

Use of Digital Resources by Scientists: A quantitative survey

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Abstract

This study investigates the awareness, use, perceived research benefits and challenges of digital resources among scientists of the Pakistan Council of Scientific and Industrial Research (PCSIR), and examines whether gender, age and education shape these patterns. A quantitative survey design was adopted. A structured questionnaire was administered to scientists, engineers and technologists of PCSIR, Lahore. The sample size of 246 was determined through Krejcie and Morgan's (1970) table from a population of 681, and 202 usable responses were received (response rate 82.1%). Data were analysed using descriptive statistics, the independent samples t-test and Pearson correlation. Respondents reported moderate-to-high awareness of digital resources, highest for electronic theses and dissertations ($M = 4.02$) and lowest for online databases ($M = 3.59$). Use was high: scientists relied more on digital than printed materials ($M = 4.50$) and regarded PCSIR's digital resources as meeting their research needs ($M = 4.47$). Saving time in literature reviews ($M = 4.36$) and faster research through online journals ($M = 4.35$) were the leading benefits, whereas low internet connectivity ($M = 4.45$), restricted access to certain databases ($M = 4.30$) and difficulty locating information in repositories ($M = 4.28$) were the major challenges. Male scientists perceived significantly greater benefits ($p = .012$) and greater challenges ($p = .001$) than female scientists. Age correlated positively with awareness, perceived benefits and library visits, whereas education showed no significant relationship with any variable. The results call for improved network infrastructure, wider and more stable database subscriptions, better discovery tools for institutional repositories, and structured, discipline-specific digital literacy training for scientists at PCSIR and comparable research organizations. Most studies on electronic resource use in Pakistan concern university students and faculty. This study provides empirical evidence from a national scientific and industrial research organization, a population that has received little attention in the literature.

Keywords: Digital resources; Electronic resources; Scientists; Research organizations; Information use; PCSIR; Pakistan

Introduction

Access to timely and authentic information is fundamental to scientific research. Over the past two decades, the information environment of scientists has changed profoundly as printed journals, books and indexes have been supplemented, and in many cases replaced, by electronic journals, e-books, bibliographic and full-text databases, citation indexes, electronic theses and institutional repositories (Tenopir, 2003). These digital resources allow scientists to search large volumes of literature quickly, read the latest research as soon as it is published and access information beyond the walls of the physical library (Tenopir et al., 2009; Vakkari, 2008). Consequently, the effective use of digital resources has become closely linked to research productivity, the quality of research outputs and the ability of research organizations to remain competitive.

The benefits of digital resources, however, depend on whether users are aware of what is available, have the skills to use it and work in an environment that supports access. This phenomenon of inadequate use of electronic resources has been demonstrated in various ways in subsequent studies conducted in developing countries such as Africa (Ani and Ahiauzu, 2008; Kinengyere, 2007; Okello-Obura and Magara, 2008) where it is found that low awareness, inadequate information literacy, poor internet connectivity, and limited database access is limiting the electronic resources. In Pakistan, the study by Rafiq & Ameen (2013) shows that the Higher Education Commission (HEC) have put in place an initiative for developing a National Digital Library which has greatly helped the access to scholarly content, however, low digital literacy and infrastructure issues continue to constrain the use of the library (Ameen & Gorman, 2009).

Pakistan Council of Scientific and Industrial Research (PCSIR) was started in 1953 and it is leading organization in the field of applied science and industrial research in the country. It's any scientists, engineers & technologists conduct research in its laboratories which is useful for industry, product development & Technical services all over Pakistan. Their work demands up-to-date information and knowledge from scientific journals, patents, standards and technical data, which are often readily available only digitally. It is, therefore important to know how PCSIR scientists become aware of digital resources, use and benefit from them and what problems confront them in the process of doing so, in planning the library services, and allocation of library resources in strengthening the research character of this institution.

The research on university's E-resource utilization is done by scientists and researchers in various universities and few research and development organizations found, but comparatively little attention was given to scientists working in government research and development centers, especially Pakistan. In addition, the extent to which demographic factors (gender, age and education) affect scientists' access to digital resources is not yet clear since previous studies have provided conflicting results (Hargittai & Shafer, 2006; Rowlands et al., 2008). This study aims to partially fill this void by furnishing some empirical findings of the PCSIR scientists.

1.1 Objectives of study

The study is significant for several stakeholders. For PCSIR management and library professionals, it identifies gaps in awareness, access and training that can guide collection development, infrastructure investment and user education programmes. For policymakers in the Ministry of Science and Technology and the Higher Education Commission, it provides evidence for extending digital library access and support to government research organizations. For researchers in library and information science, it adds to the limited literature on the information behaviour of scientists in non-academic research settings in Pakistan and other developing countries. This study was carried out to answer the following questions:

1. To know the awareness and use of Digital resources amongst PCSIR Scientists.
2. To examine the benefits of digital resources as perceived by scientists.
3. To describe the difficulties of scientists in the use of digital resources.
4. To explore the influences of gender, age and education on digital resource awareness, use, benefits and challenges.

2. Literature Review

2.1 Digital resources and scientific research

Digital resources, including electronic journals, e-books, bibliographic and full-text databases, citation indexes, electronic theses and institutional repositories, have reshaped the way scientists seek, read and use information. Tenopir (2003), in a synthesis of more than 200 user studies, concluded that electronic resources had become central to scholarly work, particularly in the sciences, and that their adoption was driven by convenience, speed and around-the-clock access. Later longitudinal work showed that scientists were reading more articles from a wider range of journals, and that the share of reading drawn from library-provided electronic collections had grown substantially (Tenopir et al., 2009). Nicholas et al. (2006) found, through deep log analysis, that users of digital scholarly journals engaged in rapid, high-volume “bouncing” and “power browsing” rather than sustained reading, indicating a fundamental shift in information behaviour. Wilson’s (1999) model of information behaviour provides a useful lens for these changes, since it frames information use as shaped by personal, environmental and resource-related intervening variables, the same variables explored in the present study.

2.2 Awareness of digital resources

Awareness is a precondition for use. Asemi and Riyahiniya (2007) reported that awareness of digital resources among users of Isfahan University of Medical Sciences libraries was uneven and that low awareness of specific databases was a major reason for their under-use. Similarly, Ali (2005) observed that users of the IIT Delhi library were familiar with a limited set of resources and lacked awareness of many subscribed databases.

In Bangladesh, Ahmed (2013) found that faculty members in public universities were aware of electronic resources in general but had limited knowledge of the full range available through national consortia. Kinengyere (2007) demonstrated that inadequate information literacy, rather than mere absence of content, explained the low utilisation of electronic resources in Ugandan academic and research institutions. These studies suggest that awareness tends to be highest for resources that users encounter routinely and lowest for specialised databases that require deliberate searching.

2.3 Patterns of use

Reliance on e-sources has been reported to be increasing across all settings. Likewise, Dutch researchers, especially from the sciences, were mostly working in electronic journals, and visiting the physical library not that often, according to Voorbij and Ongerling (2006). According to Kumar and Kumar (2010), the students from India used e-resources and the internet a good deal for their research, with e-journals and search engine being the ones being used to the maximum extent.

Madhusuddan (2010) reported that during the study, the research scholars used the electronic resources extensively while doing their research, however, while using the free web resources more than subscribed databases for keeping themselves updated. However, Rowlands et al (2008) warned that there is no evidence that heavy use equates to skilled use, as many researchers employed a simple search strategy and did not spend much time assessing the information.

2.4 Perceived benefits for research.

Digital resources have been associated with a few advantages for research in literature. Vakkari (2008) revealed that Finnish academics felt online resources would enable them to access relevant literature, save time, consult with a wider range of resources and increase their publication rate. A few online journals boost the amount of material read by academics and provide access to a wider range of content and help them keep the up to date in their areas of interest (Ollé and Borrego 2010).

Other users, such as Dadzie (2005) and Okello-Obura and Magara (2008), also found that users appreciated the use of electronic resources for the provision of up to date information and faster retrieval as compared to print collections, and for wider coverage. In terms of the Technology Acceptance Model, such perceived usefulness is a key determinant of sustained use of information technology (Davis, 1989).

2.5 Challenges in using digital resources

Despite these benefits, users in developing countries face persistent barriers. Ani and Ahiauzu (2008) identified inadequate funding, poor ICT infrastructure, erratic power supply and limited bandwidth as major obstacles to the development and use of electronic resources in Nigerian university libraries. Okello-Obura and Magara (2008) reported that slow internet, limited computers and lack of searching skills hindered access among Ugandan students.

Ahmed (2013) found that slow download speeds, limited access to full text and lack of training were the main problems faced by Bangladeshi faculty. In Pakistan, Ameen and Gorman (2009) argued that weak information and digital literacy is a significant barrier to development, and Rafiq and Ameen (2013) highlighted infrastructural, financial and skill-related constraints affecting digital initiatives in university libraries.

2.6 Impact of demographic factors on the use of digital resources

Research on demographic influences shows mixed results. Hargittai and Shafer (2006) found that men and women did not differ substantially in actual online skills, although women tended to rate their own abilities lower. Prensky (2001) proposed that younger “digital natives” would be more adept with digital technologies; yet Rowlands et al. (2008) found little evidence that younger researchers were more competent information seekers than older ones. Several studies report that experience and academic rank are associated with greater awareness and more targeted use of electronic resources (Kumar & Kumar, 2010; Tenopir et al., 2009). The relationship of gender, age and education with digital resource use therefore remains an open empirical question, especially in non-academic research settings.

2.7 The Pakistani context and research gap

In Pakistan, access to scholarly digital resources has expanded considerably through the Higher Education Commission's National Digital Library programme, institutional repositories and digitisation initiatives (Rafiq & Ameen, 2013). Studies of information-seeking behaviour among Pakistani faculty members have shown growing reliance on electronic sources alongside continuing infrastructural problems (Bhatti, 2009). Yet the existing Pakistani literature focuses mainly on universities, students and faculty. Scientists working in government research and development organizations such as PCSIR, whose work is applied, laboratory-based and closely linked to industrial development, have received little attention. The present study addresses this gap by examining the awareness, use, perceived benefits and challenges of digital resources among PCSIR scientists, and the influence of gender, age and education on these variables.

3. Research Methodology

The goals of this study were accomplished through the use of a quantitative research approach. Saunders (2009), quantitative methods enable numerical analysis of data using descriptive and inferential statistics. It is based on a survey, which gives researchers insight into human behavior within a particular community by allowing them to comprehend the correlations between factors. Powell (2006) emphasized that the survey approach is the most effective and appropriate approach for librarianship. The survey research approach was used in this study. According to a review of related literature, several earlier studies by Rambabu and Nagaraju (2015) effectively employed the survey method and quantitative research approach to achieve their goals.

The target population is the employees of the Pakistan Council for Scientific and Industrial Research (PCSIR), where the total number of employees is around 681, consisting of scientists, engineers and technologists working in several laboratories. PCSIR was established in 1953 with the objective of advancing scientific research and fostering industrial development within Pakistan. As a governmental organization, PCSIR plays a pivotal role in promoting innovation, supporting applied research, and providing technical assistance to various sectors, thereby contributing to the country's economic growth and technological progress. This population was deemed appropriate because PCSIR is a leading scientific and industrial research organization in Pakistan, and its employees actively contribute to applied and industrial research. Krejcie and Morgan (1970) formula was applied to determine the sample size. Based on the population of $N = 681$, the formula recommended a sample size of 246 respondents, which ensures both statistical validity and efficiency. The convenience sampling technique is used to reach the respondents.

Final questionnaire was distributed amongst the PCSIR scientists and faculty members as the initial step in the data collection process. The scientists and faculty were also periodically contacted to collect the completed questionnaires. As was already mentioned, PCSIR had 681 faculty members and scientists. At the initial stage the researcher visit the PCSIR Laboratory, Lahore to collect the data from the scientists. For follow up the researcher reached out to the participants via WhatsApp, email, and other social media. The data analysis technique is the technique used to scrutinize the data extracted to draw conclusions and support decision-making. The researchers used descriptive and inferential statistics for the analysis of data.

4. Results

4.1 Demographic Information of respondents

Males constitute a slight majority, with 108 individuals representing 53.5% of the sample, whereas females account for 94 respondents, corresponding to 46.5%. This distribution reflects a near-equitable gender representation, suggesting balanced participation across genders.

Participants between the ages of 31 and 35 made up the largest group (31.7%), followed by those between the ages of 25 and 30 (25.2%) and 36 and 40 (22.8%). Respondents over 45 made up 13.9% of the sample, while those between 41 and 45 made up the smallest percentage (6.4%).

The most represented fields were biochemistry (28.2%), biotechnology (18.8%), and bimolecular science (15.8%). Analytical chemistry was the least represented specialty (11.4%), followed by microbiology and zoology (12.9% each).

Findings show that 34.2% of respondents had an M.A., M.Sc., or BS degree, 36.6% had an MS or MPhil 25.7% had a Ph.D., and 3.5% had a post-doctoral qualification. Thus, it indicates that the majority of respondents have an MS or M.Phil.

Table I: Demographic information of respondents

Variables		
Specialization	Frequency	Percentage
Biochemistry	57	28.2%
Biotechnology	38	18.8%
Bimolecular Science	32	15.8%
Microbiology	26	12.9%
Zoology	26	12.9%
Analytical Chemistry	23	11.4%
Gender	Frequency	Percentage
Male	108	53.5%
Female	94	46.5%
Age	Frequency	Percentage
31 to 35	61	31.7%
25 to 30	51	25.2%
36 to 40	46	22.8%

41 to 45	13	06.4%
More than 45	28	13.9%
Education level	Frequency	Percentage
MPhil	74	36.6%
M.A/M.Sc./BS	69	34.2%
PhD	52	25.7%
Postdoc	07	03.5%
Total	202	100%

4.2 Visits of library

The distribution of respondents by frequency of library visits is displayed in Table 2. The findings show that the most frequent visits were weekly (28.7%), followed by monthly (27.7%) and daily (26.2%). Just 3.0% of respondents said they had never visited the library, while a lower percentage (14.4%) said they visited on a quarterly basis.

Table 4.5: Visit of library

Visit of library	Frequency	Percentage
Weekly	58	28.7%
Monthly	56	27.7%
Daily	53	26.2%
Quarterly	29	14.4%
Never	06	03.0%
Total	202	100.0

4.3 Awareness of digital resources

Table 3 Indicates that the average value for the factors measuring awareness of digital resources from awareness of digital resources in theses and dissertations ($m = 4.02$, $S.D = 1.331$), and electronic journals ($m = 3.71$, $S.D = 1.468$), awareness of digital resources from electronic books ($m = 3.91$, $S.D = 1.309$), awareness of digital resources in online database form ($m = 3.59$, $S.D = 1.387$) is higher than the average value for the factor measuring awareness of digital resources in library reference databases ($m = 3.81$, $S.D = 1.296$). The average level of awareness of the digital resources available in theses and dissertations is shown to be higher than the other criteria. The analysis shows that majority of the respondents were aware about the digital resources and they utilized these resources for their research.

Table 3: Awareness of digital resources

Statements	Mean	SD
Level of Awareness regarding E Theses/Dissertation	4.02	1.331
Level of Awareness regarding E-Books	3.91	1.309
Level of Awareness Reference Databases	3.81	1.296
Level of Awareness regarding Electronic Journals	3.71	1.468
Level of Awareness regarding Online Databases	3.59	1.387

Scale: (5= extremely aware, 4: Moderately aware, 3: Somewhat aware, 2= slightly aware, 1=not aware at all)

4.4 Use of digital resources

The data shows that scientists were using digital resources in higher frequency. They always and frequently get access to electronic research indexes such as Scopus and Web of Science. They also use full text online academic journals. They particularly used the repository of PCSIR to find relevant material. These resources meet the needs of researchers. Scientists rely more on electronic resources as compared to print resources.

Table 4: Use of digital resources

Resources	Mean	SD
Use online academic journals	4.00	1/086
Access electronic research indexes (e.g., Scopus, Web of Science)	4.29	1.025
Use PCSIR institutional repository to find relevant scientific documents	4.07	1.69
The range of digital resources provided by PCSIR meets my research needs.	4.47	.915
Rely more on digital resources than printed Materials	4.50	.998

Scale: (5= Always, 4: Often, 3: Sometimes, 2= Rarely, 1=Never)

4.5 Benefits of Utilizing Digital Resources in Research

Table 4 presents the ranked mean scores and standard deviations for participants' agreement with statements on the utility of digital resources in research, derived from a 5-point Likert-type scale (1= strongly disagree; 5= strongly agree). The highest endorsement was for time savings in literature reviews ($M=4.36$, $SD=0.78$), followed closely by accelerated research via online journals ($M=4.35$, $SD=0.75$). Strong agreement also prevailed for staying current with digital journal access ($M=4.28$, $SD=0.81$) and broadening research scope ($M=4.23$, $SD=0.82$). Perceptions of enhanced data accuracy ($M=4.22$, $SD=0.87$), productivity gains ($M=4.22$, $SD=0.81$), and improved research quality ($M=4.16$, $SD=0.81$) yielded slightly lower but consistently high means. SD values (0.75–0.87) reflect low variability and broad consensus. It is determined that using digital resources saves more time than the other criteria on average while performing a literature study.

Table 5: Benefits of Utilizing Digital Resources in Research

Statements	Mean	SD
Using digital resources saves time in conducting literature review	4.36	.78
Access to online journals helps to conduct research more quickly	4.35	.75
Digital access to journals increases ability to stay up to date	4.28	.81
Digital resources expand the scope and depth of research	4.23	.82
Using online databases leads to more accurate data collection	4.22	.87
Digital resources significantly boost research productivity	4.22	.81
Access to digital databases improves the quality of research findings.	4.16	.81

Scale (5=Frequently, 4=Often, 3=Sometimes, 2=Rarely, 1=Never)

4.6 Challenges in the use of digital resources

The table 6 presents the challenges faced by scientist in the use of digital resources. Low internet connectivity, difficulty to access certain databases and difficulty to locate specific information were major challenges faced by scientists. The have less time to effectively use these resources. The lack of user friendly database is also a challenge for the scientists.

Table 6: Challenges Faced by Scientists in the use of digital resources

Challenges	Mean	SD
Low internet connectivity impedes the use of online resources	4.45	.61
Feel difficulty accessing certain academic databases	4.30	.63
Difficult to locate specific information within digital repository	4.28	.84
Lack sufficient training to effectively use the available digital	4.22	.87
Time constraints make it challenging to learn and use new digital	4.17	.87
Required literature is not downloading	3.94	1.0
Databases are not user friendly	3.91	1.0

Scale (5=Frequently, 4=Often, 3=Sometimes, 2=Rarely, 1=Never)

4.7 Impact of gender on digital resources

Independent Sample T Test was used to examine differences in the use of digital resources. Results showed significant differences for benefits of digital resources in research and challenges. Male showed higher perceived benefit and also face higher challenges.

Table 7: Impact of gender on digital resources

Challenges	Male Mean	Female Mean	SD
Awareness of digital resources	3.89	3.70	.255
Use of digital resources	4.09	4.14	.580
Benefits of digital resources in research	3.80	3.64	.012
Challenges in the use of digital resources	4.39	4.14	.001
Rely more on digital resources as compared to print resources	4.50	4.50	1.000
PCSIR digital resources meet my needs	4.44	4.51	.559
How often do you visit library	2.46	2.31	.327

4.8 Relation of education and age with digital resources

Pearson correlation was used to examine the relationship of education and age with the use of e-resources. Education has no significant relationship with the use of digital resources by scientist. Age has significant positive relationships with different variables about the use of e-resources.

Table 7: Relation of education and age with digital resources

Variables	Education		Age	
	Pearson coefficient	Sig.	Pearson coefficient	Sig.
Awareness of digital resources	.055	.440	.116*	.016
Use of digital resources	-.060	.396	-.143	.042
Benefits of digital resources in research	.106	.136	.143*	.050
Challenges in the use of digital resources	-.033	.646	.036	.614
Rely more on digital resources as compared to print resources	-.080	.256	-.124	.078
PCSIR digital resources meet my needs	.097	.167	-.043	.544
How often do you visit library	.126	.075	.307**	.000

5. Findings

The main findings of the study are summarised as follows:

1. Of the 246 scientists sampled, 202 returned usable questionnaires (82.1%). The respondents were almost evenly divided by gender (53.5% male, 46.5% female), mostly aged 25–40 years (79.7%), and largely held MPhil (36.6%) or master's/BS (34.2%) degrees; one-quarter held a PhD.
2. Library use remained regular: 54.9% of scientists visited the library weekly or daily, and only 3.0% never visited.
3. Awareness of digital resources was moderate to high. Awareness was highest for electronic theses and dissertations ($M = 4.02$) and e-books ($M = 3.91$), and lowest for electronic journals ($M = 3.71$) and online databases ($M = 3.59$).

4. Use of digital resources was high. Scientists relied more on digital than printed materials ($M = 4.50$), felt that PCSIR's digital resources met their research needs ($M = 4.47$), and frequently used research indexes such as Scopus and Web of Science ($M = 4.29$).
5. The most valued benefits were time saved in literature reviews ($M = 4.36$), faster research through online journals ($M = 4.35$) and staying up to date ($M = 4.28$). Standard deviations (0.75–0.87) indicate broad agreement among respondents.
6. The most serious challenges were low internet connectivity ($M = 4.45$), difficulty accessing certain academic databases ($M = 4.30$), difficulty locating specific information in digital repositories ($M = 4.28$) and lack of sufficient training ($M = 4.22$).
7. Gender had a significant effect on perceived benefits (male $M = 3.80$, female $M = 3.64$, $p = .012$) and on challenges (male $M = 4.39$, female $M = 4.14$, $p = .001$), but not on awareness, use, reliance on digital resources, satisfaction with PCSIR resources or frequency of library visits.
8. Age was positively and significantly correlated with awareness ($r = .116$, $p = .016$), perceived benefits ($r = .143$, $p = .050$) and frequency of library visits ($r = .307$, $p < .001$), and negatively correlated with use of digital resources ($r = -.143$, $p = .042$). Education showed no significant relationship with any variable.

6. Discussion

The study found that PCSIR scientists were generally aware of digital resources, but that awareness was uneven across resource types. Awareness was highest for electronic theses and dissertations and e-books and lowest for online databases and electronic journals. This pattern mirrors the findings of Asemi and Riyahiniya (2007) and Ali (2005), who reported that users were familiar with resources they encountered routinely but less aware of specialised databases. It is notable that, for a scientific population, awareness of e-journals and databases, the core channels of current scientific communication (Tenopir et al., 2009), was lower than awareness of theses. This may reflect the prominence of the HEC thesis repository in Pakistan, while subscribed databases are less actively promoted to scientists in research organizations.

Use of digital resources was high, and scientists relied more on digital than on print materials. This agrees with the shift from print to electronic sources reported by Voorbij and Ongerling (2006), Kumar and Kumar (2010) and Madhusudhan (2010). The high frequency of using research indexes such as Scopus and Web of Science indicates that PCSIR scientists engage with international scientific literature. At the same time, more than half of the respondents still visited the library weekly or daily, which suggests that the library remains an important physical and service space even in a digital environment, perhaps as an access point for networked resources and support.

It was very clearly felt that digital resources save time, increase research speed, maintain them up to date and widen their repertoire. The results agree with the conclusions drawn by Vakkari (2008) in her study, Electronic resources have a positive impact on access, efficiency and productivity and Ollé and Borrego (2010), who observed, in their study, that access to e-journals expands the breadth of reading for scholars. These highly positive perceptions will make digital resources at PCSIR more likely to be adopted and maintained as people are more likely to use them if the perceived usefulness is high (Davis, 1989).

Major challenges identified included infrastructural and skill related challenges. The biggest issues detected were network connectivity issues and trouble with the access to some databases and finding information in repositories. The results are similar to those reported by other developing countries which attribute it to poor bandwidth and ICT infrastructure as prime impediments (Ani & Ahiauzu, 2008; Okello-Obura & Magara, 2008; Ahmed, 2013). This includes the weak information literacy that Ameen and Gorman (2009) and Kinengyere (2007) confirmed to them will

affect the use of electronic resources. High use and critical challenges indicate that scientists are utilizing digital resources in spite of (rather than because of) supporting environment.

There was no gender difference in awareness or use, but male scientists reported significantly higher benefits and higher challenges when compared to female scientists. Male scientists might have more resources or more challenging jobs leading them to use more diverse resources and have more challenges, which explains the result. The lack of difference in awareness and use is in general agreement with Hargittai and Shafer (2006) who reported few differences in actual online skills between men and women.

Older scientists reported higher use of digital resources, higher levels of awareness, and higher levels of benefits, and more often went to the library. This somewhat challenges the assumption of the "digital natives" (Prensky, 2001) and confounds with Rowlands et al. (2008) who determined that younger researchers were not necessarily more effective users of information. As is common with older scientists, perhaps they gained more knowledge of the resources available to them (knew from experience), while the younger may have utilized open web sources more.. Education had no significant relationship with any variable, suggesting that, within PCSIR, digital resource use is a shared professional practice regardless of qualification level.

7. Implications

7.1 Practical implications

For PCSIR management and library administrators, the results point to several priorities. First, internet bandwidth and network reliability in laboratories and libraries should be upgraded, since connectivity was the most serious barrier. Second, access to key academic databases should be expanded and stabilised, including remote access and fuller use of the HEC National Digital Library. Third, the institutional repository needs better metadata, indexing and search tools so that scientists can locate specific information easily. Fourth, the library should offer regular, discipline-specific training sessions on databases, advanced searching and reference management, scheduled flexibly to accommodate scientists' time constraints. Finally, awareness campaigns for subscribed e-journals and online databases, the resources of which scientists were least aware, should be conducted through orientation sessions, newsletters and email alerts.

7.2 Policy implications

At the policy level, the Ministry of Science and Technology and the Higher Education Commission should consider extending national digital library access more fully to government research organizations, and should allocate dedicated budgets for digital infrastructure and content in research and development institutions. Library and information professionals working in special libraries should also be given continuous professional development opportunities to support scientists effectively.

7.3 Theoretical and research implications

The study extends the literature on electronic resource use from academic settings to a national scientific research organization. The finding that age was positively related to awareness and perceived benefits but negatively related to use suggests that experience and digital familiarity operate differently, and this deserves further investigation. Future studies could include several PCSIR laboratories and other research organizations, use probability sampling, and combine surveys with interviews or usage log analysis to obtain a deeper understanding of scientists' information behaviour.

8. Conclusion

The objectives of this study were to analyse the awareness, use, benefits and challenges of digital resources for scientists of PCSIR. The results indicate that researchers possess strong knowledge of digital resources, make extensive use of them and favor them over print resources. They primarily value digital resources because they save time, speed inquiries, and help stay informed with developments in their areas of interest. However, they are limited in their use due to poor internet connectivity, limited access to some databases, not knowing how to search repositories and/or a lack of training. There were significant differences in perceptions of benefits and challenges, based on gender, as well as in perceived benefits, library visits and awareness by age, but no significant differences by education. The study shows that digital resources are now a part of scientific research process in the PCSIR, but their potential benefits cannot be fully realized unless the infrastructure, access and user training is enhanced. Connectivity and accessibility to databases, discovery of PCSIR repositories and selected digital literacy programmed would improve the induction of research productivity among the scientists, which would consequently lead to a greater contribution to the development of industry and technology in Pakistan. The findings should be generalized with caution as the study has been conducted in a single PCSIR lab in Lahore and with convenience sampling.

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