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Academic Librarians' Readiness to Adopt the Metaverse for Service Delivery

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ABSTRACT

Readiness is an important psychological construct that affects people's acceptance or otherwise of every technological innovation. In relation to the metaverse's adoption in libraries, librarians' readiness can significantly impact the successful implementation of the metaverse for service delivery. This study examined academic librarians' readiness to adopt the metaverse for service delivery in university libraries in South-west, Nigeria. The study adopted a quantitative research approach using a descriptive survey design of correlational type. The population comprised 158 librarians in 9 purposively selected university libraries in Ekiti, Ogun and Osun States of the South-west, Nigeria. Using total enumeration sampling, all 158 professional librarians were chosen for this study, who provided data through a self-designed questionnaire. Of these, 119 copies of the questionnaire were returned and found adequate for analysis. The instrument was validated, and its reliability was established using Cronbach's Alpha ($\alpha = 0.890$). Data were analysed using frequencies, percentages, means, standard deviations and Pearson Product-Moment Correlation (PPMC). The findings revealed that 61.3% of respondents were ready to adopt the metaverse, while 24.4% indicated uncertainty and 14.3% indicated unwillingness. Librarians demonstrated the highest readiness for Virtual Reality (VR) ($\bar{x} = 3.53$) and for user education services ($\bar{x} = 3.54$), while readiness was lowest for Lifelogging ($\bar{x} = 2.34$) and information literacy services ($\bar{x} = 2.01$). Hypothesis testing revealed a statistically significant positive relationship between librarians' readiness to adopt the metaverse and the services for which it can be adopted ($r = 0.545$, $p = 0.000 < 0.05$); hence, H_{01} was rejected. The study concludes that librarians demonstrate considerable readiness, but practical adoption is constrained by skills gaps, inadequate infrastructure, insufficient funding, technology anxiety and organisational resistance.

Keywords: Academic Librarians, Metaverse Technologies, Nigeria, Service Delivery

1. INTRODUCTION

The emergence of the metaverse represents one of the most significant and transformative developments in the contemporary digital information ecosystem. Conceptually, the metaverse is defined as an interconnected, persistent three-dimensional virtual environment, the metaverse seamlessly integrates breakthrough technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence (AI), blockchain and digital avatars (Cruz et al., 2023; Kontogianni & Anthopoulos, 2024). Metaverse technology refers to an immersive three-dimensional (3D) representation of a virtual world where users can interact with objects, virtual spaces, and each other through digital avatars. It is often considered the next generation of the internet, driven by technologies such as VR/AR headsets and wearables. This multi-dimensional tech-stack facilitates immersive user interaction, synchronous collaboration and unrestricted knowledge exchange, attracting considerable attention from educational institutions, businesses, governments and information professionals globally. Within the library and information science profession, the metaverse is increasingly recognised as a paradigm-shifting platform capable of fundamentally redefining academic library services (Gupta & Walia, 2023; Namdas, 2024). By creating virtual learning environments, collaborative research spaces, digital exhibitions and immersive reference services, the metaverse allows modern libraries to transcend traditional geographical limitations and provide highly interactive, user-centered experiences (Mahadeagouda & Pavithrabai, 2024).

The growing impetus for metaverse adoption within academic libraries is largely driven by the expansive socio-pedagogical opportunities associated with immersive digital environments. Through simulated spaces and customised digital avatars, library users can interact with information resources and librarians in real time, closely mirroring real-world physical experiences. Studies reveal that metaverse-enabled libraries effectively support virtual library tours, digital scholarship, collaborative research networks and alternative access points that promote inclusive education for users with physical disabilities (Ajani et al., 2023; Oladokun et al., 2025). As a result, cultivating metaliteracy skills (a framework that unifies critical thinking, digital skills, and collaboration to help people evaluate, produce, and share knowledge in modern online communities), which combine digital literacy, metacognition and critical thinking required by information professionals to survive the complexities in the technology-dominated information environment, becomes essential to navigating these complex virtual spaces responsibly (Sağsan, 2024). By transforming passive information retrieval into deep, experiential learning, the metaverse positions academic libraries to effectively satisfy the rapidly evolving, sophisticated information needs of twenty-first-century learners and researchers.

However, despite these compelling prospects, the practical transition from conceptual enthusiasm to systemic implementation in libraries is heavily impeded by a matrix of institutional and human-centric challenges. Extant literature consistently identifies severe

infrastructural deficits, high technological acquisition costs, inadequate institutional funding, fragile Internet connectivity and prominent cybersecurity and data privacy concerns as critical barriers to adoption (Batool et al., 2025; Subaveerapandiyan et al., 2024). In developing countries such as Nigeria, these complications are structurally compounded by unstable power supplies, policy gaps, technology anxiety and limited capital investment in emerging software. Crucially, while academic librarians frequently display an enthusiastic attitude toward metaverse innovations, a substantial portion of the workforce lacks the core technical competencies, advanced digital skills and practical training necessary to manage and sustain complex virtual library applications (Enakrire et al., 2025; Mayesti et al., 2024).

Although scholarly discourse surrounding metaverse applications has expanded rapidly over recent years, empirical research directly investigating librarians' unique perceptions and baseline readiness remains highly speculative and scarce within the Nigerian higher education sector (Eneh et al., 2024). Existing local studies have predominantly focused on broad national assessments of general digital literacy or technology acceptance, leaving a notable contextual gap regarding the specific institutional realities of universities in South-west, Nigeria, a region otherwise distinguished by its high concentration of tertiary institutions and technological development (National Universities Commission [NUC], 2025). Given that professional librarians are the fundamental drivers of digital transformation, user education and technology integration, their actual readiness and evaluations of the technology will decisively dictate the success or failure of virtual library initiatives (Sediyangingsih et al., 2023). Consequently, this study addresses this critical empirical void by investigating academic librarians' readiness to adopt the metaverse for services in universities in South-west, Nigeria, establishing context-specific evidence to effectively guide policy formulation, capacity building, and future strategic implementation.

1.1 Statement of the Problem

The rapid advancement of the Fifth Industrial Revolution (5IR) has introduced the metaverse as a groundbreaking socio-technical ecosystem capable of completely transforming traditional academic library workflows. Immersive applications such as virtual reality orientation tours, synchronous 3D reference desks, and decentralised digital exhibitions offer pathways to eliminate geographical boundaries and boost patron engagement (Gupta & Walia, 2023; Namdas, 2024). However, the successful execution of these virtual services depends entirely on the psychological, operational and technical readiness of professional librarians, who serve as the primary human component in technology integration (Mayesti et al., 2024; Sediyangingsih et al., 2023). Despite high abstract interest and strong professional willingness among academic librarians, a profound problem persists: librarians routinely exhibit a critical readiness deficit (Eneh et al., 2024). They are heavily bottlenecked by a moderate-to-low functional capacity across the core cognitive, behavioural and normative domains required to safely manage immersive environments (Enakrire et al., 2025). This imbalance between structural technological expectations and the actual practical competence of the library workforce threatens to trigger severe technostress and marginalise the library's relevance as a modern center of academic scholarship (Batool et al., 2025; Subaveerapandiyan et al., 2024).

This operational problem is structurally worsened by a matrix of deep-seated institutional vulnerabilities and severe environmental constraints specific to the Nigerian higher education landscape. While information professionals in South-west, Nigeria, display high psychological confidence regarding low-barrier applications like user orientation, their transition to complex pedagogical deployments, such as interactive simulations, is severely frustrated by acute digital skills gaps, severe technology anxiety and a persistent fear of job displacement (Ajani et al., 2024; Enakrire et al., 2025). Furthermore, these individual anxieties are compounded by systemic institutional failures, including unstable alternative power infrastructure, a complete lack of dedicated funding models, rigid organisational resistance to change and absent or weak digital policy frameworks (Ajani et al., 2023; Oladokun et al., 2025). If this combination of low professional readiness and fragile institutional support is left unaddressed, university libraries in the region will remain digitally excluded, wasting capital investments on emerging software they cannot sustain (Mayesti et al., 2024; Pierce, 2022). Therefore, there is an urgent empirical need to investigate the precise boundaries of librarians' readiness to adopt the metaverse within the unique institutional realities of South-west, Nigeria, providing the diagnostic data required to build targeted capacity-building programs and resilient digital governance frameworks.

1.2 Objectives of the Study

The main objective of this study is to examine librarians' readiness to adopt the metaverse for service delivery in universities in South-west, Nigeria. The specific objectives are to:

- i. determine the librarians' readiness to adopt the metaverse in university libraries in South-west, Nigeria;
- ii. ascertain the elements of the metaverse that librarians are ready to adopt in university libraries in South-west, Nigeria;
- iii. explore the services metaverse can be adopted for in university libraries in South-west, Nigeria; and,
- iv. establish the relationship between librarians' readiness to adopt the metaverse and the services the metaverse can be adopted for in universities in South-west, Nigeria.

1.3 Research Hypotheses

The null hypothesis below was tested at 0.05 level of significance:

H₀₁: There is no significant relationship between librarians' readiness to adopt the metaverse and the services the metaverse can be adopted for in universities in South-west, Nigeria.

2. LITERATURE REVIEW

The integration of immersive technologies in academic institutions reveals a complex, multi-dimensional shift in how library services are conceptualised and delivered. Scholars increasingly characterise the metaverse not as a transient digital trend, but as an interconnected, persistent three-dimensional socio-technical ecosystem that blends VR, AR and AI to facilitate synchronous, location-independent collaboration (Cruz et al., 2023; Kontogianni & Anthopoulos, 2024). Within contemporary higher education frameworks, this digital matrix is viewed as a platform capable of completely redefining traditional information services by converting passive text-based retrieval into experiential, user-centered knowledge creation hubs (Gupta & Walia, 2023; Namdas, 2024). The prevailing consensus among researchers establishes that the strategic value of virtual spaces lies in their capacity to break down physical boundaries, enabling libraries to deploy immersive reference desks, interactive exhibitions and simulated environments that closely mirror real-world dynamics (Mahadeagouda & Pavithrabai, 2024).

The empirical literature strongly supports the pedagogical and operational benefits of adopting the metaverse, particularly regarding user engagement and academic inclusion. Immersive environments are widely documented as effective tools for hosting interactive library orientation tours, enhancing digital scholarship and expanding collaborative research networks across global academic peer groups (Ajani et al., 2023). Furthermore, a significant body of research emphasises the inclusive architecture of the metaverse, noting that 3D virtual repositories provide alternative, highly accessible entry points for library patrons with physical and geographical limitations (Oladokun et al., 2025). This transition toward virtualised services is frequently linked to the evolution of "metaliteracy" frameworks, which mandate that both information professionals and library users develop advanced cognitive and behavioral skills to navigate, create, and responsibly share knowledge within complex algorithmic spaces (Sağsan, 2024).

Despite these compelling institutional benefits, a deep friction exists between theoretical expectations and the operational realities of developing academic landscapes. Extant literature consistently establishes that the practical deployment of immersive library infrastructure is severely bottlenecked by a combination of technical, financial, and regulatory challenges. Researchers frequently identify prohibitive technological acquisition costs, severe institutional funding deficits, fragile internet bandwidth, and deep-seated cybersecurity and data privacy vulnerabilities as major structural barriers (Batool et al., 2025; Subaveerapandiyan et al., 2024). In sub-Saharan African contexts, these macro-level limitations are further compounded by erratic power supplies, absent or weak digital policy frameworks and a lack of sustained capital investment in advanced educational software, leaving many libraries structurally unequipped to transition to higher levels of technological maturity.

Beyond these external infrastructural limitations, the human element emerges as a highly problematic variable within technology adoption models. While academic librarians generally express a high level of abstract willingness and psychological openness toward metaverse innovations, empirical evaluations uncover a stark paradox regarding actual technological

readiness. Studies indicate that a significant proportion of the library workforce experiences severe tech-anxiety and a persistent fear of job displacement due to automation (Enakrire et al., 2025). This psychological resistance is systematically worsened by a severe shortage of hands-on professional development opportunities, outdated library and information science (LIS) curricula, and a critical deficit in functional digital skills required to curate metadata or manage user interactions within 3D virtual spaces (Mayesti et al., 2024). Consequently, without deliberate institutional interventions to bridge this competency gap, professional willingness alone cannot guarantee sustainable technology integration.

A critical limitation of the current literature is the presence of deep empirical contradictions and a lack of context-specific evidence regarding institutional readiness across different university categories. While the structural challenges of technology adoption are universally acknowledged, current models fail to account for how institutional funding structures, specifically the differences among federal, state, and private universities, influence a library's ability to cope with rapid technological obsolescence (Pierce, 2022). Some research suggests that perceptions of digital readiness and technical stability vary significantly based on localized funding models and institutional ICT maturity, creating highly unequal technological environments within the same geographical region (Subaveerapandiyan et al., 2024). This divergence highlights a notable gap in general technology acceptance models, which frequently treat academic libraries as homogeneous entities and ignore the unique socioeconomic and regulatory pressures that shape individual institutional capacities.

This fragmentation leaves a major empirical void within the West African higher education sector, particularly regarding universities in South-west, Nigeria. While the region is distinguished by a high concentration of tertiary institutions and rapid digital growth (NUC, 2025), local studies remain heavily localised around broad assessments of basic digital literacy, leaving the precise boundaries of metaverse readiness unexamined (Eneh et al., 2024). Because professional librarians are the primary drivers of user education and digital repository management, their actual readiness serves as the definitive structural predictor of virtual library survival (Sediyangingsih et al., 2023). Therefore, a comprehensive study focusing on South-west Nigerian universities is strongly justified. Investigating this relationship provides the vital diagnostic data needed to move past speculative literature, allowing policymakers and university administrators to design targeted capacity-building programs and resilient infrastructure strategies to successfully integrate the library workforce into the 5IR.

3. METHODOLOGY

The study adopted a descriptive survey, using a correlational approach. A self-designed questionnaire titled "academic librarians' readiness to adopt the metaverse for service delivery" was used. The questionnaire was validated by two library and information science experts from Kwara State University, Malete to ensure proper operationalization of the constructs and language appropriateness. After conducting a pilot study with 30 librarians from Kwara State University and University of Ilorin, Kwara State, Nigeria, the reliability of the instrument was ascertained through the use of Cronbach's Alpha with a 0.890 score.

The target population for the study comprised universities in the South-west geo-political zone in Nigeria, consisting of six states, namely Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States. However, based on the large number of universities in South-west, Nigeria (76), according to the NUC (2025), only 9 were purposively selected from Ekiti, Ogun and Osun States because of their proximity to the researchers' location. Thereafter, the researchers selected three universities in each of the three states, implying one federal, one state and one private university were selected from each state covered.

Consequently, a total enumeration sampling was used to distribute the copies of the questionnaire to the 158 professional librarians in the nine university libraries selected for the study. The results were processed using the Statistical Product for Service Solutions (SPSS). The interpretation process followed a systematic classification of mean scores. The range was calculated by subtracting the lowest value (1) from the highest value (5) on the scale (5 - 1) and dividing by 5, the total number of scale categories ($4 \div 5 = 0.80$). This calculation provided the basis for the arbitrary score ranges necessary to interpret the mean scores (MS). Using these calculated ranges, the researchers developed corresponding verbal interpretations (VIs) for each range, as shown in the Decision Rule under each figure. From the 158 responses expected, only 119, representing 774.97 per cent, were returned and found adequate for analysis. The collected data were presented in charts, using frequencies, percentages, means and standard deviation, while the PPMC was used for the hypothesis.

4. RESULTS AND DISCUSSION

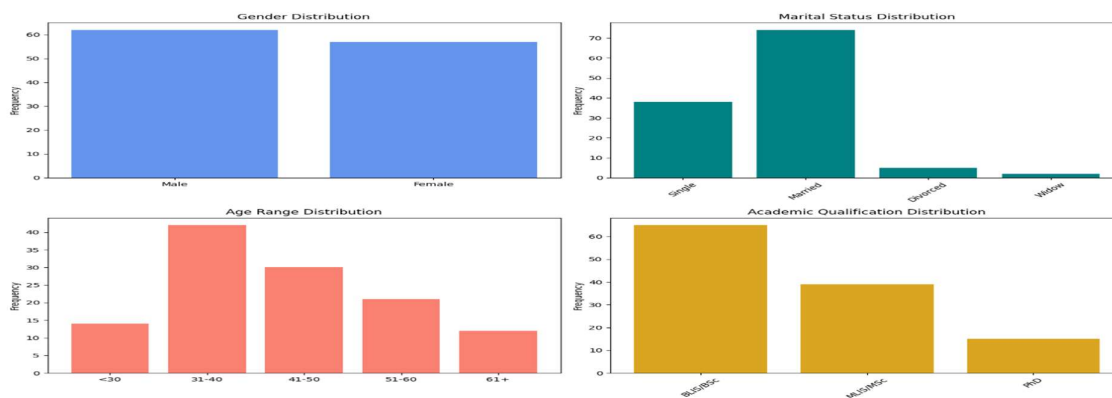


Fig.1: Fig.1: Demographic Information of the Respondents

Fig. 1 shows that the sample (N=119) is nearly gender-balanced (52.1% male, 47.9% female). Most respondents are married (62.2%), suggesting stability that may correlate with longer tenure. Age skews mid-career: 31–50 years comprise 60.5%, while early-career (<30) is only 11.8% and late-career (≥ 61) 10.1%. A notable 27.7% are 51+, indicating impending succession needs but not an immediate retirement cliff. Educationally, 54.6% hold undergraduate degrees (BLIS/BSc), 32.8% hold master's (MLIS/M.Sc.), and 12.6% hold PhDs, signaling strong baseline qualifications with room to deepen advanced specialization.

Research Question 1: What is the librarians' readiness to adopt the metaverse in university libraries in South-west, Nigeria?

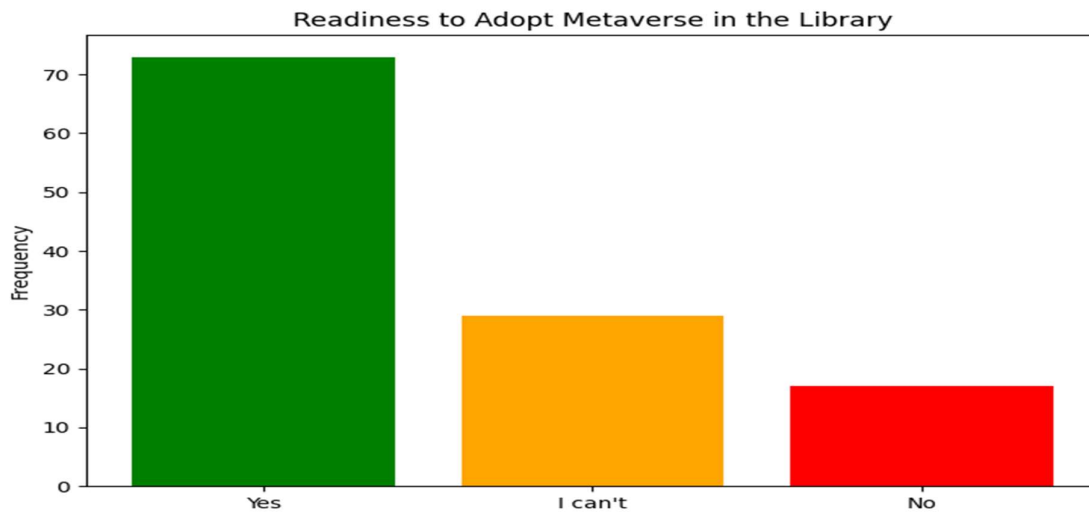
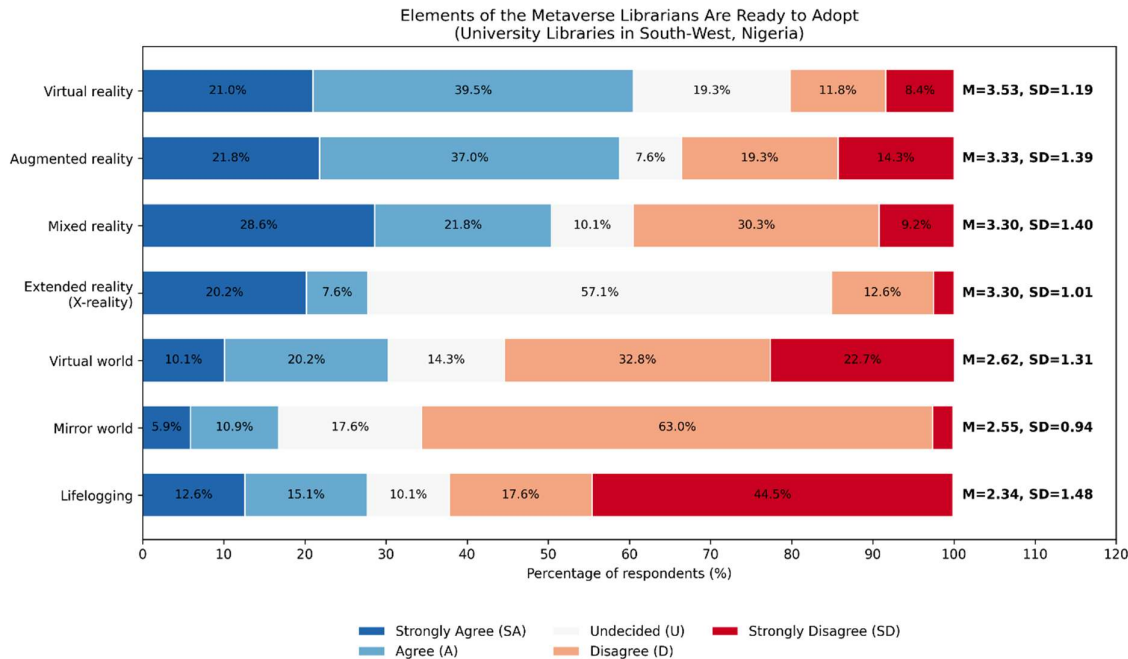


Fig. 2: Librarians' readiness to adopt the metaverse in university libraries in South-west, Nigeria

Fig.2 indicates a generally favorable orientation toward metaverse adoption in the library context. A clear majority of respondents (61.3%, 73/119) reported readiness to adopt, suggesting sufficient attitudinal support to justify pilot implementations and structured experimentation. Notably, nearly one quarter (24.4%, 29/119) selected "I can't," a response that more clearly reflects contingent constraints, such as skills, infrastructure, funding, or organizational approvals, than principled opposition. Only a minority (14.3%, 17/119) expressed outright unwillingness ("No"), implying limited ideological resistance relative to practical barriers.

Research Question 2: What are the elements of the metaverse that librarians are ready to adopt in university libraries in South-west, Nigeria?



Decision Rule: Mean 1.00–1.80 = Strongly Disagree (SD); 1.81–2.60 = Disagree (D); 2.61–3.40 = Undecided (U); 3.41–4.20 = Agree (A); 4.21–5.00 = Strongly Agree (SA).

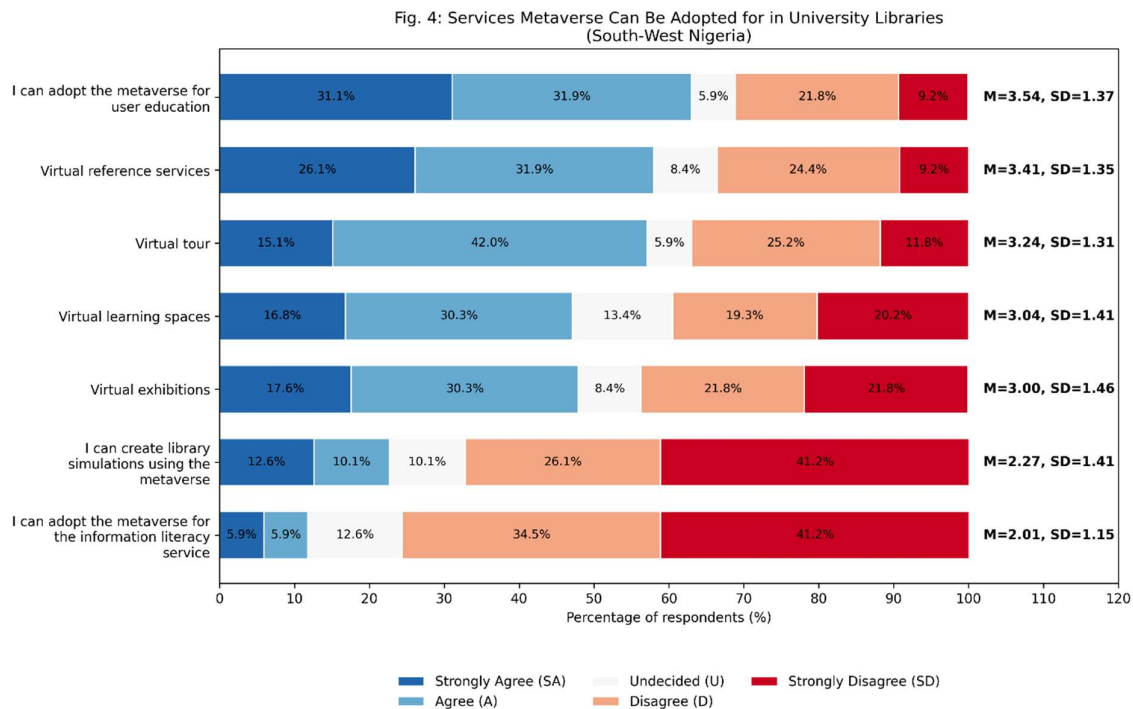
Fig. 3: Elements of metaverse librarians are ready to adopt in university libraries in South-west, Nigeria

Fig. 3 shows varying levels of readiness among librarians to adopt different elements of the metaverse in university libraries in the South-west, Nigeria. Overall, the highest readiness is observed for Virtual Reality (VR), which records a mean score of 3.53, indicating agreement. A substantial proportion (60.5%) strongly agrees or agrees that they are prepared to adopt VR. Augmented Reality (AR) follows closely with a mean of 3.33, falling within the “Undecided” range, though 58.8% show positive inclination, suggesting emerging but not fully consolidated readiness.

Mixed Reality (MR) and Extended Reality (XR) both have mean scores of 3.30, indicating contradictions. Although MR has notable support (50.4% SA/A), significant disagreement (39.5%) reveals uneven familiarity. XR shows a large undecided group (57.1%), suggesting limited awareness or exposure. Furthermore, a lower readiness is recorded for Virtual World technologies, with a mean of 2.62, reflecting general indecision and substantial disagreement (55.5%). The least readiness appears in Mirror World ($\bar{X} = 2.55$) and Lifelogging ($\bar{X} = 2.34$), where disagreement dominates (63.0% and 62.1%, respectively), indicating low acceptance and possible ethical or technological concerns.

Overall, librarians show the strongest readiness for immersive, experience-based technologies but remain cautious about data-intensive or complex metaverse elements.

Research Question 3: What are the services the metaverse can be adopted for in university libraries in South-west, Nigeria?



Decision Rule: 1.00–1.80 = SD; 1.81–2.60 = D; 2.61–3.40 = U; 3.41–4.20 = A; 4.21–5.00 = SA.

Fig.4: Services the metaverse can be adopted for in university libraries in South-west, Nigeria

Fig. 4 reveals varying levels of readiness among librarians to integrate metaverse applications into university library services in the South-west, Nigeria. Overall, respondents show the strongest readiness for user education ($\bar{x} = 3.54$), falling within the “Agree” category. A combined 63% (SA/A) indicates that librarians recognize the metaverse’s potential to enhance instructional interactions. Virtual reference services also attract considerable support ($\bar{x} = 3.41$), with 58% agreeing, suggesting openness to immersive, real-time support environments.

Moderate readiness is observed for virtual tours ($\bar{x} = 3.24$), virtual learning spaces ($\bar{x} = 3.04$), and virtual exhibitions ($\bar{x} = 3.00$), all falling into the “Undecided” category. These results imply cautious interest, likely influenced by infrastructural or technical uncertainties. Conversely, respondents show low readiness for library simulations ($\bar{x} = 2.27$) and information literacy services via the metaverse ($\bar{x} = 2.01$). In both cases, over 60% expressed disagreement, signaling significant hesitation toward highly interactive or pedagogically complex applications.

Overall, librarians appear most prepared to adopt metaverse tools for instructional support and reference services, while more advanced or technically demanding applications attract lower acceptance.

Hypotheses Testing

Ho₁: There is no significant relationship between readiness to adopt metaverse and services metaverse can be adopted for in university libraries in the South-west, Nigeria.

Table 1: Table 1: PPMC results showing the relationship between readiness to adopt metaverse and services metaverse can be adopted for in university libraries in the South-west, Nigeria

S/N	Variables	Mean	SD	Df	Correlations @	Sig. P	Remark
1.	Readiness to adopt metaverse	20.45	3.98	117	.545**	.000	Significant
2.	Library services metaverse can be adopted for	20.97	5.84	117			

** . Correlation is significant at the 0.05 level (2-tailed).

Decision Rule: Reject Ho₁ if the p-value is ($p < 0.05$). Otherwise, do not reject (i.e., if the p-value is greater than or equal to 0.05).

The Pearson Product–Moment Correlation (PPMC) result demonstrates a positive and statistically significant relationship between librarians' readiness to adopt the metaverse and the range of library services for which the metaverse can be applied in university libraries in the South-west, Nigeria ($r = 0.545$, $p = 0.000$). Given that the p-value is less than the 0.05 decision threshold, the null hypothesis is rejected. This implies that higher levels of readiness among librarians correspond with a greater likelihood of adopting metaverse technologies for various library services.

The correlation coefficient of 0.545 indicates a moderate-to-strong positive correlation, suggesting that readiness is an important predictor of metaverse service adoption. In practical terms, libraries where staff demonstrate higher awareness, skills, and willingness to engage with emerging technologies are more inclined to implement metaverse-based services such as virtual reference, user education, virtual tours, and immersive learning environments. Overall, the findings underscore the significance of strengthening librarians' readiness, through training, infrastructure support, and awareness initiatives, as a strategic pathway for expanding metaverse applications within academic library service delivery.

Discussion of the Findings

Librarians' readiness to adopt the metaverse in university libraries in South-west, Nigeria

The generally positive orientation toward metaverse adoption aligns with a growing body of scholarship asserting that librarians increasingly recognise the transformative potential of immersive technologies in academic library settings. As Subaveerapandiyan et al. (2024) argue, the metaverse provides libraries with unprecedented opportunities to enhance user engagement by enabling virtual libraries, museums, archives, and collaborative research spaces. Similarly, Gupta and Walia (2023) emphasise that the metaverse can broaden the scope

of library services by supporting virtual exhibitions, reference services, and learning environments, thereby enhancing librarians' professional efficacy. The present finding of strong attitudinal support thus resonates with Pierce's (2022) contention that the rapidly evolving information landscape requires librarians to be adaptive and technologically responsive. Consequently, the majority readiness observed suggests that librarians in South-west, Nigeria, share this global trend of recognising the metaverse as a promising avenue for innovation in library service delivery.

In contrast, the substantial proportion of respondents who selected "I can't" (24.4%) underscores the role of structural and operational constraints rather than conceptual resistance. This pattern is consistent with literature identifying inadequate ICT infrastructure, limited funding, skills gaps, and technological obsolescence as key impediments to technology adoption in libraries (Gupta & Walia, 2023; Pierce, 2022). Studies from other contexts further corroborate these barriers; for instance, Mayesti et al. (2024) and Subaveerapandiyan et al. (2024) both report that while librarians express interest in VR/AR and metaverse applications, their ability to adopt such technologies is constrained by cost, expertise deficits, and infrastructural limitations. The relatively small minority expressing outright unwillingness (14.3%) is likewise consistent with findings that ideological resistance tends to be minimal compared to practical barriers, as evidenced by Sediyaningsih et al.'s (2023) conclusion that perceptions of system usability, interactivity, and facilitating conditions strongly shape technology adoption intentions. Overall, the findings suggest that librarians' readiness is conceptually strong but remains unevenly supported by operational capacities, reinforcing the need for strategic investment and capacity building to translate attitudinal readiness into effective metaverse implementation.

Elements of metaverse librarians are ready to adopt in university libraries in South-west, Nigeria

The varying levels of readiness observed across different metaverse elements reflect broader patterns documented in the literature regarding librarians' uneven exposure to emerging immersive technologies. The comparatively high readiness for VR, which is the only element with clear agreement, corresponds with findings that VR has gained greater traction in university library environments due to its more established use cases, such as virtual tours, exhibitions, and interactive learning spaces (Gupta & Walia, 2023; Subaveerapandiyan et al., 2024). These technologies have been widely promoted as practical tools for enhancing user engagement, which may explain librarians' greater familiarity and confidence. Augmented Reality (AR), though slightly lower in readiness, similarly aligns with the literature positioning AR as a growing but still maturing component of library innovation, with developing nations increasingly exploring its use for virtual libraries and interactive collections (Subaveerapandiyan et al., 2024). Thus, the relatively stronger readiness for VR and AR reflects global trends of incremental adoption shaped by exposure, availability of devices, and established library-focused applications.

By contrast, the lower readiness associated with MR, XR, Virtual Worlds, Mirror Worlds, and Lifelogging reflects gaps identified in the literature concerning awareness, infrastructure, and perceived relevance. The uncertainty surrounding MR and XR is consistent with studies

showing that librarians often lack the technical proficiency and infrastructural support necessary to engage with more sophisticated immersive systems (Gupta & Walia, 2023; Pierce, 2022). The pronounced indecision and disagreement regarding Virtual Worlds, Mirror Worlds, and Lifelogging mirror the findings by Subaveerapandiyan et al. (2024), who reported substantial concerns among librarians related to cost, technical expertise, and ethical implications. Furthermore, Sağsan (2024) notes that while virtual libraries within metaverse platforms do exist, they remain relatively novel and underexplored in many academic contexts, especially in the Global South. These findings collectively highlight that readiness is strongest where concepts are familiar and infrastructure is attainable, whereas more complex or ethically sensitive metaverse components continue to face significant adoption barriers.

Services metaverse can be adopted for in university libraries in South-west, Nigeria

Furthermore, the high level of readiness observed for integrating the metaverse into user education and virtual reference services aligns with existing literature emphasizing the metaverse's capacity to enrich instructional and interactive library services. Gupta and Walia (2023) highlight that virtual reference, virtual learning, and training applications are among the most promising metaverse-enabled services, capable of providing more immersive and effective user support. Similarly, Subaveerapandiyan et al. (2024) underscore that university libraries are increasingly exploring VR- and AR-based teaching tools, particularly for user education and orientation, demonstrating librarians' recognition of the pedagogical value of immersive technologies. The strong readiness for user education in the present study, therefore, mirrors global trends, suggesting that librarians perceive the metaverse as an avenue for enhancing instructional engagement, improving comprehension, and enriching learner interaction within academic environments.

In contrast, the moderate readiness for virtual tours, virtual learning spaces, and virtual exhibitions, alongside the low readiness for library simulations and information literacy through the metaverse, reflects persisting concerns identified in prior scholarship. Studies by Pierce (2022) and Gupta and Walia (2023) report that technological adoption in libraries is often hindered by infrastructural deficiencies, limited expertise, and apprehension about pedagogically complex applications, factors that likely explain respondents' hesitancy toward highly interactive or simulation-based services. Moreover, Hill (2021), while noting the potential of simulations and storytelling within metaverse environments, acknowledges that these advanced applications require higher levels of skill and technological readiness than many libraries currently possess. The strong disagreement surrounding the use of the metaverse for information literacy further echoes concerns about collaboration, data management, and job security documented by Mayesti et al. (2024), suggesting that librarians may perceive such applications as disruptive or resource-intensive. Collectively, these contrasts reveal that while librarians are receptive to metaverse applications that extend existing services, they remain cautious toward those requiring deeper infrastructural capabilities and more sophisticated pedagogical transformation.

Relationship between readiness to adopt metaverse and services metaverse can be adopted for in university libraries in the South-west, Nigeria

The statistically significant positive correlation between librarians' readiness and the range of metaverse-enabled library services reinforces existing literature demonstrating that attitudes, awareness, and preparedness strongly influence the adoption of emerging technologies in library environments. Sedianingsih et al. (2023) similarly found that perceived ease of use, interactivity, and system utility significantly shape intentions to use metaverse technologies in digital library systems, indicating that higher readiness fosters greater adoption capacity. This relationship also aligns with Pierce's (2022) assertion that librarians' adaptability and technological confidence determine their willingness to integrate innovative tools into service delivery. Furthermore, Gupta and Walia (2023) emphasize that immersive services such as virtual tours, exhibitions, reference services, and VR-enhanced learning spaces are most successfully implemented where librarians possess both the readiness and the perceived competence to adopt them, mirroring this study's suggestion that readiness is a substantial predictor of uptake. Thus, the observed correlation substantiates broader scholarly conclusions that metaverse adoption is contingent not merely on infrastructural availability but on the attitudes and preparedness of librarians who drive its practical implementation.

5. CONCLUSION AND RECOMMENDATIONS

Conclusion

This study has demonstrated that while librarians in university libraries in South-west, Nigeria, exhibit a generally positive disposition toward metaverse adoption, their readiness remains uneven across different technological elements and service applications. The findings reveal strong interest in immersive technologies such as VR and AR, as well as significant openness to integrating the metaverse into user education and virtual reference services. However, more complex or resource-intensive applications, such as virtual simulations, lifelogging, and advanced virtual worlds, attract limited enthusiasm, reflecting gaps in exposure, skills, and institutional preparedness.

The study further underscores that although librarians recognise the metaverse's potential to enhance interactive service delivery, expand research collaboration, and create visually engaging library environments, several systemic factors constrain practical adoption. Key barriers identified include inadequate ICT infrastructure, limited digital skills, poor awareness, insufficient funding, and fears surrounding job displacement. These challenges highlight the broader structural and capacity-related issues that have historically shaped the uptake of emerging technologies in Nigerian academic libraries.

Interestingly, the hypothesis testing revealed a statistically significant positive relationship between librarians' readiness to adopt the metaverse and the range of library services for which metaverse technologies can be employed, leading to the rejection of the null hypothesis. This finding implies that the more prepared and willing librarians are to engage with emerging technologies, the greater the likelihood that university libraries will effectively integrate metaverse-enabled services such as virtual reference, user education, and interactive learning environments. The moderate-to-strong correlation further underscores the central role of human readiness, encompassing awareness, skills, and technological confidence, in driving successful innovation within academic libraries.

Overall, the study concludes that bridging the gap between librarians' conceptual readiness and practical adoption of metaverse technologies will require strategic interventions at the institutional and policy levels. Targeted capacity-building programmes, improved ICT investment, sustained awareness initiatives, and stronger organisational support systems are essential to position university libraries in the region for effective engagement with metaverse innovations. Strengthening these areas will not only enhance librarians' technological confidence but also enable academic libraries to leverage immersive technologies in delivering dynamic, inclusive, and future-oriented information services.

Recommendations

Based on the findings, this study recommends that:

1. University library administrations, in partnership with national and regional library associations, must design and execute a continuous, hands-on capacity-building program focused explicitly on immersive 5IR technologies. This framework must move past basic technological awareness to actively build functional cognitive, behavioral, and normative competencies in handling 3D virtual spaces and managing user interaction within decentralized digital environments.
2. University library managers should execute a strategic, phased transition roadmap that begins with low-barrier virtual offerings.
3. Library management should work through existing clusters or bodies, such as the Committee of University Librarians of Nigerian Universities (CULNU), to pool resources. This collaborative group can collectively bargain with virtual ecosystem vendors, split the hosting costs of high-powered cloud-based servers, and establish a shared repository of 3D library assets and virtual objects, drastically reducing the financial burden on individual state, public, or private universities.
4. University managements must actively prioritize and protect the funding lines dedicated to digital library transformations, ensuring that investments in emerging software are not crippled by environmental bottlenecks like erratic power supplies and weak local ICT networks.

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