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# Barriers to Web3 Technologies in Museums: A Qualitative Study in Turin

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**Abstract**
The museum sector is undergoing a significant digital transformation, accelerated by the COVID-19 pandemic, which exposed vulnerabilities such as revenue losses and reduced visitor engagement. Emerging Web3 technologies, including blockchain and Non-Fungible Tokens (NFTs), offer potential solutions for monetization, visitor engagement, and accessibility. However, adoption in Italian museums remains limited. This study explores the barriers to Web3 technology adoption from an institutional perspective, using qualitative interviews with 23 museum professionals, including directors and curators.
Key findings reveal multifaceted challenges, including skepticism about the added value of NFTs, perceived technological complexity, financial constraints, and regulatory uncertainties related to copyright and data protection. Cultural concerns also emerged, with some stakeholders fearing that digital innovations might compromise museums' traditional roles or lead to excessive commercialization. The study aligns these themes with the Unified Theory of Acceptance and Use of Technology (UTAUT), extending the model to include sector-specific factors.
The research highlights the tension between innovation and tradition in museums, emphasizing the need for compelling use cases, robust regulatory guidelines, and dedicated funding to facilitate adoption. By contextualizing Web3 adoption within UTAUT, this study provides a theoretical foundation for future empirical investigations and practical insights for museums navigating digital transformation. The findings underscore the importance of balancing technological advancement with cultural preservation, ensuring that digital tools enhance rather than overshadow the core mission of museums as custodians of heritage and education. This study contributes to a broader debate on technology adoption in cultural institutions, particularly in contexts with strong historical traditions such as Italy.

**Keywords:** Cultural Ecosystem, UTAUT, Web3, NFT, Digital Transformation

**Paper type:** Academic Research Paper

## 1 Introduction

The museum sector is undergoing a profound transformation, accelerated by the disruptive impact of the COVID-19 pandemic. Museums, as cultural institutions, play a crucial role in preserving and disseminating heritage, fostering education, and contributing to the broader social, economic, and political landscape (Falk, J.H. and Dierking, L.D. 2018). However, the pandemic exposed structural vulnerabilities, including revenue losses, reduced visitor numbers, and budget cuts for exhibitions and educational activities (Ozdil, E. 2023). In response, museums are increasingly exploring digital innovations (Lazzeretti, L. et al. 2022) to ensure sustainability and enhance audience engagement (Pourmoradian, S. et al. 2021).
Among the emerging technologies, Web3 solutions—such as blockchain, Non-Fungible Tokens (NFTs), and Decentralized Autonomous Organizations (DAOs)—have been proposed as tools to revolutionize the museum experience. These technologies offer potential advantages, including authentication and provenance verification of digital artworks, novel monetization models, and enhanced visitor engagement (Valeonti, F. et al 2021). Despite these promising opportunities, the adoption of Web3 technologies in Italian museums remains extremely limited.

While previous research has explored the factors influencing visitors' behavioral intentions toward digital museums (Zheng et al., 2024; Ch'ng et al., 2019), less attention has been paid to the institutional perspective - specifically, the organizational and contextual factors affecting museums' decisions to adopt Web3 technologies.

This study addresses this research gap by investigating adoption barriers through qualitative interviews with Italian museum professionals. The research has two primary objectives:

- to identify key adoption themes and evaluate whether existing theoretical frameworks (DOI, TAM, UTAUT);
- to analyze sector-specific factors influencing Web3 adoption, thereby expanding current technology adoption models for cultural institutions.

The paper is structured as follows: Section 2 reviews relevant theoretical foundations; Section 3 details the qualitative methodology; Section 4 presents the emergent themes and theoretical framing; Section 5 discusses key conclusions; and Section 6 provides practical implications for museum management and digital strategy development.

## 2 Literature Review

### *2.1 Web3 Technologies in the Museum Sector*

The museum sector faces cultural, economic, and technological challenges that impact its sustainability and relevance. One of the most pressing issues is cultural disengagement, particularly among younger audiences, who require innovative strategies, such as gamification and interactive experiences, to enhance their engagement with museums (Cranmer, E. et al. 2016, Ekinci, Z. 2023). Another significant challenge is the chronic underfunding of the museum sector. Following the COVID-19 pandemic, declining visitor numbers and rising operational costs have further constrained museums' ability to innovate, digital transformation remains uneven, with many institutions struggling due to skill gaps and technological maintenance challenges (Lampis, A. 2018).

In this context, Web3 technologies have emerged as transformative tools, offering innovative solutions for financial sustainability, visitor engagement, and cultural content accessibility. By leveraging decentralized systems such as blockchain and smart contracts, these technologies introduce novel interaction models that reshape audience participation and institutional strategies (Jones, M., 2023).

Among the most widely discussed applications of Web3 in the museum sector are Non-Fungible Tokens (NFTs), which facilitate digital ownership, provenance tracking, and new monetization opportunities. NFTs offer museums alternative revenue streams while enhancing audience engagement through digital collectibles (W. Lab, 2023). Major institutions, including the Museum of Modern Art (MoMA), Musée d'Orsay, and the Los Angeles County Museum of Art (LACMA), have launched NFT-based initiatives, showing a growing interest in these innovations (Musée d'Orsay, 2023; MoMA, 2024). These efforts reflect an increasing recognition of Web3's potential to reshape the cultural landscape and redefine museum engagement strategies.

Web3 technologies facilitate significant transformations in museum business models through three dominant approaches:

- Monetization: Museums generate revenue by tokenizing digital artworks, issuing limited edition NFTs, and leveraging blockchain for authentication and ownership verification.
- Engagement: Visitors interact with NFTs through QR codes, gamified experiences, and exclusive digital content, enhancing audience participation and loyalty.
- Accessibility: Web3 enables virtual exhibitions, immersive experiences, and metadata-enhanced collections, expanding global access to museum content and reducing geographical constraints.

These models illustrate the potential of Web3 in reshaping traditional museum operations (Jung, Y. 2023), yet adoption remains inconsistent, particularly within the Italian museum landscape.

### *2.2 Background and Theoretical Framing*

Understanding Web3 adoption and barriers in museums requires a theoretical framework that explains the factors influencing technology acceptance. While this study adopts a qualitative approach—allowing key themes to emerge from interview transcripts—it also seeks to assess whether existing theoretical models can adequately explain these findings. Several models have been proposed to analyze technology adoption:

*The Diffusion of Innovation (DOI) theory* (Rogers E. M. et al. 2014) explains how innovations spread within a social system over time. It emphasizes the role of perceived advantages, compatibility, complexity, trialability, and observability in shaping adoption (Dearing, J.W. and Cox, J.G. 2018).

*Technology Acceptance Model (TAM* (Davis, F. D. 1985) focuses on how perceived usefulness and perceived ease of use influence an individual's intention to adopt new technology. TAM has undergone multiple refinements, culminating in more comprehensive frameworks such as UTAUT.

*Unified Theory of Acceptance and Use of Technology (UTAUT)* (Venkatesh et al., 2003) integrates elements from multiple adoption models, identifying four primary factors influencing technology acceptance:

- Performance Expectancy: The degree to which using a technology is perceived to improve job performance.
- Effort Expectancy: The perceived ease associated with the use of the technology.
- Social Influence: The extent to which important others (e.g., family, colleagues) influence the decision to use a technology.
- Facilitating Conditions: The extent to which an individual believes that organizational and technical infrastructure supports technology adoption.

Given the specific characteristics of Web3 technologies and the cultural heritage context, this study seeks to determine whether an existing theoretical framework—DOI, TAM, or UTAUT—can adequately explain adoption patterns in museums or whether an extended framework is needed.

## 3 Methodology

This study adopts an interpretative paradigm, as the primary objective is to understand the subjective experiences and beliefs of participants in the context of early technology adoption in museums. This approach acknowledges that reality is socially constructed, emphasizing participants' perspectives as a fundamental element of the research process. To ensure that participants' perspectives remained central to our analysis, we employed an inductive approach, allowing themes to emerge directly from the interview transcripts (Patton, M.Q. 2014). This methodological choice aligns with the study's goal of identifying both theoretical constructs related to adoption of technology and sector-specific factors influencing Web3 implementation in museums.

### *3.1. Data Collection*

A total of 23 semi-structured interviews were conducted with a diverse group of museum stakeholders, including directors, curators, and employees. Museums were initially contacted via email, and upon agreement, a follow-up video call was scheduled to conduct the interview. The interview questions were designed to explore participants' perceptions of Web3 technologies, potential barriers to adoption, and institutional attitudes toward digital transformation.

Figure 1 provides an overview of the museums included in our study, detailing their size, specialization, and mission.

| # | CODE | MUSEUM | MISSION | VISITORS/YEAR |
|---|---|---|---|---|
| 1 | MU1 | University museum | cultural | 40k |
| 2 | MU2 | University museum | cultural | 40k |
| 3 | FP1 | Private foundation | cultural/corporate | 40k-60k |
| 4 | MI1 | Multimedia museum under corporate dependency | educational | 15k |
| 5 | MU3 | University museum | educational/cultural | 15k |
| 6 | MC1 | Civic museum under direct management | educational | 18k |
| 7 | FP2 | Private foundation | cultural | 12k |
| 8 | FP3 | Private foundation | cultural | 26k |
| 9 | MI2 | Corporate museum | cultural/corporate | 300k |
| 10 | FP5 | Private foundation | cultural | 115k |
| 11 | MC2 | Experimental center for contemporary art | cultural/sustainability | 23k |
| 12 | MI3 | Corporate museum | cultural/corporate | 160k |
| 13 | MN1 | National museum | educational/cultural | 135k |
| 14 | MI4 | Corporate museum | cultural/corporate | 5k |
| 15 | MI5 | Corporate museum | cultural/corporate | 60k |
| 16 | MI6 | Corporate museum | cultural/corporate | 1.6k |
| 17 | FP6 | Exhibition center | cultural | 80k |
| 18 | FP7 | Contemporary art museum | cultural | 100k |
| 19 | MI7 | Corporate museum | cultural/educational/corporate | 3.5k |
| 20 | FP8 | Private entity of origin | cultural/social | 5k |
| 21 | MC3 | Civic museum | cultural | 300k |
| 22 | MC4 | Civic museum | cultural | 240k |
| 23 | MC5 | Civic museum | cultural | 90k |

*Figure 1: list of museums interviewed*

### *3.2. Data Analysis*

The interviews were transcribed using Microsoft Word, and to ensure accuracy, a member of the research team manually reviewed and edited all transcripts before proceeding with the coding process.

A flexible coding approach was employed, allowing multiple codes to be assigned to a single unit of data when necessary (Patton, M.Q. 2014). Given our interest in identifying both existing theoretical constructs and novel sector-specific factors, we adopted an inductive coding process: The initial phase of analysis followed an open-coding approach, allowing key themes to emerge organically from the data. This ensured that the findings were grounded in the participants' perspectives rather than predefined theoretical categories. Then, during the coding process, themes were refined, consolidated, and categorized to capture the most significant insights.

## 4 Results

### *4.1 Emerged Themes*

This section presents the key themes that emerged from the analysis of interview data, highlighting the barriers to Web3 adoption in museums. The findings are structured around these themes and are supported by representative quotes from participants.

#### *4.1.1 Perception of Technology Value*

The perceived usefulness of blockchain-related technologies varied among participants. Regarding the potential monetization of digitized museum-owned artworks through NFTs, interest was notably low; almost all participants did not perceive significant value in this model.
Conversely, more than half of the interviewees acknowledged blockchain's potential to enhance visitor engagement. Specifically, museums recognized blockchain's ability to increase visitor interaction, attract a broader audience, and improve accessibility as relevant factors in assessing adoption.

*"We are currently investing in gamification and virtual reality projects that will launch in the coming months. We believe both approaches enhance visitor engagement and transform passive observers into active participants in the museum experience."*

However, participants did not consider Web3 technologies to be the only, or necessarily the best, solution for increasing visitor engagement. Many interviewees expressed skepticism regarding the added value of NFTs or blockchain-based experiences compared to existing digital tools.

*"...So what are the actual benefits? Compared to a photo I take on my phone of the artwork, what added value does it (NFT) bring? Maybe it creates a link with the museum, but often, a museum visit is perceived as a one-time event."*

While there is openness to exploring new digital tools, the benefits of Web3 technologies remain unclear to many museum professionals, leading to hesitation in adoption.

#### *4.1.2 Ease of Adoption*

A high perceived level of complexity emerged as a significant barrier to Web3 adoption in museums. Many interviewees explicitly cited the technological difficulty of blockchain-based solutions as a primary reason for their reluctance. Participants emphasized that new technologies should integrate seamlessly into existing workflows without requiring drastic operational changes.

*" There is a significant entry barrier due to the level of expertise required to develop these solutions—knowing whom to approach, understanding the market, and navigating the technical aspects."*

Additionally, several respondents indicated that they would be more inclined to adopt blockchain-related technologies if other museums implemented them first. However, this hesitation was not driven by social pressure but rather by the need for concrete implementation models to follow.

*"It would be helpful to have examples to follow—some initial cases that help museums like ours understand the pros and cons, administrative implications, and real impact. If a major national museum acted as an early adopter, it would certainly provide a reference point."*

Reducing the complexity of blockchain adoption and providing clear, practical use cases could encourage wider adoption in the museum sector.

#### *4.1.3. Propensity for Innovation*

Participants' attitudes toward innovation emerged as a significant barrier to Web3 adoption. Some respondents expressed a strong preference for traditional museum experiences over investments in emerging technologies.

*"Right now, I would rather invest in a high-quality exhibition, like a De Chirico retrospective, than spend a substantial amount on emerging technologies."*

However, other museums demonstrated a strong belief in the potential of technology as a powerful tool for cultural dissemination. These institutions viewed digital innovation as an opportunity to expand audience engagement and accessibility, rather than as a distraction from traditional curatorial priorities. This divergence underscores the diverse perspectives within the museum sector, with some institutions embracing innovation as a strategic asset while others remain cautious about its implications.

#### *4.1.4. Financial Resources*

All museums in the study recognized cost as a major barrier to implementing blockchain-related technologies. Interviewees identified multiple financial constraints, including:

- High implementation costs associated with integrating blockchain technology.
- Limited museum budgets, restricting investment in new digital solutions.
- Competing financial priorities, where other areas require more immediate funding.
- Expenses related to staff training or the need to hire external experts.

*" Cost is the fundamental issue. With adequate funding, anything is possible."*

*" There are two major limitations: first, the lack of a dedicated staff member responsible for digital development, and second, financial constraints. These two factors are clearly linked—the lack of resources prevents us from hiring the necessary expertise."*

These financial considerations highlight the importance of funding availability and strategic resource allocation in evaluating blockchain adoption.

#### *4.1.5. Market Perception*

In all interviews, stakeholders identified visitor perceptions as a critical factor in Web3 adoption decisions. Concerns about whether visitors would understand or appreciate these technologies influenced museums' willingness to experiment with them. Some interviewees described blockchain-related innovations as "… *polarizing, potentially attracting certain visitors while alienating others".*

Additionally, some stakeholders expressed the belief that their museum's target audience was generally uninterested in such technologies and that Web3 did not align with their visitor demographic.

*" Our museum is not suited for these types of technologies. Digitalization, yes, but beyond that, it becomes difficult to justify. Our target audience tends to be older and less familiar with these innovations, making their integration particularly complex."*

Research on digital innovation in cultural institutions emphasizes not only the importance of audience attitudes toward novel technological experiences but also the need to educate the public on these topics (Cuseum, 2022 and Trends, 2021). Studies highlight widespread public skepticism toward NFTs, driven by: environmental impact, social perception, and trust (Barua, S. et al. 2025). Many people perceive NFTs as speculative assets rather than tools for social good, making them a divisive and often misunderstood technology. Public skepticism and concerns about financial speculation, can create resistance to their adoption in cultural contexts (Kaczynski, S. 2021).

#### *4.1.6. Regulatory Concerns*

Legal and regulatory considerations emerged as significant barriers to adoption. Many museum stakeholders expressed concerns about copyright laws, particularly regarding the digitization of artworks. A major challenge is the presence of rights managed by collecting societies such as SIAE, which limit museums' ability to freely digitize and distribute cultural assets.

*"We cannot digitize the artworks for a very simple reason: most of them are protected by SIAE copyright regulations. It would be interesting to explore how this could change once a clear legal framework is established."*

The lack of clear regulatory guidelines for blockchain applications in the museum sector was also a frequently mentioned concern. Additional challenges include intellectual property rights, data protection (GDPR compliance), and the legal validity of smart contracts, all of which further complicate adoption. Many interviewees indicated that regulatory clarity would be a determining factor in their institution's willingness to explore blockchain technologies.

The implementation of blockchain in museums introduces complex regulatory and privacy challenges, particularly in relation to data protection and intellectual property rights. As noted in the literature, compliance with legal frameworks such as the General Data Protection Regulation (GDPR), liabilities associated with smart contracts, and uncertainties surrounding digital ownership rights constitute major adoption barriers (Lohmer, J. et al. 2020, Barua, S. et al. 2025).

The largely unregulated nature of the NFT sector exacerbates these concerns, creating an uncertain ecosystem. The absence of standardized criteria for authenticity and value assessment further increases the risk of misinformation and skepticism toward the technology (Gherghelas, S. 2022). Establishing clear regulations and guidelines for NFT transactions, ownership rights, and intellectual property protection would provide museums with a more structured foundation for considering adoption.

#### *4.1.7. Cultural Aspects*

A significant number of respondents identified cultural considerations as key factors in adopting and utilizing new technologies. In this context, cultural aspects refer to individual beliefs about the role of museums in society. Many stakeholders expressed concerns that museums should uphold their cultural integrity, which they perceived as a barrier to integrating blockchain-related technologies. This perspective manifested in three distinct ways:

- Preserving the museum space: some respondents believed that museums should remain dedicated to traditional forms of curation and avoid unnecessary technological interventions.
- Risk of losing cultural mission: others were concerned that technology-driven experiences could shift museums toward entertainment rather than cultural enrichment.

*"... The idea of enhancing the museum experience with technology seems problematic. If technology is used to create content rather than support existing content, then it feels completely misguided. I strongly oppose the notion of transforming the museum experience into mere entertainment."*

*"… We must be cautious, as there is a risk of falling into pure spectacle for its own sake. Scientific and cultural foundations must remain a priority, even when integrating new technologies. Otherwise, we risk turning museums into amusement parks, creating superficial entertainment rather than a meaningful cultural experience."*

- Museums as spaces for slowing down, not accelerating technological consumption: Some respondents emphasized the role of museums as places for reflection and contemplation rather than environments that promote technological acceleration.

*"We strive to create museum experiences that do not rely entirely on digital consumption. We live in a world where image consumption is already so intense and overwhelming that we prefer not to encourage that trend within our museum."*

Beyond technical and financial considerations, the philosophical role of museums in an increasingly digital world remains a critical factor in decisions regarding Web3 adoption.

### *4.2. Theoretical Framing*

Through an inductive analysis of museums' stakeholder interviews, several key themes emerged regarding the factors influencing museum adoption of Web3 technologies: Perception of Technology Value, Ease of Adoption, Propensity for Innovation, Financial Resources, Market Perception, Regulatory Concerns, and Cultural Aspects. These themes reflect both institutional and technological barriers, highlighting the complexity of Web3 adoption in the museum sector.

The research findings can be interpreted using the theoretical lens of the Unified Theory of Acceptance and Use of Technology (UTAUT), which has been widely applied in various contexts to assess technology adoption (Zheng,

F. et al. 2024). The constructs embedded in UTAUT, performance expectancy, effort expectancy, social influence, and facilitating conditions, serve as a foundation for understanding the key factors influencing Web3 adoption among museums.
Each of the emergent themes aligns with and extends the constructs of UTAUT, as detailed below in Figure 2:

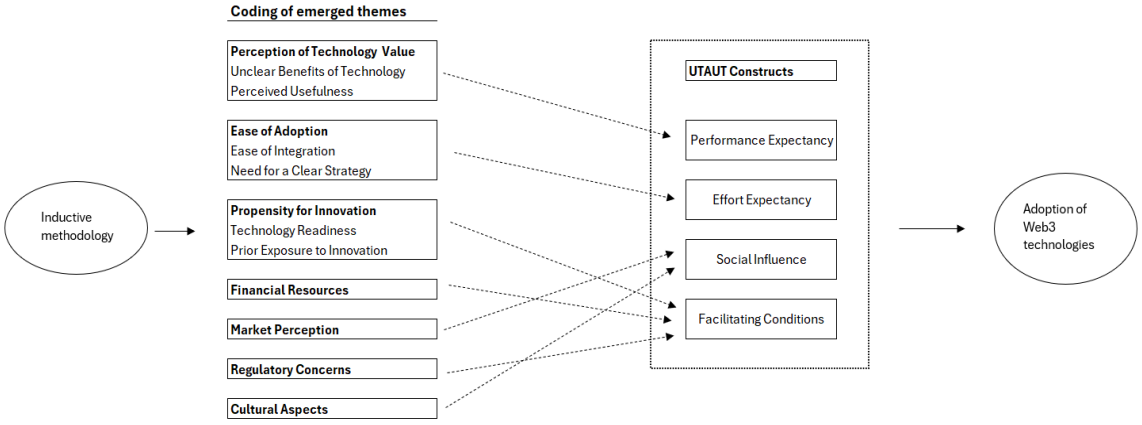



*Figure 2: Emerged themes and UTAUT constructs relationship*

- Performance Expectancy: This construct is reflected in Perception of Technology Value, as museums struggle to identify clear benefits of Web3 solutions, particularly regarding monetization. While most stakeholders questioned the added value of NFTs, some recognized blockchain's potential in enhancing visitor engagement and accessibility. The lack of compelling use cases and concerns about the long-term sustainability of Web3 initiatives further contributed to skepticism.
- Effort Expectancy: This corresponds to Ease of Adoption, as concerns about technological complexity and integration challenges emerged as major barriers. Participants highlighted the lack of internal expertise and the need for seamless integration into existing workflows. The demand for a clear implementation strategy and adequate training resources was frequently mentioned, emphasizing the necessity of structured support to facilitate adoption within museums.
- Social Influence: This construct aligns with both Cultural Aspects and Market Perception. Interviewees revealed concerns about sector-wide perceptions of museums adopting Web3 technologies, with particular anxiety that emphasizing digital experiences over traditional curation might compromise institutional credibility and lead to negative peer judgment. Additionally, external audience perceptions emerged as equally influential factors, creating pressure that either encourages or discourages adoption decisions.
- Facilitating Conditions: This construct is reflected in Propensity for Innovation, Financial Resources, and Regulatory Concerns. Museums already engaged in digital experimentation (e.g., virtual reality and gamification) showed greater openness to Web3 technologies. However, financial constraints—such as high implementation costs and competing budget priorities—acted as significant barriers to adoption. Furthermore, Regulatory Concerns, particularly regarding intellectual property rights, data protection (e.g., GDPR compliance), and copyright laws, added layers of complexity to decision-making, making institutions hesitant to fully embrace blockchain-based solutions.

By mapping the emerged themes from our qualitative analysis onto the UTAUT constructs, we provide a comprehensive framework for understanding the multi-layered challenges that museums face in adopting Web3 technologies. This alignment allows us to contextualize the findings within established technology adoption theories while emphasizing the unique institutional and cultural constraints of the museum sector.

## 5 Conclusions

This study advances the understanding of blockchain-related technology adoption in cultural institutions in several key ways.
The findings confirm that the constructs of the UTAUT model are highly relevant for analyzing the adoption of emerging technologies in museums, identifying the most suitable theoretical framework for understanding the behavior of cultural institutions.

Our study extends the classical understanding of social influence by emphasizing key aspects specific to the museum sector and emerging technologies. Two primary dimensions emerge:

- Sector Influence – The integration of Web3 technologies raises concerns about potential commercialization. Many institutions fear that prioritizing digital spectacle over curatorial rigor could undermine their credibility, making them appear more entertainment-driven rather than educational and cultural. As a result, museums are cautious about how their choices will be perceived by peers. This aspect, while not widely addressed in existing literature, is particularly relevant in cultural contexts with a strong historical heritage, such as Italy, where tradition significantly influences decision-making.
- Public Influence – Another emerging concern is the perceived lack of public education on Web3 technologies. Many museum professionals worry that audiences may not fully understand or appreciate blockchain-based initiatives, leading to skepticism or disengagement.

The study also refines the Facilitating Conditions construct by identifying specific dimensions that act as either drivers or barriers to the adoption of emerging technologies in museums. Three key factors are identified:

- Propensity for Innovation
- Financial Resources
- Regulatory Concerns

These dimensions are consistent with existing literature. Previous research has predominantly highlighted economic constraints (Valeonti, F. et al. 2021, Rennie, E. 2022), technical challenges (Cranmer, E. et al. 2016, Hackius, N. Petersen, M. 2017, Helliar, C. V. et al. 2020), and regulatory barriers (Valeonti, F. et al. 2021, Lohmer, J. et al. 2020) as primary obstacles to technological adoption (Venkatesh, V., 2012).

The proposed theory suggests that specific constructs should be integrated into the existing UTAUT framework. Given that this study is based on a qualitative approach, the outcome is a theoretical contribution. The proposed theory enhances our understanding of the factors that influence behavioral intention in the adoption of blockchain-related technologies within museums. In an era of technological innovation extending into the museum sector, our findings contribute to the broader discourse on technology adoption by identifying constructs specific to blockchain-related adoption in cultural institutions. Our proposed theory has the potential to assist cultural institutions in understanding how to integrate emerging technologies, particularly within contexts deeply rooted in historical heritage. Indeed, the study highlights that one of the most significant barriers to implementation is the tension between digital innovation and the preservation of traditional museum values.

This extended framework will guide future empirical investigations into the adoption of Web3 technologies in Italian museums, bridging theoretical gaps and offering practical insights into digital transformation strategies for cultural institutions.

## 6 Managerial Implication

This study's findings extend beyond the Italian context, offering valuable insights for cultural institutions in regions with rich historical heritage. Successful Web3 adoption requires a strategic approach that addresses institution-specific barriers while balancing innovation with the preservation of traditional values. Museums must navigate competing expectations, embracing digital transformation while maintaining their role as custodians of cultural authenticity.

The identity paradox underscores how social influence in museums operates differently from conventional UTAUT models, peer perceptions and institutional reputation often outweigh potential technological benefits. To mitigate fears of negative peer judgment, leadership should foster internal alignment on digital strategy and clearly communicate how Web3 initiatives complement rather than compromise core cultural missions.

Adoption decisions are influenced by both horizontal (peer institutions) and vertical (audience) pressures. To effectively manage these influences, museums should actively engage in sector-wide dialogues to establish ethical and curatorial standards for emerging technologies. Rather than following technological trends, Web3 adoption should be assessed through the lens of institutional missions. Leadership teams must develop clear criteria for evaluating how blockchain applications support existing curatorial and educational goals. Additionally, visitor education initiatives, such as explanatory videos and guided NFT demonstrations, can help demystify Web3 technologies for traditional audiences.

Furthermore, museums should advocate for sector-specific regulatory frameworks with cultural policymakers to address challenges related to GDPR compliance and intellectual property rights. For

practitioners, these insights highlight the importance of a phased, mission-aligned approach to digital transformation, one that prioritizes institutional readiness while proactively managing reputational risks.

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## 8 Ethics declaration

Ethical clearance was not required for the research

## 9 AI declaration

No AI tools were used for the creation of the paper.

## References

Barua, S., Golder, U., Chowdhury, R. S., & Sharmeen, K. (2025). Implications of NFT as a sustainable fintech innovation for sustainable development and entrepreneurship. *Sustainable Technology and Entrepreneurship*, 100099.

Ch'ng, E., Cai, S., Leow, F. T., & Zhang, T. E. (2019). Adoption and use of emerging cultural technologies in China's museums. *Journal of Cultural Heritage*, *37*, 170-180.

Cranmer, E., Jung, T., tom Dieck, M. C., & Miller, A. (2016). Understanding the acceptance of augmented reality at an organisational level: the case of Geevor Tin Mine Museum. In *Information and Communication Technologies in Tourism 2016: Proceedings of the International Conference in Bilbao, Spain, February 2-5, 2016* (pp. 637-650). Springer International Publishing.

Cuseum, (2022). How museums are interacting with NFTs in 2022, https://cuseum.com/blog/2022/4/26/how-museums-are-interacting-with-nfts-in-2022. [Last accessed: 12/04/2025]

Davis, F. D. (1985). A technology acceptance model for empirically testing new end-user information systems: Theory and results (Doctoral dissertation, Massachusetts Institute of Technology).

Dearing, J. W., & Cox, J. G. (2018). Diffusion of innovations theory, principles, and practice. *Health affairs*, *37*(2), 183-190.

Ekinci, Z. (2023). Non-Fungible Tokens and Select Art Law Considerations. In *Arts* (Vol. 12, No. 5, p. 192). MDPI.

Falk, J. H., & Dierking, L. D. (2018). *Learning from museums*. Rowman & Littlefield.

Gherghelas, S. (2022). All you need to know about global NFT financial regulations, https://dappradar.com/blog/all-you-need-to-know-about-global-nft-financial-regulations. [Last accessed: 14/04/2025]

Hackius, N., & Petersen, M. (2017). Blockchain in logistics and supply chain: trick or treat?. In *Digitalization in Supply Chain Management and Logistics: Smart and Digital Solutions for an Industry 4.0 Environment. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 23* (pp. 3-18). Berlin: epubli GmbH.

Helliar, C. V., Crawford, L., Rocca, L., Teodori, C., & Veneziani, M. (2020). Permissionless and permissioned blockchain diffusion. *International Journal of Information Management*, *54*, 102136.

Jones, M. (2023). Transforming the art industry: Innovation, experimentation, and the potential of web3, https://medium.com/@miajoneswriting/web3disruptingtheartworld-220a3ccfcef7 (2023). [Last accessed: 10/04/2025]

Jung, Y. (2023). Current use cases, benefits and challenges of NFTs in the museum sector: toward common pool model of NFT sharing for educational purposes. *Museum Management and Curatorship*, *38*(4), 451-467.

Kaczynski, S. (2021). How NFTs create value, https://hbr.org/2021/11/how-nfts-create-value.

Lampis, A. (2018). The museums reformation in Italy - the national museum system paper presented at the conference cultural heritage challenges 21st century in Lisbon on 26 oct 2018, https://www.academia.edu/38075537/The_Museums_Reformation_in_Italy_The_national_museum_system_Paper_presented_at_the_Conference_Cultural_Heritage_Challenges_21st_Century_in_Lisbon_on_26_oct_2018. [Last accessed: 10/04/2025]

Lazzeretti, L., Oliva, S., Innocenti, N., & Capone, F. (2022). Rethinking culture and creativity in the digital transformation. *European Planning Studies*, 1-9.

Lohmer, J., & Lasch, R. (2020). Blockchain in operations management and manufacturing: Potential and barriers. *Computers & Industrial Engineering*, *149*, 106789.

MoMA (2024). Sound machines - minted on Ethereum, https://feralfile.com/explore/exhibitions/sound-machines-xz1. [Last accessed: 10/04/2025]

Musee d'Orsay (2024). Agoria Le Code d'Orsay · digital art, https://www.musee-orsay.fr/en/whats-on/exhibitions/agoria-le-code-dorsay. [Last accessed: 12/04/2025]

Ozdil, E. (2023). Museums in 2020+, https://www.thisisjunior.com/books. [Last accessed: 12/04/2025]

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Pourmoradian, S., Farrokhi, O. S., & Hosseini, S. Y. (2021). Museum Visitors' interest on virtual Tours in COVID-19 situation. *Journal of Environmental Management & Tourism*, *12*(4), 877-885.

Rennie, E., Holcombe-James, I., Kushnir, A., Webster, T., & Morgan, B. (2022). Developments in Web3 for the creative industries.

Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. In *An integrated approach to communication theory and research* (pp. 432-448). Routledge.

Sfodera, F., Mingo, I., Mattiacci, A., & Colurcio, M. (2020). Night at the museum: technology enables visitor experiences. *Sinergie Italian Journal of Management*, *38*(1), 231-250.

Trends, (2021). How 21 museums & cultural organizations engaged with nfts in 2021, https://cuseum.com/blog/2021/11/16/how-21-museums-amp-cultural-organizations-engaged-with-nfts-in-2021. [Last accessed: 10/04/2025]

Valeonti, F., Bikakis, A., Terras, M., Speed, C., Hudson-Smith, A., & Chalkias, K. (2021). Crypto collectibles, museum funding and OpenGLAM: challenges, opportunities and the potential of Non-Fungible Tokens (NFTs). *Applied Sciences*, *11*(21), 9931.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157-178.

W. Lab, (2023). Museums tech: 10 blockchain stories — wac handbook digest, https://medium.com/@wac-lab/museums-tech-10-blockchain-stories-wac-handbook-digest-043fa433b429. [Last accessed: 10/04/2025]

Zheng, F., Wu, S., Liu, R., & Bai, Y. (2024). What influences user continuous intention of digital museum: integrating task-technology fit (TTF) and unified theory of acceptance and usage of technology (UTAUT) models. *Heritage Science*, *12*(1), 253.