

Crafting With Codes: Digital Preservation and Technology Adoption in Southeast Asian Heritage

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Abstract: In an increasingly digitalized world, the preservation of intangible cultural heritage particularly in crafts faces both opportunities and challenges. This study explores how Malaysian handicraft heritage agencies and artisans incorporate digital tools into knowledge transfer practices to safeguard and modernize traditional craftsmanship in the Asia Pacific Region. A qualitative case study approach was employed, involving semi-structured interviews with 20 stakeholders including senior artisans, proteges and heritage agency officers. Participants were purposively selected to represent diverse age groups, roles and regional backgrounds. Thematic analysis was conducted through NVivo, emphasizing recurring patterns related to digital adoption, barriers and hybrid mentorship practices. Five major themes: (1) digital tools serve as a supplementary platform for craft documentation and sharing, (2) social media amplifies cultural visibility and market access, (3) limitations in capturing tacit knowledge remain a core challenge in digital preservation, (4) the digital divide constraints access to preservation technologies in rural areas and (5) hybrids models that combine digital resources gaining traction. Younger artisans were found to embrace platforms such as TikTok and Instagram for outreach. While senior mentors expressed concern over authenticity loss and digital dilution. This study contributes to the understanding of how local heritage intersects with global digitization trends. It offers recommendations for policymakers and cultural agencies, including expanding digital literacy programs, supporting infrastructures in underserved regions and promoting blended learning models that respect both traditional values and modern innovations.

Keywords: Tacit knowledge transfer, Digital preservation, Traditional handicrafts, Social media and heritage and hybrid mentorship models

1. Introduction

Digitalizing knowledge is especially difficult when it is tacit, embodied, and rooted in culture. This challenge is clear in traditional craft heritage, where skills are passed down through observation, imitation, and hands-on practice rather than formal teaching. In Southeast Asia, handicrafts like weaving, batik-making, carving, pottery, and metalwork are key forms of intangible cultural heritage maintained through intergenerational apprenticeship. These crafts demand technical skill, aesthetic judgment, material knowledge, and cultural understanding, all of which are hard to codify. Although digital tools such as manuals, images, and videos can record procedures, they often miss the sensory, experiential, and context-specific elements of craftsmanship.

Knowledge management literature has traditionally focused on codifying, storing, and transferring knowledge within organizations (Davenport and Prusak, 1998; Alavi and Leidner, 2001). However, these approaches are less effective when knowledge is deeply embodied and only partly codifiable, as in craft heritage.

This paper contributes to knowledge management (KM) literature in three ways. First, it expands KM discourse by exploring knowledge processes in culturally embedded heritage systems, not just organizational settings. Second, it critically assesses established KM frameworks, especially the SECI model and Tacit Knowledge Theory, by identifying their limitations in contexts where knowledge is deeply embodied and only partly codifiable. Third, it introduces Hybrid Knowledge Systems (HKS) as an extension of KM theory, presenting knowledge preservation as a socio-technical process where traditional mentorship, digital tools, and institutional support combine to

sustain tacit knowledge during digital transformation. By presenting HKS as an extension rather than a replacement of existing KM models, this study addresses calls for more context-sensitive and practice-based approaches to knowledge management.

To guide this inquiry, the study addresses the following research questions:

RQ1: How are digital technologies used to support knowledge transfer in traditional craft heritage settings?

RQ2: What challenges limit the use of digital tools in preserving tacit craft knowledge?

RQ3: How do Hybrid Knowledge Systems develop from the interaction between traditional mentorship and digital knowledge platforms?

2. Literature Review

In Southeast Asia, craft knowledge systems depend on tacit, embodied learning and apprenticeship, with increasing adoption of digital technologies. However, most research addresses digital preservation and traditional knowledge transmission separately, resulting in fragmented heritage preservation. Early knowledge management literature emphasizes that tacit knowledge is embedded in action and practice, and therefore inherently resistant to full codification (Polanyi, 1966; Brown and Duguid, 1991).

From a knowledge management perspective, dominant frameworks such as the SECI model assume tacit knowledge can be externalized into explicit forms (Lusianawati et al., 2023; Bala, 2026). While this works in organizational settings, it is less effective for craft heritage, where knowledge is sensory, situated, and embodied. In these cases, tacit knowledge is often inexpressible, which limits digital representation. As a result, digital tools typically capture procedural knowledge but overlook interpretive, experiential, and context-specific elements of craftsmanship (Ramli & Shuhaida, 2025; Shaari, 2025).

This gap highlights a key limitation of codification-focused KM approaches, which often ignore the epistemological limits of tacit knowledge in practice-based fields. The synthesis identifies three related tensions in digital preservation: (1) codification–embodiment, where tacit skills cannot be fully digitized; (2) visibility–authenticity, where digital exposure may oversimplify complex practices; and (3) technology–inequality, where unequal access to infrastructure and digital literacy limits participation in craft communities.

These tensions show that digital and traditional knowledge systems should not be treated as separate processes. Instead, integrated socio-technical perspectives are needed. Recent work in KM and socio-technical systems suggests that knowledge emerges from the interaction of human practice, technology, and institutions (Bawack et al., 2025; Oguamanam, 2026). Building on this, the study introduces Hybrid Knowledge Systems as a context-sensitive extension of KM theory, explaining how traditional mentorship, digital platforms, and institutional support work together to sustain craft heritage in digitally uneven environments.

3. Research Methodology, Participants and Data Collection

This study examined craft heritage practices in Southeast Asia, focusing on batik (Indonesia), silk weaving (Thailand), lacquerware (Vietnam), and basketry (Philippines). Knowledge transmission in these contexts remains primarily apprenticeship-based and tacit. Digital tools such as social media, video documentation, and online archives are increasingly integrated, creating a socio-technical ecosystem where digital and traditional learning coexist.

Table 1: Participation Distribution by country & roles

Country	Craft Type	Senior Artisans	Protégés	Agency Officers	Total
Indonesia	Batik	3	1	1	5
Thailand	Silk Weaving	3	1	1	5
Vietnam	Lacquerware	2	2	1	5
Philippines	Basketry	2	1	2	5
Total	—	10	5	5	20

Twenty purposively selected participants took part in the study: senior artisans (n=10), protégés (n=5), and heritage agency officers (n=5). Each craft context was represented by five participants from Indonesia, Thailand, Vietnam, and the Philippines. Artisans and protégés offered craft-specific experiential insights, while agency officers contributed institutional perspectives on preservation and digitalisation.

Data were collected through semi-structured interviews (45–60 minutes), conducted either face-to-face or online and audio-recorded. Interviews addressed apprenticeship practices, digital tool usage, generational adoption, and technological challenges.

Data was analysed using thematic analysis with NVivo, following a systematic coding procedure. First, transcripts were reviewed for familiarisation. Second, open coding identified recurring concepts related to digital practices, apprenticeship, and preservation challenges. Third, codes were grouped into categories through iterative comparison across cases. Finally, higher-order themes were developed and refined to capture patterns of interaction between tacit knowledge and digital technologies.

Theme validation involved an iterative coding process in NVivo, using constant comparison and cross-case analysis. Coding consistency was ensured by reviewing transcripts and refining code definitions for coherence within categories. Patterns across participant groups were analyzed to identify converging and diverging perspectives. Node relationships and coding queries verified thematic connections and confirmed that themes accurately reflected the data. Alignment with the Hybrid Knowledge System framework strengthened theoretical validity by linking empirical patterns to established concepts.

Reflexive practices were used throughout the analysis to address potential researcher bias. These included ongoing critical reflection on coding decisions, iterative comparison of interpretations across cases, and systematic review of emerging themes to ensure they were data driven. Coding consistency was ensured through repeated transcript review and refinement of code definitions. Triangulation across participant groups (artisans, protégés, and institutional actors) reduced reliance on any single perspective. NVivo supported coding queries and node comparisons further enhanced analytical transparency and minimized subjective bias in theme development.

4. Data Analysis

Data were analysed in NVivo using thematic analysis, which involved iterative coding, categorisation, and cross-case comparison. Table 2 aligns the derived themes with the research questions, showing how the coding structure systematically addresses RQ1 (use of digital technologies), RQ2 (limitations and challenges), and RQ3 (emergence of hybrid knowledge systems).

It also outlines the progression from initial codes to categories and higher-order themes, illustrating the systematic aggregation of empirical patterns. The findings indicate that digital technologies mainly serve as supplementary documentation tools, while social media platforms act as informal knowledge-sharing spaces that increase visibility but may oversimplify complex practices.

The coding structure highlights the limited ability of digital tools to capture tacit knowledge, underscoring the ongoing importance of embodied, apprenticeship-based learning. Additionally, themes related to the digital divide reveal structural inequalities in access, capability, and resources. These patterns support the development of hybrid mentorship models that integrate digital and traditional practices. This analysis directly informs the Hybrid Knowledge System framework by linking empirical findings to the proposed multi-layered socio-technical model.

Table 2: Nvivo codes categories & themes

NVivo Codes	Categories	Themes	RQ
Video recording of craft process, Online tutorials for craft learning, Recording master artisan demonstrations	Digital documentation & archives	Digital Tools as Supplementary Knowledge Documentation Platforms	RQ1
Social media promotion, TikTok craft demonstrations, Instagram craft showcases	Online knowledge sharing & knowledge engagement	Social Media as Informal Knowledge Sharing Platforms	RQ1
Difficulty explaining craft techniques, Need for hands-on practice, Learning through observation	Tacit knowledge limitations & experiential learning	Limits of Digital Technologies in Capturing Tacit Craft Knowledge	RQ2
Limited internet access, low digital literacy, Cost of digital equipment	Infrastructure & capability constraints	Digital Divide and Technological Barriers	RQ2
Use of online videos before workshop training, digital mentor communication, blended learning practices	Hybrid learning practices	Emergence of Hybrid Mentorship Models	RQ3

5. Findings

Thematic analysis identified five interrelated themes explaining how digital technologies interact with traditional craft knowledge transmission in the handicraft sector. The findings indicate the emergence of a Hybrid Knowledge System, where apprenticeship-based learning remains the main method of tacit knowledge transfer and digital platforms serve as complementary infrastructures.

5.1 Digital Tools as Supplementary Knowledge Documentation Platforms

Participants consistently noted the growing use of digital technologies, including video recordings, digital photography, and online tutorials, to document and archive traditional craft processes. Heritage agencies often lead these efforts by recording master artisans' demonstrations for digital repositories and training platforms.

Despite this growth, digital documentation was widely viewed as supplementary rather than a replacement. These tools capture procedural aspects of production but are limited in conveying the embodied, sensory, and intuitive elements of craft practice. As one senior artisan explained:

"You can record the process, either you take video, take hundreds of pictures... but the feeling in the hand cannot be recorded. Students must still learn directly from the master. Sit by them, hold and use the tools, feel the pressure, expressions...your materials textures, feel the spirit, enthusiasm while producing it. The experience cannot be bought from any college or university..."(SA_3).

This demonstrates that tacit knowledge can only be partially codified, with digital representations serving mainly as reference points rather than complete knowledge systems. In the Hybrid Knowledge System, digital documentation improves access and recall but still relies on apprenticeship-based learning to transmit embodied skills.

5.2 Social Media as Informal Knowledge Sharing Platforms

Social media platforms have become important informal spaces for knowledge sharing and cultural promotion, especially among younger artisans. TikTok and Instagram are used to demonstrate craft processes, showcase products, and reach audiences beyond local communities. These platforms increase the visibility of traditional crafts, attract younger and international audiences, and serve as accessible entry points for observing craft techniques.

However, participants noted that increased visibility does not guarantee deeper understanding. Visually engaging content may spark interest, but often reduces complex, context-dependent practices to simplified representations. Senior artisans observed that short-form videos can raise awareness but do not convey the prolonged practice, material sensitivity, and embodied skill needed for mastery.

This highlights a tension between visibility and authenticity within Hybrid Knowledge Systems. Digital platforms improve dissemination but may dilute the complexity of tacit knowledge. As a result, social media serves as an entry-level knowledge interface: effective for exposure and engagement, but insufficient on its own for transmitting embodied craft expertise.

5.3 Limited Digital Technologies in Capturing Tacit Craft Knowledge

Participants consistently noted that digital technologies cannot fully capture the tacit aspects of craftsmanship. They described craft knowledge as embodied and experiential, requiring sensory awareness, material responsiveness, and intuitive judgment developed through sustained practice. Although digital resources like videos and tutorials offer procedural guidance, they do not provide tactile feedback, real-time correction, or contextual reasoning, all of which are essential for mastering these skills.

Protégés pointed out that self-directed digital learning lacks immediate feedback and interpretive guidance from experienced mentors. As one protégé explained:

"When watching a video, you can see the steps, but if you make a mistake, nobody corrects you. You thought you followed the steps correctly, but the results aren't the same...When the master teaches you, they immediately fix you...If only you would watch the video for me, there is no excitement. It's just like you are watching a blank canvas. For me, I can't ask anything. I'm the kind of person who loves to ask, "What is the story behind this motif? ". " Why can't awan larat be simply carved. Our traditional Malay carvings are in the "tumbuh" and "larat" styles which are derived from flora, not fauna or humans. There are several principal reasons for that...another example, let's say for metal, why I must reach the

temperature level for the bending process, if I didn't, what would happen to the metal... that knowledge, soul, I can only have it while learning with the master..." (P_5).

This demonstrates that tacit knowledge cannot be fully transferred through digital means alone, as effective learning requires feedback, dialogue, and direct engagement. According to Tacit Knowledge Theory, such knowledge is only partially codifiable. In the Hybrid Knowledge System, digital tools improve information access, but successful knowledge transfer still relies on mentorship and practical experience.

5.4 Digital Divide and Technology Barriers

A key finding is the structural inequality in digital access and technological capability among craft communities. Rural participants reported limited internet connectivity and inadequate infrastructure, which restrict their ability to use digital platforms for knowledge sharing and promotion.

Senior artisans often struggled to adopt digital tools due to limited digital literacy, relying on younger family members or intermediaries to manage online content. Although they recognized the benefits of digital engagement, adoption remained inconsistent without structured training and institutional support. Heritage agency officers highlighted the need for targeted capacity-building initiatives to address this gap.

Resource constraints intensified these challenges, as producing and maintaining high-quality digital content requires equipment, software, and stable connectivity. These resources are often unavailable to small-scale practitioners. These highlight a technology-inequality tension while digital platforms increase opportunities for visibility and knowledge exchange, uneven access and skills limit equitable participation. This demonstrates the importance of institutional intervention to support inclusive and sustainable digital engagement in craft heritage preservation.

5.5 Emergence of Hybrid Mentorship Models

The final theme highlights the rise of hybrid mentorship models that combine traditional apprenticeship with digital learning resources. Participants consistently viewed digital tools as supplements to face-to-face mentorship, not replacements. Apprentices often use online tutorials and recorded demonstrations for initial learning, then reinforce these skills through hands-on practice with experienced artisans.

Mentors also use messaging applications and social media to maintain instructional interaction beyond the workshop. These tools support video sharing, real-time feedback, and ongoing guidance, extending learning across both physical and digital environments.

This hybrid approach marks a shift from localized, workshop-based learning to distributed, multi-modal knowledge transmission. In the Hybrid Knowledge System framework, mentorship becomes a layered socio-technical process, with digital tools enhancing but not replacing experiential learning. Hybrid mentorship strengthens the adaptability and resilience of craft knowledge systems, supporting continuity amid technological change.

6. Discussion

Drawing on empirical results, this discussion examines how digital technologies transform traditional craft knowledge transmission from a knowledge management perspective. Instead of replacing apprenticeship-based learning, digital tools create hybrid socio-technical knowledge systems. The discussion addresses three key areas: the persistence of tacit knowledge, the role of digital platforms as complementary infrastructures, and the development of hybrid knowledge systems.

6.1 Persistence of Tacit Knowledge in Craft Learning

The central role of tacit knowledge in craft production underscores the limitations of codification-focused knowledge management. Digital technologies can record procedural steps, but they do not capture embodied, sensory, or context-dependent aspects of craftsmanship. Skills like pressure control, rhythm, and material responsiveness develop through repeated practice with materials under expert guidance, highlighting the experiential nature of learning.

This observation supports Tacit Knowledge Theory and extends the SECI model by showing that externalization is always partial in practice-based fields. While digital tools provide access to explicit information, effective knowledge transfer relies on internalization through hands-on practice. Therefore, apprenticeship remains the main method for transmitting tacit knowledge. This suggests that preserving craft knowledge should be seen as a hybrid approach, where digital resources support rather than replace embodied learning environments.

6.2 Digital Platforms as Complementary Knowledge Infrastructures

The growth of digital platforms marks a move toward more distributed and accessible knowledge infrastructures. Social media allows artisans to share practices, engage audiences, and exchange knowledge beyond local contexts, making these platforms informal but influential parts of modern knowledge systems.

However, greater accessibility brings trade-offs. Simplifying complex, context-dependent practices into digital content can create a false sense of ease in learning new skills. This highlights a tension between visibility and authenticity, as wider dissemination may reduce the depth and integrity of knowledge transfer.

Digital platforms are best seen as entry-level tools that support awareness and initial learning, but they are not sufficient for conveying embodied expertise. In hybrid systems, their value is in supporting, not replacing, apprenticeship-based learning.

6.3 Emergence of Hybrid Knowledge Systems

These dynamics highlight the emergence of Hybrid Knowledge Systems (HKS) as an adaptive approach to knowledge preservation. Instead of treating traditional and digital practices as separate, knowledge transmission now results from their interaction, supported by institutional structures.

In this model, apprenticeship anchors learning through hands-on practice, while digital technologies expand knowledge across locations and time. Institutions stabilize the system by coordinating training, supporting digital initiatives, and providing resource access. These elements create a multi-layered socio-technical system that balances accessibility and authenticity.

The HKS framework advances knowledge management by applying it beyond organizations to culturally embedded domains. It shows how knowledge ecosystems evolve through the integration of human expertise, technology, and institutional support during digital transformation.

6.4 Hybrid Mentorship and Intergenerational Knowledge Transfer

In this hybrid system, intergenerational dynamics are essential for maintaining knowledge continuity. Differences in technological familiarity between younger and senior artisans foster complementary knowledge functions rather than conflict.

Younger practitioners serve as digital intermediaries, making tacit knowledge accessible, while senior artisans provide expertise in embodied skills. This division supports a distributed mentorship model, allowing knowledge to be co-produced across generations and technologies. This collaboration improves accessibility and continuity, ensuring that digital adaptation strengthens, rather than weakens, the integrity of tacit knowledge transmission in craft heritage systems.

7. Proposed Conceptual Framework

This study adopts Hybrid Knowledge Systems (HKS) as its primary analytical framework, conceptualizing craft preservation as a socio-technical ecosystem that integrates tacit knowledge and digital mediation. Empirical findings reveal that knowledge transfer in craft heritage is influenced by the interaction of traditional apprenticeship, digital platforms, and institutional support.

Apprenticeship-based learning, characterized by observation, imitation, and hands-on engagement, remains the main method of knowledge transfer, consistent with Tacit Knowledge Theory. The findings confirm the enduring role of tacit knowledge and highlight the limitations of digital technologies in capturing embodied skills. Digital tools, including social media, video repositories, and digital archives, partially externalize knowledge in line with the SECI model but serve mainly as supplementary documentation and knowledge-sharing platforms.

However, the findings show that externalization is inherently incomplete because effective learning relies on experiential engagement and expert feedback. This limitation, evident in the tensions between codification and embodiment and between visibility and authenticity, highlights the need for integrated socio-technical approaches. This view aligns with Wanda Orlikowski's perspective that knowledge is situated and enacted within practice (Orlikowski, 2002). As a result, digital tools complement but do not replace traditional mentorship.

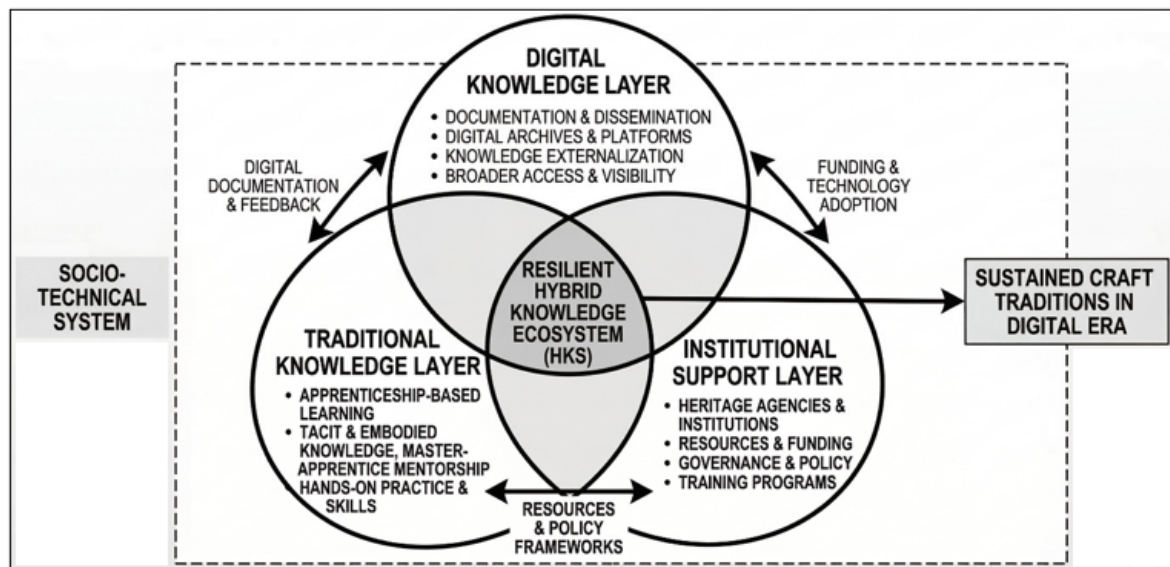


Figure 1: Proposed Hybrid Knowledge System for Digital Preservation of Craft Heritage

The proposed HKS framework includes three interrelated layers: *Traditional Knowledge*, *Digital Knowledge*, and *Institutional Support*, each based on the thematic findings. Figure 1 presents this framework as a multi-layered system that integrates traditional knowledge, digital technologies, and the *Traditional Knowledge Layer* addresses apprenticeship-based learning and tacit knowledge transmission, where embodied skills develop through mentorship and hands-on practice. The *Digital Knowledge Layer* covers digital documentation and social media, where technologies improve access and visibility but do not replace experiential learning. The *Institutional Support Layer* encompasses governance, training, and resource provision, which influence the adoption and sustainability of digital preservation practices. Preservation practices.

The interaction among these layers creates a hybrid knowledge ecosystem where digital technologies enhance accessibility and apprenticeship maintains authenticity. This structure explains the rise of hybrid mentorship models and highlights structural constraints such as digital inequality, showing how knowledge preservation is shaped by both enabling and limiting factors within craft communities.

8. Research Implications and Conclusion

This study advances knowledge management (KM) by highlighting the limitations of codification-focused models in contexts where knowledge is tacit, embodied, and practice-based. It introduces Hybrid Knowledge Systems (HKS), a socio-technical framework where apprenticeship, digital infrastructure, and institutional support work together to sustain knowledge continuity. By examining KM in culturally embedded domains, the study redefines knowledge preservation as the integration of embodied practice with technological mediation.

Practically, the findings underscore the value of hybrid strategies where digital tools, including archives, tutorials, and social media, complement experiential, mentorship-based learning. Targeted digital literacy initiatives are recommended to increase artisan participation. At the policy level, the study calls for coordinated investment in apprenticeship programs, digital infrastructure, and integrated preservation efforts that combine technological platforms with community-based practices.

Although this study offers cross-country insights, its qualitative scope limits generalizability. Future research should consider comparative or mixed method approaches to further validate the Hybrid Knowledge System framework across diverse cultural contexts and knowledge domains.

Overall, the findings challenge the belief that knowledge can be fully codified, showing that tacit, experiential knowledge requires context-specific, practice-based transmission. Digital transformation does not replace tradition but instead reshapes the conditions for the endurance of tacit knowledge, making hybrid knowledge systems essential for sustaining cultural heritage in the digital age.

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Ethics Declaration: This study followed established ethical research standards. All participants were informed of the study's purpose and gave voluntary consent. Confidentiality and anonymity were ensured by removing identifiable information and using coded identifiers (e.g., SA_3, P_5) in the findings. Participants were advised of their right to withdraw at any time without consequence. The study did not involve sensitive or vulnerable populations and posed no physical or psychological risk.

AI Declaration: Artificial intelligence (AI) tools, namely ChatGPT and Grammarly, were used ONLY to assist with language refinement, editing, and manuscript structure. The authors conducted all research design, data collection, analysis, interpretation, and conceptual framework development. They take full responsibility for the work's accuracy, originality, and integrity.

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