
Utilizing Non-fungible Token (NFT) Technologies to Preserve Cultural Histories and Artefacts

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Abstract: Non-fungible tokens (NFTs) are blockchain-based tokens that each represent a unique asset in digital format. It is an irrevocable digital certificate of ownership and authenticity for a given asset, that is securely stored for future authorized access. This research explored NFT technology as a solution for the universal problem of digitization writing over and erasing important Pacific histories, artefacts, and stories. The research developed methodology to harness the new technology for the social and cultural preservation of artefacts and histories. The methods used addressed the challenges with applying the technology and the challenges of capturing authentic socio-cultural histories. The new digital format has application in all the Pacific cultures and people groups for the preservation of what is culturally important and the transmission to future generations. The safe and sustainable development of the Pacific requires the adoption of new technologies in ways that integrate traditional knowledges into the new opportunities and solutions for real challenges.

Keywords: Non-fungible tokens (NFTs), Authenticity, Cultural Assets, Pacific heritage, Technology opportunity

Author's Biography:

Speaker 1 : Dr Vili Saulala

The Rev Dr Saulala travelled from Tonga for his undergraduate education at the University of Auckland and then Florida and California USA, to complete diplomas and bachelor's degrees. He then returned to the Pacific and completed a Master of Business Administration (Management) from the University of the South Pacific in Suva, Fiji in 2011. He then began higher research degrees earning a Master of Philosophy with a thesis titled: "Comparing Banking and National Financial Data: A Case Study", where he analyzed the financial performance of the ANZ Bank in Tonga from 2008 to 2015. He then completed a Doctor of Philosophy (PhD) with a dissertation titled: "An Evaluation of Universities' Management Systems and Business Systems". His research involved a comparative analysis of the systems used by Melbourne University, Edith Cowan University, Auckland University of Technology, and Christ's University in Pacific.

Rev Dr. Vili is the Vice-Chancellor of CUP and under his leadership, the university has continued to grow steadily, celebrating its 21st year in 2025. He credits this progress to God's grace and the dedication of the CUP community. In addition, he serves as Director of International Affairs, actively engaging in strategic partnerships and Memoranda of Understanding (MOUs) with institutions across the United States, New Zealand, Australia, Samoa, and Papua New Guinea. Dr Saulala's work is driven by his faith, vision for academic excellence, and unwavering belief in the transformative power of Christian education. As CUP moves forward, he remains committed to fostering growth, international collaboration, and strong leadership in the Pacific.

Speaker 2: Dr. George Maeakafa

Dr. George Maeakafa is a distinguished scholar and practitioner in the field of Forensic Investigation in Computer Science. His PhD is in digital forensic sciences. He has published extensively in peer-reviewed academic journals and international conferences, including contributions to IEEE, Google Scholar-indexed journals, and various

professional and university-hosted symposiums and proceedings. His research spans topics such as digital evidence preservation, cybersecurity frameworks, forensic methodologies, and the ethical implications of technology in legal systems. His work is widely cited and contributes significantly to the growing Body of Knowledge in computer science and forensic investigation.

Currently, Dr. Maeakafa is serves as the Research Project Manager at Christ’s University in Pacific (CUP) research Institute, where he oversees and coordinates interdisciplinary research initiatives, bridging academic inquiry with real-world impact. He is also the Chief Executive Officer of SINO UNION Company, a technology consultancy firm driving innovation in digital transformation and cyber resilience solutions across the Pacific region. He has led and contributed to numerous research and development projects in collaboration with the Tongan Government, focusing on national security, digital infrastructure, and capacity building in ICT. His strategic partnerships and advisory roles have helped shape national policies on cybersecurity and forensic readiness.

1. INTRODUCTION

The Pacific islands are exposed to many natural and social challenges that destroy and erode Pacific ways of life. Tsunamis, volcanoes, typhoons, and rising sea levels are natural hazards that all too regularly destroy whole villages and islands so that there is nothing left. More subtly digitization and instant communications are written over and erasing important Pacific histories, artefacts, and stories [Kaji et. al]. The internet and the mobile phone have brought many social advantages, but they also bring influences that replace social and cultural relationships that support the very fabric of being Pacific [Campbell et. al]. In this research we explore the potential for using non-fungible token (NFT) technology to preserve important artefacts and stories for the next generations. An NFT creates a unique representation of something and cannot be replaced.

The challenge and exploration in this research are identifying the features of NFT technology that best fit socio-cultural preservation and assessing the worth of such a project [Johnson et. al]. Contemporary technologies can be used to sustain or to destroy Pacific lifestyles and ways of living. If precious artefacts and memories are committed to digital technologies what are the chances that they too will be lost, destroyed or become redundant and inaccessible? There is also the question of methodology and how to procure, collect, and select artefacts. What is important in one village may not be so in another. To resolve the issue, we chose to implement a grounded theory so that the preservation of artefacts would be systematic and yet inclusive of the differing perspectives and expectations of custodians [Glaser et. al]. The methods used addressed the challenges with applying the technology and the challenges of capturing authentic socio-cultural histories.

This paper is structured to first review NFT technology and the potential to preserve socio-cultural artefacts. The third section then discusses grounded methodology for collecting socio-cultural data for preservation. The fourth section explores the scope of using technology to effectively store and protect sensitive information. The issues of data integrity, access, and protection are discussed. The fifth section evaluates NFT technology as a viable option for preservation. The research concludes by restating the assertion that the safe and sustainable development of the Pacific requires the adoption of new technologies in ways that integrate traditional knowledges into the new opportunities and solutions to meet real survival challenges.

2. NFT TECHNOLOGY

A fungible item is a product or commodity that is replaceable by another identical item or a mutually interchangeable item. Consequently, a non- fungible item is the opposite where the item is unique. A non-fungible token (NFT) is a unique digital identifier that is recorded in blockchain technology and is used to certify ownership and authenticity [Chen and Zhang]. This means any digitized item can be preserved in a unique form and with a unique identifier for ownership. It cannot be copied, changed, substituted, or subdivided to alter the original record. However, ownership may be transferred to, for example, a library or museum for safekeeping and public viewing. These features make NFT technology applicable to the preservation of social, cultural, and linguistic artefacts. NFT is an evolving opportunity for artifact preservation but must still overcome acceptance and legal hurdles to be fully useful [Morales et. al]. The legal rights conveyed by an NFT can be challenged because the ownership of an NFT as defined by the blockchain has no inherent legal meaning and does not necessarily grant

copyright, intellectual property rights, or other legal rights over the associated digital file. This is a current limitation that is expected to change overtime and through legal challenges. Hence, an NFT does not currently restrict the sharing or copying of the associated digital file or prevent the creation of links that reference identical files, but it does register a unique identifier.

NFTs can be readily created by anyone with access to the Internet and with money to invest [Zhang and Kumar]. They can be created by anybody and require little or no coding skill but rather compliance with easy-to-follow workflow forms. The NFT is a unique identifier that references digital files such as artworks, photos, videos, audio files and so on. Hence, the NFT is created and registered and then points to the associated file or files. The creation of an NFT involves several key steps for registering the unique identifier on a blockchain of choice, and the creation of the associated files. First, the artefact is selected and saved for later linking to the unique identifier. Then a blockchain platform that supports NFTs must be selected and the workflow system understood [Perez et. al]. The platform guides the user through the process of minting the NFT, which involves generating a unique token that verifies ownership and authenticity on the blockchain. The final step is to link the associated file or files. Each platform has associated costs that are paid in cryptocurrencies. The associated costs are for gas fees for minting and transactions, and if promoted to reach a wider audience there are further fees.

To create greater consistence for interoperability between NFT blockchain platforms and for simplifying the transfer of ownership rights there are several standardization protocols [Thompson et. al]. These protocols have been promoted for interoperability such as the first widely accepted non- fungible token standard, ERC-721 [O'Connor et. al]. It had an early version of the standard that was updated to formalize to define the term Non-Fungible Token (NFT). It also established a standard for smart contracts where tokens have unique attributes and ownership details, ensuring no two tokens are alike. There are also derivative standards such as Ethereum ERC-1155 that are increasing the reach and usability of NFTs [Kumar et. al]. NFT is an evolving and developing technology that is emerging from research and commercialization of blockchain technologies. Many of the related projects are pioneering works that allow versatility and the emergence of numerous use cases, such as for museum and archival works [Chen et. al]. The ERC-721 is recognized for having fundamentally changed the use of digital verification, authentication, and ownership. Hence, we see NFT technology as being an edge cutting technology that can easily be used in the Pacific to preserve artifacts, histories, and linguistic forms. Standardization and greater numbers of service supplier options are making the technology more accessible and easier to use.

3. DEVELOPING METHODOLOGY

The research developed methodology to harness the new technology for the social and cultural preservation of artefacts and histories. To enter the research field a Grounded methodology was adopted and developed to manage the scope of many different data types [Corbin et. al]. Grounded theory is a qualitative research methodology focused on developing theories directly from systematically gathered and analyzed data. The theories we were looking for are constructs that best capture artifacts into categories and manageable data groups for future access. Unlike traditional approaches that start with a preconceived hypothesis or design, grounded theory emphasizes inductive reasoning, allowing concepts and theories to emerge organically through close examination of participant experiences or phenomena by the participants and the researcher [McGhee et. al]. It allows listening to the participants and systematic emergence of categories and themes to collect and to store the stories and other artefacts. Researchers typically collect data through conversations, observations, or documents, and then engage in active coding processes—such as open, axial, and selective coding—to identify patterns, categories, and relationships within the data [Charmaz]. This iterative process continues until the researcher reaches theoretical saturation, where no new insights are emerging.

The main purpose of Grounded theory is the creation of theory by discovery from data. The theory creation mechanism is an endless loop of data collection, and critical reflection, and cessation of the loop when no new relationships are being discovered [Lee and Kim]. It is a proactive and intentional methodology that seeks to discover valuable relationships and their representation as meaningful abstractions. This is done by analyzing collected data to discover social and behavioural patterns in relation to guiding issues and problem statements. Theory is systematically generated to account for patterns of behaviour, stories, and material artefacts. The theory is relevant for the story tellers and narrative but remains problematic for those

involved. The theories are open to revision and amendment by data and feedback and represent a continuous cycle of emergent discourse [Patel et. al]. By emphasizing constant comparison and refinement, Grounded theory helps researchers build a robust framework that is deeply rooted in empirical evidence but is sufficiently coherent to carry forward holistic understandings of the core story lines and ways many people view diverse artefacts. The methodology is widely used across social sciences, nursing, education, and other fields, where understanding complex, nuanced human behaviors and social processes is essential. It systematically applies sets of methods to generate an inductive theory about a substantive area so that it may be communicated, opened for viewing, and made accessible. Grounded theory facilitates the emergence of theory, and it allows researchers to inductively theorize meaningful relationships from the data context. The primary goal of grounded theory is to produce a well- grounded, contextually relevant theory that explains how and why a particular phenomenon occurs. It delivers a framework in which communication may occur, and the diversity of data types have representation. It is particularly useful in areas where existing theories are inadequate or nonexistent. The following simple sequence defines researcher actions [Mills et. al]:

- collect data
- identify key pivot points
- code by method (see Table 1)
- form concepts
- create categories
- actively use the theory-data loop until saturation occurs

By emphasizing constant comparison and refinement, grounded theory helps researchers build a robust framework that is supported by empirical evidence. Table 1 gives a summary of required data analysis actions [Denzin et. al]. Prior to data analysis data collection tools and techniques are prepared and made ready for the field work.

Table 1. Data analysis actions.

Data Analysis	Action
Open Coding	Break down, examine, conceptualize, categorize data
Constant Comparison	Compare emerged codes against new and existing ones for data reduction
Axial Coding	Assemble and establish links between concepts to create broader themes and theme categories of recurring, steady, major and minor
Selective Coding	Identify main themes, concern or problem
Core Category Consolidation	Compile all evidence
Theoretical Saturation	Stop data collection & analysis. No new information is emerging.

4. PRESERVING SOCIO-CULTURAL ARTEFACTS

Preserving socio-cultural artefacts is essential for maintaining the historical identity and cultural heritage of communities [Lee and Patel]. Artefacts include traditional clothing, tools, artwork, and religious items. Also, today digital photos, recordings, writings, and other memorabilia capture the histories. These serve as tangible links to the past, offering insights into the customs, beliefs, and lifestyles of different generations. Proper preservation ensures that future generations can learn from and appreciate their cultural roots and observe changing social expectations and ways. Intergenerational connections can foster a sense of continuity, identity and pride within communities [Garcia and Nguyen]. Besides the many tangible artefacts that contribute to cultural heritage and community there are intangible artefacts such as oral histories, lived recollections of events and relationships, and the fabrics found in stories and songs. These intangible elements are critical for the interpretation of artefacts, understanding of contexts, and enlivening material items.

One of the key aspects of preserving socio-cultural artefacts involves careful conservation techniques [Lee et. al]. This includes collection, selection and storage. For tangible artefacts controlling environmental

conditions such as temperature, humidity, and light exposure are critical to prevent deterioration. Similarly with non-tangible artefacts usually held in digital formats consideration of magnetic and electrical interference, host material lifetimes, and accessibility when technologies and formats change. Additionally, employing non-invasive conservation methods helps maintain the artefacts' integrity. Proper storage in archival-quality materials and periodic maintenance is vital to prevent damage from pests, mold, or physical wear and tear. Cultural institutions such as museums, libraries, art galleries, and archives play a crucial role in the preservation process. They utilize specialized facilities and expertise to safeguard artefacts while making them accessible to the public for educational and research purposes. Collaborative preservation efforts with local communities also ensure that cultural artefacts are maintained with respect for their original significance and socio-cultural dignity.

Raising awareness and the public profiling of socio-cultural artefacts is vital for their preservation. Promotion enhances the importance of the artefacts and the care they can expect. High profile items receive the greatest level of care whereas other less prominent items can fall into neglect and to destruction [Rivera et. al]. Educational programs, exhibitions, and digital archiving can help highlight their value and encourage active use. By fostering a collective sense of responsibility, societies can better protect their cultural heritage, ensuring these artefacts continue to tell their stories for generations to come. Digitally stored socio-cultural artefacts, including NFTs, require special attention for preservation. The potential for damage, loss, corruption, and theft is high. Digital works can be stored on physical media or placed in the Cloud for storage [Zhang et. al].

Physical media has the same risks as any physical artefact in terms of exposure to detrimental natural effects, degradation of host materials but also technology obsolescence. Cloud storage has the advantage of remote storage and multiple images for preservation. The disadvantages are service costs and supplier integrity but many of the physical storage risks are removed.

5. IS AN NFT PROJECT WORTHWHILE?

The use of non-fungible tokens (NFTs) to preserve social, cultural, and linguistic artifacts is a problematic that has strengths and weaknesses. NFTs are blockchain-based tokens that each represent a unique asset in digital format. Linked to the token are the related artefact files which may be of any type. As a new and evolving technology, NFTs hosts are developing applications and strategies to overcome some of the earlier and current operational limitations. Rapid growth of NFT marketplaces and platforms has pushed developers to resolve many challenges and to make it easier for non-technical people to own NFTs. However, the technology still faces challenges around cost, copyright issues, and host stability. As the ecosystem matures, ongoing developments aim to address these concerns, making NFTs a dynamic and transformative repository for digital artefacts with the potential to reshape how ownership and value are managed in the digital age. Table 2 summarizes the key strengths and weaknesses of NFTs when used to preserve artefacts [García et. al].

Table 2 summarizes the key strengths and weaknesses of NFTs

Strengths	Weaknesses
Digital Provenance	Setup Costs
Blockchain Security	Digital Obsolescence
Global Access	Legal and Copyright Issues
Ownership Verification	Volatility
Standardization	Limited Physical Links
Cost-Effective Storage	Prior Art Risks
Fractional Ownership	Accessibility Barriers
Preservation Replicas	Legal Rights
Enhanced Engagement	Fakes and Scams
Organization Support	Integrity Sensitivities

The main question to now answer is if an NFT project is worthwhile? The technology is new and rapidly evolving into more usable formats with the potential to create universal digital storage and archival capacities. It also has security and ownership features that permit inter- generational transfer of knowledge. The technology architecture does not limit the data types or file scopes that maybe attached to the unique identifier allowing

substantial retention of archival information. These value propositions suggest that an NFT project can offer distinctive utility value for the retention and storage of archival information. The grounded methodology for collecting and preparing socio-cultural and linguistic information outlined in section 3 builds a strong and active community of contributors who share in the knowledge construction and long-term engagement. The technology coupled with a workable implementation methodology presents a feasible case for adoption.

We see an NFT project as being a partnership project that takes an emerging technology as a long-term vision to create an important opportunity for preserving our histories. As Table 2 suggests it is not a perfect solution but many of the negative risks are less than the material risks of natural disaster, digital value stripping, and total loss that have occurred in recent years. NFT is an opportunity to secure part of our heritage, but it is not a complete answer. The NFT project must proceed in partnership with other projects that are already preserving artefacts, oral histories, and language in digital archives and living systems such as school curriculums and local customs. However, to ignore the NFT technology is to limit what may be passed to future generations. It is a current opportunity and one of the paths to the future.

6. CONCLUSION

The use of non-fungible tokens (NFTs) to preserve social, cultural, and linguistic artifacts is a problematic that has strengths and weaknesses. Many of the strengths are greater than the vulnerabilities exposed by the recent natural and digital destruction of Island lifestyles and memorabilia. This research explored NFT technology as a solution for the universal problem of digitization writing over and erasing important Pacific histories, artefacts, and stories. The research developed methodology to harness the new technology and to provide a context for implementation. The new digital format has application in all the Pacific cultures and people groups for the preservation of what is culturally important and the transmission to future generations. The safe and sustainable development of the Pacific requires risk taking and the adoption of new technologies in ways that integrate traditional knowledges into the new opportunities as solutions for real challenges.

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