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Research Paper

Metaverse of Heritage Buildings in Jakarta's Old Town as a Media for Preservation and Historical Education Tourism

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Abstract

The objectives of this article are: 1) Discussing how to utilize the potential of cultural heritage in the form of buildings, sites and areas through the use of Metaverse in the preservation of heritage buildings in the Old City of Jakarta, 2) Exploring the Metaverse content of the Old Town Heritage Building of Jakarta as an interactive learning tool to understand history in the context of historical preservation and educational tourism. This article is limited to only exploring the existence of buildings and historical areas as well as what content is appropriate as material for presenting a metaverse of Jakarta's Old City heritage buildings, without going any further into creating the metaverse. Through previous literature studies, historical and cultural studies of heritage buildings and the Old Town area of Jakarta and physical storytelling exploration, it is hoped that a metaverse can be built that integrates visual 3d models with interesting narratives to tell the history and stories behind buildings, sites and areas.

Keywords: *Metaverse, Heritage Buildings, Jakarta Old Town, Preservation, Learning, Historical Tourism*

INTRODUCTION

Jakarta's Old Town, with its rich history and abundant cultural heritage, has become the center of attention for local and foreign tourists as an attractive historical tourist destination. Regulation of the Governor of the Special Capital Region of Jakarta Number 36 of 2014 concerning the Kotatua Area Master Plan states that the Kotatua area has high historical value and is a reflection of the historical story, way of life, culture and civilization of the people of Jakarta in the past, so its existence needs to be preserved continuously, including the Old City of Jakarta. Along with the city's rapid growth and continued modernization, many historical buildings in Jakarta's Old Town suffered significant damage and degradation. Based on the Decree of the Head Governor of DKI Jakarta Number 475 of 1993, there are 136 cultural heritage buildings in Jakarta. In Central Jakarta there are 67 buildings, North Jakarta 16 buildings, West Jakarta 35 buildings, South Jakarta 7 buildings and East Jakarta 7. Jakarta Old Town covers the areas of North Jakarta and West Jakarta which have 51 cultural heritage buildings (He et al., 2022) Therefore, the existence of these buildings must be maintained properly. One way to preserve as in Law of the Republic of Indonesia Number 11 of 2010 concerning Cultural Heritage Chapter 1 Article 1 is by utilizing it, A more innovative and interactive approach is needed in its utilization, one of which is through digital technology to create a more interesting and relevant experience for the younger generation.

Several studies discuss the metaverse of heritage buildings in Jakarta, but more discuss how to utilize them through adaptive reuse (Maulina et al., 2023), practical conservation (Eryudhawan & Andi, 2022), risk analysis (Suwandari et al., 2020) and safety aspects (Suwandari et al., 2021). Research discussing metaverses in historic buildings has also been carried out (Al-Tabeeb & Al-Desouqi, 2023), but only explores the visualization of heritage buildings using Augmented Reality technology (Ikhwan & Nasution, 2022) and even then only for documentation (Darmawiguna et al., 2014; Boer et al., 2009) and conducted outside Jakarta (He et al., 2022; Ikhwan & Nasution, 2022;

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Roginal et al., 2023). There has been no research that specifically discusses the use of metaverse for Heritage Buildings in the Old City of Jakarta. Therefore, the objectives of this article are: 1) Exploring the potential of cultural heritage in the form of buildings, sites and areas in the context of using Metaverse in the preservation of heritage buildings in the Old City of Jakarta, 2) Exploring the Metaverse content of the Old City Heritage Building of Jakarta as an interactive learning tool to understand history in the context of historical preservation and educational tourism.

LITERATURE REVIEW

The role of the Metaverse in Heritage Building Preservation is very important because it opens up new opportunities in introducing, maintaining, and promoting cultural heritage related to historical buildings. The metaverse enables the creation of accurate digital reconstructions of heritage buildings that may have been damaged or damaged. This digital reconstruction allows users to explore the building virtually, providing broad and safe access without compromising the physical integrity of the building (Varinlioglu, 2023; Rotsutee & Ketchaya, 2023). The metaverse provides a platform for interactive and engaging history learning. Users can participate in virtual tours, access educational content, and even interact with engineered historical simulations. This helps increase understanding and appreciation of the cultural and historical values associated with heritage buildings (Mystakidis, 2022; Kongpha & Chatwattana, 2023; Chen et al., 2023). The metaverse can be used as a powerful promotional tool for historical tourism. Through virtual tours, multimedia content, and direct interaction with users, the metaverse can increase the appeal and exposure of historical buildings as tourist destinations. This can help bring in more visitors and increase revenue from the tourism sector (Martins et al., 2022; Hui et al., 2023; Wu et al., 2023). By recording heritage buildings in digital form, the metaverse can help in the preservation and archiving of cultural heritage. The digital reconstruction allows periodic monitoring of the condition of the building and allows for timely maintenance measures to prevent further damage (Müller, 2012; Silva et al., 2023).

For historical tourism, the metaverse is essential in bringing an immersive and immersive experience to users who want to explore and learn about the world's cultural heritage (Um et al., 2022). The metaverse gives users virtual access to explore historical places from different parts of the world, without the need to make a physical journey. This allows them to experience and learn about various historical sites from the comfort of their own homes. Through the metaverse, visitors can explore historical buildings, watch historical presentations, and participate in other educational activities. The metaverse provides immersive and diverse travel experiences, including virtual tours, digital exhibitions, and cultural performances to create the atmosphere and beauty of historical places virtually.

RESEARCH METHODOLOGY

The research presented in this article uses qualitative methods carried out through previous literature studies, historical studies, participant observation and content analysis with the stages below (Figure 1).

Gathering Data

Data was collected starting with a study of previous research literature and documentation and archives which aimed to collect historical and contextual information about buildings and historical areas in the Old City of Jakarta. Qualitative methods were used to explore the potential of buildings and areas through historical searches and discover what content is needed for the metaverse through literature studies and field observations. The data collected comes from maps, photos and text of historical documents originating from KITLV, the National Archives of the

Republic of Indonesia (ANRI). Surveys and mapping were also carried out to document the current existence of buildings compared to the past. Participatory observation is carried out to understand interactions between people and buildings and activities around them.

Analisis Data

Data analysis was carried out in several stages, namely:

a. Spatial Historical Analysis to understand the layout and use of city space and buildings and see the spatial and functional relationships between elements in the area as well as space use patterns including streets, squares and public areas, to replicate the experience of space in the metaverse.
b. Visual Analysis to examine the representation of historical buildings in various visual media by collecting and analyzing photos, videos and other visual materials from various periods and how the buildings and surrounding areas have changed over time.
c. Historical Thematic Analysis. Through historical analysis based on the data collected, regional themes are produced which are divided into zones based on their character.
d. Digital Content Exploration based on historical analysis results. The aim is to determine how the history of the Old City of Jakarta will be presented and what activities need to be presented in the metaverse of the heritage buildings of the Old City of Jakarta

Figure 1. Method Research

FINDINGS AND DISCUSSION

The Potential of Heritage Buildings in Jakarta's Old Town

In order to revitalize and develop tourism, the Old Town area has had a grand design. Inside there are five tourist zones. The five zones, the first zone is in Sunda Kelapa Port and its surroundings, the second zone is in Fatahillah Park, the third zone is in the Glodok Chinatown area, the fourth zone is in the Pekojan Arab Village area, and the fifth zone is a supporting zone in the Glodok area. In each zone there are heritage buildings that represent the character of the zone. Figure 2 contains the presence of buildings in each zone which is divided into 3 groups, A, B and C.

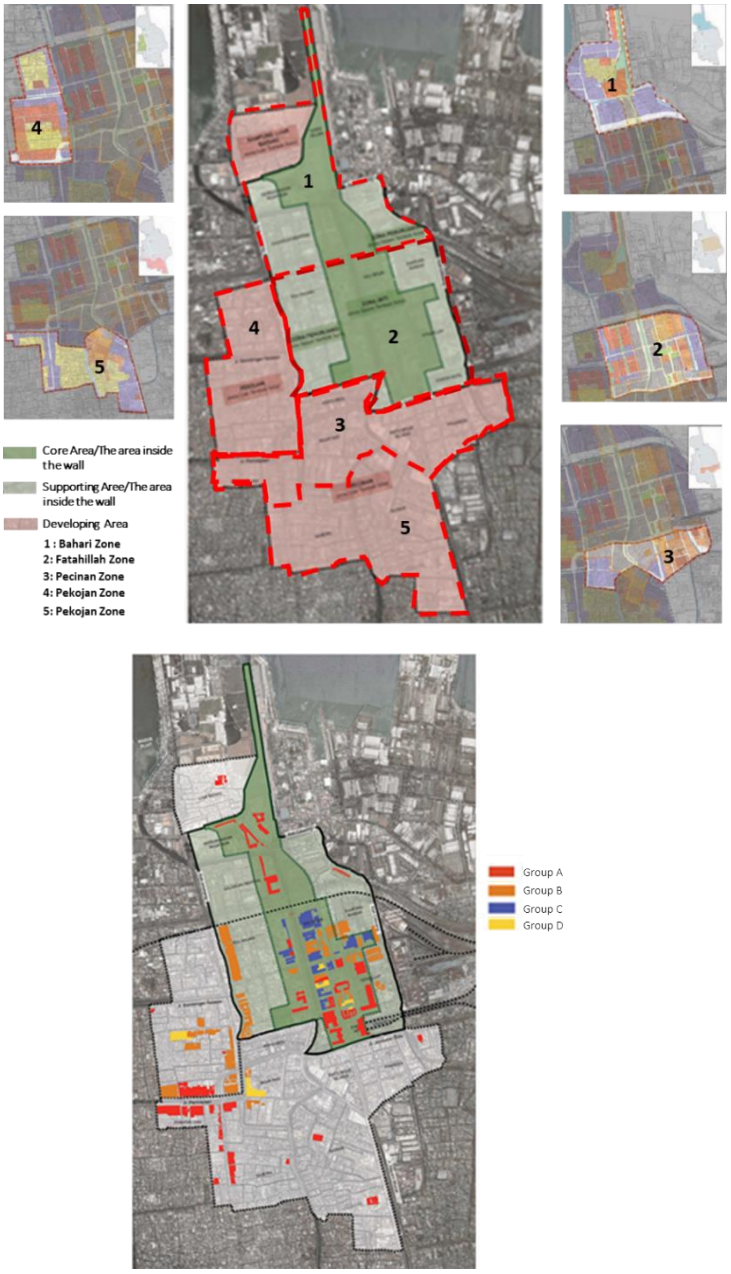

Figure 2. 5 Jakarta Old Town Zones and the Existence of 3 Heritage Building Groups
Source: Jakarta Old City Master Plan (PSDU)

Group A is a building that is prohibited from being demolished/changed, demolition can be done to be rebuilt according to the original, the use of materials must be the same and maintain ornamental details, it is possible to change the function without changing the building, additional buildings are possible. Group B is a building that is prohibited from being demolished / altered, demolition can be carried out to be rebuilt according to the original, in maintenance must not change the pattern of appearance, roof and color and maintain important details and ornaments of the building. It is possible to change the layout of the inner room. However, it is not allowed to change the main structure of the building. It is possible for additional buildings to become a whole unit. While those included in the classification of Group C buildings changes can be made while maintaining the visible pattern of the building adjusted to the surrounding buildings, the function

of the building can be changed in accordance with the city plan. Group D are buildings that have completely disappeared. In each zone there are buildings that represent the character of each zone. Zone 1. Table 1 is a list of 5 zones in Kota Tua Jakarta along with the characters and names of potential areas and buildings for the metaverse.

Table 1. Zones of Jakarta's Old City, Characters and Potential Area or Buildings

No.	Zone	Zone Characters	Name of Metaverse Potential Areas and Buildings
	Nautical Zone (Zone 1)	1. Source Vista to the sea. 2. Orientation of blocks and buildings towards the sea/river. 3. The township district is densely packed. 4. Warehouse district. 5. Styles that respond to marine climate. 6. Public open space as a center of economic activity.	1. Kampung Luar Batang 2. Sunda Kelapa Port 3. Maritime Museum 4. Fish Market 5. Shipyard/Fortress
	Fatahillah Zone (Zone 2)	1. Formality of grid patterns and block design 2. Orientation of blocks and buildings on the main circulation lines 3. Large masses, generally arcades 4. GSB = 0 *(streetwall buildings)* 5. Old building style 6. Public open space design formalities	1. Buildings along Kali Besar 2. Buildings and Sites in Fatahillah Park Area
	Chinatown Zone (Zone 3)	1. The dominance of series buildings with Chinese style nuances 2. Some are rural areas and some are urban buildings 3. The narrow path forms a labyrinth 4. Irregular shape 5. There is no sense of the axis of the region	1. Morning Market 2. Great South Door 3. Pinangsia
	Pekojan Zone (Zone 4)	1. Dominance of dense buildings and row buildings 2. Rural area 3. The narrow path forms a labyrinth 4. Irregular shape 5. There is no sense of the axis of the region 6. Public open space as a center of community and religious activity	1. Arab Village 2. Langgar Tinggi Mosque 3. An Nawier Mosque
	Development Zone (Glodok Business Busat) (Zone 5)	1. Corridor with large blocks 2. The dominance of a large mass of buildings 3. A large block covered the dense village behind it 4. Arcades have begun to be used less frequently	1. Lima Bridge 2. Tambora 3. Glodok

Exploration of Metaverse Content Heritage Buildings in Jakarta's Old Town as a Media for Preservation and Historical Education Tourism

One form of metaverse utilization for preservation is carried out through digital reconstruction of heritage buildings. Making accurate digital replicas of historical buildings and elements in the Old City of Jakarta, can help people in understanding the history of the Old City of Jakarta. The historical reconstruction of Jakarta's Old Town began from the beginning of Jakarta in the royal period followed by the colonial and post-independence periods. The existence of Jayakarta City as a royal city depicted in various sources can be reconstructed visually through animated videos. The existence of canals from the heyday to the destruction and disappearance of canals that turned into road cities (Dewi et al., 2018; Dewi et al., 2017) can be visually reimagined through the metaverse. Supporting narratives are extracted from various historical sources. For example, the narrative about the structure of Jayakarta City according to the Ijzerman Map, that the city of Jayakarta, which is surrounded by fences and inhabited by 3,000 houses and fed by a large river reinforced with piles of thorns in 1618, then began to build forts and canals in 1622 (Picture 3) until it became a complete Batavia as a canal city (Figure 4) and with various atmospheres (Figure 5).

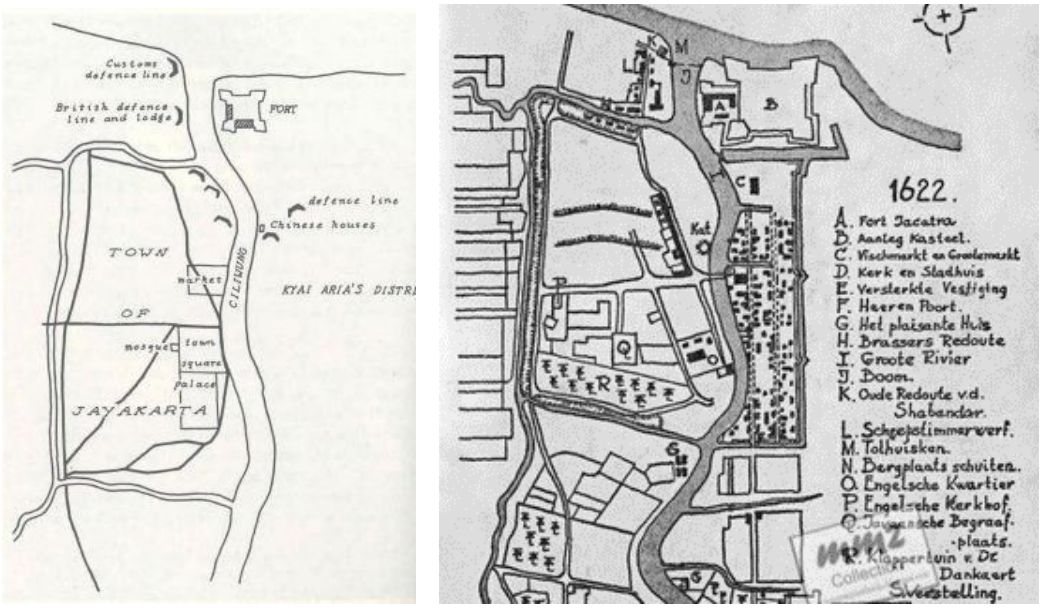

Figure 3. Early Transformation of Royal Cities into Colonial Cities
https://digitalcollections.universiteitleiden.nl/view/collection/kitmaps

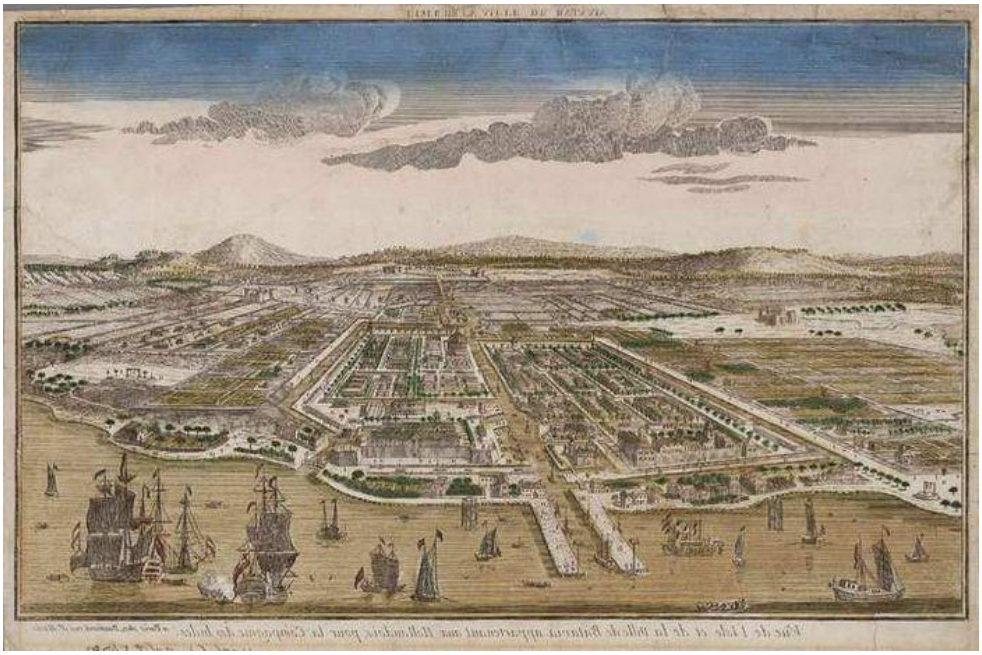

Figure 4. Visualization of Jakarta's Old Town as a Canal City
Source: ANRI

Figure 5. Building and Situation of Jakarta's Old Town as in the Heyday of Batavia
Source: Dewi, Kurniawan and Ellisa, 2018, KITLV

Historical reconstructed metaverse content can be realized through 3D modeling using 3D scanning technology or photogrammetry to create accurate digital models of buildings (Figure 6). Modeling and texturization proceed with developing 3D models based on scanning data, by adding appropriate textures and details to replicate the original appearance of the building. Through Virtual Reality (VR) technology, users can explore a digital replica of the building as if they were in its physical location. Augmented Reality (AR), on the other hand, can be used to display historical

information or reconstructions directly over the building's real-world view.

Figure 6. Example of 3D Modeling of Representative Heritage Building in Jakarta Old Town
Source: Jakarta Old City Master Paln (PSUD)

Figure 7. Examples of the Use of AR and VR in the Heritage Building Metaverse
Source: https://futureiot.tech/seouls-deoksugung-palace-opens-to-vr-tours/Konten Metaverse

Metaverse Heritage Building in Kota Tua Jakarta can be filled with various activities. Visual interaction can be realized through various activities that attract visitors and learning recipients. The following things can be included in heritage building preservation activities in Kota Tua Jakarta in accordance with the activities available in the metaverse (Table 1).

Table 1. Preservation Activities and Historical Educational Tours

	Activities in the Metaverse	Preservation Activities and Historical Educational Tours
1.	Digital Reconstruction	In the context of heritage buildings or historical sites, digital reconstruction is used to create virtual versions of the object that can be accessed and explored through computers or virtual/augmented reality devices.
2.	Virtual Interaction	Visitors can interact with objects and artifacts within the heritage building through virtual interfaces, such as viewing museum collections, reading historical information, and listening to related stories.
3.	Virtual Tour and Exhibition	Metaverse users can take a guided virtual tour through various heritage buildings in Jakarta's Old Town to get historical information delivered interactively. Visitors can visit the exhibition to see artifacts, paintings, old photographs, and other historical materials.
4.	Virtual Cultural Activities	Cultural events such as traditional art performances, fine art exhibitions, and music concerts can be held virtually within the Metaverse.
5.	Educational Games	Metaverse users can take advantage of various educational resources available, such as short videos, quizzes, and interactive learning materials.

CONCLUSIONS

Metaverse Heritage Building in Old City Jakarta as a Media for Preservation, Learning and Historical Tourism shows that the use of Metaverse has great potential as an effective tool in promoting, preserving, and sharing Indonesia's cultural and historical heritage. One form of utilizing the metaverse for preservation is carried out through digital reconstruction. Making accurate digital replicas of historical buildings and elements in the Old City of Jakarta, can help people in understanding the history of the Old City of Jakarta. Heritage Building metaverse activities in Jakarta Old Town can be filled with various activities, digital reconstruction, virtual interactions, virtual tours, virtual exhibitions, virtual cultural activities, education-based games. The results of this research can be used as a reference in creating a metaverse of heritage buildings in the context of preservation and learning.

LIMITATION & FURTHER RESEARCH

Further research could take the form of analyzing preferences, needs and perceptions of the Old City of Jakarta metaverse in the context of preservation and learning. In the end, this research can produce a metaverse that can be directly used by visitors.

REFERENCES

Al-Tabeeb, A. K. & Al-Desouqi, A. A. (2023). Metaverse in architecture: An approach to documenting and exploring the Egyptian heritage through metaverse', green building & construction … [Preprint]. https://ojs.wiserpub.com/index.php/GBCE/article/view/2300.

Boer, A. De, Voorbij, J. B. and Breure, L. (2009). Towards a 3D visualization interface for cultural landscapes and heritage information. Online proceedings of the 37th … [Preprint]. Citeseer. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=441e097acf3686668015357ec0ebb23a0ef18806.

Chen, X., Zou, D., Xie, H., & Wang, F. L. (2023). Metaverse in education: contributors, cooperations, and research themes. *IEEE Transactions on Learning Technologies*.

https://ieeexplore.ieee.org/abstract/document/10129849/.

Darmawiguna, I. G. M., Kesiman, M. W. A., Crisnapati, P. N., Wiartika, I. M. E., Suparianta, K. D., Susena, I. K., & Yudiantara, I. M. (2014). Augmented Reality for the Documentation of Cultural Heritage Building Modelling in Bali Indonesia. *Kultur und Informatik: Reality and Virtuality*. https://www.researchgate.net/profile/I-Gede-Mahendra-Darmawiguna/publication/295908053_Augmented_Reality_for_the_Documentation_of_Cultural_Heritage_Building_Modelling_in_Bali_Indonesia/links/56dd27f208aee73df6d57c7d/Augmented-Reality-for-the-Documentation-of-Cultural-Heritage-Building-Modelling-in-Bali-Indonesia.pdf.

Dewi, E. P., Kurniawan, K. R., Ellisa, E., & Budianta, M. (2017). Urban Canals in Colonial Batavia: Rethinking'Clean and Dirt'Space. *Pertanika Journal of Social Sciences & Humanities*.

Dewi, E.P., Kurniawan, K.R. and Ellisa, E. (2018). Transformation of canals in Colonial Batavia. *International Journal of Architecture and Urban Studies*, 3(June).

Eryudhawan, B., & Andi, A. (2022). The challenges in conserving the heritage based on conservation practice of AA Maramis Building in Jakarta. *International Journal of Environment, Architecture, and Societies*, *2*(01), 43-54. https://ijeas.untan.ac.id/index.php/home/article/view/eryudhawan_andi_v2n1.

He, N., Ding, K., & Zhang, J. B. (2022, November). Exploration and Research on Digital Education Scenarios from the Perspective of Metaverse. In *2022 10th International Conference on Orange Technology (ICOT)* (pp. 1-4). IEEE. https://ieeexplore.ieee.org/abstract/document/10008167/.

Hui, X., Raza, S. H., Khan, S. W., Zaman, U., & Ogadimma, E. C. (2023). Exploring regenerative tourism using media richness theory: emerging role of immersive journalism, metaverse-based promotion, eco-literacy, and pro-environmental behavior. *Sustainability*, *15*(6), 5046. https://www.mdpi.com/2071-1050/15/6/5046.

Ikhwan, A., & Nasution, A. B. (2022). Introduction to the heritage building Medan City using augmented reality. *Sinkron: jurnal dan penelitian teknik informatika*, *7*(4), 2568-2575. https://www.polgan.ac.id/jurnal/index.php/sinkron/article/view/11878.

Kongpha, R., & Chatwattana, P. (2023). The Virtual Interactive Learning Model Using Imagineering Process via Metaverse. *Higher Education Studies*, *13*(1), 35-41. https://eric.ed.gov/?id=EJ1381905.

Martins, D., Oliveira, L., & Amaro, A. C. (2022). From co-design to the construction of a metaverse for the promotion of cultural heritage and tourism: the case of Amiais. *Procedia Computer Science*, *204*, 261-266. https://www.sciencedirect.com/science/article/pii/S1877050922007694.

Maulina, A., Sukoco, I., Hermanto, B., & Kostini, N. (2023). Tourists' Revisit Intention and Electronic Word-of-Mouth at Adaptive Reuse Building in Batavia Jakarta Heritage. *Sustainability*, *15*(19), 14227. https://www.mdpi.com/2071-1050/15/19/14227.

Müller, F. (2012). *Remembering in the metaverse: preservation, evaluation, and perception* (Doctoral dissertation, University_of_Basel). https://edoc.unibas.ch/16452/.

Mystakidis, S. (2022). Metaverse. *Encyclopedia*, *2*(1), 486-497. https://www.mdpi.com/2673-8392/2/1/31.

Roginal, F. L., Rasam, A. R. A., Ghazali, R., & Jaafar, S. A. (2023). Geovisualising 3D Cultural Heritage Building for Urban Tourism Via Mobile Augmented Reality Application. *International Journal of Information & Knowledge Management (22318836)*, *13*(2). https://ijikm.uitm.edu.my/pdf/v13n2/13208.pdf.

Rotsutee, K., & Ketchaya, S. (2023, March). 3D Modeling of Building 26 Faculty of Science and Technology Suan Sunandha Rajabhat University with Spatial Metaverse Space. *International*

Academic Multidisciplinary Research Conference in Fukuoka 2023. 178-183. http://icbtsproceeding.ssru.ac.th/index.php/ICBTSFUKUOKA2023/article/view/883.

Silva, M., Neto, A., Cabada, C., Bland, K., Davanço, J., & Teixeira, J. M. (2023, November). Metaverse and cultural preservation: an alternative through NFTs of social sustainability in Brazil. In *Proceedings of the 25th Symposium on Virtual and Augmented Reality*. 131-140. https://doi.org/10.1145/3625008.3625028.

Suwandari, Y. D., Amin, M., & Primatama, M. A. (2020). Risk Analysis of Heritage Building in Jakarta. *International Journal of Applied Business and International Management (IJABIM)*, *5*(2), 91-97. http://ejournal.aibpmjournals.com/index.php/IJABIM/article/view/862.

Suwandari, Y. D., Amin, M., & Primatama, M. A. (2021). Evaluation of Building Safety System Aspect Based on Risk (Case Study Building Heritage in Jakarta). *Asia Pacific Journal of Management and Education (APJME)*, *4*(1), 66-71. http://ejournal.aibpmjournals.com/index.php/APJME/article/view/1038.

Um, T., Kim, H., Kim, H., Lee, J., Koo, C., & Chung, N. (2022, January). Travel Incheon as a metaverse: smart tourism cities development case in Korea. In *ENTER22 e-Tourism Conference*. 226-231. Cham: Springer International Publishing. https://library.oapen.org/bitstream/handle/20.500.12657/52424/1/978-3-030-94751-4.pdf#page=232.

Varinlioglu, G. (2023). New Perspectives for Cultural Heritage the Role of Digital Architects and Virtual Reality. *Dimensions. Journal of Architectural Knowledge*, *3*(5), 89-108. https://doi.org/10.14361/dak-2023-0506.

Wu, D., Yang, Z., Zhang, P., Wang, R., Yang, B., & Ma, X. (2023). Virtual-reality inter-promotion technology for metaverse: A survey. *IEEE Internet of Things Journal*. https://ieeexplore.ieee.org/abstract/document/10098667/.