PRODUCTION OF DIGITAL CONTENT (3D ASSET) SOURCE RESOURCES FOR CULTURAL HERITAGE

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ABSTRACT:

In Korea, several 3D digital documentation projects have been carried out to preserve cultural heritage, but limitations in high-capacity/high-quality data have hindered their use in virtual restoration. To address this, organizations have produced low-capacity, high-quality 3D assets since 2020, but disseminating 3D assets with metadata containing cultural heritage information is important to reduce errors in historical research during virtual restoration. To overcome this problem, the Cultural Heritage Administration of Korea initiated the 'Cultural Heritage Digital Content (3D Asset) Source Resource Production' project in 2022. The project aims to convey and share the value of cultural heritage through 3D assets, which are complex due to the artistic values of units that must be contextually connected. Spatial and asset characteristics were classified into six categories of cultural heritage 3D assets, with the goal of turning tangible and intangible cultural heritage into 3D assets for comprehensive utilization. The cultural heritage digital source resources are a valuable resource for the creative industry.

1. INTRODUCTION

1.1 General Instructions

In Korea, several projects have been carried out to create digital archives of cultural heritage using 3D scans. However, the 3D data generated from these projects had high capacity and low quality, making them unsuitable for content projects such as virtual restoration. To address this issue, content distribution organizations began producing and disseminating high-quality, low-capacity 3D assets since 2020, but this approach had limitations for disseminating cultural heritage 3D assets. In order to reduce errors during virtual restoration and historical research, it is important to share metadata containing cultural heritage information along with cultural heritage 3D assets.

To tackle this challenge, the Cultural Heritage Administration of Korea launched the 'Cultural Heritage Digital Content (3D Asset) Source Resource Production' project in 2022, which is set to run for 5 years. The main objective of this project is to convey and share the value of cultural heritage through cultural heritage 3D assets. Cultural heritage 3D assets have complexity due to the artistic values of their units, and it is necessary to contextually connect the entire cultural heritage with its value elements. Unlike typical 3D assets, cultural heritage 3D assets have context, as their cultural values are expressed through temporal and spatial context. For movable cultural assets, the value of cultural heritage can be conveyed by implementing assets based on an understanding of the site context.

The project aims to transform tangible and intangible cultural heritage, such as records, people, landscapes, stories, and digital resources, into 3D assets that can be disseminated and utilized, enabling comprehensive utilization of the linkage base in individual utilization policies. The utilization of cultural heritage digital source resources as a resource for the creative industry is also crucial. The goal is to reproduce the digital cultural heritage utilization project from simple data and information to knowledge information, utilizing the meaning and value of cultural heritage, and offering creative interpretations of the intrinsic values and functions contained in cultural heritage.

1.2 Distribution of 3D Data for Cultural Heritage

The distribution of 3D data for cultural heritage in Korea is primarily provided for free through public institution websites under the Ministry of Culture, Sports, and Tourism and the Ministry of Science and ICT. The objective is to increase public accessibility to 3D data for cultural heritage and provide processed data to meet diverse demands for its utilization.

1.2.1 National Cultural Heritage Portal : The National Cultural Heritage Portal (heritage.go.kr) provides 3D data of cultural heritage as a means of dissemination for assets provided by the Cultural Heritage Administration. The Cultural Heritage Administration collects cultural heritage data produced by its affiliated organizations and local governments to build a database and is expanding the opening of the built data. The provided 3D data is classified into printing, modeling, scanning, and scan images. It is possible to search by topic or cultural property such as "World Heritage of Korea" and "Cultural Properties in Textbooks." A preview service is also available.

1.2.2 National Museum of Korea : The National Museum of Korea provides a search function for its collection's 3D data on its website (museum.go.kr). Only search and data download functions are available, and there are no additional features.

1.2.3 3D Imagination Portal : The 3D Imagination Portal (3dbank.or.kr) is a comprehensive 3D printing information portal site operated by the Korea Institute of Information and Communications Promotion. Its purpose is to share 3D printing policy, industry, technology trends, and education-related information, and to support the creation of a 3D printing ecosystem.

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1.2.4 Culture Public Data Plaza : The Culture Public Data Plaza allows for the integrated use of public data by linking cultural information held by other agencies. Therefore, it provides not only 3D data related to cultural heritage but also various 3D data related to various cultural industries. However, it does not classify them by topic or field and provides them integrally. In addition, it mainly provides heritage data related to North Korea's heritage and modern heritage, which sets it apart from other platforms.

1.2.5 Culture Portal : The Korea Cultural Information Service provides and distributes 3D cultural heritage data through the Culture Portal (culture.go.kr) and the Culture Public Data Plaza (culture.go.kr/data/), which were built to integrate and manage cultural information held by the Ministry of Culture, Sports and Tourism's affiliated public organizations based on metadata. The Culture Portal provides cultural life-related information and publicly available data produced in the cultural industry. In the field of cultural heritage, a traditional pattern database has been built and shared, and data focused on 3D modeling of traditional patterns is provided. It is divided into seven topics by cultural industry fields such as fashion, daily necessities, interior, tourism, stationery, kitchen, and education, providing models mainly for 3D printing, which can be used as various cultural industry materials. In addition, simple metadata for the target and recommended utilization methods are also provided.

Currently, cultural heritage data provided includes Ply data for original recording and Stl data for utilization. Ply data often has higher quality than Stl data. However, for data of the same quality, Ply is lower in capacity than Stl depending on the properties of the file extension. Additionally, 3D cultural heritage data provided by the National Cultural Heritage Portal often does not include both printing data and modeling data, and various types of data for use in games and other applications need to be provided.

2. RESEARCH METHODOLOGY

The research methodology for creating source materials for cultural heritage digital content (3D assets) aims to provide a comprehensive understanding of cultural assets from diverse perspectives over a 5-year period. The roadmap is composed of a set of interconnected processes, including library construction, 3D asset production, guidelines, and 3D asset distribution, which are integrated over the course of the program's annual progression.
The four components are not executed in isolation, but are complemented as they advance each year, resulting in the development of distribution plans for 3D assets for cultural heritage that consider user needs.

3. LIBRARY CONSTRUCTION

3.1 Concept of Cultural Heritage 3D Asset

The main objective is to communicate and disseminate the value of cultural heritage through 3D assets. Cultural heritage 3D assets are different from typical single 3D assets because cultural heritage itself is a complex composite of artistic values that are accumulated in units, and designated components and contexts with assigned values based on an understanding of cultural heritage are implemented as both unit and overall assets. Additionally, unlike typical single 3D assets, cultural heritage 3D assets have contextual meaning. The cultural value of cultural heritage is manifested through the temporal and spatial context between cultural heritages, and especially in the case of immovable cultural properties, the value of cultural heritage can be conveyed by implementing assets based on an understanding of the location context where the heritage is situated.

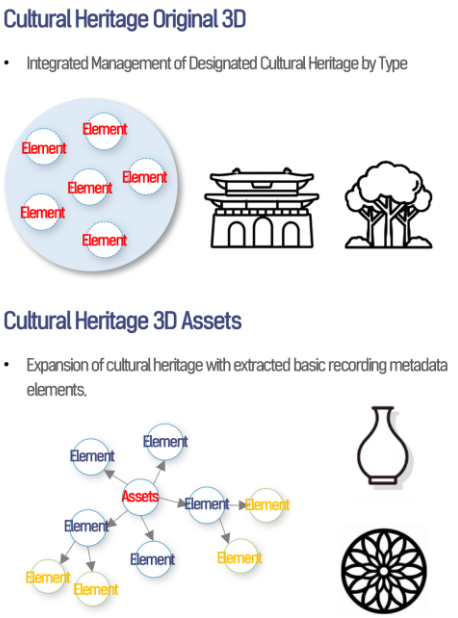

Figure 1. Cultural Heritage Assets

3.2 Analysis of project

Existing cultural heritage 3D database construction projects have followed a data construction approach prioritizing the restoration of original shapes. This method involves acquiring shape information of existing cultural heritage and has the characteristic of high precision/large-scale data. However, this high-volume data needs to be reprocessed into data suitable for content use through high-quality/low-volume data optimization operations to be utilized as assets. Furthermore, the existing data construction has limitations in constructing data for individual elements of the composite cultural heritage, as it is designed for integrated management of cultural heritage by designated categories.

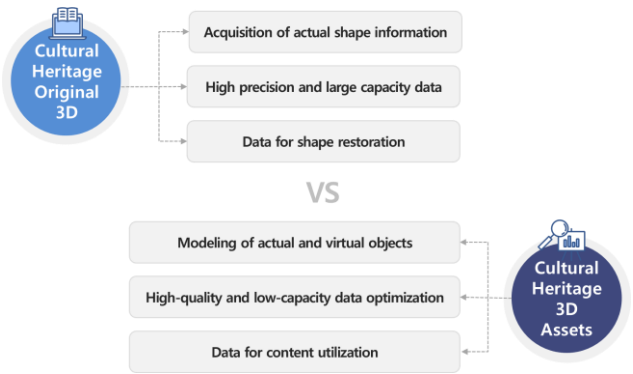

Figure 2. Difference between Cultural Heritage Documentation and Assets

3.3 Asset series composition:

In the process of selecting artifacts to obtain 3D data, it is necessary to consider their usability and authenticity. Therefore, a plan is established to group representative artifacts and related ones into a series, which can be immediately utilized upon acquisition.

The types of cultural heritage 3D assets are classified into two categories based on their spatial characteristics and details of real estate. The spatial types of cultural heritage 3D assets are classified into six categories: royal heritage, urban heritage, education and culture, religion and faith, modern industry, and natural environment.

Royal heritage includes palaces such as Changdeokgung, ritual spaces such as Jongmyo, and royal tombs such as Joseon Royal Tombs. Urban heritage includes political and military sites such as Suwon Hwaseong Fortress, and residential areas such as Nagaebupseong Fortress. Education and culture can be divided into Confucian schools and village schools, and religion and faith can be divided into Buddhism, Catholicism, Protestantism, and folk beliefs.

Modern industry can be divided into business facilities such as the National Assembly Building, commercial facilities such as stores and housing, medical facilities such as hospitals, war facilities such as ammunition depots, and educational facilities such as high schools. Finally, natural environments are classified into scenic spots as natural landscapes and cultural landscapes, and geological monuments as earth science and biological monuments.

Figure 3. Spatial types of cultural heritage 3D assets

3D assets were classified according to their characteristics, with subcategories including architectural structures, building components extracted from architectural structures, paintings, sculptures, crafts, relics, science and technology, and natural environments. In order to create 3D data that fully captures the historical and academic value of the subject artifact, it is necessary to consider the unique features of the artifact and acquire assets accordingly.

3.4 Asset Element Extraction

For complex cultural heritage such as buildings, a modularization example is proposed. In particular, architectural elements and other elements are classified, allowing for modularization to encompass grand decorations, brackets, and walls. In order to efficiently and effectively construct 3D assets, it is necessary to define specific components of cultural heritage. For similar types of cultural heritage, similar components can be selected, and the components are selected to represent the historical and academic value of the cultural heritage.

architectural elements	● Floor and Platform: Kan, Agungi, Budumak, Guldduk Umulmaru, Jangmaru, Daecheong, etc. ● Pedestal: Kidan, Wolde, Gwitulseok, Didimdol, Stairs, etc. ● Foundation Stone: Column Foundation Stone, High Ridge Stone, etc. ● Column: Pyeongju, Goju, Uju, Hwalju, Sachunju, Simju, Nusangju, Nuhaju, Dongbari, etc. ● Trim and Molding: Inbang, Jusun, Byukseon, Munsun, Byukche, etc. ● Window and Door: Meoreum, Changho, Salchang, Panmun, etc. ● Ornament: Judu, Soro, Cheomcha, Salmi, Ikgong, Haenggong, Guipo, Anchogong, etc. ● Furniture: Daedeulbo, Jungbo, Jongbo, Tudbo, Chungryang, Umirang, Changbang, Pyeongbang, Dori, Jangyeo, Hwaban, Daegong, etc. ● Ceiling: Yeondeng Ceiling, Umul Ceiling, ... ● Roof: Cheoma, Chunyeo, Sallae, Seoggarae, Giwa, etc.
other elements	● Railing: Stair railing, balcony railing, stone railing, etc. ● Ornamental Decoration: Fan-shaped ornaments, landscapes, lions, dragons, etc. ● Dancheong: Geometric dancheong, line dancheong, arabesque dancheong, etc. ● Wall: Flower wall, stone wall, etc. ● Fortress: Watchtower, castle gate, floodgate, etc. ● Stonework: Stone pagoda, stone lantern, archway, stairs, etc. ● Bridge: stepping stone bridge, plank bridge, etc. ● Tomb: Grave marker, spirit tablet, stone statue, tomb, etc.

Table 1. Proposed Components of 3D Assets for Built Heritage

4. 3D ASSET CREATION

4.1 Definition of 3D Asset Creation Types

4.1.1 Original-based 3D Assets : The creation of high-precision and high-capacity 3D assets for the restoration of cultural heritage is limited in terms of its applicability as content. However, such data can be reprocessed to create Original-based 3D assets of cultural heritage. Since the data is constructed for the purpose of restoring the original shape, the reliability of the Original model is ensured, and expandable concept 3D assets of cultural heritage can be created. Expandable concept 3D assets refer to cultural heritage 3D assets with meta-information included, created by composing assets for each element extracted from a single cultural heritage asset.

Figure 4. Expansive concept of cultural heritage assets.

4.1.2 Authenticity-based 3D assets : As the historical background becomes more specific, 3D assets, a constituent element of cultural heritage content, must comply with historical facts. The importance of authenticity has been emphasized, and even with the same object, 3D assets can be interpreted differently depending on the perspective. Therefore, when creating 3D assets through computer graphics (CG), they must be produced through authenticity verification for dissemination.

4.1.3 Motion-based 3D assets : The recording of intangible cultural heritage performances has been difficult, but with the advancement of technology, it has become possible to record the transmission of intangible cultural heritage through motion capture technology. Motion-based 3D assets for recording intangible cultural heritage performances should be produced and disseminated as content by combining motion capture technology with authenticity-based 3D assets.

4.2 3D Asset Production

The usability of device-generated Original recording data will be reviewed, and then a series construction for 3D asset composition will be conducted. The creation of data consists of building the original model and constructing a CG model based on authentication. The goal is to provide a model that can be utilized in conjunction with records for intangible cultural assets after recording them using motion capture technology in the future.

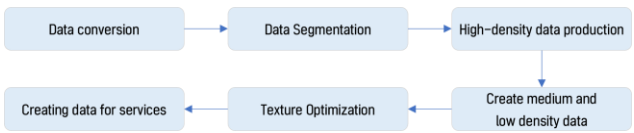

Figure 5. 3D Asset Production.

4.3 3D Asset Production Quality and Delivery Composition

A standardized procedure will be defined from planning to the production process and the resulting product for the creation of 3D assets utilizing cultural heritage models. The resulting product will be systematically managed and utilized. The objective is to establish an LOD standard with consideration for usability and distribute it considering the provided platform. The goal is to create 3D asset data for each LOD and produce it to support performance adjustment according to camera distance.

Figure 6. Criteria of LOD

5. THE GUIDELINES FOR CREATING 3D ASSETS FOR CULTURAL HERITAGE

When creating 3D assets for cultural heritage, clearly define the scope and target of the project and follow the recommended guidelines. However, if there are special regulations in other laws, follow them accordingly. When applying the guidelines to the project, pay attention to standardizing the production of cultural heritage 3D assets, quality inspections, and delivery regulations. The goal is to distribute content that minimizes damage to cultural heritage and considers utilization when creating 3D assets.

5.1 Methodology for Creating Original-Based 3D Assets

Original-based modeling production can be divided into two methods: using photographs and using photographs and 3D scans together. In principle, the modeling is created by shooting so that more than 70% of the target object overlaps using photogrammetry techniques based on photos. At this time, the photos are corrected to obtain uniform color values, and based on the corrected photos, data arrangement, triangle mesh generation, and texture generation are performed.

If the color of the completed model with generated texture is different from the actual target object, rework is carried out starting from the color correction stage. Depending on the type of cultural heritage 3D asset, the elements of the asset are subdivided for buildings.

At this time, based on the classification of asset types considering the value factors of cultural heritage, the asset production is carried out using the "component production method," and each asset is distributed by improving the quality individually.

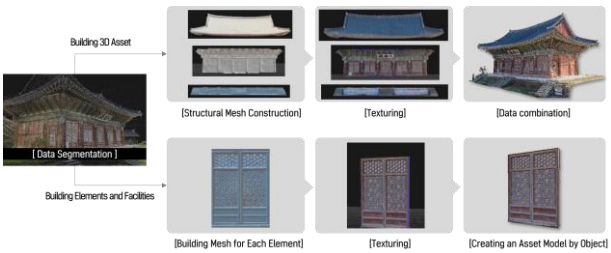

Figure 7. Construction of High-Density Data Asset

5.2 Methodology for Creating Ground-Truth-Based 3D Assets

Since the reliability of cultural heritage 3D assets is a priority, in the case of cultural heritage where the actual shape is not preserved or it is difficult to create original-based 3D assets through 3D original records, ground-truth-based 3D assets are created. Continuous validation procedures should be carried out throughout the entire 3D asset production process, and this guideline can be supplemented through the ground-truth-based model production project in the future. The steps listed below are the minimum information related to ground-truth-based modeling.

5.3 Methodology for Building Motion-Based 3D Assets

This technology involves attaching sensors to objects such as humans, animals, or machines to capture their motion information and reproduce it in visual media such as animation,

movies, and games. It can also be used to record intangible cultural heritage for archival purposes.

There are four main types of motion capture. The first is an acoustic method that uses ultrasonic waves to track positions based on the principles of triangulation. It has the advantage of real-time processing and low cost, but it is difficult to record precise movements. The second is a mechanical system that attaches devices to joints to record movements, allowing for recording over long distances without spatial constraints, but there are limitations to producing natural movements, and there is a disadvantage that movement values vary at each position. The third is a magnetic system that attaches sensors to the joints of the subject and precisely measures their position and angle using a magnetic field. It has the advantage of easy operation and no need for facility investment, but it cannot capture large movements or actions. Finally, there is an optical system that involves attaching reflective markers to the body and capturing them using an infrared camera that provides 2D positions, which are then calculated into 3D data by motion capture software. It has the advantage of allowing actors to move freely, capturing fast combat movements between two or more people, and most physically expressible movements, but it is expensive.

6. 3D ASSET POPULARIZATION

6.1 Utilization of Asset Models

According to the website providing cultural heritage 3D assets, the usage of the assets can be broadly categorized into educational materials, tourism products, household items, interior design, accessories, and content creation.

By providing images and websites of excellent examples that have utilized cultural heritage assets, specific ways of utilizing the assets can be conveyed. Additionally, by explaining the process of printing 3D assets in a specific flow, the public can be encouraged to utilize the assets.

6.1.1 Textbook: Textbooks are used as tools for class instruction and education, and play a role in arousing students' interest and leading them to be interested in history. In addition, 3D assets created for fossils and natural materials that are difficult to confirm or observe in reality are used as effective tools for delivering related content. The 2022 Social Economy Innovation Growth Project, "Experience Education of Cultural Heritage by Touch," used 3D printing models to improve the accessibility of cultural heritage for visually impaired individuals, helping them to directly touch and appreciate the form and texture of cultural heritage.

6.1.2 Exhibition goods: In cases where it is difficult to exhibit actual cultural heritage artifacts due to preservation issues or other reasons, 3D assets are used to create reproductions that can be exhibited. Additionally, 3D cultural heritage artifacts that users can touch and appreciate are created for use as tourism and exhibition products. The Ulsan Amgak Hwa Museum utilized 3D modeling and printing technology to create a half-circle Amgak Hwa rock model measuring 8m wide and 4m tall, which accurately depicts the detailed shape of the Amgak Hwa rock and restored the damaged patterns. The model was used as an exhibition product to provide an opportunity for people to view cultural heritage without having to physically visit the location.

6.1.3 Cultural Products: 3D printing technology is used to develop cultural products for the purpose of improving accessibility and promoting cultural heritage that may be difficult to appreciate without visiting the actual sites. These products can take the form of props or accessories that can be used in daily life.

6.1.4 Content utilization: Cultural heritage data that can be applied to game engines and modeling tools are provided as optimized assets that can be used on various platforms. They are used as sources for creating VR/AR content and also for video content and CG works. The "Virtual Reality Experience Content of Joseon Royal Tombs" produced by the Cultural Heritage Administration and Dexter Studio provides an opportunity for visitors to view cultural heritage without time and space constraints by implementing virtual environments of the closed Joseon Royal Tombs. The data used in the content is optimized from the reconstructed original data, resulting in high-quality and low-capacity data.

3D data is being utilized in various entertainment industries, including games, webtoons, movies, and dramas.

6.1.5 Webtoons: To improve the quality of webtoons as trends change, the "Data Voucher Support Program" has been implemented, which provides high-spec 3D background data and resources for webtoon artists to create high-quality works in a short period of time.

6.1.6 Dramas: 3D printing technology is often used to create props in dramas. Shin DoriCo 3D Square produced ornamental props for the drama "The King," set in the Empire of Korea, using 3D scanning and reverse engineering processes. When multiple props of the same shape are needed, or when the original object cannot be used, the limitations are resolved by producing models using 3D printing.

6.1.7 Games: The game "Goblin," being developed by Pearl Abyss, incorporates cultural heritage 3D data to provide both domestic and international users with an experience of Korea's palace architecture, royal artifacts, intangible cultural heritage, natural monuments, and marine cultural assets. Game developers aim to create content that combines cultural heritage and games to promote the value of cultural heritage worldwide, using 3D data provided by the Cultural Heritage Administration.

6.2 Analysis of user groups utilizing cultural heritage assets

Based on the use of asset utilization, users can be divided into producers and experts who produce content and various tools using cultural heritage data, and the general public who use the objects produced by experts.

Producers and experts can be divided into educators who conduct cultural heritage-related classes and learning, developers who create webtoons and virtual reality contents, producers who create educational aids, and producers who create cultural and tourism products using cultural heritage.

6.2.1 Educators: Based on 3D data provided by the asset distribution platform, they can create printing models or conduct 3D modeling to teach cultural heritage to students and vulnerable groups. It is possible to conduct effective education and classes without visiting the actual site, and it enables the observation of cultural heritage in a specific space.

6.2.2 Content producers: They can create high-quality virtual and augmented reality contents within a short period of time using the assets. Cultural heritage data that is difficult for producers to acquire can be obtained through the platform, and it is suitable for applying to contents based on cultural heritage.

6.2.3 Cultural product producers: They create various exhibition and cultural products using the provided cultural heritage assets and 3D printing technology. Products made as household and interior items are naturally exposed to people, increasing the popularity of cultural heritage, and the assets provided can be used in various ways.

6.2.4 General public: The data provided by the platform may be difficult for the general public to use, but they can enjoy cultural heritage assets through contents created by producers. The contents distributed by producers provide an opportunity to experience cultural heritage in an interesting way and enable learning about cultural heritage.

The cultural heritage assets provided through the platform are disseminated as secondary creative works by producers and experts, and the general public uses the distributed primary and secondary creative works.

7. ROADMAP DEVELOPMENT

7.1 Pilot construction project for the first year (2022)

The proposed project aims to establish a pilot initiative for the creation of 3D assets based on Original forms, with the goal of defining their scope and constructing a library of such assets during the first year. This pilot will enable the selection of target subjects and the initiation of production activities. The development of these assets will be outlined in a draft guideline, which will be based on data analysis of relevant material and basic data, and the establishment of production standards. The final phase of the project will involve the distribution of these 3D assets to markets such as Sketchfab and the Unreal Marketplace, as well as the design of a preliminary model for integrating these assets into a platform managed by the Cultural Heritage Administration.

7.2 2nd Year Asset Production Project (2023)

In the second year of the project, a series composition for asset creation and a detailed list of asset creation items will be extracted, and a library construction plan according to usage will be prepared. In order to establish new cultural heritage data for asset creation, a task force will be created to coordinate with the holding institution. For 3D asset creation, the draft of the guideline created in the first year will be reviewed and improved. This will help to define the types of asset creation and establish a method for reviewing original 3D asset data. The guideline will be revised based on the review of the asset creation methodology. In addition, two methods for creating original 3D assets using pre-existing data and for creating new original 3D assets will be developed. For asset distribution, the usage of the 3D assets distributed in the content market will be analyzed, and a plan for promoting the assets will be created. Furthermore, newly created 3D assets in the second year will be distributed.

7.3 3rd Year Asset Production Project (2024)

In the third year, asset components with an expanded conceptualization will be extracted, including not only 3D models but also materials, fonts, and other elements. Based on the usage analysis from the second year, a new library construction plan will be created to expand the variety of assets. For asset creation, a demonstration of the verification-based 3D asset creation will be conducted in addition to the previously established methodology. The guideline will be reviewed for original 3D asset creation methodology, and a verification-based 3D asset creation methodology will be established. The usage of the 3D assets distributed and newly created in the third year will also be analyzed, and they will be distributed accordingly. The above mentioned processes will be conducted in a scholarly writing style.

7.4 4th Year Asset Production Project (2025)

In the 4th year, a pilot project for high-authenticity-based and motion-based 3D asset production is conducted to revise the high-authenticity-based 3D asset production methodology and establish a motion-based 3D asset production methodology for the development of guidelines.

7.5 5th Year Asset Production Project (2026)

Finally, in the 5th year, the asset production types are defined and the production of original-based, high-authenticity-based, and motion-based 3D assets is carried out. This leads to the completion of guidelines for the three types of asset production for distribution.

8. CONCLUSIONS

In conclusion, the development of 3D asset production related businesses can have significant effects in various aspects, including economic, social, and cultural ones.

From an economic perspective, creators of cultural content, webtoons, and cultural products can easily access cultural heritage data, allowing for the development of 3D asset-based content and product creation, which can lead to significant savings in production time and costs. This can lead to the implementation and deployment of services related to cultural heritage asset production and utilization, as well as the commercialization of cultural heritage assets. Furthermore, as demand for such assets increases, economic activity is expected to increase, along with employment opportunities.

From a social perspective, the use of cultural heritage assets can have a wide range of benefits. It can provide cultural opportunities to low-income populations, individuals with visual impairments, and others, as well as provide services that enable them to understand and appreciate cultural heritage. Additionally, it can contribute to the development of cultural heritage asset professionals and social enterprises. Through the participation of companies with specialized skills and expertise in cultural heritage production, the development of sustainable job creation in the cultural heritage industry, and the creation of professional cultural heritage programs, social enterprises can pursue their goals. Ultimately, this can lead to the establishment of a self-sustaining cycle of cultural heritage sharing and utilization that contributes to the growth of related businesses.

In terms of education, domestically, cultural heritage values can be shared and taught through increased use of cultural heritage

tools and textbooks in the curriculum. By improving the use and quality of cultural heritage assets, new value can be created, expanding the public's right to enjoy cultural heritage. Through the use of assets in content production, cultural heritage can be brightened, and its popularity can be expanded. The economic value of cultural heritage can be delivered through regional revitalization of cultural heritage areas.

Finally, it is important to activate the cultural heritage industry by transforming traditional values into modern ones. On an international level, it is possible to focus on developing platforms for the utilization of cultural heritage assets, and concentrate on content development that incorporates our cultural heritage. Through the dissemination of outstanding games, webtoons, movies, and more, which are developed using our heritage, we can enhance our cultural competence and spread the value of our cultural heritage to the world, allowing us to share the unique cultural value of our history with people around the world.

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APPENDIX (OPTIONAL)

Construction of 3D Asset Series (2022)

The target artifacts were categorized into six series based on their themes. Moreover, the priority of each series was determined through a value analysis. The criteria for judging the priority included the following: 1) Importance: the number of cultural heritage sites designated as World Heritage, National Treasures, or Treasures within the series (50 points), 2) Ease of acquisition: the number of national institutions managing the series (30 points), and 3) Utilization: the high usability of the contents (20 points). The number of cultural heritage sites designated as World Heritage, National Treasures, or Treasures indicates that there are many highly important cultural heritage sites within the series. If the managing institution is a national agency, it means that the acquisition of 3D assets for the corresponding series is relatively easy.

1. Traditional temples of Korea
2. Time travel through 600 years of Joseon Dynasty at Jongmyo Shrine
3. The essence of Joseon's science and technology
4. The royal tombs of Silla, a thousand-year-old history
5. Memories of ancient temples, stone pagodas
6. Korea's natural heritage, preserving the mystery of nature.

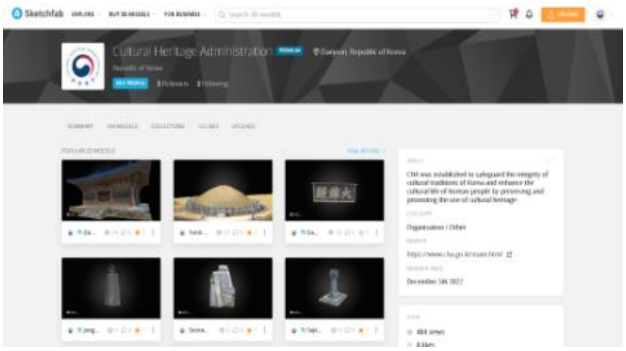

Figure 8. Sketchfab main screen of the Cultural Heritage Administration account

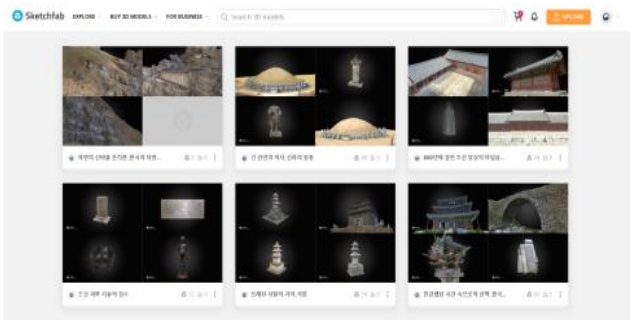

Figure 9. Sketchfab Cultural Heritage Administration Account Series