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Digital Transformation in Libraries: Readiness of Pakistani University Librarians for AR, VR, and Metaverse

Muhammad Kabir Khan[1,*], Rizwana Amin[2], Adnan Ullah[3], Nusrat Ali[4]

[1,2]Department of Effat Library and Cultural Museum, Effat University (EU), Jeddah, Makkah Region, Saudi Arabia.
[3]Department of Information Services, Riphah International University, Islamabad, Pakistan.
[4]Department of Information Management, The Islamia University of Bahawalpur, Bahawalpur, Punjab, Pakistan.
mkabir@effatuniversity.edu.sa[1], rizwana.buic@bahria.edu.pk[2], adnandani2015@gmail.com[3], nusrat.ali@gcwus.edu.pk[4]

*Corresponding author

Abstract: This study examines Pakistani university librarians' readiness for Augmented Reality (AR), Virtual Reality (VR), and the Metaverse, focusing on their awareness, competence, interest, and perceptions of these emerging technologies in Library and Information Services. Using a quantitative survey design, this study collected data from 96 Pakistani university librarians via a validated questionnaire distributed via email, LinkedIn, and WhatsApp. The survey encompassed demographic information, an assessment of awareness and competence in AR, VR, and the Metaverse, and an exploration of interest and engagement with these emerging technologies in Library Science. The surveyed librarians showcase diverse demographics, with a majority of male respondents (61.5%), a significant representation of experienced professionals (43.8% with over 15 years of experience), and a highly educated sample (100% with at least a master's degree). The findings of this study suggest that Pakistani university librarians are generally aware of AR, VR, and the metaverse but have limited practical experience with these technologies. Moreover, most respondents expressed a strong interest in learning more about emerging technologies and exploring their potential applications in library and information science.

Keywords: Augmented Reality; University Librarians; Practical Experience; Virtual Reality; Metaverse Technology; Digital Transformation; Emerging Technology; Information Services.

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1. Introduction

In the digital age, libraries are undergoing a transformative shift. Augmented reality (AR), virtual reality (VR), and the Metaverse are emerging technologies that have the potential to revolutionise library services. In contemporary tech-driven society, libraries serve as vital hubs for understanding the Metaverse, enabling people to interact with, perceive, and contribute to digital worlds. This study explores library professionals' awareness, competence, and interest in these technologies and examines their implications for the Library and Information Science (LIS) field. The traditional role of libraries has evolved from quiet spaces for solitary reading to dynamic digital information hubs, where knowledge is preserved, enriched, and interactively disseminated [11]. AR, VR, and the Metaverse represent new frontiers that hold the potential to augment and

revolutionise the library experience, transforming how information is accessed, shared, and understood. As these technologies become increasingly accessible and integral to modern society, library professionals must be well-versed in their applications and possibilities. The significance of these emerging technologies lies in their potential to revolutionise how libraries operate and the services they provide. They offer the means to transcend physical boundaries, break down information silos, and create immersive, interactive, and personalised experiences for library users [10]. AR and VR technologies, along with the concept of the Metaverse, can make information more accessible and engaging. Patrons can explore historical archives, walk through virtual stacks, and engage in interactive educational experiences. These technologies extend libraries' reach beyond their physical locations, making information and cultural heritage more accessible to a global audience [6]. Libraries are no longer confined to quiet spaces with rows of books; they can now offer dynamic, multi-sensory learning experiences. VR can transport users to different periods or locations, and AR can overlay information on physical objects [12].

These technologies cater to diverse learning styles and support experiential learning [14]. Emerging technologies enable libraries to harness the power of data visualisation, facilitating the exploration of complex datasets and the presentation of information in more accessible and understandable ways. This enhances the ability to extract knowledge from vast amounts of data and supports decision-making. AR, VR, and the metaverse are emerging technologies that have the potential to revolutionise the library experience. AR and VR technologies can create immersive and interactive learning environments, while the metaverse can provide a new platform for social interaction and collaboration. The Metaverse is a rapidly evolving concept, with new developments constantly emerging. For example, in 2023, Meta (formerly Facebook) launched Meta Quest Pro, a high-end VR headset designed for both work and play. This is one example of technology companies investing in the Metaverse, and researchers will likely see even more innovation in this space in the coming years [8]. As the Metaverse evolves, library professionals must stay informed about the latest developments and consider how these technologies can enhance library services. In light of these considerations, it is evident that library and information professionals must remain vigilant and proactive in their approach to emerging technologies. These technologies can reshape the essence of library services, and understanding their significance is paramount to addressing patrons' evolving needs, preserving knowledge, and ensuring libraries' continued relevance in the digital age. As researchers explore library professionals' awareness, competence, and interest in these technologies, they aim to shed light on their readiness to embrace the opportunities and challenges that lie ahead.

1.1. Research Objectives

- To assess the level of awareness and competence among library professionals regarding AR, VR, and Metaverse technologies.
- To gauge the interest and engagement of library professionals in these emerging technologies and explore their willingness to embrace and leverage these innovations within the realm of library and information science.
- Identify the Metaverse's Future Role in Library and Information Services

1.2. Significance of the Study

To achieve these objectives, the study presents a comprehensive survey that targets library professionals across diverse demographics. By understanding the current state of awareness, competence, and interest, this research seeks to provide insights into the readiness of library professionals to adapt to the rapidly evolving technological landscape. Furthermore, it aims to shed light on the potential impact of these technologies on the future of library and information services. In a time when libraries must adapt to remain relevant, this study offers a timely examination of library professionals' knowledge, skills, and willingness to embrace emerging technologies, ultimately shaping the trajectory of library services in an ever-evolving digital age. This paper is structured as follows: The Literature Review provides a brief overview of the existing literature and theoretical frameworks concerning the Metaverse and emerging technologies in university library settings. The Methodology section covers the research approach, sampling techniques, survey layout, data collection, and statistical analysis methods. The next section provides a comprehensive overview and discussion of the results, and the conclusion section offers implications, suggestions, and directions for further study.

2. Literature Review

2.1. Overview of the Emerging Technologies in Library Services

A notion of the Metaverse is frequently portrayed as an integration of digital virtuality with physical reality that creates an interactive, ongoing, multiuser setting. The idea emerged to be as a consequence of the innovative efforts of two individuals: Ivan Sutherland, whose 1965 publication “The Ultimate Display” Sureephong et al. [22] described the blending of the digital and physical worlds, and Morton Heilig, who built a virtual reality machine in the 1960s Merely a few of the services that libraries have benefited from the application of AI and Machine learning to uphold information retrieval, cataloguing,

classification, collection management, abstracting and indexing. However, it could have a significant impact on library services. It supports researchers in accessing personalised information by integrating AI tools with conventional library systems, enabling them to find relevant information to meet their research needs [17]. Additionally, in Pakistan, the roots of artificial intelligence (AI) development date back to 2018, when the President's Artificial Intelligence and Computing program was launched [1]. Riedl [20] introduced the idea that AI centred around humans could be classified into two realms: (a) AI systems interpreting humans from a sociocultural standpoint and (b) AI systems aiding humans in self-comprehension [20].

American science fiction writer Neal Stephenson introduced the concept of "metaverse" within his 1992 book "Snow Crash." This piece of writing illustrates an uncertain future in which the privileged emigrate to a diverse, connected, three-dimensional reality. According to Abid et al. [1], metaverses are initially fully integrated, enduring virtual environments where individuals can interact with user-generated content. Artificial Intelligence in Education (AIEd) aims to establish a synergistic platform merging human and AI elements to enrich student learning [19]. This encompasses the fusion of AI, human-computer interaction, and insights derived from the learning sciences [24]. The construction and assessment of these tools prioritise their adaptability and collaborative nature, which are crucial in practical educational settings [3]; [13]. Devagiri et al. [7] studied Augmented Reality and Artificial Intelligence in industry, analysing trends, tools, and forthcoming challenges. Their perspective aligns with the notion that AIEd aims to establish a unified platform that merges human and AI facets to augment student learning. This integration involves incorporating AI, human-computer interaction, and insights from the learning sciences. These tools are developed and evaluated with a comprehensive understanding of the collaborative and adaptive dynamics that are imperative in real-world educational contexts.

2.2. Augmented and Virtual Reality Willingness to Embrace and Leverage Innovations

In the digital era, AR and VR have a significant role in smart libraries. Consequently, in the era of technology, embracing it is unavoidable [18]. The emergence of cutting-edge technologies such as AR, VR, and others has given digital libraries a new perspective. By providing innovative and creative services for information access and learning support, these technologies have the potential to transform how digital libraries interact with their communities entirely. In a recent study led by Adeyemi et al. [2], a suggestion was put forward for public libraries to embrace cutting-edge AR applications more enthusiastically. The goal is to streamline access to users' information needs and enhance the overall patron experience. The findings revealed a positive reception among users towards both VR and AR. Additionally, the research underscored the significant influence of subjective norms in guiding library users to adopt VR and AR technologies. It emphasised the importance of collaborative efforts between users and librarians to leverage these immersive technologies effectively. Several studies consistently demonstrate that AR-based learning surpasses traditional methods, revolutionising user interactions across print, digital, and other media. This inquiry was conducted across seven libraries in Washington State, marking the initial integration of VR for drop-in programming.

The study compared users' perceptions of VR with their actual experiences, delving into informal learning and the social interactions facilitated by VR, and embedded its analysis within the framework of sociotechnical imaginaries – culturally embedded concepts elucidating the interplay between society and technology. Liu et al. [16] contributed significantly to the discussion. Another framework was devised to explore the implementation of AR in libraries associated with medical science universities. The objective was to introduce the applications, advantages, opportunities, and challenges of AR. Identified challenges encompassed technical, economic, and cultural dimensions. Strategies to engage a diverse user base included effective policies, technological integration, and enriching content. AR emerged as a valuable tool for library management, significantly enhancing the professional activities of both librarians and users [6]. Eneh et al. [15] describe AR as an advanced technology that melds aspects of the physical, tangible environment with computer-generated imagery, enabling user interaction with virtual objects. Whether two- or three-dimensional, these objects seamlessly integrate into their surroundings. Sumadio and Rambli [21] demonstrated that AR can create a "natural" experience, amplifying teaching effectiveness, enhancing students' allure to learning, and increasing attention and motivation.

2.3. Metaverse Technologies Interest, Engagement, and Future Role in Library Services

Metaverse technologies are transforming the concept of smart libraries by offering users increasingly vibrant and immersive educational experiences and new ways to engage with knowledge resources [5]. However, Sureephong et al. [22] suggested that Libraries and librarians must adapt and evolve the skills required as the metaverse unfolds, so they can continue to provide their communities with valuable resources and services in digital environments. The concept of the metaverse traces back to Neal Stephenson's 1992 science fiction novel, Snow Crash, where it was introduced as a separate virtual realm accessible through devices such as head-mounted VR glasses. Stephenson is acknowledged as a pioneer in conceptualising the metaverse in the field of computer communication [6]. As this metaverse continues evolving, libraries and librarians must adapt to remain relevant and provide valuable resources and services to their communities. Research emphasises the potential role of libraries as crucial information hubs and community spaces within the metaverse. However, navigating this digital landscape effectively

requires librarians and users to develop meta-literacy skills. These skills encompass critical thinking, digital citizenship, and ethical information use, essential for success in this digital age.

While keeping up with rapid technological changes poses challenges, continuous training and support can help digital librarians and users stay abreast of these changes. Adapting to the evolving metaverse landscape remains pivotal for libraries and librarians to sustain their relevance and offer essential resources and services. The Metaverse holds vast promise across education, entertainment, commerce, and social interaction. In education, it provides students with an immersive learning environment that enriches their educational experience. Moreover, social interaction offers novel ways to socialise, foster interpersonal communication, and disseminate information. Anna et al. [5] conclude that metaverse libraries are still in their nascent stages of development. Existing ones primarily exist in the paper, experimentation, and prototype phases. Some host communities leverage the metaverse for assembly, creation, innovation, and collaboration. Collaborations with virtual world platform providers are crucial in expediting the development of metaverse libraries. Exploring topics such as libraries' readiness to embrace the metaverse, librarians' understanding of this realm, and the skills and competencies required are intriguing avenues for future discussion.

3. Research Methodology

This study employs a quantitative survey research design to assess Pakistani University Librarians' awareness, competence, and interest in emerging technologies, specifically AR, VR, and the Metaverse. The population of interest consists of Pakistani University Librarians. A list of 150 potential respondents' email addresses was compiled from various sources, including staff directories, previous publications, and LinkedIn. Out of these 150 librarians, researchers received 96 valid responses. The survey questionnaire consists of three sections: Demographic Information, Library Professionals' Awareness and Competence in AR, VR, and Metaverse Technologies, and Interest and Engagement with Emerging Technologies in Library Science:

- **Demographic Information:** In this section, respondents were asked to provide information regarding their gender, age group, highest level of education completed, and years of experience in library and information services.
- **Library Professionals' Awareness and Competence:** This section assesses respondents' awareness and competence in AR, VR, and the Metaverse. Respondents were asked to rate their level of awareness and proficiency on a scale from “Strongly Disagree” to “Strongly Agree”.
- **Interest and Engagement with Emerging Technologies:** This section explores the librarians' interest in various aspects of emerging technologies in the context of Library and Information Science. Respondents were asked to rate their interest levels from “Not interested at all” to “Extremely interested”.
- **Pilot Testing:** Before conducting the main survey, a pilot test was conducted with 10 library professionals. This pilot test aimed to identify any ambiguities or issues in the survey questionnaire. The questionnaire was refined based on the feedback received from the pilot test. Unwanted questions were removed or clarified to ensure the instrument's validity and reliability.
- **Data Collection:** Data collection took place from September 2023 to October 2023. A validated survey questionnaire was administered through Google Forms, and the link was distributed to the selected respondents via email, LinkedIn, and WhatsApp.
- **Data Analysis:** Quantitative data collected from survey responses were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean and standard deviation, were calculated to summarise and interpret the data. The analysis also included calculating percentages and frequencies to provide a comprehensive overview of the responses.

4. Result

4.1. Demographic and Educational Profile of Respondents

The results of Figure 1 reveal several key insights about the surveyed population. Firstly, the gender distribution shows a majority of male respondents (61.5%) and a significant female representation (38.5%). The age distribution is diverse, with a concentration in the 35-44 age group (37.5%). Most respondents hold advanced degrees, with the Master of Philosophy degree being the most common (39.6%), followed by Doctoral (31.3%) and Master's degrees (29.2%). In terms of professional experience, a considerable portion of respondents (43.8%) have more than 15 years of experience, demonstrating a seasoned workforce. Notably, none reported a high school education or lower, underscoring the sample's highly educated nature. These findings provide valuable insights into the demographics and educational backgrounds of the respondents, which can help tailor research or initiatives to this specific group. The study's focus on a well-educated, experienced group suggests the potential for high levels of expertise and knowledge within this population.

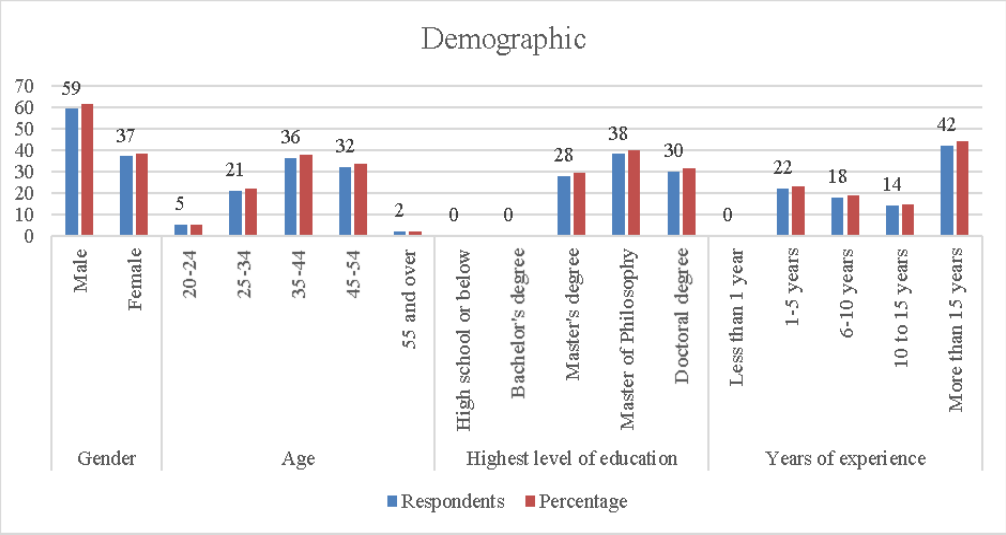

Figure 1: Demographic and educational profile of respondents

4.2. Awareness and Proficiency Levels of Library Professionals in AR, VR, and Metaverse Technologies

Table 1 [27] provides valuable insights into library professionals' awareness and proficiency in AR, VR, and Metaverse technologies.

4.2.1. Augmented Reality (AR)

Respondents demonstrated moderate awareness of AR, with a mean score of 1.72. This indicates that most library professionals have heard of AR and are aware of its existence. Additionally, the proficiency in working with AR technologies was moderately high, with a mean score of 1.89. This suggests that many respondents possess practical experience with AR. Furthermore, awareness of AR tools and platforms commonly used in the library field is relatively high, with a mean score of 1.72. This indicates that library professionals are acquainted with AR tools and platforms relevant to their profession.

4.2.2. Virtual Reality (VR)

In contrast to AR, library professionals displayed a slightly lower level of awareness about VR, with a mean score of 1.57. This implies that VR is less well-known among the surveyed professionals. However, the proficiency in working with VR technologies was relatively higher, with a mean score of 2.02. This suggests that, despite lower awareness, library professionals who are aware of VR tend to have practical experience with it. Awareness of VR tools and platforms commonly used in the library field was moderate, with a mean score of 2.08.

4.2.3. Metaverse Technologies

Respondents demonstrated some awareness of metaverse technologies, with a mean awareness score of 1.71. This indicates that library professionals have at least heard of metaverse technologies. Proficiency in metaverse technologies was moderately high, with a mean score of 1.86, suggesting practical experience among respondents. Additionally, awareness of metaverse tools and platforms commonly used in the library field was relatively high, with a mean score of 1.93.

Table 1: Awareness and proficiency levels of library professionals in AR, VR, and metaverse technologies

Library Professionals' Awareness and Competence in AR, VR, and Metaverse Technologies	Mean	SD
AR Awareness and Proficiency Levels in the Library Field		
I have never heard of AR.	1.5	0.78
I am aware of AR but have no practical experience with it.	1.30	0.73
I have some practical experience with AR.	1.96	0.85
I am proficient in working with AR technologies.	1.89	0.80
I am aware of AR tools and platforms commonly used in the library field.	1.72	0.71
VR Awareness and Proficiency Levels in the Library Field		

I have never heard of VR.	1.57	0.84
I am aware of VR but have no practical experience with it.	1.65	0.94
I have some practical experience with VR.	1.93	0.77
I am proficient in working with VR technologies.	2.02	0.81
I am aware of VR tools and platforms commonly used in the library field.	2.08	0.88
Metaverse Awareness and Proficiency Levels in the Library Field		
I have never heard of metaverse technologies.	1.36	0.81
I am aware of metaverse technologies but have no practical experience with them.	1.71	0.95
I have some practical experience with metaverse technologies.	1.79	0.79
I am proficient in working with metaverse technologies.	1.86	0.76
I am aware of metaverse tools and platforms commonly used in the library field.	1.93	0.85

The study's findings show that library professionals have varying levels of awareness and proficiency in AR, VR, and the Metaverse. While AR and Metaverse technologies exhibit higher awareness and proficiency, VR lags slightly in awareness. These findings suggest opportunities for further training and development in VR, with the potential to increase the integration of these technologies into library settings, ultimately enhancing the services and experiences provided to library patrons.

4.3. Interest and Engagement with Emerging Technologies in Library Science

Table 2 [27] reveals that library professionals are keenly interested in embracing the potential of emerging technologies, including AR, VR, and the Metaverse, within the realm of Library and Information Science. Their collective enthusiasm is evident, with a strong overall interest score of 3.70, demonstrating their eagerness to explore these technologies. Library professionals are particularly intrigued by how AR can enhance the library experience (3.86) and the potential applications of VR in educational settings (3.71). Furthermore, they are enthusiastic about integrating Metaverse technologies into library services and resources (3.88) and staying updated on the latest trends (3.96).

Table 2: Interest and engagement with emerging technologies in library science

AR, VR, and Metaverse Interest	Mean	SD
I am interested in learning more about AR, VR, and the metaverse in the context of Library and Information Science.	3.70	0.87
I am interested in exploring how AR (Augmented Reality) can enhance the library experience.	3.86	0.89
I am interested in understanding the potential applications of VR (Virtual Reality) in educational settings within Library and Information Science.	3.71	0.85
I am interested in learning how to integrate metaverse technologies into library services and resources.	3.88	0.90
I am interested in the impact of AR and VR on information retrieval and access in libraries.	3.79	0.89
I am interested in exploring the ethical considerations and challenges of using AR, VR, and the metaverse in libraries.	3.83	0.92
I am interested in discovering how AR and VR can support immersive learning experiences in library-related fields.	3.72	0.95
I am interested in the role of metaverse technologies in preserving and presenting cultural heritage and historical collections in libraries.	3.84	0.98
I am interested in staying up to date on the latest trends and developments in AR, VR, and the metaverse in Library and Information Science.	3.96	0.91
I am interested in exploring collaborative and social aspects of the metaverse within the library community.	3.91	0.93
I am interested in investigating the potential cost-effectiveness and resource allocation for implementing AR, VR, and metaverse technologies in libraries.	3.92	0.93

They also express a commitment to understanding the ethical considerations, challenges, and cost-effectiveness of implementing these technologies in libraries. This collective enthusiasm and open-mindedness underscore the library community's readiness to harness technology for advancing library services, education, and the preservation of cultural heritage. These findings reflect a considerable interest and enthusiasm among library professionals in leveraging emerging technologies to enhance library services, improve access to information, and engage with evolving trends in the field. The high levels of

interest indicate a potential for increased integration of AR, VR, and Metaverse technologies in library settings, with a focus on innovation, education, and the preservation of cultural heritage.

4.4. Perceptions of the Metaverse's Future Role in Library and Information Services

Table 3 shows that Library professionals hold diverse perceptions about the future role of the Metaverse in Library and Information Services. A substantial proportion (19.8%) believes the Metaverse will have no significant impact, while 21.9% anticipate limited applications. A larger group (44.8%) expects a moderate influence, believing that traditional services will remain essential.

Table 3: Perceptions of the metaverse's future role in library and information services

Perceptions of the Metaverse	Respondents	Percentage (N=96)
The metaverse will play no significant role.	19	19.8
The metaverse may have some limited applications.	21	21.9
The metaverse will have a moderate impact on library services.	43	44.8
The metaverse will have a significant impact, but traditional services will still be important.	47	49
The metaverse will completely transform library and information services.	38	39.6

Additionally, 49% envision the Metaverse as having a significant impact yet still coexisting with traditional services. Notably, 39.6% hold an optimistic view, believing the Metaverse will completely transform library and information services. These findings provide valuable insights into the diverse perspectives within the library professional community regarding the Metaverse's future role. While a considerable portion envisions significant change, a segment remains cautious or sceptical about its impact on traditional library services.

5. Discussion

5.1. Awareness and Proficiency Level of Pakistani University Library Professionals

The study on Pakistani university librarians' awareness and proficiency in AR, VR, and the Metaverse provides valuable insights into this professional community's readiness to embrace emerging technologies. The findings reveal moderate to high levels of awareness and proficiency among librarians, particularly in AR and the Metaverse. While AR and the Metaverse are more familiar, VR lags slightly behind, suggesting a potential area for targeted training and development initiatives [9]. The variation in awareness and proficiency levels across the three domains underscores the need for tailored interventions to enhance VR competence among library professionals. By addressing this gap, stakeholders can ensure that librarians possess the necessary skills to harness immersive technologies effectively in library settings. Additionally, the study highlights the importance of ongoing professional development efforts to keep pace with technological advancements and emerging trends in the field.

The findings also suggest that library professionals are receptive to new technologies, as evidenced by their demonstrated proficiency in AR and the Metaverse. This positive attitude towards innovation bodes well for the future of library services, as librarians are poised to leverage emerging technologies to enhance user experiences and expand access to information resources. The study's insights into awareness and proficiency levels provide a roadmap for strategic planning and capacity-building initiatives within the library profession. By addressing the identified gaps and fostering a culture of continuous learning and adaptation, stakeholders can position libraries as hubs of innovation and technological excellence, serving the evolving needs of patrons in an increasingly digital world.

5.2. Interest and Engagement of Pakistani University Library Professionals

The study of Pakistani university librarians' interest and engagement with emerging technologies in Library and Information Science offers compelling insights into the professional community's readiness to embrace innovation. The findings reveal a strong interest among librarians in exploring and leveraging emerging technologies, including AR, VR, and the Metaverse, to enhance library services and engage with patrons. Librarians express particular enthusiasm towards understanding the potential applications of AR and VR in educational settings, integrating Metaverse technologies into library services, and staying updated on the latest trends in the field. This collective eagerness to embrace new technologies reflects a progressive mindset within the library profession, underscoring librarians' commitment to innovation and continuous learning.

5.3. Perceptions of the Metaverse's Future Role in Library and Information Services

The study's findings also highlight the importance of collaboration and knowledge-sharing initiatives within the library community to foster a culture of innovation and experimentation. By providing platforms for librarians to exchange insights, best practices, and lessons learned, stakeholders can leverage collective expertise to drive technological innovation and enhance library services. Moreover, the study underscores the need for ongoing professional development to ensure librarians possess the skills and competencies to leverage emerging technologies effectively. By investing in training programs and capacity-building initiatives, stakeholders can empower librarians to harness the full potential of AR, VR, and the Metaverse to enrich library experiences and expand access to information resources.

5.4. Implications and Recommendations

The study findings have several implications for professional development and strategic planning within the library sector in Pakistan. Firstly, there is a need for targeted training programs and initiatives to enhance awareness and proficiency in VR among library professionals. Additionally, efforts should focus on fostering collaboration and knowledge sharing within the library community to facilitate the effective integration of emerging technologies into library services. Furthermore, it is essential to continue monitoring technological advancements and trends while also considering the ethical implications and challenges associated with their adoption.

5.5. Future Research Directions

Building on this study's findings, future research could explore the practical implementation of AR, VR, and the Metaverse in library settings, examining their impact on user experience, information retrieval, and educational outcomes. Additionally, longitudinal studies could track librarians' attitudes and perceptions towards emerging technologies over time, providing valuable insights into the dynamics of technological adoption within the library profession. The study's discoveries reveal moderate awareness among library professionals of AR tools and platforms, yet they demonstrate proficiency in working with these technologies. In Table 2, 18 statements were assessed to gauge awareness and proficiency in AR, VR, and Metaverse Technologies, and none of the respondents strongly disagreed or disagreed with any statements. Previous studies similarly noted a high level of awareness among respondents regarding these technologies, particularly emphasising academic librarians' preference for readily available emerging technologies [26]. On the flip side, there's keen interest among library professionals in adopting emerging technologies such as VR and the Metaverse.

Research by Alkhwaldi [4] demonstrated that user satisfaction significantly influences intentions toward adopting the Metaverse. Additionally, Yi Xiao [25] concluded that audiences were enthusiastic about adopting Virtual Reality environments, prompting various library departments to express interest in developing similar programs for their websites or online guides. Using panorama-based VR and similar technologies marks an emerging trend in the digital production and distribution of extensive visual information. Addressing the practicalities, Van Arnhem and Spiller [23] stressed the need for libraries and educators to invest time, money, and resources in AR projects for long-term success, highlighting the necessity of budgeting for annual funding. The results underscore the eagerness and motivation of library professionals to leverage emerging technology to enhance information access, elevate library services, and stay abreast of industry shifts. Further, emphasise the pivotal role of the Metaverse in Library and Information Services. They highlight the value of diverse teams in providing significant insights through their varied backgrounds, specialities, abilities, and knowledge. Consequently, these findings align with prior studies and affirm the growing interest among library professionals in AR, VR, and the Metaverse. This research is anticipated to prepare the future generation of library personnel, ensuring they possess the expertise necessary to flourish in the digital era.

6. Conclusion

This study's results show that librarians at Pakistani universities have a good understanding of new technologies, including Augmented Reality (AR), Virtual Reality (VR), and the metaverse. However, even though they are conversant with these ideas, they still don't have much practical experience with these technologies. This difference between knowing about something and actually using it shows that, even if librarians recognise the importance of new technologies, they may not be able to use them effectively in academic libraries due to institutional, infrastructural, and skill-related constraints. Most of the people who answered the survey were really eager to learn more about AR, VR, and metaverse-based apps. This positive attitude shows that library workers are ready to embrace technological change and meet users' evolving needs. Such openness offers a significant opportunity for academic institutions and library managers to establish structured training programs that emphasise practical application, system integration, and user-centred service design utilising emerging technologies. The results underscore the essential function of ongoing professional development in equipping librarians for the future of library and information services. Library schools and professional groups should ensure that their students learn about new technology, so

that they have both theoretical and practical skills upon graduation. Collaborative efforts between schools, tech companies, and industry experts can be very helpful in creating new learning modules, workshops, and hands-on training opportunities. Libraries can close the skills gap and improve service delivery in the digital age by working with businesses and investing in technology-enabled education. In the end, equipping librarians with the skills needed for AR, VR, and the metaverse will help them transform how libraries operate, support immersive learning environments, and remain relevant in a world where information is increasingly digital and tech-focused.

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