

Exploring Metaverse-Based Digital Governance of Gambia: Obstacles, Citizen Perspectives, and Key Factors for Success

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Abstract. The metaverse concept has recently garnered substantial attention, with growing interest in its potential application in governance. This study examines the obstacles, citizen perspectives, and crucial factors that may facilitate or impede the success of metaverse-based digital governance in a country. Through an in-depth analysis of survey data, the research reveals that weak internet connections and insufficient infrastructure constitute the primary barriers to adopting metaverse-based digital governance in The Gambia. However, addressing these challenges could significantly contribute to its successful implementation. The findings indicate that citizens' familiarity with the metaverse has a mixed impact on their confidence in the government's capacity to utilize the technology effectively. Additionally, a positive correlation was observed between satisfaction with existing digital governance and the public's propensity to engage in metaverse-driven initiatives. Privacy and security concerns surfaced as notable factors influencing citizens' willingness to participate in digital governance efforts within the metaverse. To ensure the effective adoption or execution of metaverse-based digital governance in The Gambia, the study proposes a roadmap prioritizing digital literacy programs, and infrastructure development, addressing privacy and security concerns, and cultivating trust in the government's ability to manage the transition competently. This research may serve as a valuable resource for other nations considering the adoption of metaverse-based digital governance systems.

Keywords: Metaverse, Digital Governance, The Gambia, Roadmap.

1 Introduction

In the realm of digital governance, which Scholl [1] defines as "the effective use of information and communication technologies in managing a state or other entity," the metaverse could play a pivotal role. Technology's rapid advancement has revolutionized how governments engage with their citizens, leading to the emergence of digital governance [1]. Recently, the concept of the metaverse has garnered attention as technological breakthroughs have allowed individuals to create and participate in immersive virtual experiences. This signifies the next evolution of the web, transitioning from a 2D interface to a 3D environment that fully immerses users [33]. Consequently, metaverse-based digital governance systems may substantially alter how governments deliver services and interact with their constituents, paving the way for innovative governance and civic engagement approaches.

This research aims to assess the metaverse landscape in The Gambia and its potential for digital governance. The study seeks to gauge the current awareness of the metaverse among Gambian citizens. This insight will establish the foundation for evaluating the viability and receptivity of the population regarding a metaverse-based digital governance framework in The Gambia. Subsequently, the research endeavors to identify the primary challenges and opportunities that warrant attention for the successful implementation of a metaverse-based digital governance system in The Gambia. Recognizing these factors will help guide the development of strategies and initiatives tailored to the country's unique context, ensuring potential obstacles are mitigated, and opportunities are seized. Moreover, based on the information gathered, we aim to develop a comprehensive plan or roadmap for implementing a metaverse-based digital governance system in The Gambia. This roadmap addresses the identified opportunities and challenges, providing policymakers and stakeholders with a clear and actionable framework for harnessing the metaverse's potential to enhance governance and civic engagement within the nation.

Section 2 presents a literature review of the domain, with section 3 discussing the methodology guiding the work. In Section 4, the approach to validating the measurement scales is introduced, while section 5 reports on the hypotheses examined, and Section 6 presenting a brief discussion. Finally, section 7 outlines the primary conclusions.

2 Literature Review

In this section, we delve into the theoretical background of The Gambia's digital government progress, examining the strides made thus far and comparing the country's development to that of more advanced nations. Then we will further delve into the topic of the metaverse and its applications, especially its potential in digital governance.

2.1 Digital Governance - The Gambia

Despite facing challenges like scarce resources and low digital literacy [3], Africa holds potential for digital governance transformation, key initiatives include digital infrastructure investment and e-government services [5]. Collaboration, public engagement, and innovative approaches are crucial for success [28, 4, 7], alongside addressing drawbacks and ensuring policy compliance [28].

Just like other African countries, The Gambia is also improving with several digital initiatives for its citizens. We looked at several research studies to comprehend the present status of digital governance in The Gambia. The use of information technology has been identified as a major area for Africa's entry into the information era, claims Islam [6], who produced a study on the preliminary evaluation and processes for the construction of an e-government approach for The Gambia. Ceesay and Bojang's [10] study of The Gambia during the period of the pandemic, found that e-government practices increase transparency and government-citizen interaction, which in turn enhances the delivery of public services. Similarly, research conducted by Lin et al. [8] focuses on the uptake of e-governance activities by Gambian individuals. By using the TAM (Technology Acceptance Model), the intentions of users toward e-government facilities are examined. Their research indicates that TAM strongly affects the decision to employ e-government services, which may help The Gambians' government run more efficiently and cheaply. As stated by Jung [9] in his assessment of the study of Lin et al. [8], the key TAM parameters such as PEOU (perceived ease of use), IQ (information quality), and PU (perceived usefulness) are essential to the success of e-government operations in The Gambia. In accordance with the research, people in The Gambia are open to adopting e-governance projects, provided they are created with TAM's fundamental principles in mind. Bojang [11] mentioned in his research that citizens' intentions to embrace e-governance services were shown to be directly correlated with the degree of public awareness and the availability of high-quality services. It is strongly influenced by citizens' perceptions of the accessibility, usability, timeliness, accuracy, and responsiveness of government websites.

In their evaluations of The Gambia's e-government, Jung [9], Ceesay and Bojang [10], and Bojang [11] offer insights into the state of the sector there. Jung [9] found that the e-government sector in The Gambia is still in its initial stages, but Ceesay and Bojang [10] pointed out that more investment in infrastructure and people is needed to improve the way e-government services are delivered. According to Bojang [11], to enhance the success of e-governance efforts in The Gambia, there should be an emphasis on citizen involvement and participation. Moreover, it is essential to understand how people embrace and utilize e-government applications. More effective and cost-effective governance operations in The Gambia may be achieved using TAM's central components in the planning, development, and promotion of e-government systems there. PEOU, IQ, and PE are three fundamental characteristics of the TAM that the authors believe should be considered while developing e-government efforts. To guarantee the accomplishment of e-government efforts,

governments must take measures to develop confidence and offer excellent service delivery, which in turn requires cooperation between the public sector and individuals.

Considering the metaverse's potential to revolutionize various industries, The Gambia can explore its application in digital governance to provide more immersive and interactive experiences for citizens, enhancing government-citizen interaction, transparency, and public service delivery. By leveraging the insights from the literature and prioritizing the development of an e-governance approach that meets the needs and desires of the population, The Gambia can pave the way for a more efficient and cost-effective digital governance model.

2.2 The Metaverse

The metaverse, encompassing social VR platforms and enabled by 5G and edge computing, holds the potential to revolutionize industries like education, entertainment, healthcare, and governance [26, 14]. Essential components include immersive realism, ubiquitous access, and seamless user experiences [12]. In education, the metaverse offers immersive learning experiences but raises concerns about support systems, educator preparation, and security [32, 30, 31]. Robust support systems and comprehensive teacher training are necessary [15, 13]. Blockchain can enhance security [16, 17]. In tourism, the metaverse enhances customer satisfaction through personalized experiences and digitized cultural heritage [18, 19]. Further research is needed for practical applications. In healthcare, the metaverse improves patient satisfaction, health education, and medical training accessibility [22, 20, 21].

The metaverse offers opportunities to enhance governance, communication, and service delivery, but faces challenges such as costs, privacy, and safety concerns [34]. South Korea is proactively embracing metaverse technology, while other countries adopt a cautious approach [35, 36]. Metaverse applications in public universities seek to improve education and career preparation. Cities worldwide are building digital twins for urban planning, potentially benefiting developing countries [33]. Despite challenges like infrastructure, governance, taxes, intellectual property, and cybersecurity, the metaverse can address concerns in urban planning, healthcare, education, and employment [33]. Strategic futures groups, virtual tech frontier ministries, and national digital twin policies can help countries prepare for the metaverse transformation. In Africa, the metaverse can improve public engagement, transparency, and information access, but faces issues like limited mobile network access and privacy concerns [37, 39]. Blockchain technology can also address privacy issues in the metaverse [27, 38], and strengthen enabling technologies such as IoT, digital twins, AI, and big data [23, 24]. Ethical metaverse design should prioritize privacy, governance, and ethical design [25].

By embracing ethical metaverse design, prioritizing privacy and governance, and utilizing blockchain technology to strengthen enabling technologies, The Gambia can harness the potential of the metaverse to drive innovation and progress in various sectors, ultimately benefiting its citizens. Considering its applications in education, tourism, and healthcare, the Metaverse can contribute to The Gambia's overall development. However, further research is needed to understand its practical applications.

3 Research Methodology

In order to comprehensively examine the potential of leveraging the metaverse for digital governance in The Gambia, this study employed a robust methodology that combined various data collection methods and analytical techniques. The methodology aimed to give a detailed comprehension of the present state of digital governance, identify key stakeholders' perspectives and ultimately develop a metaverse-based digital governance roadmap.

3.1 Research Design

This study adopts a quantitative research approach, employing a combination of literature review, document examination, and survey to collect and analyze data. The survey carried out from 29th March 2023 to 7th April 2023, represented 115 respondents and functioned as a principal source of data to strengthen the findings from the literature review and document analysis.

3.2 Sample Selection

The study's sample comprises key stakeholders in The Gambia's digital governance, including government officials, technology experts, business representatives, academia, students, and community members. These diverse participants offer insights into the current state of digital governance and the potential for metaverse-based governance. A survey was distributed via personal contacts and word of mouth to reach a wide range of respondents, ensuring an accurate representation of the population interested in digital government usage in The Gambia.

3.3 Data Collection Methods

Besides the literature review and research papers, an online survey utilizing Google Forms was carried out to amass primary data from a chosen sample of stakeholders. The survey delved into various subjects, including the present state of digital governance in The Gambia, harnessing the metaverse for digital governance, potential advantages and challenges of metaverse-centric governance, and attitudes towards employing the metaverse for digital governance. This combination of data-gathering techniques ensured a comprehensive and well-balanced understanding of the topic at hand.

3.4 Descriptive Analysis

The survey collected demographic information, such as age, gender, occupation, and monthly earnings, from respondents involved in digital governance in The Gambia to better

understand their perspectives on metaverse-based digital governance. Most respondents (59.1%) were aged 26-31, indicating that younger individuals, more familiar with digital technology, participated in the survey. Gender distribution showed 74.8% male and 25.2% female respondents, highlighting the need for increased gender diversity in metaverse-based governance discussions and implementations. The occupation breakdown included students (33%), technology experts (27%), and government officials (19.1%), providing a comprehensive understanding of The Gambia's digital governance landscape and the potential for metaverse-based governance. Regarding monthly earnings, 56.5% reported a range of \$101-\$500, while 17.4% preferred not to disclose their income. This data emphasizes the cruciality of establishing strategies for metaverse-based digital governance, ensuring affordability and ease of use in order to cater to individuals with varying financial capacities. Consequently, the opportunity to partake in this new realm will remain equitable for all citizens. Further insights will be provided in the later part, when discussing the hypothesis.

4 Validation of the measurement scales

In the study, Cronbach's reliability test was utilized, yielding a satisfactory alpha value of 0.724, ensuring internal consistency among survey questions [40]. This value demonstrates that the survey effectively measures various aspects of metaverse-based digital governance, providing reliable insights into respondents' perceptions and attitudes, thus enhancing the study's credibility.

5 Hypothesis Testing

We have developed 5 hypotheses, drawing from our comprehension of the research problem and relevant literature. These hypotheses encompass a variety of aspects pertaining to digital governance in the metaverse, including citizens' acquaintance with the metaverse, confidence in governmental entities, anticipated economic implications, concerns about confidentiality and safety, the digital divide, and the interplay between these elements and citizens' inclination to partake in metaverse-based digital governance initiatives.

Below are the five hypotheses:

Hypothesis 1: The degree of satisfaction with the current digital governance condition in The Gambia is negatively correlated with the populace's inclination to partake in metaverse-driven administrative initiatives.

Hypothesis 2: If infrastructure improvements and increased internet accessibility are implemented, then the primary barriers to establishing metaverse-based digital governance in The Gambia will be significantly reduced.

Hypothesis 3: The level of familiarity with the metaverse is negatively associated with the level of trust citizens have in the government's ability to responsibly leverage the metaverse for digital governance.

Hypothesis 4: Prioritizing digital literacy programs in The Gambia will increase the likelihood of successful implementation and widespread adoption of a metaverse-based digital government.

Hypothesis 5: The people who are very familiar with the concept of the metaverse will be less likely to participate in a metaverse-based digital governance in The Gambia.

Table 1. The relationship between satisfaction in DG in The Gambia and the likelihood to participate in the metaverse initiative.

How satisfied are you with the current state of digital governance in The Gambia?	How likely would you be to participate in a digital governance initiative in the metaverse?	Percentage %
Not at all satisfied	Completely likely	16.52%
	Moderately likely	11.30%
	Not at all likely	1.74%
	Slightly likely	7.83%
	Very likely	30.43%
Not at all satisfied Total		67.83%
Slightly satisfied	Completely likely	2.61%
	Moderately likely	5.22%
	Slightly likely	0.87%
	Very likely	14.78%
Slightly satisfied Total		23.48%
Moderately satisfied	Completely likely	0.87%
	Moderately likely	2.61%
	Slightly likely	0.87%
	Very likely	4.35%

Moderately satisfied	8.70%
Total	
Grand Total	100.00%

Table 1 supports Hypothesis 1, stating that satisfaction with current digital governance in The Gambia positively correlates with citizens' inclination to participate in metaverse-driven initiatives. Among the "Not at all satisfied" respondents, 67.83% indicated varying likelihoods of participating in metaverse-based initiatives, with 30.43% being "Very likely" to participate. This implies that dissatisfaction with current digital governance may drive citizens to seek alternatives like the metaverse. For "Slightly satisfied" respondents, 23.48% expressed their likelihood to participate in metaverse initiatives, with 14.78% being "Very likely." Moreover, 8.70% of "Moderately satisfied" respondents showed their likelihood to partake in metaverse-based ventures, with 4.35% being "Very likely." This reveals that regardless of satisfaction levels, a significant portion of respondents show interest in exploring metaverse-based solutions.

Concerning Hypothesis 2, respondents identified the two most significant challenges in leveraging the metaverse for digital governance as "Poor Internet Connections" (73.9%) and "Lack of Good Infrastructures" (53.9%). This supports the hypothesis that infrastructure improvements and increased internet accessibility are crucial to overcoming primary barriers to metaverse-based digital governance in The Gambia. Additional challenges, such as "Technological barriers and challenges" (59.1%) and "Digital divide and cost of necessary gadgets" (37.4%), could also be addressed through enhanced infrastructure and internet accessibility. "Privacy and security concerns" (40.9%) represent another challenge, necessitating robust security measures and privacy protection policies within metaverse-based digital governance systems. Furthermore, 7.8% of respondents indicated "Other" challenges, warranting further investigation.

Table 2. Relationship between the level of familiarity with the metaverse to the level of trust for the government to implement the initiative for DG.

How "familiar" would you say you are with the concept of the "metaverse"?	How would you rate the level of trust you have in the government to responsibly leverage the metaverse for digital governance?	Percentage%
Slightly familiar	Moderately likely	9.57%
	Not at all likely	12.17%
	Slightly likely	7.83%
	Very likely	2.61%
Slightly familiar Total		32.17%
Moderately familiar	Moderately likely	8.70%
	Not at all likely	6.96%
	Slightly likely	12.17%

	Very likely	3.48%
Moderately familiar Total		31.30%
Not at all familiar	Moderately likely	5.22%
	Not at all likely	6.96%
	Slightly likely	7.83%
	Very likely	2.61%
Not at all familiar Total		22.61%
Very familiar	Moderately likely	5.22%
	Not at all likely	3.48%
	Slightly likely	2.61%
Very familiar Total		11.30%
Extremely familiar	Completely likely	0.87%
	Not at all likely	1.74%
Extremely familiar Total		2.61%
Grand Total		100.00%

From table 2, we can deduce the following observations and conclusions regarding the validity of Hypothesis 3, which states, "The level of familiarity with the metaverse is negatively associated with the level of trust citizens have in the government's ability to responsibly leverage the metaverse for digital governance." Among the survey participants who possess a slight familiarity with the metaverse, the majority (12.17%) lack confidence in the government's competence to responsibly implement the metaverse for digital governance, followed by those who exhibit moderate trust (9.57%). This suggests that as familiarity increases, faith in the government's capability appears to reduce. Similarly, respondents who are moderately familiar with the metaverse show a higher percentage (12.17%) of slight trust in the government's ability, followed by moderate trust (8.70%). This trend supports the hypothesis that increased familiarity is negatively associated with trust in the government's ability. Interestingly, among the respondents who are not at all familiar with the metaverse, a higher percentage (7.83%) have slight trust in the government's ability, while 6.96% do not trust the government at all. This might imply that a lack of familiarity could lead to more neutral or uncertain trust perceptions.

For respondents who are very familiar with the metaverse, the majority (5.22%) have moderate trust in the government's ability. This finding does not align with the hypothesis, as it suggests that increased familiarity may not necessarily lead to decreased trust. In this case, data provide mixed support for Hypothesis 3. While the majority of respondents with slight and moderate familiarity appear to have less trust in the government's ability to responsibly leverage the metaverse for digital governance, the same trend does not hold for respondents who are very familiar with the metaverse. Hence, we can categorize it as not supported.

Table 3. Importance of digital literacy programs

How important is it for governments to prioritize digital literacy programs to help citizens participate in the metaverse?	percentage %
Very important	45.22%
Extremely important	44.35%
Moderately important	5.22%
Slightly important	4.35%
Not at all important	0.87%
Grand Total	100.00%

Table 3 shows that digital literacy programs are considered very important or extremely important by the vast majority of respondents (89.57%) for successful implementation and widespread adoption of metaverse-based digital governance in The Gambia. This finding supports Hypothesis 4, which suggests prioritizing digital literacy programs to increase the likelihood of successful implementation of a metaverse-based digital government. Only a small fraction of respondents (0.87%) deems digital literacy programs as not important, indicating limited resistance to prioritizing digital literacy programs in The Gambia.

Table 4. Familiarity with the Metaverse and the likelihood to participate in digital governance initiatives

How "familiar" would you say you are with the concept of the "metaverse"?	How likely would you be to participate in a digital governance initiative in the metaverse?	Percentage %
Slightly familiar	Completely likely	1.74%
	Moderately likely	8.70%
	Slightly likely	5.22%
	Very likely	16.52%
Slightly familiar Total		32.17%
Moderately familiar	Completely likely	9.57%
	Moderately likely	6.96%
	Not at all likely	0.87%
	Slightly likely	0.87%
	Very likely	13.04%
Moderately familiar Total		31.30%
Not at all familiar	Completely likely	4.35%
	Moderately likely	3.48%
	Not at all likely	0.87%
	Slightly likely	2.61%
	Very likely	11.30%

Not at all familiar Total		22.61%
Very familiar	Completely likely	2.61%
	Slightly likely	0.87%
	Very likely	7.83%
Very familiar Total		11.30%
Extremely familiar	Completely likely	1.74%
	Very likely	0.87%
Extremely familiar Total		2.61%
Grand Total		100.00%

The data above examines Hypothesis 5, suggesting that those highly familiar with the metaverse concept are less likely to participate in metaverse-based digital governance in The Gambia. Interestingly, respondents with slight familiarity displayed the highest participation likelihood at 32.17%. As familiarity increases, there isn't a consistent decline in participants' willingness to engage in metaverse-based digital governance. Moderately familiar participants accounted for 22.61%, while those highly familiar represented 10.44%. The data doesn't conclusively support the hypothesis. Moreover, a considerable percentage (15.65%) of respondents unfamiliar with the metaverse remain likely to participate in metaverse-focused digital governance. This suggests that a lack of familiarity doesn't inherently hinder interest in digital governance initiatives within the metaverse. In conclusion, the data doesn't provide strong support for Hypothesis 5. Although a slight decrease in participation likelihood is observed as familiarity increases, this trend isn't consistent or significant enough to confirm the hypothesis.

6 Discussion

This study investigated key factors affecting the implementation of metaverse-based digital governance in The Gambia and analyzed the public's perceptions and attitudes toward these initiatives. Five hypotheses were assessed, covering various aspects of digital governance in the metaverse.

The analysis showed mixed results for the hypotheses. Hypothesis 1 found a positive correlation between satisfaction with current digital governance and the public's inclination to participate in metaverse-driven initiatives. Hypothesis 2 demonstrated that addressing primary barriers, such as poor internet connections and inadequate infrastructure, would significantly contribute to the successful implementation of metaverse-based digital governance in The Gambia. However, addressing additional challenges like privacy and security concerns is crucial for a comprehensive strategy. Mixed support was found for Hypothesis 3, which suggested a negative relationship between metaverse familiarity and trust in the government's capacity for effective digital governance. While respondents with slight and moderate familiarity displayed less trust, the trend did not hold for those with high familiarity, implying that other factors may influence trust. Hypothesis 4 was supported, as most respondents recognized the importance of digital literacy programs in facilitating the successful implementation and adoption of metaverse-

based digital governance. However, the data did not strongly support Hypothesis 5, which claimed that individuals with high metaverse familiarity would be less inclined to participate in metaverse-oriented digital governance.

7 Conclusion

In conclusion, this study provides valuable insights for the development of effective strategies and policies to implement metaverse-based digital governance in The Gambia. Policymakers are advised to focus on the execution of metaverse-driven digital governance projects, prioritize infrastructure improvements, foster trust through transparent communication, emphasize digital literacy programs, and conduct further research. Despite limitations such as the cross-sectional design and reliance on self-reported data, the study serves as a foundation for future research to explore emerging challenges and technological advances in metaverse-based digital governance using larger, diverse samples and additional data collection methods. Ultimately, the findings of this study will contribute to shaping the future of digital governance in The Gambia, promoting innovation and enhancing civic engagement.

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References

1. Scholl, H. J. (2020). Digital government: Looking back and ahead on a fascinating domain of research and practice. *Digital Government: Research and Practice*, 1(1), 1-12.
2. Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New public management is dead—long live digital-era governance. *Journal of public administration research and theory*, 16(3), 467-494.
3. Holden, K., & Van Klyton, A. (2016). Exploring the tensions and incongruities of Internet governance in Africa. *Government Information Quarterly*, 33(4), 736-745.
4. Breuer, A., Blumenkemper, L., Kliesch, S., Salzer, F., Schädler, M., Schweinfurth, V., & Virchow, S. (2017). Decentralisation in Togo: the contribution of ICT-based participatory development approaches to strengthening local governance. *German Development Institute Discussion Paper*, (6).
5. Demuyakor, J. (2021). Ghana's Digitization Initiatives: A Survey of Citizens Perceptions on the Benefits and Challenges to the Utilization of Digital Governance Services. *International Journal of Publication and Social Studies*, 6(1), 42-55.
6. Islam, K. M. (2003). Strategy Paper on e-Government Programme for The Gambia. *United Nations Economic Commission for Africa Addis Ababa*.
7. Srinivasan, S., Diepeveen, S., & Karekwaivanane, G. (2019). Rethinking publics in Africa in a digital age. *Journal of Eastern African Studies*, 13(1), 2-17.

8. Lin, F., Fofanah, S. S., & Liang, D. (2011). Assessing citizen adoption of e-Government initiatives in Gambia: A validation of the technology acceptance model in information systems success. *Government Information Quarterly*, 28(2), 271-279.
9. Jung, D. (2019). "Assessing citizen adoption of e-government initiatives in Gambia: A validation of the technology acceptance model in information systems success". A critical article review, with questions to its publishers. *Government Information Quarterly*, 36(1), 5-7.
10. Bojang, M. B., & Ceesay, L. B. (2020). Embracing e-government during the Covid-19 pandemic and beyond: Insights from The Gambia. *Global Journal of Management and Business Research*, 20(A13), 33-42.
11. Bojang, M. B. (2021). Critical factors influencing E-government adoption in The Gambia. *Society & Sustainability*, 3(1), 39-51.
12. Dionisio, J. D. N., III, W. G. B., & Gilbert, R. (2013). 3D virtual worlds and the metaverse: Current status and future possibilities. *ACM Computing Surveys (CSUR)*, 45(3), 1-38.
13. Ng, D. T. K. (2022). What is the metaverse? Definitions, technologies and the community of inquiry. *Australasian Journal of Educational Technology*, 38(4), 190-205.
14. Davis, A., Murphy, J., Owens, D., Khazanchi, D., & Zigurs, I. (2009). Avatars, people, and virtual worlds: Foundations for research in metaverses. *Journal of the Association for Information Systems*, 10(2), 1.
15. Mustafa, B. (2022). Analyzing education based on metaverse technology. *Technium Soc. Sci. J.*, 32, 278.
16. Contreras, G. S., González, A. H., Fernández, M. I. S., Martínez, C. B., Cepa, J., & Escobar, Z. (2022). The importance of the application of the metaverse in education. *Modern Applied Science*, 16(3), 1-34.
17. Kye, B., Han, N., Kim, E., Park, Y., & Jo, S. (2021). Educational applications of metaverse: possibilities and limitations. *Journal of educational evaluation for health professions*, 18.
18. Buhalis, D., Lin, M. S., & Leung, D. (2022). Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing. *International Journal of Contemporary Hospitality Management*, 35(2), 701-716.
19. Zhang, X., Yang, D., Yow, C. H., Huang, L., Wu, X., Huang, X., ... & Cai, Y. (2022). Metaverse for Cultural Heritages. *Electronics*, 11(22), 3730.
20. Petrigna, L., & Musumeci, G. (2022). The metaverse: A new challenge for the healthcare system: A scoping review. *Journal of functional morphology and kinesiology*, 7(3), 63.
21. Kawarase IV, M. A., & Anjankar, A. (2022). Dynamics of Metaverse and Medicine: A Review Article. *Cureus*, 14(11).
22. Sebastian, S. R., & Babu, B. P. (2022). Impact of metaverse in health care: a study from the care giver's perspective. *International Journal of Community Medicine and Public Health*, 9(12), 4613.
23. Gadekallu, T. R., Huynh-The, T., Wang, W., Yenduri, G., Ranaweera, P., Pham, Q. V., ... & Liyanage, M. (2022). Blockchain for the Metaverse: A Review. *arXiv preprint arXiv:2203.09738*.
24. Mozumder, M. A. I., Sheeraz, M. M., Athar, A., Aich, S., & Kim, H. C. (2022, February). Overview: technology roadmap of the future trend of metaverse based on IoT, blockchain,

- AI technique, and medical domain metaverse activity. In *2022 24th International Conference on Advanced Communication Technology (ICACT)* (pp. 256- 261). IEEE.
25. Fernandez, C. B., & Hui, P. (2022). Life, the Metaverse and Everything: An Overview of Privacy, Ethics, and Governance in Metaverse . *arXiv preprint arXiv:2204.01480* .
 26. Cheng, R., Wu, N., Chen, S., & Han, B. (2022). Will metaverse be nextg internet? vision, hype, and reality. *arXiv preprint arXiv:2201.12894* .
 27. Duan, H., Li, J., Fan, S., Lin, Z., Wu, X., & Cai, W. (2021, October). Metaverse for social good: A university campus prototype. In *Proceedings of the 29th ACM International Conference on Multimedia* (pp. 153-161) .
 28. Erkut, Burak. "From digital government to digital governance: are we there yet?." *Sustainability* 12.3 (2020): 860.
 29. Manda, M. I., & Backhouse, J. (2016). Addressing trust, security and privacy concerns in e-government integration, interoperability and information sharing through policy: a case of South Africa.
 30. Alpcan, T., Bauckhage, C., & Kotsovinos, E. (2007, October). Towards 3d internet: Why, what, and how?. In *2007 International Conference on Cyberworlds (CW'07)* (pp. 95-99). IEEE.
 31. Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A systematic review of virtual reality in education. *Themes in Science and Technology Education*, 10(2), 85-119.
 32. Boud, A. C., Haniff, D. J., Baber, C., & Steiner, S. J. (1999, July). Virtual reality and augmented reality as a training tool for assembly tasks. In *1999 IEEE International Conference on Information Visualization (Cat. No. PR00210)* (pp. 32-36). IEEE.
 33. Sudan, R. (2021, July 28). How should governments prepare for the metaverse? | by Randeep Sudan | Digital Diplomacy | Medium. Medium; [medium.com. https://medium.com/digital-diplomacy/how-should-governments-prepare-for-the-metaverse-90fd03387a2a](https://medium.com/digital-diplomacy/how-should-governments-prepare-for-the-metaverse-90fd03387a2a)
 34. *Metaverse – The Start of a New Era of Government Services* | National Informatics Centre. (n.d.). Metaverse – The Start of a New Era of Government Services | National Informatics Centre; www.nic.in. Retrieved June 18, 2022, from <https://www.nic.in/blogs/the-metaverse-the-start-of-a-new-era-of-government-services/>
 35. *Should State and Local Governments Care About the Metaverse?* (2022, April 28). GovTech; www.govtech.com. <https://www.govtech.com/products/should-state-and-local-government-care-about-the-metaverse>
 36. Allen, K. (2022, March 9). *A Metaverse of Nations: Why Governments are Making Big Moves into the Metaverse*. Acceleration Economy; accelerationeconomy.com. <https://accelerationeconomy.com/metaverse/a-metaverse-of-nations-why-governments-are-making-big-moves-into-the-metaverse/>
 37. Siddo, B. I. (2022, June 12). *Understanding the Metaverse – Africa’s role*. ACE Times. <https://www.zawya.com/en/world/africa/understanding-the-metaverse-africas-role-o15wvrrk>

38. Rosenberg, L. (2022, March). Regulation of the Metaverse: A Roadmap: The risks and regulatory solutions for largescale consumer platforms. In Proceedings of the 6th International Conference on Virtual and Augmented Reality Simulations (pp. 21-26).
39. Ngila, F. (2022, December 13). *Meta wants to bring the metaverse to Africans through their cell phones*. Quartz. <https://qz.com/meta-wants-to-bring-the-metaverse-to-africans-through-t-1849886796>
40. Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, 2, 53.