	**Please indicate the type of information you need at work (Tick all that apply)**				
A	**General agriculture information**				
B	**Health information**				
C	**Environmental information**				
D	**Technological information**				
E	**Business and trade**				
F	**Government policies and plans**				
G	**Any other, please specify**				
2	**Do you have any other purpose of seeking information?** ☐ **Yes** ☐ **No** **If yes, please specify?**				

No.	SUB-SECTION B: Specific Types of Information Needed by Aquaculture Farmers				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please indicate the specific type of information you need at work (Tick all that apply)				
A	Market information				
B	Weather conditions				
C	Post-harvest i.e. preserve, store				
D	Breeding				
E	Credit facilities				
F	Market trend, price, stock available				
G	Diseases and pest management				
H	Soil and water management				
2	Do you need any other specific information? ☐ Yes ☐ No If yes, please specify?				

No.	SUB-SECTION C: Medium of Accessing Information on Aquaculture				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please indicate the medium used to access information on aquaculture (Tick all that apply)				
A	Newspaper				
B	Radio				
C	Television				
D	Training				
E	Library				
F	Professional colleagues				
G	Posters				
H	Textbooks				
I	Internet				
2	Do you have any other medium of accessing aquaculture information? ☐ Yes ☐				

No.	SUB-SECTION C: Medium of Accessing Information on Aquaculture				
	Statement	Very Often	Often	Sometimes	Rarely
	No. If yes, please specify?				

No.	SUB-SECTION D: Place of Access of Aquaculture Information				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please indicate the place of access of Aquaculture Information (Tick all that apply)				
A	Homes				
B	Government information centres				
C	NGOs/ CBOs				
D	Library				
2	Do you have any other place where you access aquaculture information? ☐ Yes ☐ No. If yes, please ?				

No.	SUB-SECTION E: Problems encountered by Aquaculture farmers in accessing Information				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please indicate problems encountered when accessing information (Tick all that apply)				
A	Inability to use media and tools				
B	Illiteracy				
C	Inadequate transport facility				
D	Inadequate extension agents				

No.	SUB-SECTION E: Problems encountered by Aquaculture farmers in accessing Information				
	Statement	**Very Often**	**Often**	**Sometimes**	**Rarely**
E	Lack of rural electrification				
F	Ignorance of government responsibility				
2	Do you encounter any other problems when accessing aquaculture information? ☐Yes ☐ No. If yes, please specify?				

No.	SUB-SECTION F: Usage of information by aquaculture farmers in Accessing Information				
	Statement	**Very Often**	**Often**	**Sometimes**	**Rarely**
1	Please indicate how you use aquaculture information (Tick all that apply)				
A	Problem solving				
B	Performing tasks				
C	Constructing of new knowledge				
D	Making decisions				
E	Sharing information				
F	Influencing others				
2	Do you have any other uses of aquaculture information? ☐ Yes ☐ No. If yes, please specify?				

No.	SUB-SECTION G: BARRIERS TO INFORMATION ACCESS AND USE	
1	Which of the following problems have you encountered while seeking information? **(Please tick all that apply)**	☐ Required information sources are not available ☐ Library staff does not treat customers well ☐ Incomplete information materials ☐ Information sources are far apart from each other ☐ I do not have enough time to look for relevant information ☐ I don`t know how to search the library catalogue ☐ I don`t have adequate knowledge on libraries ☐ Information is scattered in too many sources ☐ Information on my subject is too vast ☐ Some information sources are outdated Any other, please specify
2	If you do not use the Internet at work, what are your major reasons? **(Please tick all that apply)**	☐ Cost of hardware is prohibitive ☐ Cost of using the Internet is discouraging ☐ I do not know the benefits of using the Internet ☐ I have limited knowledge of Internet products and services ☐ I do not have access to a computer ☐ I do not have access to the Internet ☐ I do not trust information found on the Internet ☐ I have limited Internet search skills ☐ Due to a heavy workload, there is not enough time to keep up with everything I would like ☐ Speed of access or downloads is too slow
3	**Do you encounter any other barriers while accessing aquaculture information?** ☐ **Yes** ☐ **No.** **If yes, which one?**	

SECTION 4: FREQUENCY OF USE OF INFORMATION SOURCES

No.	SUB-SECTION A: Frequency of use of information sources				
	Statement	Very Often	Often	Sometimes	Rarely
1	**Please indicate how often you use the following sources of information at work (Tick all that apply)**				
A	**Government officials**				
B	**Extension personnel**				
C	**Professional colleagues**				
D	**School teacher/ lecturer**				
E	**Community leader**				
F	**Textbooks**				

No.	SUB-SECTION A: Frequency of use of information sources				
	Statement	Very Often	Often	Sometimes	Rarely
G	**Newspapers**				
H	**Leaflets**				
I	**Television**				
J	**Radio**				
K	**The Internet**				
L	**Mobile phone**				
M	**Workshop**				
N	**The Library**				
O	**Any other, please specify**				

No.	SUB-SECTION B: Most valuable Information Sources				
	Statement	1	2	3	N/A
1	**In case of an urgent information need at work, which 3 sources of information would you consult first? Rank your choices 1, 2, 3 where 1 is first choice and 3 is last choice**				
A	Knowledgeable person (expert) in my field				
B	Internet				
C	Textbooks				
D	Guidelines/ Manuals/ Reports				
E	Work Colleagues				
F	Any other, please specify				

No.	SUB-SECTION C: Information sharing by aquaculture farmers				
	Statement	**Very Often**	**Often**	**Sometimes**	**Rarely**
1	**Please indicate the type of information shared by aquaculture farmers (Tick all that apply)**				
A	**Market for fish harvests**				
B	**Weather forecasts**				
C	**Types of fish species**				
D	**Modern fishing methods**				
E	**Sites for fish shoal**				
F	**Fish feeds**				
G	**Fishing regulations and government policy**				
H	**Any other, please specify**				

No.	SUB-SECTION D: Information sharing Strategies of aquaculture farmers				
	Statement	**Very Often**	**Often**	**Sometimes**	**Rarely**
1	**Please indicate the platforms used by fish farmers for sharing information (Tick all that apply)**				
A	**Social networks (Facebook, WhatsApp etc.)**				
B	**Associations and cooperatives**				
C	**Seminars and meetings**				
D	**The Internet**				
E	**Mobile phones eg. text messages**				
F	**Other ICT tools, please specify**				

	SUB-SECTION E: Use of Internet Technologies					
	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Kno w
1	**To what extent do you agree with the following statements? (Tick all that apply)**					
A	The Internet enhances my ability to access the latest aquaculture information					
B	The available information on the Internet confuses me					
C	I mainly use the Internet to communicate					
D	The Internet allows me to enjoy my job					
E	I feel overloaded with all the information available					
F	I feel comfortable with the way I conduct information searches on the Internet					

	SUB-SECTION F: Information Communication Technologies (ICTs) Used					
	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Kno w
1	**Which ICTs are you consulting when accessing and using information**					
A	Radio					
B	Internet					
C	Television					
D	**Which other ICTs are you consulting when accessing, using and sharing information? (Please specify)**					

SECTION 5: INFORMATION LITERACY LEVELS

No.	SECTION 5: INFORMATION LITERACY		
1	How often do you get training to upgrade your skills and knowledge?	☐ Weekly ☐ Monthly ☐ Once in 3 months ☐ Rarely get training	
2	Are you satisfied with the information on aquaculture?	☐ Yes ☐ No	
3	If not satisfied, how do you make up for the gap in your information requirements?	☐ Consult experts ☐ Ask colleague ☐ Send query to Library ☐ Search the Internet Any other, please specify	
1	**Have you ever received any training in the programmes listed below?**		
A	Library user education	☐ Yes	☐ No
B	Information Literacy Instruction	☐ Yes	☐ No
C	Internet searching skills	☐ Yes	☐ No
D	Do you think it is important to attend aquaculture conferences and seminars?	☐ Yes	☐ No
E	Have you ever presented a paper on aquaculture at a conference/ seminar?	☐ Yes	☐ No
F	Do you think it is important to share information and knowledge acquired at conferences and seminars with colleagues?	☐ Yes	☐ No
G	Have you ever used information to solve a problem at work?	☐ Yes	☐ No
1	**Have you ever published in any of the following?**		
A	An article in a work (industry) magazine, journal, newspaper, etc	☐ Yes	☐ No
B	Do you think that you should be consulted before an aquaculture information system is designed?	☐ Yes	☐ No
C	Do you use any current awareness services or alerts, to help you know when new literature becomes available that is relevant to topics that interest you?	☐ Yes	☐ No

SECTION 6: POLICIES GOVERNING INFORMATION AND AQUACULTURE PRODUCTION

No.	SUB-SECTION A: Frequency of Consulting Policies Governing Information and Aquaculture Production				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please indicate how often you consult the following tools governing aquaculture production (Tick all that apply)				
A	Vision 2030				
B	National Developments Plan (NDPs)				
C	Strategic Plan for Aquaculture (2004)				
D	Aquaculture Act (2002)				
E	Any other, please specify				

SECTION 7: INFORMATION SEEKING

No.	SUB-SECTION A: INFORMATION SEEKING				
	Statement	Very Often	Often	Sometimes	Rarely
1	Please answer the following questions:				
A	Do you feel uncertain when you lack information?				
B	Do you use the information acquired to solve problems?				
C	Do you have a sense of accomplishment when you use the information?				

SECTION 8: OTHER QUESTIONS

1	Do you think information is important in your work?	☐ Yes ☐ No
2	If Yes, (above) how would you want to be supported with information on aquaculture production?	
3	Do you have any other ideas on how fish farmers should be supported with information?	
4	State the preferred language of your reading materials.	

Thank you for successfully completing this questionnaire.

ANNEXURE B: INTERVIEW GUIDE

Annexure B: Interview Guide for Aquaculture Managers

Thank you for voluntarily agreeing to participate in this interview on *"Access and utilisation of information and knowledge by aquaculture farmers in Namibia"*

Rights to participate

Your participation in this interview is voluntary and you may skip questions or withdraw from completing the interview at any time without penalty. There are no foreseeable risks associated with this study. This is an entirely anonymous study. In case of doubt about participants` rights, please contact my supervisors of this research Dr Beukes-Amiss at (061) 206 3001 or e-mail cmbeukes@unam.na Director, Centre for Open, Distance and eLearning, University of Namibia or Prof J. K. Mchombu Pro Vice Chancellor, International University of Management (IUM), email: k.mchombu@ium.edu.na Tel (061) 4336000. All information received through these interviews will be kept strictly confidential and will not be accessible to any unauthorized UNAM officials. Data gathered from the study will be summarized in the aggregate, excluding all references to any individual responses.

Interview Guide

This Interview Guide was developed in order to fill the gaps arising from the questionnaire on *"Access and utilisation of information and knowledge by aquaculture farmers in Namibia".* This guide is therefore not an entirely separate instrument or tool for data collection, but complements the survey questionnaire on aquaculture farmers.

Purpose

The purpose of this study is to determine the information needs, information seeking behaviours, information use and sharing strategies of aquaculture or fish farmers in Namibia. For this reason, the researcher has prepared this interview guide to gather data from managers of fish farms or cooperatives as they carry out their daily routine. Respondents will be requested to answer a 20-minute interview. If you are willing to participate, the interviewer will ask questions about your background (age, gender, education, job title) as well as your role in the fish farming industry, how you look for information, and the types of resources you may use to locate information and sharing strategies. The interview aims to establish the information seeking patterns and to have a better understanding of the information needs and information seeking behavior of aquaculture managers in Namibia. This interview is being carried out in order to fulfil the requirements of a Doctor of Philosophy degree in Information Science, Faculty of Humanities and Social Sciences (FHSS) at UNAM. The results will be used to develop a model characterizing the information needs and seeking behaviours of aquaculture farmers in Namibia.

There are no foreseeable risks associated with this study, nor are there any direct benefits to you. This is an entirely anonymous interview; no responses will be identifiable in any way. Your participation is voluntary, and you may withdraw from the interview at any time.

ANNEXURE B: INTERVIEW GUIDE

INTERVIEW GUIDE FOR AQUACULTURE MANAGERS/ EXTENSION OFFICERS

Name of Company/ Cooperative: ………………………………………..

Professional Responsibility: ………………………………………..

No.	SECTION A: What are the information and knowledge needs, access and usage of information by aquaculture farmers in Namibia?	
1	Do fish farmers have any specific information needs when performing their duties? If yes, please explain your information needs	☐ Yes ☐ No
2	How does this information in (1) above help in their work?	☐ Emergency problem solving, e.g., aquaculture management, etc ☐ Performing tasks ☐ Decision making ☐ Others (please specify)
3	How frequently do aquaculture farmers look for information?	☐ Once a week ☐ 2 times a week ☐ 3 times a week ☐ 4 times a week ☐ Others, please specify
4	How does this information (Q1) help in their work?	
5	Where do aquaculture farmers access or get the mentioned information? (Tick the appropriate)	☐ Television ☐ Radio ☐ Internet ☐ Newspapers ☐ Seminars ☐ Library ☐ Professionals ☐ Posters ☐ Textbooks ☐ Info Centres ☐ NGOs/ CBOs Any other, please specify

6	What do aquaculture farmers do when they lack aquaculture information?	
7	If yes above, please state why?	
8	How do they use the information that they have accessed above?	
No.	**SECTION B:** What are the information and knowledge sources including sharing strategies of aquaculture farmers?	
1	Which information sources do fish farmers use to gather information?	
2	Which medium is this information communicated?	
3	How do fish farmers share aquaculture information?	
No.	**SECTION C:** What are the information literacy levels and knowledge competencies of aquaculture farmers?	
1	When fish farmers need information for aquaculture which 3 sources do they consult first?	

2	Do fish farmers shared information about their work at a meeting, seminar or conference?	☐ Yes ☐ No
3	If your answer is yes in 2, state what kind of information do they share?	
4	Do farmers feel knowledgeable about their work without using information? If no, please elaborate	☐ Yes ☐ No
5	Do fish farmers feel satisfied after using information to accomplish their task? If no, please elaborate	☐ Yes ☐ No
6	What information is used by your workers/ employees or fish farmers when carrying out tasks?	
No.	**SECTION D**: What are the policies governing information and aquaculture production in Namibia?	
1	Are fish farmers aware of policies governing information and aquaculture production, eg, NDP3, Aquaculture Act, National Policy on Aquaculture, etc.	☐ Yes ☐ No
2	In what situation do fish farmers consult such policy documents?	
	Do farmers know about these policy and regulatory documents? If no, how do you encourage them to acquaint themselves with these policy and regulatory documents	☐ Yes ☐ No
3	How does these blue prints assist in their work?	

4	Are you satisfied with how aquaculture farmers are supported by aquaculture information?	☐ Yes ☐ No
5	Can you suggest how you would want the government to support fish farmers with aquaculture information?	
6	Does the Internet provide with information needed on aquaculture production	☐ Yes ☐ No
7	Explain why you think ICT tools are necessary in the work of fish farmers to support information access, usage and dissemination?	
8	Do you have any other comments on information needs, access and usage of aquaculture information by fish farmers?	

Thank you once again for agreeing to participate in this interview.

ANNEXURE C: OBSERVATION CHECKLIST

Observation Checklist – Access and use of knowledge and information by Aquaculture farmers

Date of Observation: ____

Name of Company/ Cooperative: ____

Total time spend at the Site: ____

Beginning Time: ____

Ending Time: _______________________________________

The following areas will be observed by the researcher so as to check how Aquaculture farmers access and use knowledge and information

No.	Activities to be Observed	Observation
1	**Frequency of materials used by aquaculture farmers** - What materials - How often do they use the material	
2	**Availability of information resources** - Medium of communicating information - Policies - Acts	
3	**Availability of ICTs** - Types of gadgets - Inability to use ICT gadgets	
4	**Description of information sharing:** - Who was involved? - Who said what? - Who initiated the exchange? - Did other information occur as a result? - What types of emotions were attached to the information exchange	
5	**Photographs**	
	Remarks:	

ANNEXURE D: CONSENT LETTER AND FORM

University of Namibia
P. Bag 13181
Windhoek

Dear Sir/ Madam

Re: Permission for Consent to conduct research

My name is Wilson Yule. I am conducting a research on *"Access and utilisation of information and knowledge by aquaculture farmers in Namibia"* in fulfilment of a Doctorate in Philosophy degree in Information Science.

I am seeking your consent to be interviewed and request you to show your consent by signing a consent form as attached.

I kindly request you to answer questions in this interview to the best of your ability. However, you should not be worried if you can't give details. If possible refer me to anyone in your organisation/ cooperative/ company/ community whom you think will be in a position to give more details.

I am planning to be taking notes as well as tape recording our discussion and if you are not comfortable to be tape recorded, I am willing not to use a tape recorder.

Thanking you in advance for your cooperation.

Yours sincerely

....

Wilson Yule, PhD Student (UNAM)
Tel: +264 61 2063683
Cell:+264 813819489
E-mail: wyule@unam.na

RESEARCH ETHICS: CONSENT FORM

Full title of Project: Access and utilisation of information and knowledge by aquaculture farmers in Namibia

Name, position and contact address of Researcher: Wilson Yule, PhD Student UNAM

Please Initial Box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason. ☐
3. I agree to take part in the above study. ☐
4. I understand that my name will not appear in any reports, article or presentations ☐

____________________	____________	____________________
Name of Participant	**Date**	**Signature**
____________________	____________	____________________
Name of Researcher	**Date**	**Signature**

ANNEXURE E: APPROVAL LETTER TO CONDUCT A RESEARCH

14-2/0001

REPUBLIC OF NAMIBIA

MINISTRY OF FISHERIES AND MARINE RESOURCES

Tel (00 264 61) 205 3007
Fax (00 264 61) 224566
Enquiries: Mr. RR Cloete

Brendan Simbwaye Square
Dr. Kenneth Kaunda str.
Private Bag 13355
WINDHOEK
12 January 2017

Mr. Wilson Yule
Univ. Of Namibia
P.Bag 13301
Windhoek

RE: Request to conduct study on access and utilization of information and knowledge by aquaculture farmers in Namibia

The Ministry of Fisheries and Marine Resources has no objection to the proposed study of Mr. Yule. We will support him wherever possible, however keep in mind that the aquaculture farmers are independent and are not under the control of the Ministry. Mr. Yule may contact the Directorate of Aquaculture for any further information.

Yours sincerely

MINISTRY OF FISHERIES & OFFICE OF THE PERMANENT SECRETARY 2017 -01- 12 Private Bag 13355 WINDHOEK MARINE RESOURCES

Dr. Moses Maurihungirire
Permanent Secretary

2147-0

All official correspondence must be addressed to the Permanent Secretary.

ANNEXURE F: ETHICAL CLEARANCE

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: SEC/FHSS/18/2014 **Date: 12 March, 2014**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's **Research Ethics Policy and Guidelines. Ethical** approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: ACCESS AND UTILISATION OF KNOWLEDGE AND INFORMATION BY AQUACULTURE FARMERS IN NAMIBIA

Nature/Level of Project: Doctorate

Principal Researcher: WILSON YULE

Host Department & Faculty: Information& Communication Studies, Faculty of Humanities and Social Sciences

Supervisor (s): C. Beukes-Amiss (Main) K. Mchombu (Co-)

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
(d) The UREC retains the right to:
  (i). withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
  (ii). request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Prof. I. Mapaure
UNAM Research Coordinator
<u>ON BEHALF OF UREC</u>

ANNEXURE G: LANGUAGE EDITOR CERTIFICATE

ACET Consultancy
Anenyasha Communication, Editing and Training
Box 50453 Bachbrecht, Windhoek, Namibia
Cell: +264814218613
Email:mlambons@yahoo.co.uk/ nelsonmlambo@icloud.com

31 October 2019

To whom it may Concern

LANGUAGE EDITING – WILSON YULE

This letter serves to confirm that a DOCTOR OF PHILOSOPHY IN INFORMATION SCIENCE entitled *ACCESS AND UTILISATION OF KNOWLEDGE AND INFORMATION BY AQUACULTURE FARMERS IN NAMIBIA* by WILSON YULE was submitted to me for language editing.

The thesis was professionally edited and track changes and suggestions were made in the document. The research content or the author's intentions were not altered during the editing process and the author has the authority to accept or reject my suggestions.

Yours faithfully

DR NELSON MLAMBO PhD in English
M.A. in Intercultural Communication
M.A. in English
B. A. Special Honours in English – First class
B. A. English & Linguistics