A Study of Cross-Border BIM + Concept Based on Film and Architecture
Take Film Art Production as an Example

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Abstract. With the rapid development of the country's economy, BIM has gained wide attention and application in the construction industry with its novel and efficient working mode. Traditional films have many problems in the artistic design and execution process. This paper adopts an innovative approach to apply the concept of "BIM" in architecture to film production, solving many problems that cannot be solved by traditional methods. Using the BIM + concept to build a 3D model containing all visual and execution information and exporting the required information directly from the model facilitates the rational allocation of budget, the streamlining of the film production process and the establishment of a collaborative model, thus greatly improving the efficiency of film production.

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Keywords-BIM + · Cross-border · Film Art Production · Application

1 Introduction

The combination of BIM and the development of networking in the construction industry has produced "BIM + ", which has become a new force to promote the development of the construction industry. With the gradual deepening of BIM application, fewer and fewer projects simply apply BIM, and more and more BIM is integrated with other advanced technologies or with application systems in order to play a greater comprehensive value. The coming of "BIM + " era, combined with the Internet, cloud computing, big data, as well as 3D printing, VR/AR technology, etc., makes the BIM technology platform have more room for extension [5] (Fig. 1).

2 The Extension of BIM + in Film Production

BIM is a building information model, which integrates the information of the building and converges all the information of the building from design to completion into the database summary of the model [10]. In recent years, BIM has been gaining popularity in China's construction industry due to its efficient working mode. Applying the concept of "BIM" in the construction field to the film production process has its unique advantages

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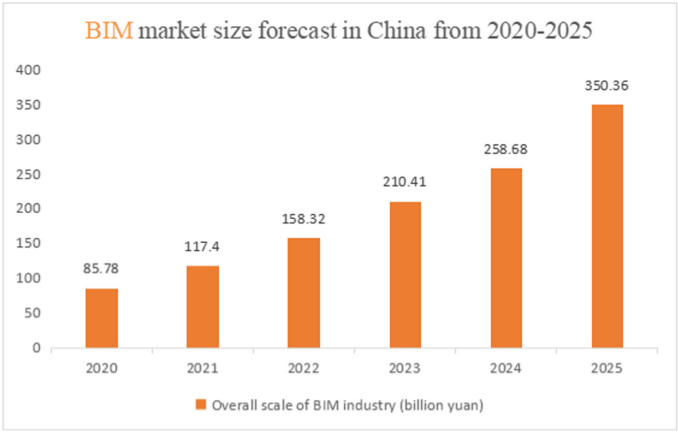

Fig. 1. Overall scale of BIM industry (billion yuan) Image Source: Discovery Data.

and can effectively avoid the problems in the traditional film art design and execution production process.

2.1 Revising the design is costly and laborious. In particular, some changes in the initial design plan often require redrawing drawings and repeated revisions. And if the modification is proposed after the scene is completed or even renovated, the cost and labor consumed will be even higher.

2.2 Information management problems, the same scene design execution generally requires many staff to cooperate to complete, and the design plan often requires repeated revisions and constant communication to avoid information clutter and difficult to manage.

2.3 Cost budget control problems, the traditional art design work budget often requires experience to estimate, and sometimes there are some uncontrollable deviations [3]. Traditional film art production, there are drawbacks in the creation process, the BIM reference to film production, simplify the design process, the main design work focused on the construction of a complete scene model, this model contains the previous visual information, space size, environmental lighting, set materials, furnishing props and other complete information of a scene [12]. In this way, through this model, with the relevant software, a series of drawings can be directly exported, including the visual preview part of the scene; the atmosphere diagram; the production diagram of the docking set part; the stage material of the docking prop procurement; props, lists, budgets, dynamic 3D preview, and even VR interactive preview, etc (Fig. 2).

3 Application of BIM + Concept in Film Art Production

3.1 BIM + 3D Printing

BIM + 3D printing, mainly micro-printing of BIM models using 3D printers at the design stage for scheme presentation, review and conducting simulation analysis; it also provides a more efficient solution for processing and fabrication of complex components.

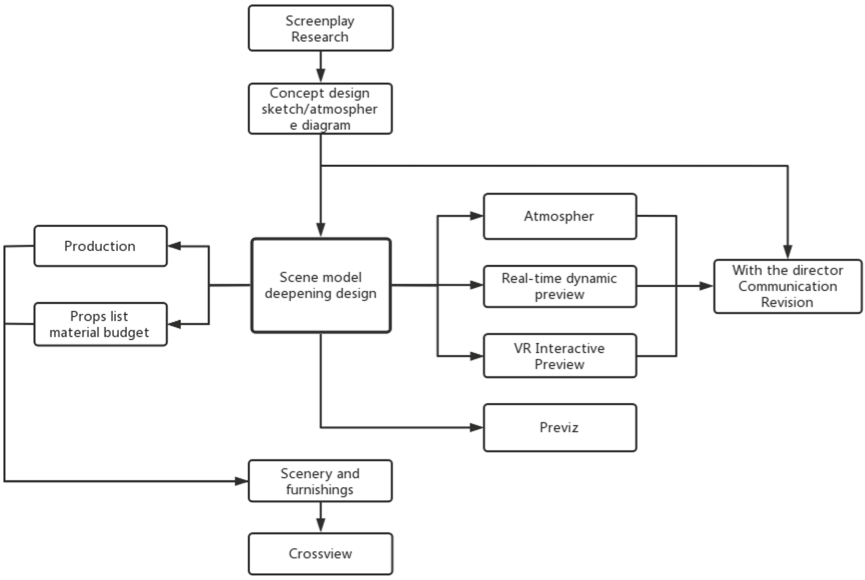

Fig. 2. Improving the creative execution process with BIM concepts.

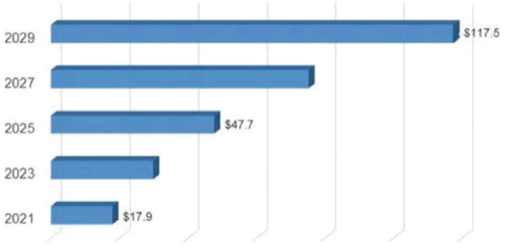

Fig. 3. Future Market Forecast Image Source: Discovery Data.

The three models are BIM-based 3D printing of the building as a whole, BIM- and 3D printing-based fabrication of complex components, and BIM- and 3D printing-based display of physical models of construction schemes [2]. BIM is applied for architectural design, and the design model is delivered to a special 3D printer to print out the overall design model (Fig. 3).

According to the survey, the market for 3D printing products and services continues to grow, and there is a lot of room for future market development. The use of 3D printing technology can effectively reduce labor costs, and the operation process basically does not produce dust and construction waste, which is a green process and has obvious advantages over traditional processes in terms of energy saving and environmental protection [15]. With the rise of the personalized custom building market, 3D printed buildings have a very broad market prospect in this field. The volume of cinematic art is relatively small and the precision is not as high as that required for architecture. Therefore, it will be relatively easy to use BIM on cinematic art. In personalized, small-volume architecture,

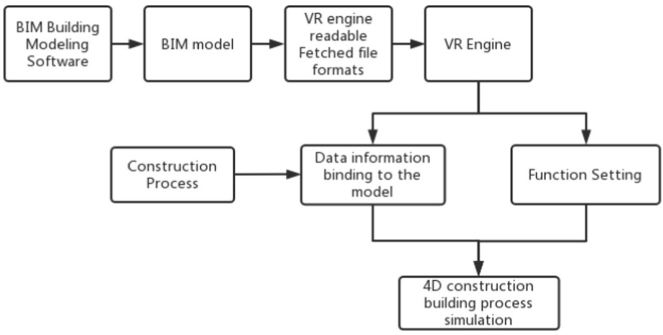

Fig. 4. BIM + VR construction simulation process Image source Discovery Data

especially for some costume films or science fiction films will be very helpful, and can be used to design some special props.The advantages of 3D printing are very obvious, so the use of film and television works is also increasing [7].

3.2 BIM + Virtual Reality

Also known as virtual environment or virtual reality environment, it is a three-dimensional environment technology that integrates advanced computer technology, sensing and measurement technology, simulation technology, microelectronics technology, etc. Through it, a realistic three-dimensional sensory environment can be created with visual, auditory, tactile and force sensing to form a virtual world. BIM + virtual reality can build virtual scenes, simulate construction progress, simulate complex local construction plans, simulate construction costs, simulate multi-dimensional model information jointly and roam interactive scenes, with the aim of applying BIM information base to assist virtual reality technology to show the overall virtual scenes and improve the realism of film and television The purpose is to apply the BIM information base to assist virtual reality technology to show the overall virtual scene, improve the realism of the design simulation, and make people feel immersive [6] (Fig. 4).

For example, walking, flying, jumping, colliding, realizing atmosphere rendering, 3D preview, etc. in the scene, which will be more helpful for more complex movie (e.g. science fiction) scenes. The integrated application of BIM and virtual reality technology can improve the interactivity of simulation work. In the virtual three-dimensional scene, you can switch between different construction solutions in real time, feel the same observation point or the same observation sequence of different construction processes, which helps to compare the advantages and disadvantages of different construction solutions and determine the best solution. At the same time, specific local areas can be modified and analyzed and compared with the pre-modification scheme in real time. In addition, it is also possible to directly observe the 3D virtual environment of the whole construction process to quickly view the unreasonable or wrong points and avoid rework during the construction process [8]. The design preview part, in addition to the atmosphere map and dynamic 3D preview, there are also panoramic previews and VR in a richer form. With VR interactive preview, the director can observe, walk around,

Fig. 5. Visualization scene of model export panorama preview.

and even make changes to the details of the scene in a 1:1 ratio in the virtual scene through VR equipment before the scene is built. Realistic scene perception also allows the director to have a more comprehensive and accurate design of the space reserved for camera positions, actor scheduling, and camera movement trajectory [4]. VR can also help designers communicate design information more completely and reduce shooting problems due to scale perception errors. VR is a great tool for directors, art directors, writers, cinematographers, and other departments to resolve all issues in pre-production communication whenever possible [13] (Fig. 5).

1. VR previews can help directors and others, get a feel for the scale of the scene in advance.
2. The director can walk in the VR scene, fully understand the design before the scene is built, and timely feedback to the art department to feel the scale of the scene in advance.

3.3 BIM + 3D Scanning

3D laser scanning technology, also known as real-world replication technology, uses high-speed laser scanning measurement method, which can quickly obtain 3D coordinate data of the measured object surface in large area and high resolution, and provides a new technical means for quickly establishing 3D image models of objects. It has the advantages of fast measurement speed, high accuracy and ease of use, and its measurement results can be directly interfaced with various software (Dai, 2017). For example, 3D scanning of an interior requires only one turn with the scanner, no modeling is required, and then the model is rested in. The 3D laser scanning technology can effectively and completely record the complex situation of the engineering site, and visually reflect the real construction situation on site by comparing with the design model, which brings great help to the engineering inspection and other work [14]. At the same time, for some ancient buildings, 3D laser scanning technology can quickly and accurately form electronic records to form digital archival information, which is convenient for subsequent repair and renovation work. In addition, for the construction status quo that is difficult to modify on site, 3D laser scanning technology can be used to obtain real information on site and cut the materials such as decorative components. BIM + 3D scanning is to compare, convert and coordinate the BIM model with the corresponding 3D scanning model to achieve the purpose of assisting engineering quality inspection,

rapid modeling and reducing rework, which can solve many problems that cannot be solved by traditional methods [11]. The production drawings can be directly exported from the BIM model, and when the model is modified, the production drawings are also automatically modified, which reduces a lot of repetitive work and errors.

3.4 BIM + Model Library

The budget list refers to the budget of set production and the budget of props, the traditional budget is mostly based on empirical estimation, there is uncertainty in estimating more or less, in the actual implementation needs to be flexible adjustment. The budget in film production is an important part of the introduction of BIM thinking. The BIM model is based on the generation of a relatively accurate budget, in the estimation of volatility, labor costs, loss rate, etc., so as to form a relatively well-founded, more convenient budget for the set materials budget, these construction list plug-in volume is relatively small, can not meet the requirements of the existing materials budget. Many materials budget can not simply according to the volume or area multiplied by the unit price to calculate, different materials will be calculated differently, such as some footings are calculated by length, floor tiles may be calculated by the number of blocks, if the scene is a pure wood structure may be more complex. If the material props of the whole model are categorized and managed according to the scenery props for statistical calculation, we can get a relatively accurate list of quotation. At the same time, we need a database like BIM for architecture, so that we can count the price of common materials in real time without manual estimation. The same goes for the prop budget part, because it is impractical to build prop models one by one, but for many plays, especially those with the same theme, many props are commonly used props. Having a library of digital models for the art of film, each with price budget information and even a prop library or purchase address, would be a huge time saver. Designers could simply select the props they need from the categories in the library and place them in their scenes. If they need to further check the purchase or rental situation, they can check the properties of the prop model, the information contained or the links. As you can see, the BIM model can simplify the work of materials, prop list and cost budget of scene design, which helps to allocate the budget more rationally [9]. Throughout the operation, BIM tends more to the concept of using technology to simplify the workflow.

4 Conclusion

The application of BIM + in film art is a new attempt. There is no BIM software specifically for film, and the application of BIM concept in film production has a lot of room for development in the future, and new research and development should be done specifically for the technology of the film industry. Film itself is an industry that relies heavily on technology development, so it should not reject technology, but should be ahead of the curve and introduce new concepts and technologies. Applying BIM technology to the production of the film industry circumvents some of the drawbacks of traditional film production, and many improvements are needed in the future. The development of digital cinema also brings new opportunities and challenges, which

will certainly promote the innovation and development of film art creation [1]. With the continuous development of BIM and its combination with various industries, the development of BIM application in film production will become more and more extensive in the future.

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