

Developing Responsible Innovation Framework for Shanxi Intangible Cultural Heritage Digitization

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Abstract. The role of digital technology in protecting intangible cultural heritage in Shanxi Province is significant. It facilitates the inheritance and dissemination of intangible cultural heritage through digital collection, intelligent inheritance, and interactive digital content experience, thus modernizing traditional culture. The responsible innovation framework has identified four key elements to ensure policy sustainability (government), ethical standardization on digital platforms (agency), establishment of diverse intangible cultural heritage brands (innovator), and promotion of multi-level participation (public). In the future, these requirements will be integrated into the strategic planning and guidelines design of Shanxi's intangible cultural heritage digitalization to ensure their seamless integration into daily operations.

Keywords: Digitization of Cultural Heritage. Responsible Research and Innovation (RRI). sustainable development

1 Introduction

The strategy for safeguarding intangible cultural heritage should encompass a comprehensive understanding and implementation of the concept, with particular emphasis on sustainable development. Systematic intervention in protecting intangible cultural heritage involves measures such as confirmation, documentation, research, preservation, safeguarding, promotion, education, and revitalization. The systematic protection of intangible cultural heritage requires collaborative efforts from various stakeholders including inheritors, government agencies, researchers, businesses and institutions, and the general public to collectively establish and reinforce a sense of community in order to enhance cultural identity[1] and social cohesion in alignment with the conceptual framework of responsible innovation.

The Responsible Research and Innovation (RRI) framework is designed to achieve ethical, sustainable, and socially desirable research and innovation outcomes through responsible practice. It aims to foster mutual responsiveness and shared responsibility for outcomes and process requirements among all stakeholders involved in research and innovation practices.

2 The development status of digitization of intangible cultural heritage

2.1 Current challenges in the preservation of intangible cultural heritage

The development of intangible cultural heritage faces challenges from machine production, including the risk of homogenization, changes in raw materials, and threats to inheritance. Machine production poses several threats to the development of intangible cultural heritage. Firstly, it can lead to product homogenization, as mass-produced items may lack the uniqueness and creativity found in handicrafts. For example, mass-produced paper-cut works may lack the uniqueness and creativity of hand-made paper-cuts, affecting the inheritance of intangible cultural heritage[2]. Secondly, there is a risk of material substitution where traditional materials may be replaced by cheap synthetic alternatives, affecting the authenticity and quality of cultural heritage. For example, industrial production may replace the traditional process using large lacquer in producing Pingyao push-light lacquer ware[3]. Finally, machine production may threaten the transmission of intangible cultural heritage as certain traditional crafts and skills are replaced by industrial methods leading to loss of cultural diversity and heritage. These challenges underscore the importance of preserving traditional craftsmanship and promoting sustainable practices in developing intangible cultural heritage.

2.2 The digital framework of intangible cultural heritage

Currently, the conservation of intangible heritage is transitioning towards a more digitalized approach, utilizing technologies such as virtual reality (VR), augmented reality (AR), mixed reality (MR), and three-dimensional modeling to transform the methods of preserving and transmitting heritage. Digital technology is extensively employed for extracting resources related to intangible cultural heritage, achieving intelligent inheritance, and providing interactive digital content experiences in order to facilitate the preservation and promotion of intangible cultural heritage. The strategies for promoting the digitization of intangible cultural heritage can be categorized into three aspects, as illustrated in Figure 1.

- 1 Through digital platforms, traditional intangible cultural heritage can be transformed into shareable and renewable digital forms, thus providing new possibilities for the reinterpretation, preservation and utilization of intangible cultural heritage. Media platforms such as e-commerce and short videos are becoming increasingly popular, providing new opportunities for the dissemination and inheritance of intangible cultural heritage.
- 2 Utilize digital media technologies such as national and provincial cultural resource databases, and comprehensively use digital means such as public accounts, mini programs, and mobile terminals to provide the public with convenient digital publicity and technical service channels, promote an interactive platform for the exhibition of intangible cultural heritage, and drive young people Participate in the development of the intangible cultural heritage field.
- 3 Give full play to the new momentum of urban IP, build an intangible cultural heritage digital industry chain, promote the construction and development of intangible cultural heritage brands, release new vitality in the protection of intangible cultural heritage, and promote the digital industrialization of intangible cultural heritage.

Fig. 1. Ways to promote the digitization of intangible cultural heritage

In 2023, the Cultural Tourism Department of Shanxi Province launched a series of intangible cultural heritage digital creative products presented through digital platforms, featuring three representative projects: Xiaoyi shadow puppet play, Pingyao Tuiguang lacquer decoration technique, and Zhongyang paper-cut. This initiative aims to enhance public understanding and appreciation of Shanxi's rich intangible cultural heritage through digital displays.

Utilizing 3D panoramic modeling technology, the exquisite craftsmanship and timeless elegance of Pingyao push-light lacquerware's classic lady pattern are vividly brought to life in National intangible cultural heritage inheritor Xue Shengjin's work "The Beautiful Lady of Harmony," allowing visitors to experience a tactile connection with this silk-smooth artistry.

Digital technology has enabled Xiaoyi Shadow Play, a national intangible cultural heritage, to transform its traditional performance into a cinematic experience through the use of film production and 3D modeling technology. This not only preserves the traditional skills but also enhances the presentation effect, allowing Xiaoyi shadow play to exude new vitality in modern society.

Through the use of digital activation technology, Zhongyang paper-cut, known for its simple style and rich vitality, has gained increased flexibility. Wang Jiru, a national intangible cultural heritage inheritor, utilizes this technology in his work Monkey Offering Peach Doll to bring joy to visitors.

Through the utilization of these platforms, the promotion and transmission of intangible cultural heritage can be facilitated, leading to a more effective integration of intangible cultural heritage into contemporary society and its continued preservation.

2.3 Digitization challenge is not from legacy systems

The advent of digital technology has brought forth a myriad of opportunities and challenges in the preservation of intangible cultural heritage, encompassing concerns such as the financial implications of technology, security measures for data privacy, regular maintenance and updates for technological infrastructure, bridging the digital divide, ensuring cultural adaptability and transmission, as well as safeguarding intellectual property rights. To address these multifaceted challenges effectively, it is imperative to implement strategies including but not limited to providing substantial financial backing, establishing robust mechanisms for data protection, ensuring consistent upkeep and modernization of technological resources, fostering digital literacy and collaboration through educational initiatives, upholding reverence for cultural traditions while also fortifying legal frameworks for intellectual property protection. These measures are indispensable in guaranteeing the sustainable development and widespread dissemination of intangible cultural heritage within the context of our increasingly digitized world. (refer to the table1)

Table 1. Digitization challenge is not from legacy systems

Digitization challenge is not from legacy systems						
Challenges	Technical costs	Data privacy and security	Technical updates and maintenance	Digital divides	Cultural adaptability and inheritance	Protection of intellectual property

content	The adoption of high-fidelity digital recording and preservation methodologies often necessitates a substantial financial commitment, presenting a potential impediment for numerous intangible heritage initiatives.	The digitization process involves a substantial volume of data, which may contain sensitive information. Therefore, it is imperative to ensure the security and privacy of the data.	The rapid evolution of digital technologies necessitates continuous updating and maintenance in order to sustain their effectiveness.	There are disparities in the capacity to acquire and apply digital technology across different regions and groups, potentially resulting in a digital divide in the protection of intangible cultural heritage.	The process of digitalization has the potential to alter the traditional transmission of intangible cultural heritage and impact its cultural adaptability and authenticity.	The digital intangible cultural heritage works are susceptible to intellectual property infringement risks.
Solution strategy	The government and social organizations can provide financial support and establish dedicated funds for the digitization of intangible cultural heritage. Simultaneously, it is advisable to explore more cost-effective digital solutions, such as leveraging open source software or engaging in collaborative development of shared platforms.	Implement stringent data management and protection measures, including encryption technology and access control, to safeguard data. Additionally, regular security audits are conducted to ensure the integrity of data.	Develop long-term maintenance and renewal plans, and regularly assess and upgrade technology. Simultaneously, train professional and technical personnel to ensure the sustainable advancement of technology.	Enhance digital education and training to enhance the digital literacy of non-hereditary recipients and related groups, while also promoting cross-regional and inter-group collaboration for the sharing of digital resources.	During the process of digitization, it upholds the cultural connotation and tradition of intangible cultural heritage, collaborating closely with non-genetic inheritors to ensure the seamless integration of digital technology and traditional skills.	Establish a robust intellectual property protection mechanism to legally safeguard intangible cultural heritage works, while simultaneously enhancing public awareness of intellectual property rights.

2.4 Challenges faced by intangible genetic inheritors

The digitization of intangible cultural heritage has facilitated its revitalization, transitioning from the static preservation of objects to the dynamic safeguarding of living culture. Consequently, there is an increasing focus on the inheritors of intangible cultural heritage[4]. The traditional oral and hand-taught methods have resulted in the influence of socio-economic conditions and cultural development on its content, leading to an aging demographic among inheritors with limited participation and drive from younger generations. Furthermore, widespread preservation of intangible cultural heritage requires extensive involvement of digital technology.

2.5 Summary

The protection and dissemination of digitally empowered intangible cultural heritage can include the following aspects:

First of all, the construction of digital intangible cultural heritage information database based on intelligent technology has become an important support to promote the protection and communication innovation of intangible cultural heritage projects. Through the construction of a scientific intangible cultural heritage database system with a clear division of functions, tasks and responsibilities, the development and operation of provincial intangible cultural heritage websites can realize the effective protection, dissemination and utilization of intangible cultural heritage resources. Secondly, the wide application of mobile terminals such as smart phones provides a new platform for the dissemination of intangible cultural heritage, and relevant application software develops rapidly in the direction of socialization. For example, accounts related to the dissemination of intangible cultural heritage are established and operated on platforms such as tiktok, Weibo and wechat to realize the integration of intangible cultural heritage products and modern life. Finally, a multi-subject symbiotic co-creation ecosystem centered on intangible cultural heritage should be built to give full play to the subjective role of non-genetic inheritors in the protection, development and dissemination of intangible cultural heritage. Through the institutional advantages of combining government and social forces, inheritors should be helped to participate in the intelligent enabling process of intangible cultural heritage protection and inheritance, and the digital protection, dissemination, transformation and utilization of intangible cultural heritage projects should be promoted.

3 Responsible Innovation (RRI) in the digitization of intangible heritage

Responsible Research and Innovation(RRI) is a crucial concept being applied across various domains, including the safeguarding, transmission, and advancement of intangible cultural heritage. Key aspects of responsible innovation encompass identifying who bears responsibility for innovation, to whom innovation should be accountable, what responsibilities are involved, and the conceptual and policy orientation of innovation. While the systematic integration of responsible innovation into the digitalization process of intangible heritage has yet to be fully realized, certain digital practices have exhibited characteristics aligning with responsible innovation principles. These include engaging stakeholders in the design of innovative initiatives and assessing both positive and negative impacts stemming from the incorporation of digital technology[5]. The deliberate pursuit of social responsibility in safeguarding, transmitting, and innovating intangible cultural heritage has given rise to exemplary cases that embody the essence of responsible innovation. These cases offer valuable insights and guidance for China's efforts in digitally preserving its intangible cultural heritage towards achieving sustainable development objectives.

4 Research process

4.1 Develop a framework encompassing responsible innovation elements of intangible cultural heritage

Firstly, based on previous research findings, five representative frameworks and evaluation systems related to responsible innovation were ultimately identified (refer to the table2). Secondly, in order to select a development framework suitable for the field of intangible cultural heritage, three criteria are utilized for screening[6]: 1. The framework designer possesses professional and authoritative expertise in their research field. 2. The elements encompassed within the framework can fully and comprehensively embody the requirements of responsible innovation and provide guidance for the digitalization of intangible cultural heritage; 3. The framework is applicable to entities engaged in responsible innovation.

Therefore, ultimately, this paper selects the " Report on the quality criteria of Good Practice Standards in RRI " as the foundation for guiding the evaluation framework of responsible innovation elements in digital intangible heritage. This framework offers fundamental components for developing or selecting assessment, monitoring, and implementation tools, as well as for conceptualizing and refining research and innovation practices to enhance accountability and suitability for the digital preservation of intangible cultural heritage.

Table 2. RRI related framework

number	article	author	main points
1	Report on the quality criteria of Good Practice Standards in RRI[7]	Kupper F, Klaassen P, RijnenM, etal	The key actors in responsible innovation encompass the public, accountable agents, and responsible institutions. The outcomes should adhere to "ethical acceptability," "sustainable development," and "alignment with societal needs," including considerations for "diversity and inclusivity," "transparency and openness," as well as "foresight and reflection" alongside "responsiveness and adaptability to change."
2	Quality criteria and indicators for responsible research and innovation: learning from transdisciplinarity[8]	Fern Wickson, Anna L. Carew	The indicators, including "socially relevant and solution-oriented", "sustainable development as the center and looking forward to the future", "diversity and prudence", "reflection and response", "rigor and stability", "innovation and exquisiteness", "honesty and responsibility," are further categorized into four levels: exemplary, outstanding, good, and fair.

3	Victor Scholten and Emad Yaghmaei. Company Strategies for Responsible Research and Innovation (RRI): A Conceptual Model[9]	Ibo van de Poel , Lotte Asveld , Steven Flipse , Pim Klaassen, Victor Scholten and Emad Yaghmaei	Businesses can incorporate social and ethical considerations into the process of innovating new products and services by integrating responsible research and innovation (RRI) into their corporate social responsibility policies and business strategies. The article emphasizes the significance of companies considering social challenges and values at the early stages of innovation activities in order to achieve greater societal, environmental, and economic success.
4	Assessment of Responsible Innovation Methods and Practices[10]	Emad Yaghmaei and Ibo van de Poel	The achievement of this goal is facilitated by the provision of empirical evidence regarding the advantages of responsible innovation, as well as the demonstration of enhancements in monitoring systems. Additionally, where applicable and beneficial, proposed evaluation scenarios for responsible innovation are presented.
5	Indicators for promoting and monitoring Responsible Research and Innovation[11]	Roger Strand	Incorporating governance, public participation in policy development, regulations and frameworks, event and initiative development for public engagement, capacity building for public involvement, gender equality promotion, science education advancement, and open access science.

The aforementioned framework integrates the outcomes of Responsible Research and Innovation into the realm of intangible cultural heritage digital innovation, encompassing the following dimensions: Ensuring policy sustainability (government), Strengthening ethical standardization on digital platforms (agency), Establishing diverse intangible cultural heritage brands (innovator), Promoting multi-level participation (public), and refining secondary indicators and problem elements based on an understanding of Responsible Research and Innovation (refer to Figure 2).

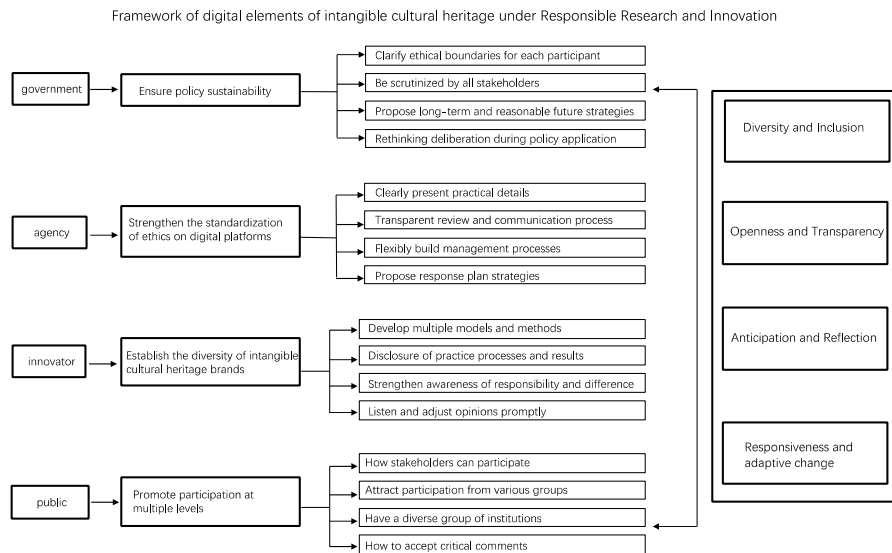


Fig. 2. Framework of digital elements of intangible cultural heritage under Responsible Research and Innovation

The principles of diversity and inclusion, openness and transparency, anticipation and reflection, responsiveness and adaptive change are all evident in various aspects. For instance, long-term (government) policies require the communication content to be delivered openly and transparently to the audience at a policy level. This is fundamental for establishing mutual understanding and trust among all stakeholders involved in the digital innovation of intangible heritage. An open and transparent process also aids in clarifying ownership and responsibility, which is crucial for responsible innovation.

The enhancement of ethical standards on digital platforms necessitates a heightened awareness among all types of platforms regarding the impact of their outcomes and advancements, in order to deliberate on subsequent steps through systematic evaluation. These evaluations should not be confined to the conclusion of a practice, but should permeate throughout the process of innovation development. Contingency strategies must be established, updated, and implemented in constant collaboration with all stakeholders. Only through this responsive approach can research and innovation effectively adapt to evolving environments and emerging knowledge.

Multiple models and approaches should be considered to ensure diverse outcomes in establishing the variety of intangible cultural heritage brands. Engaging the public in the decision-making process of digitizing intangible cultural heritage can contribute to demand-driven innovation and enhance the acceptance of the final digital product.

Enhancing multifaceted engagement is crucial for integrating diverse stakeholder groups into digital R&D practices. Responsible innovation should be inclusive from the outset, employing various methods to engage different types of stakeholders, in order to ensure their involvement and contribution to the dissemination, development, and innovation of intangible cultural heritage.

4.2 Framework and assessment criteria for digitizing intangible cultural heritage

In order to further elucidate the operationalization of responsible innovation within the context of digitizing intangible cultural heritage, the author will endeavor to dissect the specific connotations of each element and delineate the detailed criteria for evaluation standards.

1) Ensure policy sustainability (government) (refer to the table3)

Table 3. Ensure policy sustainability

Ensure policy sustainability		
critereon	index	Thought-provoking evaluation rules
Clarify ethical boundaries for each participant	means of communication	Have appropriate communication methods for the actors involved and affected in the digitization process of intangible cultural heritage been considered?
	shared	Have you thought about what information can and should be shared with whom?
Be scrutinized by all stakeholders	Reflection	Have you considered how and when to receive feedback on the results of digitization of intangible cultural heritage and how to use the feedback?
Propose long-term and reasonable future strategies	future impact	Are the early, medium and long-term social, environmental and economic impacts and resulting consequences (intentional and unintentional) of the digitization of intangible cultural heritage actively identified and considered?
	Established method	Are forecasting methods thoughtfully selected and implemented? (such as scenario development, real-time technology evaluation, etc.)
	R&D trajectory	Have you considered various presentation forms of digital innovation?
Rethinking deliberation during policy application	Thoughtful	Is there room for reflection and deliberation, such as impacts, alternatives, needs and practical processes?
	comprehensive reflection	Do relevant actors regularly conduct critical analyzes of problematic perceptions, needs, and interests in their practice?

2) Strengthen the standardization of ethics on digital platforms (agency) (refer to the table4)

Table 4. Strengthen the standardization of ethics on digital platforms

Strengthen the standardization of ethics on digital platforms		
critereon	index	Thought-provoking evaluation rules
Clearly present practical details	Target	Are all goals and objectives of digital presentation of intangible cultural heritage expressed honestly and clearly?
	statement	Is there a statement of interests and affiliations for all participants?
	communication	Is there a policy on open access and information sharing?

	policy	Are these intangible cultural heritage digitization policies accessible to stakeholders?
Transparent review and communication process	role participation	Are all relevant actors in the digitization process of intangible cultural heritage described and explained, and at what stage of the trajectory are they involved? Do participants understand the extent to which they can influence decisions?
	Feedback	Was input from different participants used? Or feedback on what impact their opinions have in practice?
Flexibly build management processes	Stakeholder needs	Is it possible to change the course of digital innovation practices in response to changing needs/interests/values/perceptions of stakeholders?
	Flexible process	Is it possible to adjust the process of digitizing intangible cultural heritage based on interim results or conflicting data?
	environmental context	Is it possible to change the course of digital innovation practices in response to environmental changes?
Propose response plan strategies	Assessment framework	Is it specific enough to develop a framework for internal evaluation of digital products as they emerge?
	index	Have (preliminary) key presentation indicators been identified?

3) Establish the diversity of intangible cultural heritage brands (innovator) (refer to the table5)

Table 5. Establish the diversity of intangible cultural heritage brands

Establish the diversity of intangible cultural heritage brands		
critrion	index	Thought-provoking evaluation rules
Develop multiple models and methods	Diversity of methods	Are research and innovation methods discussed with different stakeholders in order to meet their needs and expectations?
	Audience	Is there diversity in the audience?
Disclosure of practice processes and results	result	Are initial, interim and final results shared with all participants?
	limitation	Are uncertainties and limitations in practice identified and shared?
Strengthen awareness of responsibility and difference	awareness of difference	Do the participants involved in the digitization of intangible cultural heritage recognize the differences between their own assumptions, values, and purposes and those of others?
	Sense of responsibility	Do participants in the digitalization process realize and reflect on their roles and responsibilities?
Listen and adjust opinions promptly	organization	Do the innovative organizations involved provide the adaptive space to respond flexibly to changing circumstances and changing needs?

4) Promote participation at multiple levels(public) (refer to the table6)

Table 6. Promote participation at multiple levels

Promote participation at multiple levels		
critrion	index	Thought-provoking evaluation rules
How stakeholders can participate	early involvement	Are governments, creative agencies, intangible cultural heritage inheritors, the public, etc. involved from the early stages of the innovation trajectory of digital intangible cultural heritage?
	way of participation	Have different ways and techniques for engaging specific stakeholder groups in the dialogue been considered?
Attract participation from various groups	Promote discussion	Are you reaching out to more groups to participate in discussions during the digitization of intangible cultural heritage?
	related participation	Has the public participated in the stages of digital R&D and innovation of intangible cultural heritage?
	Capability development	Are different possibilities explored or activities undertaken to promote public participation in development?
Have a diverse group of institutions	internal differences	Are group/social differences (such as gender, race/ethnicity, class, ability, and culture, politics, religion) paid attention to and respected in the practice of intangible cultural heritage digitization?
How to accept critical comments	Collect opinions	Do you actively seek critical input and feedback from a range of stakeholders?
	feedback path	Are ways to incorporate feedback implemented during the digitization process of intangible cultural heritage?

4.3 Discussion and suggestion

The AHP hierarchical analysis of the framework for evaluating the digitalization of intangible cultural heritage clearly indicates that, among the four core dimensions, diversity in establishing intangible cultural brands (innovators) holds the most significant position, with a weight of 0.4545, ranking first. This is followed by promoting multifaceted participation (public participation) with a weight of 0.2783, strengthening ethical norms on digital platforms (institutions) with a weight of 0.1694, and ensuring policy-level sustainability (government) with a weight of 0.097. (refer to the table7)

Table 7. AHP hierarchical analysis of data

Primary index	First-order index weight	Secondary index	Secondary index weight
Ensure policy sustainability(government)	0.097	Clarify ethical boundaries for each participant	0.491
		Be scrutinized by all stakeholders	0.2772
		Propose long-term and reasonable future strategies	0.148
		Rethinking deliberation during policy application	0.0836

Strengthen the standardization of ethics on digital platforms(agency)	0.1694	Clearly present practical details	0.492
		Transparent review and communication process	0.155
		Flexibly build management processes	0.265
		Propose response plan strategies	0.0883
Establish the diversity of intangible cultural heritage brands (innovator)	0.4545	Develop multiple models and methods	0.475
		Disclosure of practice processes and results	0.281
		Strengthen awareness of responsibility and difference	0.154
		Listen and adjust opinions promptly	0.087
Promote participation at multiple levels(public)	0.2783	How stakeholders can participate	0.156
		Attract participation from various groups	0.488
		Have a diverse group of institutions	0.268
		How to accept critical comments	0.086

The ability to innovate is paramount (weight value 0.4545) and serves as the primary driving force behind the sustained prosperity and robust development of the cultural industry. This capacity not only dictates the industry's continued progression, but also stands as a pivotal metric for its potential for future breakthroughs. Only through continual innovation can the cultural industry ensure its enduring success and ascend to new heights. The digitization of intangible cultural heritage should place greater emphasis on innovation, interactivity, and visual presentation. This approach will not only captivate a larger audience, particularly among younger generations, but also facilitate broader participation in cultural preservation through social media platforms, thereby infusing traditional culture with renewed vitality in modern society.

Multifaceted participation serves as the foundation (weight value 0.2783), and the public, as both creators and inheritors of intangible cultural heritage, should actively engage in digital development. This involves organizing interactive experiences and participatory creation through online and offline activities, while making more extensive use of modern technology and social media platforms such as short videos. In doing so, the public can not only appreciate the allure of intangible cultural heritage but also contribute to its protection and preservation.

The focus is on enhancing digitalization (weight value 0.097). Throughout the process of digitalization, there should be an increase in interactive exhibitions and experiential activities to promote greater community collaboration and interaction, such as simulating the traditional handicraft production process, allowing the public, particularly young people, to have a more intuitive experience and understanding of intangible cultural heritage.

The durability of the policy is essential (weight value 0.1694). The digitalization of intangible cultural heritage should be closely integrated with the national cultural development strategy, and proactive policies should be devised to ensure the long-term sustainability of the policy.

5 Conclusion

In conclusion, while the concept of "Responsible Research and Innovation (RRI)" has not yet been consciously integrated into the daily practices of workers involved in the digitization of intangible cultural heritage, there have been numerous exemplary cases that demonstrate a conscious commitment to cultural preservation, dissemination, and innovation as part of their social responsibility. These cases offer valuable references and guidance for the digital preservation of intangible heritage in pursuit of sustainable development goals. However, currently, most digital innovation practices related to intangible cultural heritage still predominantly rely on traditional methods. If these practices only support the sustainable development goal of intangible cultural heritage, they may be insufficient and challenging to fully realize. Therefore, it is crucial to introduce the concept of responsible innovation and establish a framework to guide effective innovative activities in daily work for the digital application of intangible cultural heritage. This will help promote its sustainable development through protection, development, and innovation.

To enhance the integration of the framework into digital practice, stakeholders should utilize the framework for self-assessment and gap identification with regards to the Sustainable Development Goals. Simultaneously, based on an understanding of their own current situation and deficiencies, digitalization of intangible cultural heritage should reference relevant responsible innovation cases domestically and internationally, incorporate framework requirements into strategic planning, guidelines, and norms design, and ensure comprehensive integration into daily operations and development. Through active exploration and implementation of responsible innovation initiatives, digitalization of intangible cultural heritage can not only preserve and safeguard intangible cultural heritage but also serve as a proponent and practitioner of responsible innovation. This can provide guidance and inspiration for other heritage preservation efforts while contributing significantly to overall societal sustainable development.

For instance, the development of a digital intangible cultural heritage that aligns with sustainable development principles can enhance public engagement in the digitalization process. Looking ahead, the digitization of intangible cultural heritage should bolster theoretical research on responsible innovation, establish specific action guidelines, and promote exemplary cases to truly integrate the concept of responsible innovation into daily digital management and operations as a voluntary standard, thereby playing a greater role in achieving sustainable development goals.

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