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Digitizing Aceh's Historical Heritage: Exploring the Role of Technology in Cultural Preservation

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ABSTRACT
Aceh is a region that has a rich historical and cultural heritage, which reflects its civilization and identity from time to time. However, the threat to the preservation of these historical relics is increasing over time, especially due to natural factors, urbanization, and social changes. Digitalization has emerged as a potential solution to address these challenges. The digitization of historical and cultural heritage offers a new way to preserve, access, and promote Aceh's cultural heritage more broadly. This research aims to explore the role of digital technology in the preservation of Aceh's cultural heritage, as well as its impact on local and global communities. This study uses a qualitative approach with a case study on the Aceh Historical Trail Map (acehhistorytrailmap.id). Data were collected through in-depth interviews with stakeholders, document analysis, and observation of platform usage. The analysis was conducted thematically to identify the benefits of digitalization, the technology used, and challenges in preserving cultural heritage. The study focuses on historical sites in East Aceh, such as Perlak and Idi, as the research locus. Through the analysis of case studies from the historical heritage digitization project in Aceh, this study examines the effectiveness of digital devices such as digital imaging, virtual tours, and online platforms in documenting and disseminating important elements of Acehnese culture, such as: artifacts and historical sites. The results of this research are expected to provide insight into effective strategies for cultural heritage preservation through technology, as well as the potential for collaboration between stakeholders in realizing sustainable digital transformation for the preservation of Aceh's historical heritage.

INTRODUCTION

The development of digital technology has brought significant changes in various fields, including preserving historical and cultural memory (Bukhari, Aulia Rahman, 2021; Bukhari, Rahman, & Riyani, 2020; Poulopoulos & Wallace, 2022). Technology opens up opportunities to reconstruct historical narratives through digital mapping in history and culture, providing more comprehensive and interactive public access (Noiret, 2018). Mapping Aceh's historical footprint is one example of how technological interventions can be effectively used to preserve and visualize historical heritage (Ariza-Colpas et al., 2024; Tribhuvan, 2024; Zhang, Zhi, Xu, & Han, 2022). Against the backdrop of rich history and culture, Aceh has many historical sites that reflect essential events in the past,

primarily related to the struggles and cultural identity of the Acehnese people (Aulia Rahman, Usman, Madhan Anis, Husaini Ibrahim, 2024; Rahman, 2020; Rahman, Ibrahim, Prasetyo, Usman, & Riyani, 2024; Usman, Rahman, Riyani, & Shamadiyah, 2024)

However, many historical sites and narratives are threatened by various factors, including the changing times and the lack of conservation efforts (Bui, Jones, Weaver, & Le, 2020; Mantzou, Bitsikas, & Floros, 2023; Price, Talley, & Vaccaro, 2016). Digital mapping of historical and cultural relics is one of the solutions to strengthen the community's collective memory by providing a platform that integrates historical and cultural relics into the digital space (Beel et al., 2017; Holtorf, 2018; van der Hoeven, 2019). Therefore, analyzing the use of technology in mapping Aceh's historical footprint is essential to understanding how cultural memory can be preserved and accessed by future generations through these technological innovations.

Recent research in digital heritage preservation has demonstrated the transformative potential of technology in preserving cultural memory. Key developments include immersive documentation through 3D laser scanning and photogrammetry (Tribhuvan, 2024; Zhang et al., 2022), and the integration of AR/VR for interactive experiences (Lian & Xie, 2024). Projects such as PALIMPSEST (Mantzou et al., 2023), highlight participatory approaches in bringing intangible heritage to life through mobile applications. Meanwhile, the DPUKV framework (Zhang et al., 2022) proposes the conversion of tacit knowledge into structured digital forms, such as knowledge graphs and virtual exhibitions. Howe, however, challenges such as the fragmentation of digitized local narratives (Lian & Xie, 2024) and the tension between technological innovation and cultural authenticity (Liew, Yeates, & Lilley, 2021) remain concerns. Previous studies have also highlighted the importance of bottom-up approaches for "minor" heritage (Albuquerque, Fernández, Janáč, & Krajíček, 2022; Maietti, 2023a, 2023b) and the need for visualizations that empower public engagement (Windhager et al., 2019). This study makes a novel contribution by adapting immersive technology specifically for Acehnese historical sites, such as the Munyang Bunin Tomb and several other historical sites, addressing the lack of digital attention in the regional context.

Although digital technology has been widely utilized for the preservation of cultural heritage globally, its implementation in the Aceh context still faces several limitations. First, there is no approach truly adapts digital technologies such as interactive mapping, AR/VR, and knowledge graphs to address the specific needs of Aceh's heritage, which is rich in local values and indigenous perspectives. Second, existing digitization efforts tend to be fragmented, lacking integration into a holistic platform that unites multiple narratives with active community participation. Third, most digitization projects in Aceh remain top-down, with minimal community involvement, which risks overlooking local kin in the documentation process. Fourth, the issue of digital decolonization has rarely been addressed, where Western approaches still dominate while local Acehnese perspectives have yet to become central to technology development. Lastly, previous studies have inadequately discussed long-term sustainability strategies, including digital data preservation and socio-cultural impacts on communities. This research aims to bridge these gaps by proposing a hybrid approach that combines physical and narrative preservation while positioning the Acehnese people as active subjects in the digitization of their heritage.

By involving the Acehnese community in documentation and data collection and

FGD, this approach unites top-down and bottom-up perspectives that have been separated so far. The proposed hybrid framework combines tangible (3D scanning) and intangible (multilingual narrative) preservation, inspired by DPUKV but modified for Acehnese identity. This study also emphasizes the principle of digital decolonization by placing the Indigenous Acehnese perspective at the center, in line with Liew et al.'s findings on the need for a cultural value-based approach. Practically, the developed interactive map can serve as a template for preserving neglected Southeast Asian heritage, while contributing to the theory by synthesizing cultural memory theory and digital humanities. This innovation fills an academic gap and offers a sustainable solution for heritage preservation in a global context.

This article analyzes how technological interventions, such as the Aceh Historical Footprint Map, preserve cultural memory and facilitate an interactive understanding of local history. Through this study, digital mapping can be strengthened as an effective method for preserving history and culture, especially in areas vulnerable to losing their historical traces.

This paper departs from the argument that technology not only functions as a documentation tool but also as a bridge between the past and future generations. Historical digital maps can increase historical awareness among the public, strengthen cultural identity, and provide more comprehensive access to the public about local history that is in danger of being lost (Pica, 2018).

This study uses the Cultural Memory Theory and the Theory of Digitalization and Technology in Cultural Preservation approaches. Cultural Memory Theory refers to a society's collective efforts to preserve memories relevant to social identity (Eyerman, 2004). In this context, cultural memory not only functions as a tool for preserving history but also as a means of forming identity and instilling shared values (Wang, 2017). Access to cultural memory is now more accessible, especially for the younger generation, through technologies such as digital mapping. Meanwhile, the Theory of Digitalization and Technology in Cultural Preservation explains how digital technology can document, preserve, and disseminate historical and cultural information (Maietti, 2023b; Zhao & Kim, 2024). Rooijakkers explains that digitalization enables a more effective and accessible historical preservation process for to the global usemmunity (Manžuch, 2017). Digital maps combine visual elements and historical narratives as a form of technological intervention, making it easier for various groups to understand and access historical information (Hunt & Stevenson, 2017).

RESEARCH METHODS

This study employs a descriptive qualitative approach to thoroughly examine the digitalization process of Aceh's cultural heritage, focusing on non-quantifiable aspects such as community perceptions, lues, and participatory dynamics in digital preservation. This methodology was chosen for its ability to capture the socio-cultural complexities inherent in digitalization efforts while allowing emergent findings to surface from field observations. The research location is situated in East Aceh Regency, specifically in the areas of Perlak, Idi, Simpang Ulim, and Serbajadi, which were selected based on historical and geographical considerations. Located at coordinates 4°-5° North Latitude and 97°-98° East Longitude, this eastern coastal region of Aceh contains significant heritage sites from the early Islamic Sultanate period that remain under-documented digitally. The selection of this site also considers its unique geocultural characteristics, representing a blend of coastal and inland traditions while bearing witness to pivotal historical events in Aceh. Through qualitative methods in this location, the study aims to develop a holistic understanding of the challenges and opportunities in heritage digitalization

within East Aceh's specific socio-cultural context.

This study focuses on the analysis of the Aceh Historical Footprint Map as a form of technological intervention in the preservation of cultural memory, which can be accessed at *www.acehhistorytrailmap.id.* Information about the website's appearance can be shown in Figure 1.

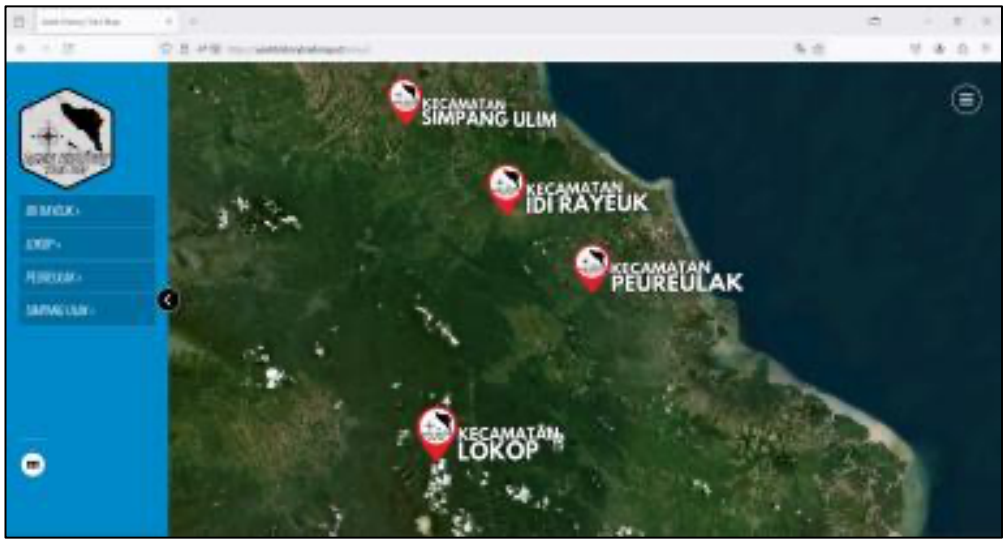

Figure 1. Display on the Aceh History Trail Map website (www.acehhistorytrailmap.id)

The data were collected through in-depth interviews with relevant stakeholders, including map developers, historians, and community members. Additionally, a document analysis related to digital mapping and cultural preservation was conducted. Direct observation of the Aceh Historical Footprint Map's use is also conducted to understand user interaction with the platform. The data obtained were analyzed by descriptive-qualitative methods to identify the role of technology in preserving and disseminating local historical narratives.

The data obtained from interviews and observations will be analyzed using thematic analysis methods. In this process, researchers will identify several key themes relevant to the research topic. The first theme that will be explored is the benefits of digitalization for cultural preservation, which includes how digital technology can improve accessibility and keep cultural heritage from being lost over time. The next theme is the technology used in digitizing cultural heritage, where researchers will examine various digital tools and platforms applied, such as virtual tours and the digitization of artifacts or historical sites. In addition, the theme of challenges in implementing digitalization projects will also be explored, focusing on technical obstacles and resources encountered during the digitalization process, as well as potential solutions to overcome these obstacles.

This research will be conducted across several historically and culturally significant sites in East Aceh Regency, Indonesia, including Perlak, Idi, Simpang Ulim, and Serbajadi. These locations were selected due to their rich historical value aisir a representation of Aceh's cultural heritage.

RESULTS AND DISCUSSION

Historical Relics Recorded in the Aceh History Trail Map

The Aceh History Trail Map documents various historical relics that hold significant historical and cultural value. This map records historical sites from four sub-districts in East Aceh: Simpang Ulim, Perlak, Idi, and Serbajadi, aiming to preserve and visualize Aceh's cultural heritage. Information about the website's appearance can be shown in Figure 2.

Figure 2. Display on the Aceh History Trail Map website (www.acehhistorytrailmap.id)

Perlak Area

Perlak District has a significant advantage in Islamic history, being famous as the center of Islam's entry into the archipelago. The various historical sites in the region are closely linked to the early development of Islam. They are an integral part of the Aceh History Trail Map, representing the importance of Islamic history. One of the important sites is the Tomb of Sultan Alaiddin Sayid Maulana Abdul Azis Syah, the founder of the Bandar Khalifah Perlak Kingdom, which is in Bandar Khalifah Hamlet, Bandrong Village, Perlak District, East Aceh Regency. The region is known as Bandar Khalifah, encompassing eight villages.

Sultan Alaiddin's tomb has a vital role in the social and religious life of the local community. Many people from various regions come to the grave to release wishes or pray. Every year, at least three feasts are held at the tomb location, namely Kenduri 1 Muharam, to commemorate the death of *Sultan Aladdin Sayid Maulana Abdul Azis Shah, Kenduri Blang*, and *Kenduri Jerat*. On the feast of 1 Muharam, the history of the founder and the establishment of the Perlak Sultanate is always recounted. The tradition of feasting at this tomb has been ongoing for generations, becoming an integral part that binds the community to its historical and spiritual heritage.

In the past, the Sultanate of Bandar Khalifah Perlak had a large area covering the region from Kuala Beukah to Semanah Jaya (Nurul A'la's Tomb), which the Perlak River connected. At that time, this river became the primary means of transportation. The sultanate's trading center is located in Kuala Perlak, an important port and one of the historical relics whose information is documented in the records of Marco Polo and Ibn Battutah. Marco Polo, who stopped at Perlak in 1292 on his way back to Venice, noted that the inhabitants of Perlak were initially primarily pagans. However, many had converted to Islam thanks to the influence of the Saracen merchants who frequented them.

Kuala Perlak, at the time, was inhabited by many Muslim traders from various countries, including Persia, Arabia, and India. The Port was also a center for pepper exports on the east coast of Aceh, even before pepper became a significant commodity in the 18th century. The Perlak River itself empties into Kuala Beukah and flows into the Strait of Malacca, with its headwaters located at Lokop. Along the river are several ports where ships dock, including Blang Bitra Port, Balang Balo Port (Kampung Besar), Pasir Putih Port, and the Port in the Semanah Jaya area.

Idi Area

Idi District has the advantage of being a center of the pepper trade, and it played an essential role in it in the past. As an ancient state territory, Idi holds many historical

relics closely related to pepper trading activities, making it one of the central locations recorded in historical maps.

The landscape of Idi Rayeu stretches between the Idi Cut in the north and Peudawa Rayeu in the south, with the Strait of Malacca serving as the eastern border and the Land of Gayo extending to the west. Although the region had long been inhabited mainly by fishermen, a new era of progress began with the arrival of Warlord Nyak Sien. Originally from the Blang Me kingdom, Warlord Nyak Sien had previously explored the landscapes of Djoelo, Bago, and Deli, bringing progress to Idi Rayeu by establishing pepper plantations in the region.

As a reward for his services, Warlord Nyak Sien was recognized as uleebalang by a member of the Sultan's family, Tuanku Oesen. After his death, his son, Teungkoe Tjik Hasan Ibrahim ibn Goetji, better known as T. Tji bin Goetji, succeeded his father. Soon after, T. Tji bin Goetji asked for direct recognition from the Sultan. He was also the first uleebalang to try to approach the Dutch Government by sending letters to the Dutch controller in Deli, the commander of the battleship in 1871, and the Resident of Riau in 1872, requesting that his territory be under the sovereignty of the Dutch East Indies.

However, the request was rejected because of Idi's close relationship with the Sultanate of Aceh. After the first unsuccessful expedition against Aceh Besar, the Dutch finally responded to a re-request made with the same purpose by sending a controller. On 6 May 1874, the Dutch flag was officially raised in Idi, and the Idi Rayeu area became part of the Dutch territory. Information about the *Uleebalang* house in East Aceh is shown in Figure 3.

Figure 3. *Uleebalang* house in East Aceh can be found at (www.acehhistorytrailmap.id)

Simpang Ulim Area

Simpang Ulim District has the advantage of being a 17th-century pepper port city and the birthplace of anticolonial figures. One of the historical monuments, the first Pepper State Monument, was established in 1880 in this region. In addition, Simpang Ulim is also the birthplace of Teuku Nyak Malem, an uleebalang who persistently resisted Dutch colonialism. Until now, historical sites such as the Al-Hikmah Ancient Mosque can still be found in this area.

The Simpang Ulim area became necessary after the arrival of T. Moeda Nyak Malim, a native of Aceh from Mukim XXVI, whom the Sultan of Aceh ordered to open a pepper plantation on the East Coast of Aceh. T. Moeda Nyak Malim arrived in Kuala Simpang Ulim around 1860. After successfully cultivating the land, he married the village chief's daughter, Lho Nibong, and assumed control of the area's

government. Along with the ongoing war in Aceh Besar, the number of residents in Simpang Ulim increased rapidly because many residents of Mukim XXVI fled and settled there.

When the Dutch conducted an expedition on the East Coast of Aceh, T. Moeda Nyak Malim led the Simpang Ulim State and refused to submit to the colonial army. However, through the conquest, the State was finally declared conquered, and T. Moeda Lamkoeta, one of the Peutoeha-Ampat, replaced T. Muda Nyak Malim as the leader of the state in 1876.

The monument of the first port city of Simpang Ulim is in Keude Tuha Village, Simpang Ulim District. Based on the information written on the monument and supported by local informants, the port city of Simpang Ulim was founded in 1880 by T. Moeda Nja Malim, a wealthy pepper trader on the East Coast. This port is the center of pepper trading activities, which is very important for the Simpang Ulim State.

In addition to T. Moeda Nja Malim, his best friend, Tengku Paya, he also played an essential role in the history of the port of Keude Tuha. Tengku Paya, a successful pepper entrepreneur, was the ninth delegation sent to Penang, Malaysia. These two figures symbolize the glory of the pepper trade in the area and strengthen the relationship between Keude Tuha and Penang. Information about the Monumen Kota Pelabuhan in East Aceh can be seen in Figure 4.

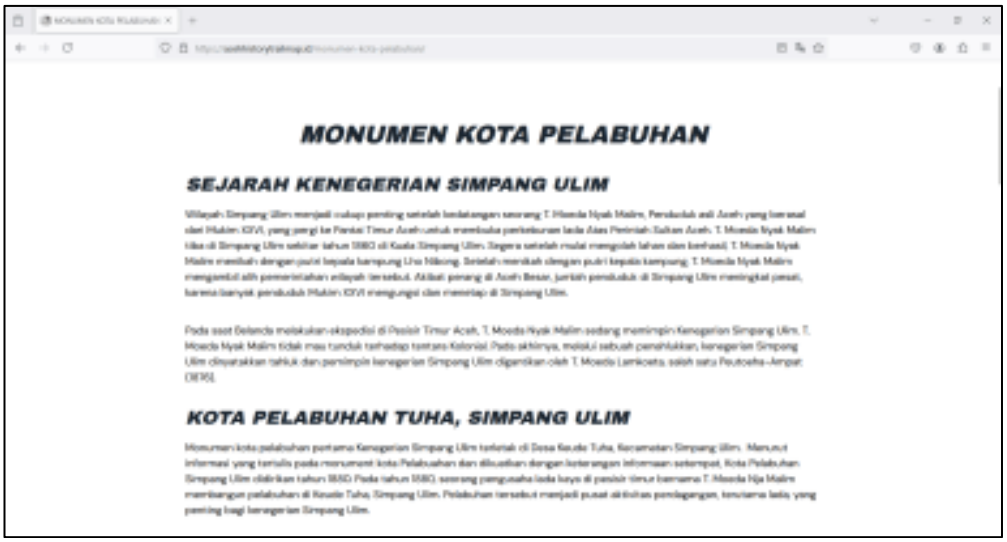

Figure 4. Kota Pelabuhan Monument in East Aceh (www.acehhistorytrailmap.id)

The construction of the port in Keude Tuha not only involves infrastructure such as boat docks and barges, but also stimulates the development of commercial facilities and defensive fortifications. Around the port, various stalls were built to serve the needs of sailors and merchants, which have now been transformed into modern shops. Additionally, defensive fortifications were constructed to safeguard the area against the threat of Dutch invasion. The area around the port, known as Lamkuta and now a hamlet in Keude Tuha Village, was once an important center of economic and defensive activities for Simpang Ulim.

Serbajadi Area

Serbajadi District has an advantage through Gayo's rich cultural heritage and traditions. This area is renowned for its rich history and culture, particularly in terms of the customs of the Gayo people, which are still preserved today. Colonial heritage sites and Gayo's traditional arts make Serbajadi essential for historical and culture-based tourism (Rahman, 2020; Wibowo et al., 2019). Customs that are still maintained are valuable cultural assets recorded in the historical map of Aceh.

One of the important cultural heritages in this region is the Munyang Bunin Tomb, which is in Bunin Village, Serbajadi District,

East Aceh Regency. Munyang Bunin is a legendary figure who has a significant role in the history and cultural development of the Bunin people. Bunin is associated with Sheikh Banian, also known as Munyang Bunin. The Bunin people believe that Munyang Bunin is their ancestor, who established the Bunin Gampong region. Although there is no definitive record of when it was founded, it is believed that the area was established during the Linge Kingdom, which was founded around 1025.

Munyang Bunin is believed to have originated from the Middle East, precisely from a region known as Banian, which in Arabic is read as "Bunun" or "Bunin." He came to Central Aceh (Linge) with several people, including his brother, Sheikh Merah Habok, to spread the teachings of Islam. Since Islam had developed in Linge, Munyang Bunin spread it to other regions. One story claims that to determine his destination, Shaykh Banian threw a bamboo stick, which was later found in Bunin, marking the spot as his intended destination.

After arriving in Bunin Village, Munyang Bunin and his followers began to develop and open up the area. The stories of Munyang Bunin are passed down through generations in the Linge region, a kingdom once founded by the Gayo tribe on the Gayo Plateau. Until now, the descendants of Munyang Bunin still exist, and they have become khadam (tomb guards) at the Munyang Bunin Tomb. Only direct descendants of Munyang Bunin are permitted to become khadam in this tomb, underscoring the significance of lineage in preserving heritage and tradition.

In the Serbajadi area, there are several munyang (ancestral) tombs, but only in the Munyang Bunin Tomb, whose khadam must come from direct descendants. This indicates that Munyang Bunin holds a special position and is highly respected among other ancestral figures.

Digital Mapping and Improved Accessibility

Digital mapping, as seen in the Aceh History Trail Map project, enables broader access to Aceh's historical narratives through interactive media. This technology presents historical narratives in a format that is easily accessible to both local and global communities through digital devices, such as smartphones and computers.

Through digital platforms, the Acehnese community, including younger generations, can now engage with their historical heritage without the need for physical visits. These interactive tools offer enriched visualizations, complemented by textual and multimedia narratives that provide context for key historical events. This digital accessibility strengthens the local community's connection to their cultural identity and historical roots, overcoming barriers such as geographical remoteness or site inaccessibility.

On a global scale, digital mapping transcends geographical constraints that traditionally restrict engagement with regional histories. Researchers, international tourists, and students worldwide can now explore Aceh's historical legacy in depth through interactive platforms, without requiring physical presence. These digital tools enable users to virtually navigate heritage sites, analyze event chronologies, and contextualize cultural developments through integrated multimedia resources, including images, scholarly descriptions, and archival materials. By facilitating such immersive access, this approach not only democratizes historical knowledge but also amplifies the international visibility of Acehnese cultural narratives.

Furthermore, digital mapping can be seamlessly integrated into both formal and informal educational curricula, serving as an interactive pedagogical tool. For instance, secondary and tertiary students can leverage these platforms to study Aceh's history through immersive, visually enriched formats, transcending the limitations of conventional textbooks.

Collectively, this approach fosters three transformative outcomes: (1) the equitable dissemination of historical knowledge across diverse audiences, (2) the democratization of historical access by overcoming socioeconomic and geographic barriers, and (3) the active engagement of

global communities in preserving and interpreting Aceh's cultural memory. By merging technology with heritage education, digital mapping redefines historical pedagogy as a participatory, inclusive endeavor.

Map of Aceh's History Trail and Strengthening Historical and Cultural Memory

The Aceh Historical Trail digital map plays a crucial role in strengthening cultural memory by creating a digital platform to preserve, visualize, and share the historical narrative of Aceh. For the people of Aceh, this platform serves as a repository of local history, connecting them to their cultural roots. This helps to maintain a collective memory of important events, figures, and sites that shape Aceh's identity, including the local history of the Acehnese people in the era of the pepper nation, the influence of cosmopolitanism, and the resilience of their people in responding to Dutch colonialism.

Through this digital map, the people of Aceh can engage more deeply with their history, transcend geographical boundaries, and integrate diverse perspectives. Digital maps of history and culture have made it possible for individuals and the wider community to reconnect with ancestral stories, local legends, and key milestones that were previously difficult to access due to a lack of documentation or physical access. Some of the data digitized through digital maps is obtained through observation of site locations with difficult access.

For the broader community, the Aceh Historical Trail digital map will deepen their understanding of Aceh's unique contributions to history and culture. By making these historical narratives accessible online, the platform helps bridge the gap between local and national histories, enriching the nation's collective memory. This highlights Aceh's significant contributions to building civilization in the archipelago, establishing a religious identity, and developing pepper trade routes, thereby strengthening appreciation for the diversity of Indonesian history.

Additionally, the innovation of the Aceh Historical Trail digital map will enhance cultural memory through its role as an educational resource. Schools and universities can utilize these maps as a dynamic and interactive tool for learning history, as they allow students to explore Aceh's historical heritage in a more engaging and visual format than traditional learning materials. As an interactive and dynamic educational resource, this map helps students by presenting Aceh history materials in an attractive, easy-to-understand visual format. Students can explore Aceh's various sites, events, and historical figures directly through digital maps, allowing for more in-depth learning than just reading traditional texts.

The digital map also offers an immersive learning experience, allowing students to view digital reconstructions of historical sites that are difficult to access or have been damaged. This allows students to gain a more complete understanding of the cultural and historical context of Aceh.

The digital map also enables students to trace ancestral stories, local legends, and historical events chronologically or by specific region, providing a more comprehensive picture of Aceh's historical development. Thus, this map enriches the learning material and encourages students to be more active in learning, exploring, and engaging in further research on Aceh's cultural heritage.

Overall, the Aceh Historical Trail Map facilitates a more inclusive distribution of historical narratives, democratizes access to history, and encourages more people to participate in preserving and understanding Aceh's cultural heritage.

Digital History Map as an Educational Tool for the Community

Mapping the Aceh Historical Trail has excellent potential as an effective educational tool in schools and communities. Not only does this map provide more accessible historical information, but it also offers an interactive learning experience. Students can explore Aceh's historical sites visually, which has

implications for increasing community involvement and understanding local historical events. With this technology-based learning method, history education can be strengthened by integrating engaging digital media, which can connect students more deeply with their local history. The map offers a more substantial visual context than conventional learning, enabling students to learn from both books and dynamic digital exploration.

The importance of digital history education has allowed the public to engage critically with historical information. Additionally, public history can serve as a form of historical education for the community, thereby strengthening historical awareness. Digital-based history and culture learning media can also increase students' interest in learning history at school, and digital teaching materials in history learning can improve students' historical thinking skills.

Additionally, the community can utilize this map to commemorate their cultural heritage and foster historical awareness among the younger generation. Using maps in informal education activities, such as seminars or community discussions, can enrich public understanding of the importance of preserving local culture and historical heritage, thereby encouraging active participation in preserving these cultures.

Challenges in the Implementation of Aceh's Historical Footprint Map

Although the Aceh Historical Trail Map offers innovative solutions in preserving cultural memory, several challenges affect its success in achieving these goals. One of the primary challenges is the need for increased user engagement. While the map provides valuable information, there are still obstacles to encouraging local and global communities to use the platform regularly. Low user engagement can be caused by a lack of promotion, unclear incentives for using maps, or the platform's inability to engage users in more immersive and interactive experiences.

Digital maps require a robust technological infrastructure, encompassing both hardware and software. In some areas of Aceh and Indonesia as a whole, limited internet access and the availability of supporting devices can be obstacles to utilizing this digital map. Additionally, potential technical constraints on the platform itself, such as bugs, a lack of intuitive navigation features, or the inability to update data in real-time, can hinder the effectiveness of using the platform.

Although the Aceh Historical Trail Map aims to present a comprehensive historical narrative, a gap remains in its representation of broader historical events. Some historical sites or essential figures may need to be represented or noted on these platforms. Imbalances in historical representation can impact people's understanding of Aceh's history as a whole and, in the long run, lead to distortions of the actual historical narrative.

The findings demonstrate that the Theory of Cultural Memory and the Theory of Digitalization and Cultural Preservation are very relevant to studying the Historical Footprint Map of Aceh. The theory of cultural memory emphasizes the importance of preserving collective memory as part of a society's social identity. This digital map serves as a medium to preserve Aceh's rich cultural narrative by archiving historical sites in a virtual form, making it easier for people to access their history, even though the physical sites are endangered.

The Theory of Cultural Memory emphasizes the importance of preserving collective memory as an essential component of social identity. Digital maps like this help preserve Aceh's cultural narrative by archiving historical sites that may be at risk of physical loss. This creates a virtual space that enables wider access to local history, supports the transmission of cultural memory to future generations, and ensures that cultural heritage is preserved during times of change. In addition, the Theory of Digitalization and Cultural Preservation emphasizes that digital technology provides a means to document and disseminate historical and cultural

information (Lian & Xie, 2024; Liew et al., 2021). In the context of the Aceh Historical Trail Map, the digitization of historical sites enables richer visualization and easier access for both local and global communities. However, this digitalization also faces technical challenges such as accessibility and limited user engagement.

The application of these two theories to the Aceh Historical Footprint Map demonstrates that technology plays a crucial role in connecting people with their cultural roots. The platform combines technology and collective memory to create easier access to cultural heritage, but still needs improvements in terms of user engagement and more comprehensive historical representation.

The patterns found in the implementation of digital mapping show that technology has successfully expanded access to historical sites, both at the local and global levels. However, challenges in user engagement and uneven representation of history pose limitations in its use. Technology does allow people to connect with their histories interactively, but the low engagement can be attributed to the lack of immersive features and limited access to technology infrastructure.

However, while digital mapping offers innovative solutions in historic preservation, there remains a need to enhance the quality of user interaction and ensure a more inclusive representation of historic sites that have not yet been highlighted. This also requires an increase in public promotion and education regarding the use of the platform.

The implication is that this platform must be further refined in both technical aspects and content to bridge the gap in historical representation and increase community involvement in preserving Aceh's cultural heritage. It can also serve as a more effective means of education if integrated into the school curriculum and community.

This study reinforces previous findings and provides a new perspective on digital heritage preservation. Salerno's study of 'minor' cultural landscapes has provided insights into the importance of digital technology for neglected heritage (Salerno, 2016). Still, this study goes further by presenting a concrete implementation in Aceh that takes into account the post-conflict context and unique local values. While previous studies tend to focus on tourism aspects, we emphasize heritage preservation as a means to maintain the cultural identity and collective memory of the Acehnese people more holistically. When compared to Prakash's technology review, this study identifies digital methods such as photogrammetry and augmented reality and tests their application in the field with all technical and non-technical challenges (Tribhuvan, 2024). Our findings show that the success of digitization depends not only on technological sophistication but also on a participatory approach that involves local communities throughout the process. This is a crucial distinction from previous studies that focus solely on technical aspects. Lian & Xie's analysis of digital heritage research trends reveals the dominance of developed countries in this study (Lian & Xie, 2024). This study addresses this gap explicitly by highlighting Aceh as a concrete example of a region with an under-explored heritage richness. This study confirms the importance of an interdisciplinary approach suggested by previous researchers. It develops a more structured stakeholder model involving local government, academics, and local communities within a clear framework. This study makes several contributions. First, it provides a specific contextualization for Aceh by considering the dynamic socio-cultural conditions, including post-conflict and ethnic diversity aspects, which have not been widely addressed in previous literature. Second, our participatory approach ensures that the digitization process is not only technical but also culturally meaningful for local communities. Third, a critical evaluation of the Aceh History Trail Map project provides valuable insights into the implementation challenges

on the ground that are often overlooked in theoretical studies.

CONCLUSION

This article aims to highlight the role of digital technology in preserving Aceh's historical heritage. This topic is becoming increasingly relevant as technological advancements and threats to cultural sites due to changing times. The main argument presented in this article is that digitization is not only a tool to extend the life of historic sites but also enables wider access to cultural riches that may have been previously difficult to reach. Additionally, this article highlights the benefits, technologies employed, and challenges encountered in digitalization projects in Aceh.

Cultural digitization facilitates the preservation and dissemination of historical knowledge to future generations, both locally and globally, more effectively. It's not just about maintaining physical sites, but also about ensuring that Acehnese cultural identity can remain alive and accessible to the public. In addition, the study offers insights into the most effective technologies and best practices in digitalization, identifying areas where further improvements are still needed. This can serve as a reference for local governments, cultural institutions, and technology developers to collaborate on creating more effective solutions for preserving cultural heritage.

This research is essential because it makes a tangible contribution to efforts to preserve culture through technology, a field that is constantly evolving. In the current state of knowledge, this research provides a new understanding of how technology can be integrated into cultural preservation efforts (Shiri, Howard, & Farnel, 2022), especially in Aceh. This provides scientific justification for digitalization as an efficient approach to protecting cultural heritage, while also addressing the practical challenges faced during this process.

Ongoing experiments, such as the project to digitize Aceh's historical archives through digital maps like the Aceh History Trail Map, demonstrate that conservation efforts utilizing technology are still in the development stage. Future research could focus on enhancing the quality of digitalization, utilizing artificial intelligence for cultural analysis, and expanding digital projects to less accessible areas.

Overall, this article concludes that digitalization is a critical approach to cultural preservation for Aceh and other regions with rich historical heritage. Specifically, this study emphasizes the importance of a planned and collaborative digitalization strategy. It provides recommendations for stakeholders in Aceh to maximize the use of technology in historical and cultural preservation. Thus, this article achieves its original goal, which is to provide a comprehensive view of the role of technology in preserving Aceh's cultural heritage and offer a way forward for further research and implementation in the future.

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