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Factors and challenges affecting the information-seeking behavior of science and technology researchers

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Abstract

This study investigates the factors and challenges affecting the information-seeking behavior of multidisciplinary science and technology researchers of the six departments of the Federal Institute of Industrial Research Oshodi (FIIRO) in Nigeria. This study depicts a non-academic setting and by extension the African context. One hundred and sixty five researchers were given questionnaires of which responses of 114 questionnaires were finally analyzed. Based on the questionnaire results, the respondents provided suggestions on how certain factors and challenges have influenced their information-seeking behavior. The authors make recommendations on how these factors and challenges can be adequately tackled in order for researchers to optimally derive lasting benefits from their information-seeking process as they engage in research. An excellent recommendation is the effective collaboration of FIIRO library with the functional libraries of higher institutions and research institutions both home and abroad.

Introduction

The actions that researchers exhibit during the critical research process of searching for information characterize how he/she will be guided to getting research facts and this essentially encompasses the researcher's 'information-seeking behavior'. Eftekhar and Hayati (2016) opine that information seeking behaviors exhibited by information users are derived from users' information needs when they have the urge for information. In our today's world where so many traditional print information sources are being replaced by diverse electronic sources (e-journals, online databases, and digital libraries), we should expect an array of adoption factors and challenges brought by this transformation. Chandel and Saikia (2012) indicate that the challenges of traditional print resources when combined with that of electronic sources pose a threat to the process of seeking and obtaining research information by researchers and these problems have to be overcome. Azadeh and Ghasemi (2016) posit that researchers can apply different methods to

acquire information which are basically influenced by different factors, and consequently, researchers will show different information-seeking behaviors.

In an effort to overcome the challenges posed by traditional print resources and electronic sources in non-academic context, it is of great benefit that more studies on the information-seeking behavior of non-academic researchers should be carried out. This is important in order to understand the factors and challenges affecting information-seeking behavior of researchers of different disciplines towards making the process of information seeking and exhibited behavior seamless. This study talks about the impact of discovered factors and challenges on information-seeking behavior of science and technology researchers. The focus of this paper is to understand how science and technology researchers in a non-academic setting (FIIRO researchers) engage in information searching, the interactions between disciplines, organizational context, and information-searching behaviors. The goal is to discover connections between factors, challenges and behaviors and to be able to predict specific behaviors when subject and organizational context are known. The findings presented in this paper are drawn from a larger doctoral research project (Makinde, 2018) that investigated the information needs and information-seeking behavior of researchers of a science and technology federal research institution in Nigeria.

Statement of the problem

Several academic setting studies have been done to find out factors and challenges influencing researchers' information-seeking behaviors and they include Connaway, Dickey and Radford (2011), Hemminger, Lu, Vanghan and Adams (2007), Pareek and Rana (2013), Leckie et al. (1996), Krikelas (1983), Leckie (2005), Phabha et al. (2007), Perley et al. (2007), Nel (2015), Niu and Hemminger (2012), Evans and Saponaro (2005) and Anderson et al. (2001). However, very few studies have been published that focus on factors and challenges affecting the information-seeking behavior of science and technology researchers of different disciplines of federal research institutions in Nigeria with a wide range of occupations in the Nigerian context. Therefore, this present study is set to determine the factors and challenges affecting the information-seeking behavior of science and technology researchers of FIIRO in Nigeria. This study depicts a non-academic setting in the Nigerian context and by extension the African context and the world at large.

Contextual setting

The Federal Institute of Industrial Research Oshodi (FIIRO), Nigeria, is an organization under the agency of the Federal Ministry of Science and Technology. The broad mandate of FIIRO is to assist in accelerating industrialization of Nigeria through finding utilization for the country's raw materials and upgrading of indigenous production techniques (Adeboye, 1988; Onilude & Apampa, 2010). There are a total of 171 multidisciplinary science and technology researchers at FIIRO (According to Federal Institute of Industrial Research Oshodi (letter, 19 May 2016); Adeboye, 1988). The number of researchers and areas of specialization are shown in Table 1.

Table 1: Departments and number of researchers at FIIRO (According to Federal Institute of Industrial Research Oshodi (letter, 19 May 2016)

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

FIIRO as a research institute stands out and its uniqueness informs this study emanating from its broad mandate of accelerating industrialization in Nigeria. FIIRO has a special library which was established in 1957 out of the necessity to provide information support to research and development activities of the institute (FIIRO, 2016).

Literature Review

Campbell (2017) described information behavior as a relatively new but growing research field in the expansive field of library and information science. In this field, several researchers have investigated the information behavior of faculty and students at academic institutions, as well as professionals within the workplace. Bruce (2014), Case and Given (2016) and Ford (2015) stressed that the study of information behavior has developed since its inception during the 1960s when most research was directed towards understanding how professionals searched for information and the resources they consulted. Some of these researches focused on specific disciplines, while others addressed general populations. However, in any endeavor that has to do with information behavior research, there are so many hurdles to overcome and it is imperative to appreciate the factors that will affect the successes and the challenges to overcome (Downing, MacAdam & Nicholas, 1993). This section describes prior works that have examined relating

factors and challenges affecting information-seeking behaviors, which are relevant to the analyses performed in this article. This section will reveal the basis for drawing comparisons between the findings of this study and prior experiments and as a result help in making viable conclusions.

An assessment of the literature indicated that there is no exact definition for the term 'information-seeking behavior'. Korobili, Malliari and Zapounidou (2011) described information seeking as the process of searching and finding information, and of producing new knowledge. Krikelas (1983) described information-seeking behavior as ''any activity of an individual that is undertaken to identify a message that satisfies a perceived need''. To put in another way, information-seeking starts when someone perceives that the current state of possessed knowledge is less than that needed to deal with some issue. It can also be succinctly stated as the way people search for and utilize the information they need (Fairer-Wessels, 1990) or the way people identify, locate and acquire needed information (King, Casto & Jones, 1994). Wilson (1999) defined it as "those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way and using or transferring that information". Marchionini (1995) defined it as a process in which humans purposefully engage in order to change their state of knowledge, and which is closely related to learning and problem solving. Wilson (2000) defined it as ''the purposive seeking for information as a consequence of a need to satisfy some goal". Mostofa (2013) related it to those actions a person engages with when identifying his or her own need for information, searching for such information in any way and using or transferring information.

Phabha, Connoway and Olszowski (2007) discussed the factors that negatively impact information-seeking behavior (challenges). They included: the feeling of information users obtaining sufficient information and consulting trusted sources, lack of time, limited financial resources, nature of the problem to be answered or question to be solved, nature of task at hand and task-domain knowledge. Others are context, situation or setting in which the information user is living or working, the particular search system engaged and motivation level of the information user and his/her information-seeking ability. Perley, Gentry, Fleming and Sein (2007) itemized the factors (challenges) relating to information-seeking behavior contributing to why information seekers do not physically visit the library and why they tend to use library websites through remote access. These are: limited time due to other works/tasks, convenient

access to a computer with internet connection, lack of awareness of available library services, poor arrangement of a full range of library collection and resources, inconvenient library opening and closing hours, inconvenient physical location of library premises and availability of resources from the internet. Azadeh and Ghasemi (2016) findings with respect to information-seeking behavior of researchers showed that the most important goal was publishing a scientific paper, and their least important goal was updating technical information. Therefore, the unavailability of resources to assist them in publishing scientific papers will be a major challenge to them. Azadeh and Ghasemi (2016) also found that most researchers' information-seeking behaviors tilt towards using internet-based resources to meet their information needs. Korobili et al. (2011) found out that the internet has been used as the primary source of information by many researchers and that the issues of accessibility and convenience of access, as well as issues of time and constraints or level of difficulty are challenges to researchers. They also reported that researchers faced challenges with information retrieval techniques. Wilson (1999) explored the problems and difficulties the searchers experience in carrying out their own searches. He interviewed twenty respondents in his study which spanned a wide variety of disciplines. He stated that most of the interviewees expressed some dissatisfaction with their own capacity to search the relevant information sources; they had difficulty in determining the appropriate keywords and did not bother to explore the advanced search capability of any system. Wilson (1999) also referred to challenges of intervening variables in information-seeking behavior. These were the personal barriers (emotional, educational, and demographic), social or role-related barriers and environmental barriers (economic and source characteristics), while risk is another important variable.

Anderson, Glassman, McAfee and Penelli (2001) pointed forward to coexisting factors affecting information-seeking behavior of researchers. They are accessibility, task characteristics, information carrier characteristics, user characteristics and demography. Anderson et al. (2001) discussed accessibility as an information-seeking factor in terms of preference for seeking information from one's own store of information as opposed to seeking information from others, oral communication as opposed to written communication, communication with sources inside the organization as opposed to communication with sources outside the organization, and direct communication with a source as opposed to through mediating carriers such as those provided by library personnel. This is based on principle of least effort which holds that people strive to solve

their problems in such a way as to minimize the total work that must be expended (Zipf 1949). Also, an important factor of information-seeking behavior is successful prior use of a carrier. The concept of successful prior use of a carrier as a factor in information-seeking behavior was upheld by Culnan (1985), Hardy (1982), Johnson, Donohue, Atkin and Johnson (1995), Johnson (1996) and Swanson (1987). Early works by March and Simon (1958) and Allen (1977) noted that information seekers are more likely to obtain information from carriers familiar to them rather than seek new carriers and that this practice becomes self-reinforcing. Wilson (1977) proposed that non-users of a particular carrier are likely to underestimate the existence of the carrier's potentially useful information and to overestimate the difficulty of obtaining the desired information. A substantial amount of literature pointed to characteristics of written information carriers as a factor that affects information-seeking behavior. Various authors identified carrier characteristics such as accessibility (Culnan 1983, 1985; O'Reilly, 1982), quality (O'Reilly, 1982), and ease of use (Hardy, 1982), usefulness (Swanson, 1987), promptness or the time it takes to deliver the information (Hardy, 1982) and cost (Mick, Lindsey & Callahan, 1980; Swanson, 1987). Anderson et al. (2001) were of the opinion that despite differences in measures used and characteristics studied, the literature provides evidence of two competing written carrier characteristics, which are accessibility and quality. A review by Leckie, Pettigrew and Sylvain (1996) concluded that accessibility and familiarity are more important than perceived quality.

Leckie et al. (1996) stressed that "the way information is sought" was influenced by various factors. They used the phrase "factors affecting information seeking" to denote "information is sought" process. They stated that the factors are connected with the sources of information, the awareness of information and the outcomes of the information-seeking behavior. These factors make up the last three components of their model of information behavior. Leckie et al. (1996) explained that sources of information point to professionals seeking information from various types of sources in which combination of multiple sources may also be required to satisfy an information need, professional's awareness of information sources also known as information content determined the path that information seeking will take and the outcomes of information seeking had to do with the final stage of information - the ideal outcome is that the obtained relevant information is put to use by the professional but there is the possibility that the outcome of information-seeking process may not satisfy the information need and additional information seeking is required. Leckie et al. (1996) also listed the factors linked to information awareness

which included familiarity and prior success, trustworthiness, packaging, timeliness, cost, quality and accessibility. Krikelas (1983), Leckie et al. (1996) and Leckie (2005) stated that work-related situations (as a factor) revealed the information needs of professionals and thus their information-seeking behavior. Also, Leckie et al. (1996) listed the factors influencing information-seeking behavior which included personal reasons for seeking information, the kinds of information being sought, and the ways and sources with which needed information is being sought.

Nel (2015) elucidated factors that played a role in information-seeking behavior of researchers. They are: (i) information needs - these included topic complexity, topic familiarity, prior topic search experience, purpose and type of search, (ii) information seeker - this included demography (e.g. age, gender, academic level), discipline, time, awareness of service and sources, knowledge of service and sources and search skills, and (iii) information source - this included location of the information source, format of the information delivery system (print versus electronic), and ease of access of the source (convenience). Nel advised that these factors are very important and should be taken into account by libraries when developing services and purchasing products to address information-seeking behaviors of researchers. Haines, Light, O'Malley and Delwiche (2010) maintained that the basic science researchers expressed a positive attitude toward the library but they did not view its resources or services as integral to their work. This suggested that the library was not playing its role properly. Therefore, the library needed to assume a centralized role in creating, sharing and managing resources.

Wilson (1981, 1999) and Bhatti (2009) noted that information-seeking behavior may be determined by a wide variety of user needs factors which may include personal, psychological, demographical, role-related (professional), interpersonal, environmental and source-related characteristics. Wilson (1981, 1999) further pointed out that the decision to seek information is dependent on motivation which may have a cognitive origin or be emotionally based as in the need to reinforce previous values. Ucak and Kurbanoglu (1998) emphasized that the field of research is the main reason that determines the type of information being sought. Likewise, Niu and Hemminger (2012) in their survey data of academic researchers in natural science, engineering, and medical science from five research universities in the United States of America explored the influence of demographics, environmental context, and disciplines on the information behavior of scientists. Overall, many factors were found to affect the specific

information-seeking behaviors of scientists, including demographic, psychological, role-related, and environmental factors. Of the factors having an effect, academic position was the most important determinant of information behavior which might be due to the academic setting of the study. While there were differences at the discipline (department) level and at the department type level (medical, natural science, engineering), these were not consistent across information behaviors. Thus, it was difficult to recommend different support strategies based on department groupings or department types. Additionally, a number of studies showed that discipline is not the most important factor that affects information-seeking behavior (Wilson, 1981; Sharifabadi, 1996; Wilson, 1997; Heinström, 2003; Wilson, 2006).

Recent studies found that this new age information-seeking behaviors may be challenging, resulting in inexperienced researchers moving away from subject-specific resources and towards search engines and similar digital tools (Lacovic, 2015; Lo & Chu, 2015; Taylor, 2012). Researchers strive to be effective and productive, noting that keeping up on research is crucial for success. However, staying current continues to be a scary task for researchers (De Groote, Shultz & Blecic 2014; Niu & Hemminger 2012; Pontis, Blandford, Greifeneder, Attalla & Neal, 2017). While technology is supposed to help researchers work faster and more efficiently, researchers are gradually feeling deluged by information choices (Larsen and Ins, 2010; Levitin, 2014; Pain, 2016). However, recent studies exploring researchers information-seeking behaviors have involved engineering (Engel, Robbins & Kulp, 2011; Freund, 2015; Johnson & Simonsen, 2015), basic sciences (Bartlett, Ishimura & Kloda, 2011; Haines et al., 2010; Niu & Hemminger, 2012; Niu, Hemminger, Lown, Adams, Brown, Level, McLure, Powers, Tennant & Cataldo, 2010), computer science (Athukorala, Hoggan, Lehtiö, Ruotsalo & Jacucci, 2013), and veterinary research (Nel & Fourie, 2016). These studies collectively agreed that researchers aspire to stay current in their research fields, need to remain flexible, use a variety of resources, and be open to different strategies when exploring unfamiliar and new research areas. This current study attempts to investigate the information-seeking behaviors of multidisciplinary science and technology researchers in their bid to remain informed, productive and discover obstacles they face in the course of their work.

Purpose of the study

The purpose of this study was to investigate factors and challenges affecting the information-seeking behavior of science and technology researchers of a federal research institute in Nigeria.

Methodology

A questionnaire consisting of both closed-ended and open-ended questions was used as the data collection instrument in order to generate quantitative responses. The copies of the questionnaire were administered to 165 researchers (excluding 6 Directors that made the total number of researchers 171 in all) of the six departments of FIIRO namely - Food Technology Department (FT), Project Development and Design Department (PDD), Biotechnology Department (BD), Chemical, Fiber and Environmental Technology Department (CFET), Production, Analytical and Laboratory Management Department (PALM) and Planning, Technology Transfer and Information Management Department (PTTIM). Out of 165 copies of the questionnaire that were administered to researchers, a total of 121 were returned (response rate of 73%). Inaccuracies were identified in seven of the questionnaires and they were discarded and not analyzed. Therefore, usable returns totaled to 114 (67%). During the time of this study, the institute library had library collections estimating to 14,849 books, 223 journal titles, more than 250 research reports and 100 conference proceedings. The library did not subscribe to electronic resources/journals or provide access to open source available on the internet because there was neither internet connectivity nor Wi-Fi networks provided by either the institute or its library. Formerly, the institute and its library had internet connection. But, it was non-existent throughout the period of this study.

Findings

Factors responsible for difficulty faced in accessing information

The respondents indicated the factors responsible for the difficulty they faced in accessing information at the institute's library. Generally, the result in Table 2 shows that the lack of recent books (77; 67.5%) was a major factor. This was followed in descending order by poor infrastructure (74; 64.9%), environment (64; 56.1%), bibliographic obstacles (43; 37.7%), costs of accessing information (32; 28.1%), lack of awareness (27; 23.7%), library staff (10; 8.8%), information explosion (9; 7.9%) and declining budgets and rising costs (5; 4.4%). FT, PDD, CFET and PTTIM respondents pointed more to the factor of poor infrastructure than lack of recent books as a factor making information access difficult. Also, FT and PDD respondents pointed to the factor of the environment as a difficulty in accessing information by respondents than lack of recent books. Seventy five percent of PTTIM respondents also pointed to the factor

of bibliographic obstacles as a factor creating more difficulty in information access than lack of recent books.

Table 2:   Factors responsible for the difficulty faced in accessing information N=114

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

* Multiple responses received

Factors affecting information-seeking behaviors

The respondents indicated the factors that affected their information-seeking behaviors as they seek for information for their projects. Generally, the respondents revealed that trustworthiness (96; 84.2%) was considered the topmost information-seeking behavior factor as they sought for information. This was followed by accessibility (93; 81.6%), nature of problem (91; 79.8%), source of information (88; 77.2%), familiarity and prior success (85; 74.6%) and time (63; 55.3%). Limited financial resources (33; 28.9%) were revealed by the researchers as the least information-seeking behavior factor. FT respondents showed that the factors of source of information, nature of problem and accessibility were considered more important in influencing their information-seeking behavior than trustworthiness. PALM respondents indicated that the factor of nature of problem was more important than trustworthiness. Detailed analysis is shown in Table 3.

Table 3: Factors that influenced information-seeking behaviour N=114

Factors forming behaviour	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	

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

* Multiple responses received

Challenges faced when searching information in manual environment

The respondents revealed the challenges they had searching in a manual environment. Generally, topmost among the challenges revealed was circulation (78; 68.4%). Others in descending order were issuing (73; 64.0%) and then time (31; 27.2%). The least challenges were indexing and cataloguing/classification, with both indicated by 26 (22.8%) of the researchers. PDD and CFET respondents indicated the challenge of issuing to be more important compared to circulation. This is shown in Table 4 below.

Table 4: Challenges in searching information in manual environment N=114

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

* Multiple responses received

Challenges faced when searching information on the web

The respondents indicated the challenges they had with searching information on the World Wide Web while trying to access electronic resources. Topmost among the challenges revealed was electrical power stability (91; 79.8%). Others in descending order were reliability of e-resources (48; 42.1%), HTML documents (39; 34.2%) and issues with referencing e-resources (37; 32.5%). This is shown in Table 5.

Table 5: Challenges faced searching electronic resources N=114

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

* Multiple responses received

Formal training/orientation on searching for scientific/technical information in manual environment/electronic environment

The respondents indicated whether they had received formal training/orientation on how to search for scientific/technical information in a manual environment or electronic environment (web resources). Twenty (17.5%) of the respondents had received formal training/orientation with respect to how to search in a manual environment while 93 (81.6%) of the respondents had not received formal training. For electronic environment, 28 (24.6%) of the respondents had received training/orientation while 75 (65.8%) of the respondents had not received training/orientation. The detailed analysis is shown in Table 6.

Table 6: Researchers trained on searching for scientific/technical information in manual/electronic environment N=114

Training/Orien tation	FT		PDD		BT		CFET		PALM		PTTIM		ΣF & %
	F	%	F	%	F	%	F	%	F	%	F	%	
Yes (received training for manual environment)	3	10.0	6	30.0	5	20.0	4	19.0	1	7.1	1	25.0	20 (17.5)
No (not received training for manual environment)	27	90.0	14	90.0	20	80.0	17	81.0	13	92.9	2	50.0	93 (81.6)
Yes (received training for web resources)	5	16.7	8	40.0	8	32.0	5	23.8	0	0	2	50.0	28 (24.6)

| No (not received training for web resources) | 25 | 83.3 | 12 | 30.0 | 7 | 68.0 | 16 | 76.2 | 14 | 100.0 | 1 | 25.0 | 75 (65.8) |

Training/orientation received (manual environment)

The respondents revealed the trainings they received related to searching in a manual environment. Fifteen (13.2%) of the respondents received formal training/orientation in indexing (the highest). Circulation was ranked second with eleven (9.6%) of the respondents indicating it. Seven (6.1%) of the respondents received formal training/orientation in classification/cataloguing (the lowest). The detailed analysis is shown in Table 7.

Table 7: Training/orientation received by respondents (manual environment) N=114

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

* Multiple responses received

Training/orientation received (electronic environment)

The respondents indicated the training/orientation they received related to searching electronic resources. Twenty-five (21.9%) of the respondents received training/orientation in searching databases (the highest). This was followed by use of search engines (24; 21.1%) and then advanced searching (19; 16.7%). Ten (8.8%) of the respondents received training/orientation in determination of web information reliability (the lowest). The detailed analysis is shown in Table 8.

Table 8: Training/orientation received by researchers (electronic resources) N=114

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

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

* Multiple responses received

Discussion

Wilson (1981, 1997), based on the context of information need (person, social role and environment) pinpointed personal, interpersonal and environmental barriers as factors affecting information seeking and suggested that analysis be made on an expansive and all-inclusive view of information user. This study has highlighted the factors and challenges affecting the information-seeking behavior of science and technology researchers from a non-academic point of view (investigating researchers of a federal research institution) as they utilize library resources.

The results of this study showed that the lack of recent books is a major factor faced by researchers in accessing information (Table 2). Little wonder the attraction of the researchers towards the characteristic of trustworthiness (up datedness) of information (the need for current books) in their quest to obtain information and the lack of it (Table 3). Azadeh and Ghasemi (2016) observed that with respect to information-seeking behavior of researchers, the most important goal for researchers was publishing a scientific paper. Of course, based on the finding of this study, this is related to researchers complaining about the difficulty faced in accessing information due to lack of recent books. Recent books will be needed and have to be provided by FIIRO library for researchers to get updated knowledge on scientific papers to be published.

Poor infrastructure of the library is another factor affecting access to information and invariably determining researchers' information-seeking behavior. It pointed to the lack of adequate supply of electricity as well as information communication facility such as internet. This concurs with Table 5 in which researchers indicated electrical power stability problem as a challenge to accessing electronic resources. Thus, this affected the information-seeking behavior of researchers. The lack of electrical power stability discouraged searching web resources because it affected internet connectivity in terms of timeliness and brought about extra cost. Since researchers might resort to spending their money to get internet connection by means of internet modems or cybercafés. This concurs with Eke, Omekwu and Agbo (2014) and Obioha (2005) who cited unstable power supply as a problem encountered while searching web resources.

Poor infrastructure, poor library environment and surprisingly library staff were indicated as highly ranked factors that negatively affect information access thus affecting information-seeking behavior of researchers. Clearly, these showed that the institute's management and library staff have a lot of work to do towards having researchers' information needs attended to. The findings concur with the works of Perley et al. (2007), Kamba (2008) and Ugah (2007) that cited lack of awareness of available library services, poor arrangement of a full range of library collection and resources, inconvenient library opening and closing hours, inconvenient physical location of library premises, inadequate library collections, high cost of international journals and books, poor infrastructure/environment and poor funding as major challenges affecting accessibility of information in research libraries.

Table 3 showed that the need to get concrete and trusted information for laudable research works from the perspective of information-carrier characteristics has exerted considerable pressure on the researchers. Ninety six (84.2%) of the researchers revealed the factor of trustworthiness as a major factor influencing their information-seeking behavior. In addition, accessibility which is also an information-carrier characteristic was also ranked second with 93 (81.6%) of the researchers indicating so. In agreement with the findings stated in this study, Anderson et al. (2001) pronounced that despite differences in measures used and characteristics studied, the literature provides evidence of two competing carrier characteristics that influence information behavior, that is, accessibility and quality in the form of trusted sources (trustworthiness). Essentially, the revelation of the key factors of trusted information sources and access to the sources are indisputable as they are important in shaping information-seeking behaviors of science and technology researchers.

Table 4 implied that basic functions of the library such as circulation and issuing were not well understood by the researchers and not adequately attended to by information specialist (librarians). This meant that researchers were not well assisted at the circulation desk, there was poor communication between the researchers and librarians, materials were not properly shelved and librarians were not resolving issues that had to do with researchers' queries. This finding concurs with Uganneya, Ape and Ugbagir (2012) who indicated that researchers indicated poor shelf management of books and library staff unresponsiveness which invariably affected circulation and issuing in research libraries. This also concurs with findings of this study that 93 (81.6%) of the researchers indicated that they had not received any formal training/orientation in

searching in manual environment (Table 6) and just 11 (9.6%) of the researchers receiving formal training/orientation in circulation (Table 7).

Tables 7 and 8 showed that trainings/orientations for manual environment searching and for electronic resources searching were poor at the institute. Given that the library had no internet access, it could be possible that the probability of introducing training would be minimal for electronic resources. The implication of this is that researchers would have problems with fundamentals relating to searching for information in the manual and web environment. This explains the reason why researchers had challenges with circulation and issuing (for manual environment) and researchers having challenges with web navigation (for electronic environment).

Table 7 showed that the researchers were poorly trained and they would need an appreciation or orientation program of the catalogue and classification system of the library and how to locate resources on the shelves. This concurs with results obtained for the major challenges researchers had when searching in manual environment. This finding gives credence to Okonoko, Njideka and Mazah (2015) who indicated that the majority of researchers complained of inadequate knowledge of the use of catalogue hindering their search for information.

Table 8 emphasized the fact that the researchers were poorly trained. This concurs with 48 (42.1%) of the researchers citing reliability of e-resources as a challenge in searching electronic resources, that is, researchers unable to ascertain how reliable electronic sources are. This corroborates with Nel (2015) who indicated that researchers need thorough knowledge in information searching involving knowledge about tools to search for information, database/literature searches, access to resources (e-collections and document delivery) and knowledge about resources (to know which sources to access to obtain the latest or relevant information – web information reliability). The finding of this study also agrees with Wilson (1999) who pinpointed the factor of proper training for researchers when he cited that researchers of varying disciplines expressed dissatisfaction with their own capacity to search relevant information sources with them having difficulty in determining the appropriate keywords and also not bothering to explore the advanced search capability of the existing system.

Generally, this paper has shown that many factors were found to affect the specific information-seeking behaviors of science and technology researchers, including financial, social, psychological, economic, and environmental factors. Of the factors having an effect, materials up

datedness (recent books) and trustworthiness of materials were the most important determinants of information-seeking behavior which might be due to the research setting of the study. Also, the findings in this study have shown variations along discipline line with respect to information-seeking factors with these differences not being consistent across information behaviors. Consequently, it was difficult to recommend different support strategies based on department groupings or department types. This assertion concurs with a number of studies such as Wilson (1981), Sharifabadi (1996), Wilson (1997), Heinström (2003) and Wilson (2006) that showed that discipline is not the most important factor that affects information-seeking behavior.

Conclusion

Our empirical study of 114 science and technology researchers of FIIRO suggests that the lack of internet connectivity at the institute and its library will negatively affect the way researchers behave when they seek research information. The researchers did not have confidence in the institute's library and this will hamper research works with researchers not having access to electronic resources as they search for research information. This will slow down industrialization process in Nigeria when there are no tools to carry out research to produce excellent research results to translate to positive economic changes. Other factors and challenges such as trustworthiness of information sources, formal training/orientation of researchers with respect to searching for information in a manual environment and searching for web resources, provision of recent books (up datedness factor), proper shelf management of the library, library staff responsiveness and electrical power stability must also be urgently attended to. The attendance to these factors will make researchers to exhibit good information-seeking behavior.

Recommendation

Based on the findings of the study, the following recommendations are made:

    a. The resurgence of the institute's internet connection and other ICTs in order to enhance access to research information as researchers seek for research information.

    b. An information audit should be carried out to ascertain the current state of the institute and the institute's library in order to make adequate provision for the paucity of research materials from which research information can be obtained from.

    c. The institute should utilize alternative sources of power supply (solar, generators) so that access to e-resources is guaranteed.

d. In addition, it is further recommended that for researchers to maximize their use of library resources when provided, library resources must be accessible via FIIRO website and departmental websites.

e. The use of library services may be increased by cultivating relationships with key departmental administrative personnel with the aim of improving communication with researchers in the hopes of meeting their information needs.

f. Finally, FIIRO library should urgently move to seek partnerships with other academic (higher institutions) and research libraries and other organizations in the information and technology fields (both home and abroad) with the aim of getting information assistance, trainings and funds from such collaborations.

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