Journal of
Advanced Civil and Environmental Engineering
Vol.7, No.1, 2024, pp 98-108
ISSN: 2599-3356
DOI: http://dx.doi.org/10.30659/jacee.7.1.98-108

Utilizing Metaverse Technology for the Preservation of Indigenous Houses in Southeast Sulawesi: A Study of Bajo, Tolaki, Muna, and Buton Cultural Heritage

Ahsan Hidayat Setiadi[1*] and Andi Al Mustagfir Syah[2]

[1] *Civil Engineer Department, Universitas Sulawesi Tenggara, Indonesia*
[2] *Architectural Department, Universitas Muhammadiyah Kendari, Indonesia*
** Corresponding author: ahsanhidayat686@gmail.com*

(**Received:** April 27th, 2024 ; **Revised:** June 13th, 2024 ; **Accepted:** June 19th, 2024)

Abstract: Southeast Sulawesi, as one of the Provinces in Indonesia, has cultural artifacts that serve as diverse reflections of its culture and need to be preserved to ensure their continuity for future generations. There are four major indigenous ethnic groups in Southeast Sulawesi, namely Tolaki, Muna, Buton, Moronene, and Bajo, which represent the cultural diversity of the region. These ethnic groups have traditional houses that serve as cultural hubs, preserving cultural values and acting as iconic representations of the local culture in Southeast Sulawesi. The development of metaverse technology, a tangible proof of recent technological advancements, is known for its ability to create spatial environments in virtual reality. The urgency of this research arises from the lack of community interest in traditional houses, as evidenced by the eclectic and minimalist architectural designs, as well as the threat of extinction faced by traditional houses in Southeast Sulawesi. This study aims to preserve traditional houses in Southeast Sulawesi by integrating them with metaverse technology, enabling the transmission of cultural values to future generations. The research will employ a qualitative descriptive method. Additionally, this research aims to fill the gaps in previous studies by introducing metaverse technology as a groundbreaking innovation in addressing the threat of cultural artifact extinction in Southeast Sulawesi province.

Keywords: *Southeast Sulawesi; cultural preservation; traditional houses; indigenous ethnic groups; metaverse technology*

1. Introduction

Traditional houses are an integral part of the cultural heritage of a society. In Southeast Sulawesi, there is a wealth of traditional houses that reflect the ethnic identities of the Bajo, Tolaki, Muna, Buton, and Moronene(Hak 2019). These traditional houses have become cultural symbols and valuable historical remnants for the local communities. However, in recent years, these traditional houses have faced various serious threats that jeopardize their continuity. One of the main threats faced by traditional houses in Southeast Sulawesi is rapid modernization, influenced by urbanization and social changes. In this era of globalization, traditional culture is often marginalized by dominant modernization trends. Many people are adopting modern lifestyles and abandoning their traditions and traditional houses. This results in damage, loss of value, and even the disappearance of these valuable traditional houses as part of the cultural heritage(Alwi et al., 2022).

In order to preserve the existence of traditional houses and transmit the associated knowledge and cultural values to future generations, innovative preservation efforts are required. In this context, one technology that has garnered attention is the Metaverse.(Al-Ghaili et al. 2022). The Metaverse is a technology that enables the creation of an interactive virtual world that can be accessed globally. Through the use of the Metaverse, traditional houses in Southeast Sulawesi can be immortalized in a virtual form, allowing for global access and interactive experiences(Moneta 2020).

By utilizing Metaverse technology, the potential for preserving traditional houses becomes broader and more inclusive. In the virtual environment of the Metaverse, users from various parts of the world can visually explore traditional houses and gain knowledge about the culture, architecture, and daily life of the communities that preserve them(Tang et.al, 2022). In this virtual experience, people can learn about the history, traditions, and cultural values passed down through these traditional houses(Sugiharto et al., 2022).

By harnessing Metaverse technology for the preservation of traditional houses in Southeast Sulawesi, it is hoped that awareness of the importance of cultural heritage will be strengthened, and the appreciation of the local community towards traditional houses and their inherent values will be enhanced. It is also expected that through this virtual experience, younger generations can become more involved in preserving and promoting traditional houses and local culture. Thus, the efforts to preserve traditional houses in Southeast Sulawesi can become more sustainable and make a positive contribution to the preservation of culture and the identity of the local community(Afdholy, 2022).

Brief Explanation about the Traditional Houses of the Bajo, Tolaki, Muna, and Buton Tribes:The traditional houses of the Bajo, Tolaki, Muna, and Buton tribes are unique and culturally significant dwellings found in Southeast Sulawesi, Indonesia(Wardhani, Permatasari, and Dwiasmaraditya 2022). Here is a brief explanation about the traditional houses of each tribe:

1. Traditional House of the Bajo Tribe: The Bajo tribe is a coastal community in Southeast Sulawesi known for their seafaring lifestyle. Their traditional house, called "rumah panggung," is built on sturdy wooden stilts and located along the coastal areas. The Bajo's elevated houses have multi-tiered roofs and are designed to protect against floods and ocean waves.
2. Traditional House of the Tolaki Tribe: The Tolaki tribe is one of the indigenous tribes in Southeast Sulawesi, primarily engaged in farming. Their traditional house, known as "ruma bassi," is a stilt house made of wood with walls constructed from woven bamboo. The roof is typically made of rumbia or ijuk leaves. Ruma bassi consists of multiple rooms used for living, sleeping, cooking, and family activities.
3. Traditional House of the Muna Tribe: The Muna tribe inhabits Muna Island in Southeast Sulawesi. Their traditional house, known as "ruma lawa," has a rectangular shape with walls made of woven bamboo and a roof made of coconut leaves. Ruma lawa usually features a raised wooden floor.
4. Traditional House of the Buton Tribe: The Buton tribe resides on Buton Island in Southeast Sulawesi. Their traditional house, called "rumbia," is a raised stilt house with a strong wooden structure. The walls are made of woven bamboo or wooden planks, and the roof is constructed with rumbia leaves. Rumbia comprises several rooms used for living, sleeping, and daily activities.

The traditional houses of the Bajo, Tolaki, Muna, and Buton tribes hold significant cultural value and reflect the local wisdom and dependence on the surrounding environment. These houses are an essential part of preserving the cultural heritage and identity of these tribes in Southeast Sulawesi.

The urgency of preserving traditional houses in Southeast Sulawesi through the use of Metaverse technology can be explained as follows:

1. Preserving cultural identity

2. Promoting cultural awareness
3. Global accessibility
4. Education and research
5. Sustainability of preservation

By combining Metaverse technology with the preservation of traditional houses in Southeast Sulawesi, the urgency of cultural preservation can be realized through global accessibility, education, community awareness, and sustainable heritage preservation. This is important to maintain cultural diversity, enrich ethnic identities, and ensure that this valuable cultural heritage is appreciated and enjoyed by both the current and future generations(Al-Ghaili et al. 2022).

One of the highly anticipated outcomes of research conducted on the use of Metaverse technology in preserving traditional houses in Southeast Sulawesi is gaining a deeper understanding of the history, architecture, and related traditions of these traditional houses. Such research can contribute to the discovery of new knowledge about the role of traditional houses in the local culture and uncover aspects that may have previously remained undisclosed. Furthermore, the research findings can offer insights into how Metaverse technology can be effectively utilized as a tool for cultural preservation and documentation, providing practical guidance for preservation efforts concerning traditional houses in other regions.

2. Methodology

2.1 SWOT Analytic

The descriptive qualitative methodology with a literature review using SWOT analysis will be employed in this research to analyze the preservation of traditional houses in Southeast Sulawesi through the use of Metaverse technology. The following are the steps to be taken:

a. Identification of Internal Factors (Strengths and Weaknesses): a. Strengths: Identify internal strengths that support the preservation of traditional houses, such as strong cultural values, unique traditional architecture, and rich local knowledge related to traditional houses. b. Weaknesses: Identify internal weaknesses that may hinder preservation efforts, such as a lack of technical understanding regarding the use of Metaverse technology and limited skilled human resources.
b. Identification of External Factors (Opportunities and Threats): a. Opportunities: Identify external opportunities that can be utilized in the preservation of traditional houses, such as global interest in cultural heritage, advancements in information technology, and global accessibility through the internet. b. Threats: Identify external threats that may impede preservation efforts, such as rapid urbanization, social changes leading to a decline in interest in traditions, and the tendency of globalization to overlook local cultural uniqueness.
c. SWOT Analysis: a. Strengths-Opportunities (SO): Identify how internal strengths can be leveraged to optimize external opportunities. For example, utilizing Metaverse technology to showcase the uniqueness of traditional houses to attract global interest. b. Strengths-Threats (ST): Identify how internal strengths can mitigate external threats. For example, strengthening cultural values and raising awareness among local communities to counteract the negative influences of globalization. c. Weaknesses-Opportunities (WO): Identify strategies to address internal weaknesses and capitalize on external opportunities. For example, providing training for human resources on the use of Metaverse technology. d. Weaknesses-Threats (WT): Identify actions needed to address internal weaknesses and confront external threats. For example, establishing collaborations with relevant stakeholders to overcome human resource limitations.
d. Interpretation and Conclusion: a. SWOT Interpretation: Analyze the findings from the SWOT analysis to gain a deeper understanding of the situation regarding the preservation of traditional houses and the potential of using Metaverse technology. b. Conclusion: Draw conclusions based on the results of the SWOT analysis and provide recommendations for more effective preservation efforts, such as optimizing the use of Metaverse technology to promote and

strengthen community awareness of traditional houses and enhancing technical expertise.

Table 1. Strength of Metaverse Technology for the Preservation of Indigenous Houses in Sulawesi Tenggara.

No	Strength
1	Cultural Significance: Traditional houses hold immense cultural value, reflecting the identity and heritage of local communities.
2	Unique Architectural Features: Traditional houses in Southeast Sulawesi exhibit distinct architectural elements that showcase the region's rich cultural diversity.
3	Local Knowledge and Expertise: Communities possess valuable knowledge and expertise in traditional house construction techniques, materials, and cultural symbolism.
4	Tourism Potential: Traditional houses serve as significant cultural attractions, contributing to the tourism industry in Southeast Sulawesi.
5	Community Engagement: The preservation of traditional houses fosters community engagement and pride, encouraging active participation in preservation efforts.
6	Educational Opportunities: Traditional houses provide educational opportunities, allowing for the transmission of knowledge about history, traditions, and architectural details.
7	Global Accessibility: Metaverse technology enables global accessibility, allowing people worldwide to explore and learn about traditional houses.
8	Cultural Significance: Traditional houses hold immense cultural value, reflecting the identity and heritage of local communities.

Source : Analysis

Table 2. *Weakness* of Metaverse Technology for the Preservation of Indigenous Houses in Sulawesi Tenggara.

No	**Weakness**
1	Limited Technical Understanding: There may be a lack of technical understanding and expertise among local communities regarding the implementation and utilization of Metaverse technology for preserving traditional houses.
2	Limited Resources: The availability of resources, such as funding, technology infrastructure, and skilled human resources, may pose challenges to effectively implement and sustain the use of Metaverse technology for preservation efforts.
3	Changing Cultural Practices: Social changes and modernization may lead to a decline in interest and participation in traditional cultural practices, including the preservation of traditional houses.
4	Urbanization Pressures: Rapid urbanization and development in Southeast Sulawesi can result in the encroachment on traditional lands and the destruction or alteration of traditional house sites.
5	Maintenance and Conservation: Traditional houses require regular maintenance and conservation efforts to ensure their longevity. However, limited resources and knowledge in this aspect may hinder effective preservation.
6	Risk of Misrepresentation: The use of technology for virtual representations of traditional houses carries the risk of misrepresentation or oversimplification, potentially diluting the cultural significance and authenticity of the houses.
7	Accessibility and Connectivity: Limited access to reliable internet connectivity and technological devices may hinder the widespread use and accessibility of Metaverse technology, limiting its potential impact.
8	Limited Technical Understanding: There may be a lack of technical understanding and expertise among local communities regarding the implementation and utilization of Metaverse technology for preserving traditional houses.

Source: Analysis

Table 3. Opportunity of Metaverse Technology for the Preservation of Indigenous Houses in Sulawesi Tenggara.

No	Opportunity
1	Potential utilization of large forest resources
2	State commitment in organizing forestry
3	Great international support for sustainable forest management
4	The existence of forestry partners as well as potential community participation potential in supporting forestry development through its involvement in planning, implementation and supervision
5	High dependence on forest resources
6	Market demand for high forest product yields.
7	Investment opportunities for forest resources are high
8	Creation of an efficient and sustainable management unit, ecologically,economically and socially

Source: Analysis

Table 4. Threat of Metaverse Technology for the Preservation of Indigenous Houses in Sulawesi Tenggara.

No	Threat
1	Urbanization and Development: Rapid urbanization and development can result in the destruction or alteration of traditional house sites, as well as encroachment on traditional lands, posing a threat to their preservation.
2	Changing Social Dynamics: Social changes and modernization may lead to a decline in interest and participation in traditional cultural practices, including the preservation of traditional houses.
3	Limited Financial Resources: Limited funding and financial resources can hinder the implementation and sustainability of preservation efforts, including the utilization of Metaverse technology.
4	Lack of Awareness and Appreciation: There may be a lack of awareness and appreciation among local communities and the wider society regarding the cultural significance and value of traditional houses, potentially undermining preservation initiatives.
5	Risk of Misrepresentation: The use of technology for virtual representations of traditional houses carries the risk of misrepresentation or oversimplification, potentially diluting the cultural significance and authenticity of the houses.
6	Natural Disasters and Climate Change: Traditional houses may be vulnerable to natural disasters and the impacts of climate change, such as flooding, erosion, or increased humidity, which can accelerate their deterioration and pose challenges to their preservation.
7	Limited Technical Infrastructure: Limited access to reliable internet connectivity, technological devices, and technical expertise may hinder the widespread use and accessibility of Metaverse technology, limiting its potential impact on preservation efforts.
8	Urbanization and Development: Rapid urbanization and development can result in the destruction or alteration of traditional house sites, as well as encroachment on traditional lands, posing a threat to their preservation.
9	Changing Social Dynamics: Social changes and modernization may lead to a decline in interest and participation in traditional cultural practices, including the preservation of traditional houses.

Source: Analysis

After obtaining all the influential factors, the next step in the research on the Study of Metaverse Technology in the Effort to Preserve Traditional Houses in Southeast Sulawesi: A Study on the Cultural Heritage of the Bajo, Tolaki, Muna, Buton, and Moronene Tribes is data processing. The processing of data influencing factors is done using the tabulation method. The obtained factors will be displayed using tables for easy readability and understanding.

After the tabulation of data is completed, the next stage is the description of the factors to obtain an understanding of the relationship between the factors. The responses from the questionnaire will be converted into certain values to obtain a total assessment. This assessment can be visualized in the SWOT quadrant, which can be used as a guide in the analysis activities. The preparation of strategies in the context of achieving the research goal, which is the preservation of traditional houses in Southeast Sulawesi, involves leveraging the strengths and opportunities available while addressing the weaknesses and threats encountered. The strategies formulated to achieve the research goals can be developed using the SWOT matrix.

By applying these methods, it is expected that the research on the Study of Metaverse Technology in the Effort to Preserve Traditional Houses in Southeast Sulawesi: A Study on the Cultural Heritage of the Bajo, Tolaki, Muna, Buton, and Moronene Tribes can provide a better understanding of the cultural heritage of the Bajo, Tolaki, Muna, Buton, and Moronene tribes and provide strategic guidance in their preservation efforts.

Table 5. SWOT Matrix.

Internal **Eksternal**	***Strength (S)***	***Weakness (W)***
Opportunity (O)	**Strategy S-O** list of strengths to take advantage of opportunities	**Strategy W-O** List to minimize weaknesses by taking advantage of the opportunities
Threats (T)	**Strategy S-T** List of powers to avoid threats	**Strategy W-T** List to minimize weaknesses by avoiding threats

Source : (Wijesooriya and Brambilla 2021)

In the Study of Metaverse Technology in the Effort to Preserve Traditional Houses in Southeast Sulawesi: A Study on the Cultural Heritage of the Bajo, Tolaki, Muna, Buton, and Moronene Tribes, the internal factors will be compared with the external factors to determine the strategies to solve the identified problems(Schumacher 2022). By analyzing the SWOT matrix, it is expected to derive a minimum of four strategies for achieving the research objectives.

However, it is important to prioritize the strategies derived from the SWOT matrix. A sorting process will be conducted to determine the priority strategy that will be used to achieve the research objectives. This prioritization will help in identifying the most effective and feasible approach to address the identified challenges and leverage the opportunities available.

By applying this approach, the Study of Metaverse Technology in the Effort to Preserve Traditional Houses in Southeast Sulawesi aims to determine the most suitable strategy to preserve the cultural heritage of the Bajo, Tolaki, Muna, Buton, and Moronene tribes. This will ensure that the research efforts focus on the most impactful and relevant actions to achieve the desired object

There are 8 steps in compiling SWOT matrix, that is:

1. Identify the objective: Determine the specific objective or goal that you want to analyze using the SWOT matrix. This could be related to a business, project, or any other strategic decision.
2. Conduct a SWOT analysis: Perform a comprehensive analysis of the internal strengths and weaknesses, as well as the external opportunities and threats that are relevant to the objective. Gather relevant data and information through research, surveys, and consultations.
3. List the strengths: Identify and list the internal factors that provide a competitive advantage or positive attributes to achieving the objective. These could include unique resources, expertise, capabilities, or positive aspects of the organization or project.
4. Identify the weaknesses: Recognize and list the internal factors that act as limitations or obstacles to achieving the objective. These could include resource constraints, lack of expertise, or other internal challenges that need to be addressed.

5. Identify the opportunities: Identify and list the external factors or trends in the business environment that could potentially contribute to the achievement of the objective. These could include market trends, emerging technologies, or favorable industry conditions.
6. Identify the threats: Identify and list the external factors or trends in the business environment that could pose challenges or risks to the achievement of the objective. These could include competition, changing consumer preferences, or regulatory changes.
7. Evaluate and prioritize: Assess the significance and impact of each strength, weakness, opportunity, and threat identified. Prioritize them based on their importance and relevance to the objective.
8. Construct the SWOT matrix: Create a matrix or table that visually represents the identified strengths, weaknesses, opportunities, and threats. Place each factor in the appropriate quadrant of the matrix to provide a clear overview and facilitate strategic decision-making.

By following these steps, you can effectively compile a SWOT matrix that provides a structured analysis of the internal and external factors related to your objective, helping you make informed strategic decisions.

2.2 Implementation of Research

The implementation of the research includes several activities and stages schematically shown in Fig. 1.

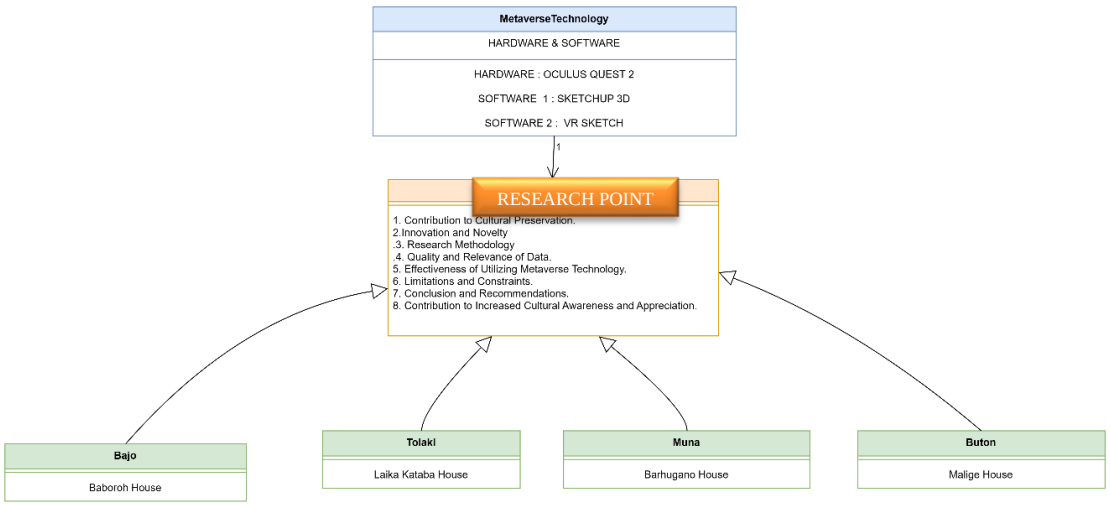

Fig. 1. Method of Research Flowchart.

The implementation of the research "Study of Metaverse Technology in the Effort to Preserve Traditional Houses in Southeast Sulawesi: A Study on the Cultural Heritage of the Bajo, Tolaki, Muna, Buton, and Moronene Tribes" can be done by following the following steps:

1. Identify Objectives: Clearly define the research objectives, such as investigating the potential use of metaverse technology in the preservation of traditional houses of the Bajo, Tolaki, Muna, Buton, and Moronene tribes in Southeast Sulawesi.
2. Identify Internal Factors: Identify and analyze relevant internal factors in the preservation of traditional houses, such as unique characteristics of the traditional houses and cultural knowledge possessed by the respective tribes.
3. Evaluate Internal Factors
4. Identify External Factors: Identify external factors that influence the preservation of traditional houses
5. Evaluate External Factors: Evaluate the impact and implications of external factors on the preservation efforts.
6. Develop SWOT Matrix: Create a SWOT matrix by categorizing internal factors into strengths and weaknesses, and external factors into opportunities and threats.

7. SWOT Analysis: Analyze the relationships and interactions among the factors in the SWOT matrix
8. Strategy Development: Prioritize the most relevant and effective strategies to achieve the research objectives

3 Recommendation

3.1 Sketh up 3D Implementation

Here are the steps to use SketchUp in the effort to preserve traditional houses in Southeast Sulawesi:

1. SketchUp Installation
2. Reference Preparation: Gather references about traditional houses in Southeast Sulawesi, such as images, sketches, photos, and detailed descriptions. These references will help you design accurate and appropriate 3D models.
3. Interface Familiarization: Get acquainted with the SketchUp user interface. Learn how to use basic tools like lines, polygons, circles, and 3D object modeling to construct the traditional house model.
4. Initial Sketch Design:
5. Detailing and Refining the Model: Add architectural details, decorative elements, and unique features of the traditional house to the SketchUp model. Ensure that the model reflects the characteristics and distinct features of the traditional house you aim to restore or preserve.
6. Coloring and Texturing
7. Simulation and Visualization

3.2 VR Sketch & VR Sketch Plugin Implementation

Here are the steps to use the collaboration between SketchUp 3D, VR Sketch plugin, and VR Sketch application in the effort of simulating the preservation of traditional houses in Southeast Sulawesi:

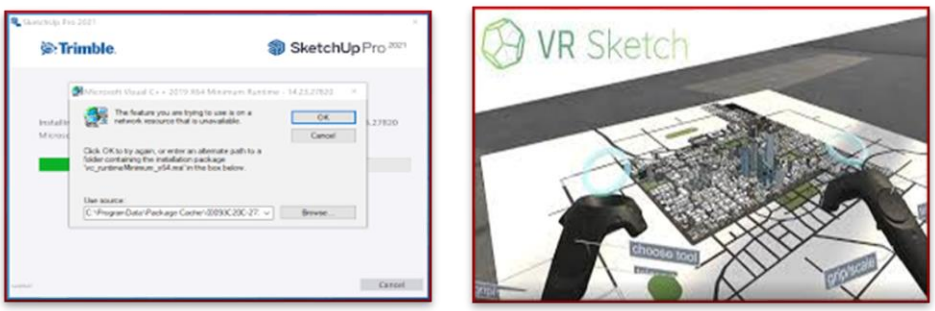

Fig. 2. Sketch Up & VR Sketch Installation.

Preparation of 3D Models in SketchUp:

a. Use the SketchUp software to design and model the traditional houses in detail.
b. Add architectural details, decorative elements, and unique features of the traditional houses.
c. Ensure that the models reflect the characteristics and distinctive features of the traditional houses you wish to restore or preserve.
d. Installation of VR Sketch Plugin: Download and install the VR Sketch plugin for SketchUp according to the instructions provided by the developer.
e. Installation of VR Sketch Application: Download and install the VR Sketch application on your VR device following the instructions provided by the developer.
f. Make sure you have a VR device that is compatible with the VR Sketch application.
g. Importing 3D Models into VR Sketch Application:
h. Open the VR Sketch application on your VR device.
i. Import the traditional house models exported from SketchUp into the VR Sketch application

using the available import options.

j. Ensure that the models are displayed correctly in the VR environment

k. Simulation and Interaction in VR:Use the VR device to enter the VR environment within the VR Sketch application.

l. Collaboration and Discussion:Involve local communities, cultural heritage experts, and relevant stakeholders in collaborative sessions and discussions using the VR Sketch application.

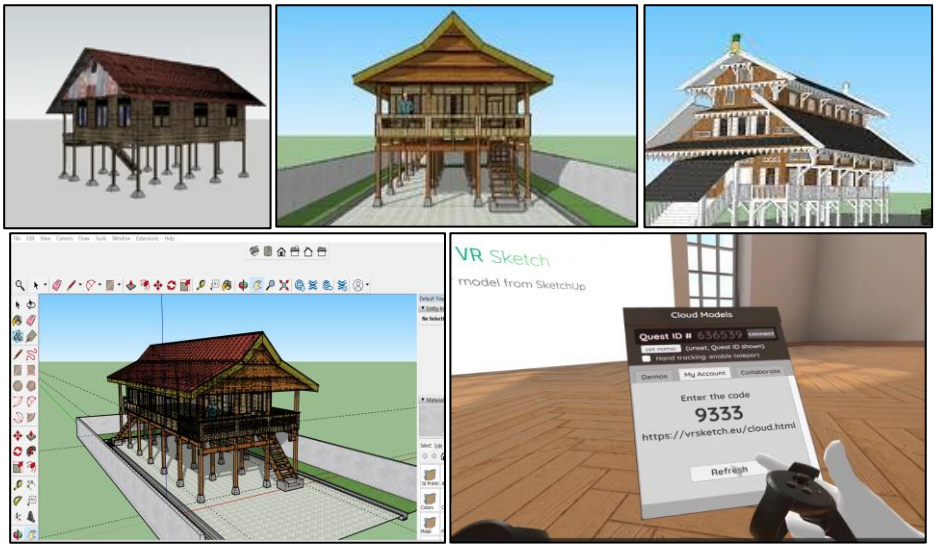

Fig. 3. Preparing Traditional House Object to VR Sketch.

Fig. 4. Virtual Tour By Using VR Sketch in Oculus Quest 2.

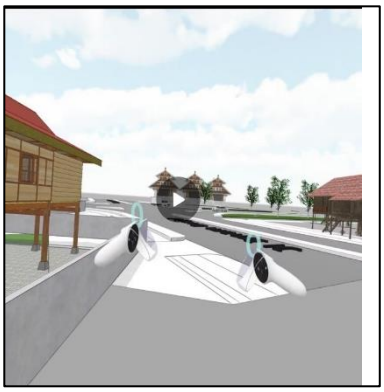

Fig. 5. Virtual Tour in scale 1:1.

4. Conclusion

The conclusion of this journal is that the use of Metaverse Technology holds great potential for preserving traditional houses of the Bajo, Tolaki, Muna, and Buton ethnic groups in Southeast Sulawesi. These traditional houses have high cultural value and serve as significant symbols of the local ethnic identity. However, they are facing threats from modernization and globalization, which could lead to a loss of cultural significance and the disappearance of these traditional houses.

Through the use of Metaverse Technology, these traditional houses can be immortalized in a virtual form, allowing for global access and interactive experiences. This enables people from all over the world to learn about the history, traditions, and cultural values associated with these traditional houses. Thus, Metaverse technology can raise awareness of the importance of cultural heritage and promote appreciation of these traditional houses, especially among younger generations.

In this journal, the research used SWOT analysis to identify relevant internal strengths, weaknesses, external opportunities, and threats related to the preservation of traditional houses. The results of the SWOT analysis helped in formulating strategies to achieve the research goal, which is the preservation of traditional houses in Southeast Sulawesi through the use of Metaverse Technology.

In conclusion, this research highlights the urgency of preserving traditional houses as a vital part of the culture and ethnic identity in Southeast Sulawesi. Metaverse Technology is seen as an effective tool in this preservation effort, with the potential to enhance understanding of traditional houses and their cultural values. By involving this technology, it is hoped that efforts to preserve traditional houses in the region can become more sustainable and make a positive contribution to the preservation of culture and the identity of the local community.

Acknowledgment

I would like to express my sincere gratitude and appreciation to the individuals and organizations who have contributed to the successful completion of this study on utilizing Metaverse technology for the preservation of indigenous houses in Sulawesi Tenggara, with a special emphasis on the cultural heritage of Bajo, Tolaki, Muna, and Buton.

First and foremost, I would like to extend my deepest appreciation to the indigenous communities of Bajo, Tolaki, Muna, and Buton for their invaluable participation, knowledge, and insights. Their willingness to share their cultural heritage and collaborate in this research has been fundamental in shedding light on the importance of preserving and promoting their unique architectural traditions.

I would also like to express my gratitude to the local authorities, cultural organizations, and research institutions in Sulawesi Tenggara for their support and cooperation throughout this study. Their assistance in providing access to resources, facilitating fieldwork, and offering guidance has been instrumental in the successful execution of this research.

Furthermore, I would like to acknowledge the guidance and expertise of my academic advisor, for their invaluable insights, supervision, and support. Their mentorship has been crucial in shaping the direction and methodology of this study.

Lastly, I would like to thank my family, friends, and colleagues for their encouragement and understanding throughout the research process. Their unwavering support has provided me with the motivation and strength to overcome challenges and complete this study.

Without the contributions and support of the aforementioned individuals and organizations, this research would not have been possible. I am truly grateful for their involvement and commitment to the preservation of indigenous houses and cultural heritage in Sulawesi Tenggara.

Reference

[1] Sugiharto, A., Musa, M. Y., Falahuddin, M. J. (2022). *NFT & Metaverse: Blockchain, Dunia Virtual & Regulasi* Vol. 1 (Indonesian Legal Study for Crypto Asset and Blockchain)

[2] Al-Ghaili, A. M., Kasim, H., Al-Hada, N. M., Hassan, Z. B., Othman, M., Tharik, J. H., Kasmani, R. M. D., & Shayea, I. (2022) *A review of metaverse's definitions, architecture, applications, challenges, issues, solutions, and future trends* (IEEE Access)

[3] Alwi, A., Kasnawi, T., Syukur, M., & Upe, A. (2022). Social Construction of Integration in Multicultural Society in West Muna Regency, Southeast Sulawesi Province *Journal of Positive School Psychology 6*(6) 516-525

[4] Hak, P. (2019) Etnopedagogik pada masyarakat Suku Muna, Tolaki, dan Bajo di Sulawesi Tenggara (strategi pengintegrasian kearifan lokal dalam pembelajaran sejarah untuk penguatan karakter siswa) *Seminar Nasional Sejarak ke-4 Jurusan Pendidikan Sejarah Universitas Negeri Padang* pp 279-296

[5] Moneta, A. (2020) Architecture, Heritage, and the Metaverse *Traditional Dwellings and Settlements Review 32*(1) 37–49

[6] Schumacher, P. (2022) The metaverse as opportunity for architecture and society: design drivers, core competencies *Architectural Intelligence 1*(1) 11

[7] Tang, S. K. & Hou, J. H. (2022) *Designing a framework for metaverse architecture* vol 2 (Proceedings of the 27th CAADRIA Conference) pp. 445-454

[8] Wardhani, C. A. R., Permatasari, F. P., & Dwiasmaraditya, N. (2022) *Kajian Etnomatematika pada Konstruksi Rumah Suku Muna dari Sulawesi Tenggara* vol 5 (PRISMA: Prosiding Seminar Nasional Matematika) pp. 354-363

[9] Wijesooriya, N., & Brambilla, A. (2021). Bridging biophilic design and environmentally sustainable design: A critical review *Journal of Cleaner Production 283* 124591

[10] Winarni, S., & Afdholy, A. R. (2022). Metaverse Dalam Arsitektur Sebagai Media Pelestarian Arsitektur Nusantara Di Indonesia *Prosiding SEMSINA 3*(1) 178-183