Strategies for the Digital Protection and Development of Light Industrial Cultural Heritage

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Abstract: Under the background of globalisation and informatisation, the protection and development of light industrial cultural heritage is facing unprecedented opportunities and challenges. The purpose of this paper is to explore how to achieve the overall protection of light industrial cultural heritage through digital technology and formulate effective development strategies to promote the sustainable development. Firstly, this study reviews the definition and classification of light industrial cultural heritage, as well as its historical value and cultural significance; subsequently, it analyses in detail the current risks and challenges faced by light industrial heritage. On this basis, a set of systematic digital preservation methods is proposed, including digital recording and archiving, 3D scanning and modelling, and the application of virtual reality and augmented reality technologies, and the key technologies of digital storage and management are discussed in depth. Finally, the development mode of digital light industrial cultural heritage is studied, including online education platform, creative industry integration and marketing strategy, and successful development practice is demonstrated through case studies.
Keywords: Light Industrial Cultural Heritage, Digital Preservation, Development Strategy

1. INTRODUCTION

With the rapid development of information technology, digitalisation has become a powerful tool for modern cultural heritage preservation and development. Especially in the field of light industry, this process not only provides a new way for the preservation of heritage, but also opens up a wide world for its creative transformation and innovative development. However, despite the promising future, the road of digitisation of light industrial cultural heritage is still full of thorns. In traditional concepts, light industrial heritage is often regarded as a by-product of industrialisation rather than an important part of cultural heritage. However, with the passage of time and the development of society, people are beginning to realise the historical value and cultural significance behind these heritages. From ancient handicraft techniques to modern industrial production

methods, each heritage site carries the imprint of human wisdom. It is therefore particularly important to systematically organise and protect this heritage. However, conservation is far from easy. Problems such as the deterioration of the physical environment, lagging laws and policies, and insufficient public awareness come one after another, posing serious challenges to heritage conservation. (Yang & Kang, 2019) Against this background, the intervention of digital technology has undoubtedly injected new vitality into heritage conservation. By means of high-precision digital recording and archiving, three-dimensional scanning and modelling with a strong sense of three-dimensionality, and immersive virtual reality and augmented reality technologies, we are able to protect and study heritage in a more comprehensive and in-depth manner. Therefore, this paper will focus on the digital preservation and development of light industrial cultural heritage for in-depth discussion. Through the analysis of the current situation, the analysis of challenges and the study of strategies, it aims to provide theoretical support and practical guidance for the digital transformation of light industrial cultural heritage, and hopes that under the light of digitalisation, light industrial cultural heritage can glow with a more brilliant luster. (Xue, Yu, & Yu, 2022)

2.OVERVIEW OF LIGHT INDUSTRY CULTURAL HERITAGE

2.1 Definition and Classification

Light industrial cultural heritage refers to the tangible and intangible remains with historical, artistic and scientific values from traditional handicrafts to industrialised production. This kind of heritage covers everything from ancient handicrafts and special crafts nurtured by local customs to manufacturing technologies and equipments emerging in the process of modern industrialisation. Based on its form and function, light industrial cultural heritage can be classified into two categories: tangible and intangible. Tangible heritage includes tangible assets such as buildings, machinery, and products, while intangible heritage includes intangible assets such as craft skills, production practices, and related symbolic expressions. (Zheng & Xu, 2020) This categorisation not only facilitates systematic management, but also helps to adopt corresponding protection and inheritance measures for different types of heritage.

It is worth noting that the definition of light industrial cultural heritage is not static, but evolves with the development of society and the progress of science and technology. The latest theoretical frontiers emphasise the

dynamic nature of light industrial cultural heritage, i.e. it refers not only to historically developed heritage elements, but also to today's innovative practices and technological developments related to light manufacturing. Therefore, the understanding of light industrial cultural heritage should also be updated in time to reflect new trends in contemporary socio-cultural and economic contexts. (Wang, 2017) When exploring the categorisation of these heritages, scholars usually also take into account the geographic and cultural context in which they are located, as well as the social and economic information embedded in the heritage itself. For example, a factory building in an old industrial area is more than just a building, it may also represent the history of changes in the social structure and economic development of the area. Similarly, a craft that has been passed down for centuries is not just a skill in itself, but may also carry insights into the way of life and social relations of the people in the area. Therefore, when talking about the cultural heritage of light industry, we are actually discussing a multi-dimensional concept, which includes both physical objects and the human activities and social structures associated with them.

2.2. Historical Value and Cultural Significance

As a witness to the historical development of human society, light industrial cultural heritage carries rich historical value and cultural significance. Firstly, from the perspective of historical value, light industrial cultural heritage reflects the level of social productivity, the state of scientific and technological development as well as people's lifestyles and values in a specific historical period. For example, early textile factories and ceramic workshops not only represented the industrial technology level at that time, but also reflected the social demand for material culture and aesthetics. In addition, the cultural heritage of light industry also witnesses the transformation of China from a traditional agricultural society to a modern industrial society, which has an important historical research value. Secondly, from the perspective of cultural significance, light industrial cultural heritage reflects the cultural characteristics and creativity of a particular region or nation. Many light industrial products, such as silk, porcelain, tea, etc., not only enjoy a great reputation at home, but are also exported overseas and become the messengers of cultural exchange. These cultural heritages have inherited the excellent traditional culture of the Chinese nation and are of great significance in promoting the national spirit and enhancing national self-confidence and cohesion. (XIE, WANG, & HAN, 2016) Thirdly, the cultural heritage of light industry also has the

value of education and enlightenment. Through visiting and studying these cultural heritages, people can better understand the history and culture so as to cultivate their aesthetic interests and improve their cultural literacy. At the same time, light industrial cultural heritage is also an important carrier of patriotic education for future generations, which helps to cultivate their national sentiment and sense of national identity. The historical value and cultural significance of light industrial cultural heritage cannot be ignored. In the context of globalisation and information technology, more attention should be paid to the protection and inheritance of such cultural heritage, so that more people can understand and recognise the rich historical and cultural connotations they contain. At the same time, it should also actively explore the transformation of these cultural heritages into the driving force for the development of modern society and realise its sustainable development.

3. CURRENT SITUATION AND CHALLENGES OF LIGHT INDUSTRIAL CULTURAL HERITAGE

3.1. Analysis of the Current Situation

3.1.1. Types and Distribution of Light Industrial Cultural Heritage

As an important part of industrial heritage, light industrial cultural heritage is diverse and widely distributed. These heritages not only include sites, buildings and mechanical equipment in material form, but also cover technical skills, production processes and industrial culture in non-material form, etc. (Klimas, 2016) In the context of globalisation and informatisation, the study of the categorisation and geographical distribution of light industrial cultural heritage is of great significance in understanding the strategies for its digital preservation and development. Specifically, light industrial cultural heritage can be broadly classified into the following categories: traditional handicrafts, long-established enterprises, abandoned factories and facilities, and related intangible cultural heritage. Traditional handicrafts, such as ceramics, weaving, embroidery, etc., (Garcia, 2022) tend to be concentrated in regions where handicrafts were more developed historically or in specific cultural groups. Old businesses, on the other hand, are often found in cities with a long economic history, and they bear witness to the industrial and commercial development of an era. Abandoned factories and facilities, on the other hand, are often forgotten corners in the process of urbanisation, and they carry the memory of industrial development. As for intangible cultural

heritage, it focuses more on the skills and knowledge of the inheritors. In terms of geographical distribution, light industrial cultural heritage is unevenly distributed in different regions. In some countries and regions in Europe and Asia, there is a relative concentration of such heritage due to the historical flourishing of handicrafts and light industry, while in some developing countries, the quantity and state of preservation of such heritage may not be satisfactory due to the late start of industrialisation. With its unique historical value and cultural significance, light industrial cultural heritage is a bridge between the past and the future. An in-depth classification study of these heritages, combined with a comprehensive survey and analysis of their distribution by means of modern technologies such as GIS, will provide a solid foundation for subsequent digital preservation and intelligent development. (Li, Liu, & Qian, 2019)

3.1.2. Current Situation of Protection and Development of Light Industrial Cultural Heritage

Under the wave of globalisation and informatisation, the protection and development of light industrial cultural heritage is undergoing a major transition period. At present, as society's awareness of the importance of cultural heritage increases, a series of achievements have been made in the protection work, but at the same time, many problems and shortcomings have been exposed. Firstly, looking at the aspect of achievements, numerous countries and regions have included light industrial heritage in the statutory protection category, for example, China's intangible cultural heritage list covers a large number of traditional handicraft techniques. (Qian, Vaddiraju, & Khan, 2023) In addition, international organisations such as United Nations Educational, Scientific, and Cultural Organization (UNESCO) have enhanced the global awareness of the protection of light industrial cultural heritage through the formulation of various conventions and recommended lists. However, shortcomings are equally obvious. Despite the increased awareness of protection, in practice, many valuable light industrial heritage has not been adequately protected due to the lack of funds, technology and professional talents. At the same time, some traditional crafts are on the verge of being lost due to the shrinking market, and there is an urgent need for an effective inheritance mechanism to guarantee their continuation. On the other hand, in terms of development and utilisation, although there are successful cases showing that cultural heritage can bring economic benefits to the local community through appropriate commercial operations, such as transforming old

factories into cultural and creative parks, these successful cases are not common. When developing light industrial cultural heritage, many regions still face the problems of how to balance protection and development, and how to deal with the contradiction between the originality and commercial value of the heritage. (Ali, Thomas, & Gupta, 2013) Thus, it can be seen that the current situation of light industrial cultural heritage protection and development is a complex mixture. On the one hand, increased awareness of conservation and technological advances have made it possible to protect heritage; on the other hand, problems such as lack of funds, market-driven over-commercialisation, and lack of long-term planning are still the main obstacles restricting the sustainable development of light industrial cultural heritage. Therefore, it is an urgent task in front of us to explore a new path that can both protect and effectively develop the heritage under the premise of respecting history and culture.

3.1.3 Challenges Faced

3.1.3.1 Conflict between Cultural Heritage Protection and Economic Development

When discussing the challenges of light industrial cultural heritage, one issue that cannot be ignored is the contradiction between cultural heritage protection and economic development. With the acceleration of global economic integration, many regions are under pressure to commercialise cultural heritage for economic growth. (Hong, 2010) This pressure has led to a series of conflicts and problems, especially in those regions with economies in transition or less developed. On the one hand, the preservation of cultural heritage requires large financial investments, including restoration and maintenance costs, the construction of conservation facilities and the training of professionals. These inputs often require government subsidies or depend on external funding. However, with limited resources, governments and policymakers tend to prioritise projects that contribute directly to economic development, while cultural heritage conservation may be marginalised. In addition, even with sufficient funding, it is a challenge to balance the originality of conservation with the necessary modernisation. For example, when conserving a historical factory, whether its original production facilities should be preserved or whether it should be renovated to suit the needs of modern exhibitions requires weighing the pros and cons and making an informed decision. On the other hand, economic development is often accompanied by the advancement of urbanisation and industrialisation, which may lead to the destruction of the ecological environment and the disappearance of

traditional lifestyles in cultural heritage sites. (Ozansoy, 2006) For example, some historical buildings and sites may be demolished in order to build new commercial districts or tourist facilities, and intangible cultural heritage may lose the significance and space for transmission due to changes in market demand. In some places, traditional handicrafts cannot compete with industrial products because of low production and high costs, resulting in fewer and fewer inheritors of traditional skills and the gradual loss of traditional crafts. This contradiction is not only reflected in the process of conservation and development, but also in the recognition of the value of cultural heritage. In some regions, people may pay more attention to short-term economic benefits and neglect the long-term value of cultural heritage. Such short-sighted behaviour may lead to the destruction of cultural heritage which, once lost, will have a value that cannot be measured in monetary terms.

3.1.3.2. Inheritance and Innovation of Traditional Craftsmanship and Technology

In the discussion of the current challenges facing the cultural heritage of light industry, the issue of inheritance and innovation of traditional craft technology is also particularly prominent. With the continuous advancement of modernisation and globalisation, these crafts with historical value are encountering great pressure for survival. On the one hand, the inheritance of traditional crafts requires time and patience, as well as craftsmen with appropriate skills. However, due to the influence of the market economy and the lack of interest in traditional crafts among the younger generation, these skills often face a lack of successors. (Suchan & Sobiesk, 2006) On the other hand, even with inheritance, the challenge of how to innovate and develop while maintaining their uniqueness and traditional charm is not easy to solve. As a response strategy to this challenge, some experts and scholars have proposed the use of digital technology to promote the inheritance and innovation of traditional craft techniques. For example, digital archives containing detailed craft processes and techniques can be established, and crafts can be demonstrated and taught through virtual reality (VR) and augmented reality (AR) technologies, enabling more people to learn and experience these crafts without physical constraints. At the same time, technologies such as digital simulation and 3D printing have opened up new possibilities for the design and production of traditional crafts, enabling traditional crafts to be combined with modern design and manufacturing techniques to create new products and markets. However, while digital technology provides new

ways for the inheritance and innovation of traditional crafts, how to ensure that the uniqueness and cultural connotation of the crafts themselves will not be lost in the process is an issue that we must seriously consider. In addition, the digital transformation of craftsmanship requires corresponding financial support, policy guidance and market promotion to ensure its survival and development in modern society.

3.1.3.3. Limitations in the Recognition and Dissemination of Cultural Heritage

When discussing the preservation and development of the cultural heritage of light industry, it is necessary to mention the limitations faced by the traditional cultural heritage in terms of recognition and dissemination. These limitations not only restrict the conservation and development of cultural heritage, but also affect the transmission and education of cultural heritage. (Terzija et al., 2010) The first is the cognitive limitations of traditional cultural heritage. In modern society, with the rapid development of science and technology and changes in people's lifestyles, the awareness of traditional cultural heritage has gradually decreased. Especially among the younger generation, there is relatively little knowledge and awareness of traditional cultural heritage. This is mainly due to the relative lack of education on traditional cultural heritage in the modern education system, which leads to a lower level of awareness of traditional culture among the younger generation. At the same time, due to the development of modern media, people are more exposed to modern culture and have relatively less exposure to traditional cultural heritage, which also limits the knowledge of traditional cultural heritage. Secondly, the dissemination of traditional cultural heritage is limited. The dissemination of traditional cultural heritage is limited by many factors. On the one hand, the dissemination channels of traditional cultural heritage are relatively limited, and the dissemination of traditional cultural heritage is less powerful than that of modern cultural products. On the other hand, the content of the dissemination of traditional cultural heritage also has certain limitations. The dissemination of traditional cultural heritage is often confined to some specific cultural forms, such as traditional arts and traditional festivals, while there is relatively little dissemination of such material cultural heritage as light industrial cultural heritage. In addition, the dissemination of traditional cultural heritage in the international arena faces certain challenges due to language and cultural differences. Therefore, when exploring the preservation and development of light industrial cultural heritage, it is important to consider how to break through the limitations

of the recognition and dissemination of traditional cultural heritage. This requires efforts from various aspects such as education, media and policies. In terms of education, the education of traditional cultural heritage should be strengthened and the awareness of traditional cultural heritage among the younger generation should be enhanced. In terms of media, the channels of traditional cultural heritage should be broadened and the methods of dissemination should be innovated to improve the dissemination of traditional cultural heritage. In terms of policy, the protection and support of traditional cultural heritage should be strengthened and the inheritance and innovation of traditional cultural heritage should be encouraged.

4. OVERALL PROTECTION METHODS OF DIGITALISATION OF LIGHT INDUSTRIAL CULTURAL HERITAGE

4.1.Digital Recording and Archiving

In the protection and development of light industrial cultural heritage, digital recording and archiving is an important method. Digital recording and archiving is to record and archive the cultural heritage in detail by using digital technology, such as photography, video, scanning, etc. so as to facilitate future research and utilisation. The steps of digital recording and archiving usually include the following: firstly, a detailed survey and documentation of the cultural heritage (Cheng, 2024). This includes detailed investigation and understanding of the type, distribution, historical background and cultural value of the cultural heritage. Comprehensive research and recording of cultural heritage is carried out by means of field visits, interviews with relevant people, and consultation of relevant literature; secondly, it is the digital filming and scanning of cultural heritage. This includes detailed filming and scanning of the appearance, structure, decoration and craftsmanship of cultural heritage. Comprehensive digital recording of cultural heritage is carried out through high-definition photography, videography and three-dimensional scanning. Again, it is the collation and archiving of digitally recorded data. This includes the work of classifying, organising, editing and archiving the digitally recorded data (Zheng & Xu, 2020). Through the establishment of a comprehensive database and management system, the digital records are effectively managed and preserved for future research and utilisation. The advantage of digital recording and archiving is that it can provide a more objective, comprehensive and accurate way of recording, avoiding the subjectivity and inaccuracy that may occur in the traditional way of recording. At the

same time, digital recording and archiving can also provide a more convenient and efficient way of researching and utilising cultural heritage. Through digital technology, people can access, process and utilise cultural heritage information more conveniently so as to better protect and pass on cultural heritage. However, digital recording and archiving also face some challenges, such as the updating of technology, data security and privacy protection, and the reliability and authenticity of digital records. Therefore, these factors need to be fully considered when conducting digital recording and archiving, and corresponding measures need to be taken to ensure the quality and effectiveness of digital recording and archiving.

4.2.Three-Dimensional Scanning and Modelling Technology

3D scanning and modelling technology plays a crucial role in the protection of light industrial cultural heritage. With its advantages of high efficiency and high precision, this technology provides a powerful means for the digital archiving of heritage. Using advanced 3D scanning instruments, the external dimensions and surface details of the heritage can be quickly obtained to generate high-precision point cloud data. Subsequently, these data are processed by professional modelling software, which can construct an accurate 3D digital model. In the specific operation process, technicians need to adopt different scanning strategies for the heritage of different materials and structures. For example, for metal or ceramic heritage, scanning parameters suitable for hard materials should be selected; while for fabric or wood products, scanning equipment needs to be adjusted to adapt to their soft or rough characteristics. In addition, complex geometries or fine decorative patterns impose higher technical requirements, which require continuous optimisation and innovation in the scanning and modelling process. Current research at the forefront of theory suggests that 3D scanning and modelling not only replicate the form of a heritage object, but more importantly capture its historical information and cultural connotations. This kind of deep information recording has an irreplaceable value for academic research and educational dissemination of heritage. However, this technology still faces some challenges, such as how to deal with the storage and management of huge data and how to ensure the long-term usability of the digital model, all of which require us to further explore solutions. It is worth mentioning that 3D modelling technology also offers the possibility of virtual restoration of heritage. In the case that some heritage is damaged due to old age, digital technology can achieve the simulation reconstruction of its original appearance, which is of great significance to the educational display of heritage and the

dissemination of history and culture.

4.3. Virtual Reality and Augmented Reality Applications

The application of virtual reality (VR) and augmented reality (AR) technologies plays an increasingly important role in the digital protection and development of light industrial cultural heritage. These technologies enable users to experience heritage in a new, intuitive way, as if they were there to understand and feel the charm of history and culture. With VR technology, it is possible to build an all-encompassing 3D simulation environment that allows the user to roam freely in the virtual world and gain a deeper understanding of the historical and cultural context of the heritage. For example, by wearing a VR helmet, users can "travel" to different historical periods and observe the state of light industrial cultural heritage sites in different eras, as well as the process of change in craft production. This immersive experience is extremely effective in raising public awareness and participation in history and culture. Meanwhile, the application of AR technology lies in the superimposition of digital information into the real-world view, providing users with an enhanced sensory perception. For example, through smartphones or AR glasses, tourists can see additional layers of digital information, such as textual descriptions, historical images or animated presentations, while viewing the physical heritage, resulting in a richer interpretation and interactive experience. However, there are challenges in applying these cutting-edge technologies. Firstly, there is the issue of the popularity and cost of hardware devices, which may limit the wide application of these technologies. Secondly, the creation and maintenance of content requires interdisciplinary expertise, which not only requires a high level of technical competence on the part of technicians, but also an in-depth understanding of cultural heritage. Despite these challenges, VR and AR technologies show great potential in the preservation and development of light industrial cultural heritage. They not only provide new ways to display and educate about heritage, but also open up new horizons for creative product development and marketing of heritage. With the continuous advancement of technology and the gradual reduction of costs, it is expected that these technologies will play an even more crucial role in the digitisation of light industrial cultural heritage.

4.4. Digital Storage and Management

Digital storage and management play a central role in the preservation of light industrial cultural heritage. Effective digital storage not only provides the possibility of long-term preservation of heritage, but also

facilitates information retrieval, analysis and sharing. Currently, with the development of cloud computing and big data technologies, digital storage capacity has been significantly improved, and these technologies provide powerful computing power and flexible storage solutions for processing and analysing huge amounts of heritage data. In order to achieve efficient data management, it is crucial to establish a standardised metadata framework. Through a unified classification and indexing system, data consistency and interoperability can be ensured. In addition, adopting a suitable data backup and recovery strategy is key to ensuring data security. In this regard, distributed storage and blockchain technologies show potential applications, which enhance data tamper resistance and persistence through encryption and decentralisation. Meanwhile, advances in artificial intelligence technology are bringing new ideas to data management. Machine learning algorithms can automatically identify and classify multimedia content such as images and videos, which greatly improves the efficiency of data processing. On the other hand, the application of the semantic web and Linked Data makes it possible to link and integrate cross-domain data, providing new ways to deeply mine and understand the knowledge system behind cultural heritage (Figure 1).

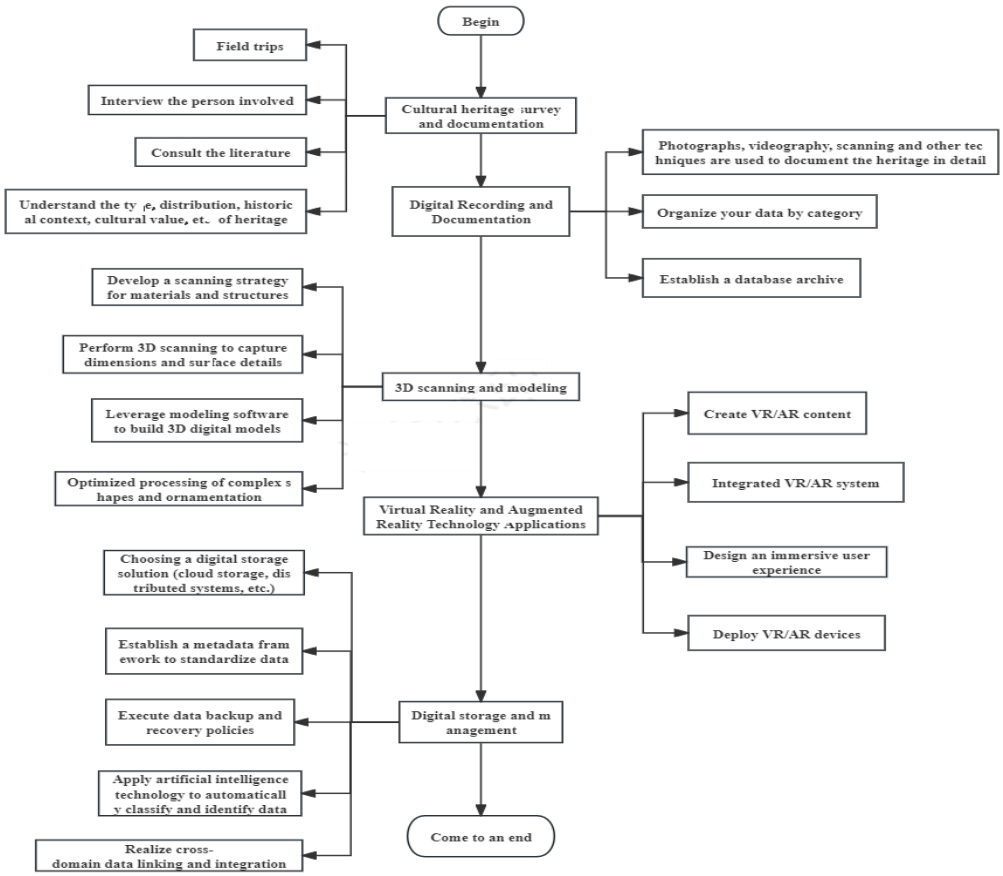

Figure 1: The overall protection method of digital protection of the cultural heritage of light industry

5. OVERALL DIGITAL DEVELOPMENT STRATEGY FOR LIGHT INDUSTRY CULTURAL HERITAGE

5.1. Digital Display and Education

Digital display and education are one of the important strategies for the protection and development of light industrial cultural heritage. Through digital technology, light industrial cultural heritage can be displayed to the public in a new form to enhance the public's knowledge and understanding of the cultural heritage, and at the same time, the public's awareness of and participation in the protection of the cultural heritage can also be improved through education. Firstly, light industrial cultural heritage can be displayed through digitalisation. This can be achieved through the establishment of digital museums, virtual exhibitions, digital cultural experience centres and so on. Through these digital display methods, the light industrial cultural heritage can be presented to the public in a new form, enhancing the public's cultural experience and cultural awareness. Secondly, education of cultural heritage through digitalisation. This can be achieved through the development of digital educational resources, online courses, mobile apps and so on. Through these digital education methods, the knowledge and value of cultural heritage can be conveyed to the public, and the public's cultural literacy and conservation awareness can be enhanced. Again, interaction and participation in cultural heritage can be promoted through digitalisation. This can be achieved through social media, online forums, virtual reality experiences, and so on. Through these digital interactive methods, public engagement and interaction with cultural heritage can be enhanced, and public awareness of conservation and participation can be increased. The advantage of digital display and education is that it can provide a more vivid, interactive and convenient way of display and education. Through digital technology, the knowledge and value of cultural heritage can be transmitted to a wider public, and the public's cultural cognition and protection awareness can be improved.

5.2. Creative Industry and Cultural Product Development

The digital development of light industrial cultural heritage is especially important in the field of creative industry and cultural products. As a medium, digital technology not only gives new life to traditional heritage, but also provides unlimited possibilities for cultural product innovation. Accompanied by the continuous progress of technology, creative industries are no longer limited to the physical form of products, but extended to the virtual space and service experience. For example, through augmented reality (AR) technology, consumers can virtually immerse themselves in

their own living environments and experience the process of traditional craftsmanship, an interactive experience that makes cultural heritage more vivid and intuitive. In addition, in order to transform cultural heritage into economic value, designers and artisans can work together to create cultural products that are both historically significant and aesthetically pleasing to the modern world by integrating traditional elements into modern designs using technologies such as 3D printing. These products not only satisfy the market's pursuit of personalised and customised needs, but also preserve the core values of cultural heritage. However, attention should also be paid to two core issues in the process of cultural product development: firstly, ensuring that the essence of cultural heritage is not eroded by excessive commercialisation; secondly, weighing the balance between preservation and development so as to avoid the loss of uniqueness of cultural heritage in the process of digitisation.

5.3. Online Platform and Marketing

In the development strategy of digitalised light industrial cultural heritage, it is also crucial to make reasonable use of online platforms and marketing tools. This process requires a deep understanding of how to storytell, visualise and ultimately commoditise this heritage to suit the needs and tastes of modern consumers. With the help of diverse online platforms—including social media, e-commerce sites and dedicated cultural heritage showcases—the vastness of light industrial culture can be conveyed to a worldwide audience. These platforms not only provide a broad arena for the promotion of cultural products, but also enhance user engagement and loyalty through interactivity and personalised recommendation systems. On the marketing side, the use of data analytics tools to gain insights into consumer behaviour has become particularly critical. Understanding the characteristics and consumption habits of the target market can help develop more accurate marketing strategies. For example, by analysing user interaction data on social media platforms, it is possible to identify potential customer groups and target relevant cultural product information. In addition, cross-border co-operation has also become a way of innovative marketing. Co-operating with brands or artists from different fields to develop co-branded products or organise special exhibitions can not only enhance the visibility of light industrial cultural heritage, but also attract more attention and interest.

5.4. Community Participation and Benefit Sharing Mechanism

In the digital preservation and development strategy of light industrial cultural heritage, community participation and benefit-sharing mechanism

are important parts of ensuring the successful implementation of the project. This section will focus on how to build a system that promotes active community participation and achieves a balanced distribution of benefits. The key to community participation is to make local residents and culture bearers the beneficiaries of conservation and development projects. Through education and training, their understanding and ability to apply digital technology can be enhanced so that they can participate in the process of heritage storytelling and the creation of cultural products. For example, workshops and courses can be organised to teach local artisans how to use digital tools to innovate their skills or how to sell their products online. It is also crucial to establish an equitable benefit-sharing mechanism. This requires adequate communication and consultation between the project developers, local government, culture bearers and community members to ensure that all stakeholders receive a fair return from the project. For example, a transparent revenue-sharing policy can be formulated to ensure that community members are able to earn a stable income from the sale of cultural products and tourism activities. Further, the use of digital platforms to increase community participation and influence is also an effective means. Through social media and online forums, community members can be directly involved in the dissemination of heritage stories and the planning of cultural activities, thereby increasing their sense of participation and belonging. In addition, a socialised support network can be formed through crowdfunding and other means to involve the wider public in light industrial cultural heritage conservation and development projects (Figure 2).

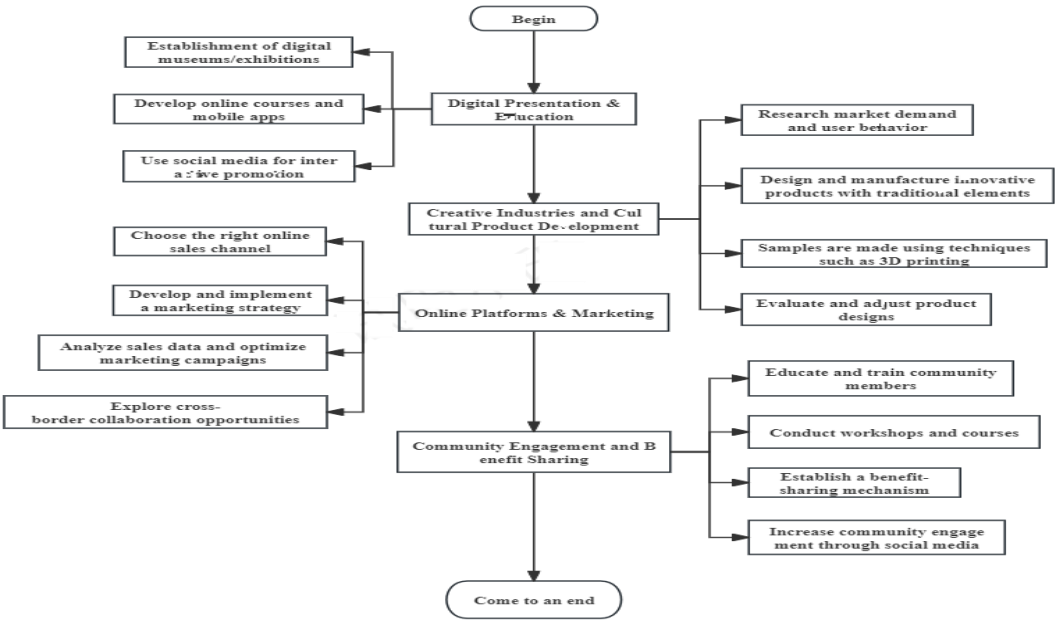

Figure 2: The overall development strategy of the digitization of light industry cultural heritage

6. CONCLUSIONS AND RECOMMENDATIONS

The core of this paper is to explore the conservation and development strategies of light industrial cultural heritage in the digital era, aiming to provide theoretical support and practical guidelines for the sustainable development of this field. Through the comprehensive use of digital recording and archiving, 3D scanning and modelling techniques, as well as virtual reality and augmented reality, this paper proposes an innovative approach to the overall conservation of light industrial cultural heritage. This approach not only effectively preserves heritage information, but also enables the sustainable use of resources through digital storage and management. In terms of development strategies, the study emphasises the importance of digital display and education, promotes the in-depth integration of creative industries and cultural products, and advocates the establishment of online platforms and marketing mechanisms to broaden the social impact and economic potential of light industrial cultural heritage. In addition, community participation and benefit-sharing mechanisms are seen as key factors in stimulating local vitality and promoting cultural heritage. Although this paper has achieved certain results, we also recognise that with the advancement of science and technology and social changes, there are still many unknowns in the field of light industrial cultural heritage preservation and development. For example, how to balance the relationship between high-tech applications and traditional skills, how to ensure data security and cultural authenticity in the process of digitisation, and how to maintain cultural diversity and uniqueness in the context of globalisation all require further in-depth research. The digital preservation and development of light industrial cultural heritage is a multidimensional, interdisciplinary and complex subject, which requires us to explore and innovate continuously, with a view to finding the most suitable path for the survival and development of light industrial cultural heritage in the ever-changing environment.

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