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DIGITIZATION OF LIBRARY RESOURCES IN UNIVERSITY LIBRARIES OF PUNJAB, PAKISTAN: A DEVELOPING COUNTRY PERSPECTIVE

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ABSTRACT

The purpose of this study is to find out the status of digitization activities and the relationship between digitization activities and demographic variables of universities. Furthermore, types of information resources that have been digitized and level of library capability regarding digitization activities in university libraries of Punjab were also assessed, A survey research design and quantitative research approach were applied. A structured questionnaire was emailed to the heads librarians of all public sector university libraries of Punjab province recognized by Government of Punjab and the Higher Education Commission of Pakistan, and the response rate was 74 percent. The analysis showed that majority of the university libraries are engage in digitizing their information resources and the factors category, year of establishment, total number of library staff, and fund for digitization are positively link with digitization activities. I addition, theses and dissertations, rare books, and historical documents/archival materials were digitized by majority universities. Mainstream of university libraries are still "incapable" for the digitization of information resources lacking human resources, technological resources, digitization plan, policies and procedures, and fund. This study has numerous practical and theoretical contributions regarding digitization of information resources in academic libraries, especially those engaged in digitization activities, practices and strategies. The results enlighten trends in digitization activities and different factors affecting digitization practices in university libraries of Punjab. This study help library administration and university top management to pay more attention towards technology infrastructure, human resources development, fund, frame policy and procedures for digitization to create digital environment in university libraries.

Keywords: *Digitization Practices, Information Resources, University libraries, Head librarians, Punjab Provence, Pakistan*

INTRODUCTION

The rapid development of technology has dramatically transformed the information landscape, revealing new possibilities for converting and utilizing knowledge resources in multifunctional ways. The advancement and application of information and communication technologies (ICT) have revolutionized how we obtain, process, retrieve, and store information across all fields. This transformation has redefined traditional libraries into automated,

electronic, virtual, and digital libraries. In today's world, digitizing library resources is not just a technological upgrade but a strategic necessity. It expands global access, preserves valuable scholarly materials, enhances search and retrieval processes, supports collaborative research, and aligns with the evolving needs of education. As universities embrace digital transformation, digitized libraries are becoming essential to academic excellence, ensuring that the pursuit of knowledge is limitless and inclusive. Digitization also brings significant operational efficiencies. Digital repositories streamline library resource management, improve search and retrieval, and reduce the physical space required (Arlitsch & Obrien, 2013). Additionally, digitization supports modern teaching methods by integrating seamlessly with digital learning environments and e-learning platforms, enriching the educational experience (Wang, 2023).

The process involves converting traditional resources like books, manuscripts, and journals into digital formats to ensure wider access, preservation, and effective management. This involves scanning, creating metadata, and developing digital repositories to store and organize content (Alhaji, 2009). Digitization aligns with the broader goal of libraries to adapt to the digital age, ensuring cultural and scholarly resources remain accessible for future generations (Singh, 2020).

Rare documents and manuscripts are often vulnerable to theft, damage, and deterioration due to their fragility, brittleness, or other factors like termite attacks or calamities (Beagrie, 2006). Digitization mitigates these risks by preserving and making these materials accessible online, significantly increasing their visibility and accessibility to scholars worldwide. As information needs evolve, particularly for researchers and academics that require both printed and electronic resources, digitization and preservation have become essential. Libraries, archives, and other custodians must ensure long-term access to information, which is crucial for university libraries in Pakistan, as they play a central role in the country's research infrastructure.

This study will examine the status of digitization efforts in university libraries, highlighting the types of resources digitized, the libraries' digitization capabilities, and the impact of factors like university category, year of establishment, staff size, and funding on these activities. The findings will guide the development of a digitization policy and framework for university libraries, offering a roadmap for resource digitization in academic institutions. Additionally, the study's insights will benefit academic, public, and special libraries, research institutions, and library professionals interested in digitization.

Research Questions

This study addresses the following research questions:

RQ1. What is the status of digitization activities of public sector university libraries of Punjab?

RQ2. What types of information resources have been digitized by public sector university libraries in Punjab?

RQ3. What is the level of library capability regarding digitization activities?

RQ4. Are there significant mean variations between digitization activities and demographic variables among universities?

Hypothesis

H01: There is no statistically significant variation linking digitization activities and category of the university.

H02: There is no statistically significant variation linking digitization activities and year of establishment of the university.

H03: There is no statistically significant variation linking digitization activities and number of library employee.

H04: There is no statistically significant variation linking digitization activities and fund.

Literature Review

Concept of Digitization

For every industrial sector, digitization is the new buzzword. Digital business and/or digital transformation are the priorities of corporate sector today (Gartner 2018; Dutta et al, 2022; Wißotzki et al, 2021). Several digital technology

players have furthermore arisen in the digital business to suit end-users and industries' needs for digitalization (Mentsiev et al., 2020). Digitization involves converting analog objects into their digital counterparts by encoding analog content into binary code, represented as strings of 0s and 1s, allowing for computer interpretation and processing; it is the technical process of transforming analog signals into digital signals and further into binary integers (Lyytinen et al., 2016; Legner et al., 2017). Digitization is the process of turning analog materials like books, newspapers, microfilm, and videotapes into digital copies for use in libraries, archives, and museums. Digitization is the process of creating digital files from physical, analog originals using a scanner, camera, or other electronic equipment. Library digitization involves the conversion of traditional library resources, such as books, manuscripts, journals, and other materials, into digital formats to facilitate wider access, preservation, and efficient management. This transformative process leverages technology to create digital versions of physical collections, enabling users to access information remotely and engage with resources in innovative ways (Choy et al, 2016; Parent et al. 2021). The digitization concept aligns with the broader goals of libraries to adapt to the digital age, ensuring that valuable cultural and scholarly resources remain accessible to present and future generations (Saunders, 2015; Kalolo, 2019). Library digitization refers to the process of converting physical books and other library information resources such as pictures, maps, music notation, manuscript collections, and video and audio files into digital formats so they can be accessed and read online. This process typically involves scanning the pages of a book and converting the images into a digital format, such as PDF or ePub. Furthermore, digitizing library resources entails converting tangible books, documents, manuscripts, photographs, audio recordings, and other materials into digital formats. This conversion enables libraries to extend access to their collections, overcoming the constraints imposed by physical space and temporal limitations.

Digitization Status of University Libraries: International Perspective

University libraries have undergone a significant transformation, shifting from traditional repositories of physical materials to dynamic knowledge hubs in today's technological era (Duderstadt, 2009). This evolution has enabled remote access to digital content, fundamentally changing how users engage with scholarly resources. Globally, the academic community is embracing digitization initiatives, covering a diverse range of materials including books, journals, newspapers, artifacts, music, theses, and historical documents (Mat & Kolej, 2005). In the United States, prominent examples include Johns Hopkins University's digitization of sheet music from 1780 to 1960, UC Berkeley's medieval and Renaissance manuscripts, and the University of Maryland's project on children's literature (Liu, 2004). Similarly, Cleveland State University Library has extensively engaged in digitization efforts (Boock et al., 2002). In Australia, university libraries are digitizing course materials and exam papers, with initiatives like the Sydney Electronic Text and Image Service (SETIS) (Cathro, 2007). Indonesia has made notable progress in higher education digitization, evidenced by the Ganesha Digital Library Network and the Indonesian Digital Libraries Network (IDLN) (Sulistyo-Basuki, 2004). In Malaysia, 13 university libraries have digitized theses, student projects, and academic publications (Mat & Kolej, 2005). The digitization wave also reaches Africa and India, where universities are actively involved in resource digitization (Chauhan & Chopra, 2011; Alhaji, 2007; Ezeani, 2009; Emmanuel Baro et al., 2013). This global trend reflects a shared commitment among academic institutions to leverage digital technologies for enhancing the accessibility of scholarly resources.

Initiatives for Digital Transformation of Information Resources in Pakistani Libraries

Pakistan's higher education sector has experienced substantial growth, with universities and degree-awarding institutions (DAIs) increasingly focusing on research programs.

Central to this transformation is the Higher Education Commission of Pakistan (HEC), which has played a pivotal role in fostering a research-oriented environment at the postgraduate level. HEC has not only provided numerous opportunities but also offered incentives to encourage faculty participation in research activities. A significant initiative in this regard is the HEC-National Digital Library (HEC- NDL) program, which has been instrumental in enhancing research capabilities across the country.

The HEC-NDL program has significantly shaped the landscape of higher education in Pakistan. By funding the development of university libraries and establishing the National Digital Library, HEC has enabled widespread online access to a vast collection of e-journals and e-books from globally renowned publishers. Launched in 2004 as part of the International Network for the Availability of Scientific Publications, this initiative has become a cornerstone for researchers. It provides access to resources from publishers such as AAPT, ACS, AMS, AIP, IEEE Xplore, Emerald, JStor, Cambridge University Press, Elsevier, Springerlink, and others (HEC-NDL, 2023). The HEC National Digital Library now offers over 30 databases, 24,000 e-journals, and 45,000 e-books, providing researchers and academics with unparalleled access to information.

University libraries in Pakistan hold a relatively superior position compared to other sectors, benefiting from enhanced resources in terms of professionalism, finances, and knowledge. This elevated status is largely due to HEC's proactive efforts in providing grants for the development of information and communication technology (ICT)-based infrastructure in universities (Rafiq & Ameen, 2013). The positive trend is further reflected in the proliferation of library websites and the adoption of web-based Online Public Access Catalogs (OPACs) in many university libraries, demonstrating a commitment to technological advancements (Mahmood & Shafique, 2009). Despite these advancements, the digitization of Pakistan's rich manuscript collections has been slow. Although still in its early stages, there is a concerted effort by social scientific institutions to preserve Pakistan's cultural heritage by digitizing manuscripts and historical documents (Ahsan, 2009). The country currently holds approximately 0.15 million manuscripts in Sanskrit, Arabic, Persian, Urdu, Pashto, and Sindhi, with initiatives underway to digitize these invaluable resources. Libraries such as the Sindh Archives, Pakistan National Library, International Islamic University, University of Punjab, and Pashto Academy Peshawar have begun digitizing their collections, though they face challenges like limited resources, infrastructure, and expertise (Warraich & Tahira, 2010). The Punjab University Library, which houses Pakistan's largest manuscript collection with over 13,000 manuscripts, has made significant strides in digitizing its holdings. This effort includes Urdu, Arabic, Persian, and native language theses, as well as Hindi and Sanskrit texts, unlocking a vast reservoir of cultural and historical knowledge (Warraich & Tahira, 2010). The "Nuqoosh Research Centre" (NRC) and museum collection have also gained recognition, offering a unique resource for Urdu scholars worldwide and enhancing evidence-based research opportunities in Pakistan (Khan et al., 2017).

Rafiq (2011) conducted a PhD dissertation on the "prospects of digitization in university libraries of Pakistan," noting an increase in the use of web-based resources in higher education. However, only a small number of libraries actively participated in the digitization process, often in a haphazard manner due to the absence of a clear policy or plan. Rafiq et al. (2018) identified major barriers such as a lack of clear digitization plans, policies, funding, technology, and skilled human resources. Rafiq and Ameen (2014) emphasized the importance of developing and implementing comprehensive digitization guidelines and highlighted HEC's role in ensuring the sustainability and standardization of such projects in Pakistani university libraries. Additionally, Rafiq and Khan (2021) reported that LIS professionals face significant technological challenges when developing digital libraries, including selecting appropriate equipment, software, and digitization standards, applying Optical Character

Recognition (OCR), assigning metadata, and implementing measures to preserve and secure digital content.

Conclusion and Inferences

The researcher took comprehensive steps to gather relevant material on the study's objectives. The literature review concludes the following:

Various studies have addressed digitization, library projects, digital preservation, and related challenges, both conceptually and empirically. However, systematic research specifically focused on university libraries in Punjab, Pakistan, remains limited.

No comprehensive study on the digitization of library resources in Punjab's university libraries has been conducted, with only a few studies addressing digitization in Pakistan overall.

Previous studies by Rafiq and colleagues have explored the prospects, barriers, and challenges of digitization in university libraries across Pakistan, highlighting the need for further research in Punjab

Methodology and Procedure

Research Design and Method

This study used non experimental, survey research design and quantitative research approach. Utilizing a standardized questionnaire, no sampling technique used and data was collected from the entire population. The same research design and methodology were used in studies in the fields of social science, information management, and library and information science by (Pandey & Misra, 2014; Habib et al. 2022; Bahader et al. 2018; Bahader, 2022b).

Instrument Development

A thorough literature review was used to develop the survey questionnaire, which was then reviewed by specialists, refined and pilot-tested. Many of the questions of the draft questionnaire were adapted from the questionnaires that had previously been successfully employed in research conducted by Rafiq (2011), Singh (2020) respectively. On the basis of subject experts' judgments, the questionnaire's initial draft was changed many times to combine similar questions and statements together and to reduce their brevity.

Validity

The Cronbach's alpha for the overall statements on the questionnaire is 0.84, suggesting that the instrument is dependable and trustworthy for the study's implementation.

Population of the Study

This study focused on all public sector universities and degree-awarding institutes (DAIs) in Punjab Province, recognized by the Higher Education Commission (HEC) of Pakistan as of 2023. Punjab, being the most populous province, hosts the majority of the country's universities. Data was collected from the head librarians of 51 public sector universities, categorized as general (62.8%), engineering and technology (16.2%), agriculture and veterinary sciences (14%), and medical sciences (7%). Of these universities, 14% were established before 1970, 25.6% between 1971-2000,

41.9% between 2001-2010, and 18.5% between 2011-2022. Regarding library staff, 25.6% of libraries had 1-5 employees, 23.3% had 6-10, 15.7% had 11-15, 14.3% had 16-20, and 21.1% had more than 21 employees. In terms of digitization funding, 50% had no special fund, 29.5% had up to 3 million PKR, 11.4% had 3-5 million PKR, and 9.1% had more than 5 million PKR. ***Questionnaire Administration***

The instrument accompanied with cover letter was sent to all chief / in-charge / head librarians of central library of Public Sector University through e-mail, social media groups', WattsApp, and personal visits etc. In the begging the response rate was low and only few filled questionnaire were received. To speed up the data collecting cycle and assure enhanced responsiveness, the mailing was supported by telephone follow-up calls, e-mail messages, and periodical visits to non-respondent participants. As result, 43 respondents i.e. 84% of the questionnaires were returned filled, which was deemed an acceptable response rate for data analysis.

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Data Analysis

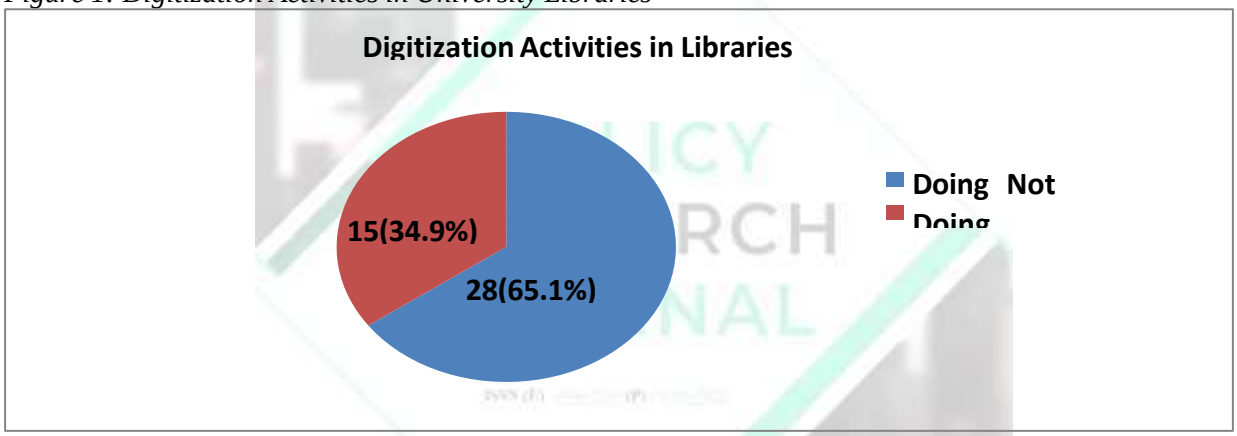
Collected data was entered in Statistical Package for Social Sciences (SPSS) version 22. Different codes and numbers were allotted to questions. Descriptive and inferential statistics were applied to derive conclusions and same tests have been utilized in similar research studies in the field (Bahader, 2023; Bahader, 2022 a; Bahader et al. 2022; Bahader et al. 2021; Bahader et al. 2020).

Results and Discussions

Status of the Digitization Activities

A majority (65.1 percent) of the public sector university libraries are currently involved in digitization activities (Figure 1). Pakistani universities are now familiar with digitization, and it seems encouraging that most of the libraries are currently engaged in such initiatives. These results are not similar to the study by Rafiq and Ameen, (2013) in which (30.9 percent) limited number of the libraries were engaged in digitization activities in Pakistan and in Nigerian as well Emmanuel et al. (2013). This study results are coherent with the studies conducted in university libraries by Boock et al. (2002) in United States, Mat and Kolej (2005) in Malaysia, Chauhan and Chopra (2011) in India, and Cathro (2007) in Australia.

Figure 1: Digitization Activities in University Libraries



Information Resources Already Digitized

The data shows in (Table1) materials and information resources that have already been digitized by the university libraries in Punjab. The materials that stood first rank wise with frequency and percentage (n=37, 86.2%) is "theses and dissertations" and align with Mat and Kolej (2005) and Alhaji (2007) results, where university libraries are actively involved in digitizing theses and dissertations. Most of the university libraries possess their own information resources in the form of theses and dissertations and develop digital databases for further use and preservation. Similarly, "rare books" with (n=25, 58.2%), "historical documents/archival materials" with (n=24, 56%), and "Journals and other serials" with (n=19, 44.2%), and "Manuscripts" with (n=17, 39.6%), coherent with studies conducted by Cathro (2007) and Liu, (2004) respectively. it means that after theses and dissertations, most of the university libraries are engaged in rare books, archival materials, journals, and other serial digitization. In addition, limited libraries are engage in digitization of "items of special value (e.g., art work, artifacts)" with (n=16, 37.3%), "maps" with (n=8, 18.7%), photographs with (n=7, 16.3%), "audio visuals" with (n=6, 14%), and "reports/ government publications" with (n=4, 9.4%). It is important to mention here that two types of information resources, "old newspapers " and "correspondence, diaries and other personal records" are not yet being practiced for digitization.

Table 1: *Descriptive Statistics about Materials Already Digitized (N=43)*

Materials Already Digitized	Frequency	Percentage
Theses and dissertations	37	86.2%
Rare books	25	58.2%
Historical documents/archival materials	24	56.0%
Journals and other serials	19	44.2%
Manuscripts	17	39.6%
Items of special value (e.g., art work, artifacts)	16	37.3%
Maps	8	18.7%
Photographs	7	16.3%
Audio Visuals	6	14%
Reports/ Government publications	4	9.4%
Old Newspapers	0	0.0%
Correspondence, diaries and other personal records	0	0.0%

Library Capabilities

Table 2 show level of library capability for digitization activities and the respondents were asked about how they see the availability of staff with requisite skills and expertise for carrying out the digitization process and ranked on the top "human resources (availability of staff with needed skills and expertise) with, mean value of (3.33). Similarly, "technological resources (hardware i.e. computer, scanner, etc. and software)" and "development of digitization plan, policies and procedures" were ranked on 2nd and 3rd level with mean values (3.28) and (3.02) respectively. Availability of the financial resources was ranked on the 4th with mean value (2.70). The overall mean value of library capability is (3.08), means that majority of university libraries are still "incapable" for the digitization of information resources.

Table 2: *Descriptive statistics about Library Capability (N=43)*

Statements	Rank	Mean	SD
Human resources	1	3.33	.919
Technological resources	2	3.28	1.182
Development of digitization plan, policies and procedures	3	3.02	1.300
Financial resources (availability of fund)	4	2.70	1.264
Overall, Library Capability		**3.08**	**1.166**

Scale: *Very Incapable 1, Incapable 2, Neutral 3, Capable 4, Very Capable 5*

Hypotheses Testing

Mean variances between the values of digitization activities and selected demographic variables of institutions were evaluated using inferential statistics. The results of the null hypotheses are shown in (Table 3).

Digitization Activities and Category of the University (H01)

The results of the one-way ANOVA test (F-value of 2.41 with a level of significance .042) exhibit that the two variables have a relationship. There is a statistically significant mean variation of digitization activity with respect to category of university. Thus, H01 was rejected as a null hypothesis. Four subject groups were examined using a post hoc least significant difference (LSD) analysis which showed that digitization activities of engineering & technology were

currently doing more as compare to general category of university. While there is no mean variations exist between other groups of university category. These finding reflects that engineering & technology sector university libraries are more inclination towards digitization of their information resources. Category of university is directly and positively connected to the practice of digitization.

Digitization Activities and University Year of Establishment (H02)

The one-way ANOVA test results (F-value of 7.093 with a level of significance value .001) show that the two variables are strongly linked. There is a statistically significant mean variation in digitization activities and year of establishment of universities. Thus null hypothesis H02 is rejected. Four subject groups were examined to a post hoc LSD analysis and showed that digitization activities currently in practicing ability of university established before 1970 group were higher than that of university established between 2001-2010 and 2011-2023 years' groups. Similarly, university established between 1971-2000 group were more oriented towards digitization as compare to university established in 2001-2010 and 2011-2023 years' groups. These findings reflect that old universities are more oriented toward digitization practices in comparison of universities established after 2000. It means that year of establishment of universities is inextricably correlated to digitization activities.

Digitization Activities and Total Library Staff (H03)

The results of one-way ANOVA test (F-value of 3.820 with a level of significance value 0.038) demonstrate that the two variables have relationship. There is a statistically significant difference in digitization activities and total library employees. As a result, H03 was rejected as a null hypothesis. After conducting a post hoc LSD analysis, it was found that there were significant variances between the five groups. It means that those libraries having total employees more than 21 and 16-20, rang are in more involve in digitization in relation to number of employees up to 5, 6- 10, and 11-15 range. These results demonstrate that total number of library employees is straightforwardly and positively associated with digitization of library resources.

Digitization Activities and Fund (H04)

One-way ANOVA test results (F-value of 2.873 with a level of significance value .040) show that the two variables are positively linked. There is a statistically significant mean variation in digitization activities and fund allocated for digitization. Thus null hypothesis H04 is rejected. Four subject groups were examined to a post hoc LSD analysis and showed that digitization activities are high of those universities having fund for digitization in range PKR 3-5 million, and more than 5 million in comparison of no special fund, PKR up to 3 million fund groups. These findings show that university libraries with larger and special funds for digitization are more inclined toward digitization practices than institutions with no special funds and less than 3 million in PKR. It means that funding for digitization purposes in university libraries is closely linked to digitization initiatives and practicing.

Table 3: ***Mean Variations of Category, Year of Establishment, and Total Library Staff of the University with Digitization Activities***

Variables	Mean	Statistics	Sig.	Results
Category of the University		F=2.41	.042*	$H_0$1: Rejected
General	1.48			
Agriculture/Veterinary	1.16			
Engineering & Technology	1.00			
Medical	1.33			
Year of Establishment		F= 7.093	.001**	H02: Rejected

Before 1970 year	1.00			
1971-2000	1.00			
2001-2010	1.55			
2011-2023	1.62			
Total Number of Library Staff		F= 3.820	.038*	$H_0$3: Rejected
Up to 5	1.72			
6-10	1.70			
11-15	1.50			
16-20	1.50			
More than 21	1.12			
Fund for Digitization in PKR		F= 2.873	.040*	$H_0$4: Rejected
No Special Fund	1.82			
Up to 3 Million	1.77			
3-5 Million	1.35			
More than 5 Million	1.20			

** Significant at p < .001; * *Significant at p < .05*

Conclusions

Digitization of information resources is a significant component of academic libraries in the twenty-first century. Digitization improved accessibility by enabling remote information retrieval for researchers and students. This change makes it easier to collaborate and share knowledge, eradicating regional boundaries and fostering a worldwide academic community. Digital archives also guarantee the preservation of priceless materials, preserving academic and cultural legacy for upcoming generations.This study focused on the current status of digitization activities and how demographic variables of universities relate to digitization activities. Data was collected through questionnaire from head librarians of public sector universities in Punjab province of Pakistan. An analysis of the digitization activities current status reveals that majority of the university libraries are engage in digitizing their information resources. Theses and dissertations, rare books, and historical documents/archival materials were digitized by majority universities. Majority of university libraries are still "incapable" for the digitization of information resources lacking human resources, technological resources, digitization plan, policies and procedures, and fund. A mean variation of digitization activities was verified in this study with university category, year of establishment, total library employees, fund and gender for digitization. All the demographic variables of the university are directly and positively associated with the digitization practices and activities.

Implications, Limitations and Recommendations

Digitization is a relatively new phenomenon in Pakistani libraries that is growing in popularity and significance. This study provides guideline for development of digitation policy framework at universities libraries. It also motivates top management of universities to provide sufficient fund, trained library staff, and technological resources for digitization practices. These findings might capture the interests of other scholars to conduct more detailed study at other libraries in Pakistan as well as in other developing countries. The study will also make a significant contribution to existing knowledge as there were a few studies which addressed the subject.

Some limitations should be considered when analyzing the results of this study. This study covered the whole population, and no sample techniques were used. This study covered only a public sector and does not covered private sector university libraries, university departmental or institutional libraries, and public libraries in the Punjab province of Pakistan. The opinions of the head/in-charge librarians were taken into account while the views of other stakeholders including university top management, other

library professionals, users, and library Para staff were not included. This study addressed the status of the digitization activities and materials that have been already digitized but the detailed practical aspect was ignored. The generalization of the results is limited to public-sector university libraries in Punjab and cannot be extended without further confirmation to other markets.

Head/in-charge librarians of university must adopt a proactive strategy to spread awareness among diverse stakeholders, including university top management, library staff, and users regarding the importance of digitization of resources. University libraries should improve their preparedness for digitization programmes. They should improve their technology infrastructure, develop human resources, get fund, frame policy and create strategies and procedures for digitization. Training of digitization practical aspects should be conducted for the employee of academic libraries. University top management must cooperate and provide sufficient budget for the digitization activities. It was suggested that Library Schools provide mandatory courses and specializations in digital librarianship by providing practical training for librarians in establishing and administering digital libraries.

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