Original Research Article

Cost Control and Optimization Strategy of Film and Television Works Based on Virtual Production Technology

XiaoJian Chen[1,2], Ahmad rashdi bin yan ibrahim[1]

1 City University Malaysia, Kuala Lumpur, 50470, Malaysia

2 Guangzhou huashang college, Guangzhou, Guangdong, 510000, China.

Abstract: With the rapid development of film and television industry, cost control has become a key issue in the production process. As a new production method, virtual film technology has attracted wide attention for its potential in cost control. This paper aims to explore the cost control and optimization strategy of film and television works based on virtual production technology, in order to provide an effective cost management method for film and television industry. In this paper, literature analysis and network data are used to analyze the overview of virtual production technology and the current situation of cost control of film and television works, and a cost control strategy based on virtual production technology is proposed. It is found that virtual production technology can realize effective cost control and optimization in the creative stage, production stage and post-production. Through the application of script rehearsal, scene construction, special effects production, editing and color mixing, virtual production technology has significantly improved production efficiency and reduced costs. Virtual production technology provides a new way and method for the cost control of film and television works, which is helpful to promote the healthy development of film and television industry.

Keywords: **v**irtual film production technology; cost control; film and television works; optimization strategy; post-production.

1. Introduction

Under the background of the rapid development of the film and television industry, the production cost of film and television works continues to rise, which has become a major challenge for producers. With the intensification of market competition, how to effectively control costs and improve production efficiency has become an urgent problem for the film and television industry. Traditional film and television production methods have certain limitations in cost control, which is difficult to meet the needs of the development of the industry. Therefore, exploring new production technology to optimize cost control strategy is of great significance for the healthy development of film and television industry. Virtual production technology, as a new means of film and television production, has been widely concerned at home and abroad in recent years. Relying on computer graphics, virtual reality (VR), augmented reality (AR) , game engines and other advanced technologies, it has brought revolutionary changes to film and television production. Virtual production technology has shown great potential in improving production efficiency, reducing cost and expanding creative space, providing new development opportunities for the film and television industry.

2. Overview of Virtual Production Technology

2.1. Definition and Characteristics of Virtual Film Production Technology

Virtual production technology, as a way of film and television production based on computer graphics, virtual reality (VR) and augmented reality (AR), is leading a revolution in the film and television industry[1].

The technology enables an efficient creative process by building a virtual filmmaking environment that allows production teams to visually preview movie scenes, character animations, and special effects. Compared with traditional production methods, virtual production technology has obvious advantages, such as improving production efficiency, reducing labor costs, and providing a broader space for film creation. The core features of virtual film technology include its powerful interactivity and flexibility. It is not only a technological change, but also an innovation in the concept of film production. By combining the digital world with the physical world in real time, the technology blurs the line between pre-production and the final result, allowing directors, cinematographers and producers to see the finished product much earlier in the production process, increasing the flexibility and efficiency of production. In addition, virtual production technology covers a variety of types, such as visualization, performance capture, hybrid virtual production and so on. Among them, visualization technology allows the production team to create a three-dimensional visualization of the entire virtual world in the story through storyboarding, animation, and asset construction, and realize the interaction with the virtual environment or character assets. This technology not only helps in finding investment for the project, but also assists the stunt team in visualizing the stunt.

2.2. Application Fields of Virtual Film Technology

Virtual production technology is widely used in film and television production, including creative rehearsal and technical rehearsal, stunt rehearsal and post-rehearsal, on-site synthesis and virtual scene prospecting, in-camera visual effect, virtual set and real-time rendering, and multi-user workflow[2]. These technologies allow production teams to use virtual and augmented reality to rehearse storylines and visual effects during pre-production, optimize special effects and post-processing, and increase the efficiency and flexibility of live shooting by synthesizing virtual backgrounds and actual shooting content in real time. In addition, in-camera visual effects technology enables real-time rendering of special effects, reducing the cost and time of post-production, while virtual set and real-time rendering technology facilitates scene construction, light adjustment, and camera Angle selection. The support of multi-user workflow further promotes the real-time communication and collaboration between different departments, improves the collaborative efficiency of production as a whole, and reflects the diversity and flexibility of virtual production technology in film and television production.

2.3. The Development Trend of Virtual Production Technology

Virtual production technology, as a technical innovation in the field of film production, its development trend shows that the traditional production process is completely subverted and reshaped. Through the integration of digital technology, this technology permeates all aspects of film production, and promotes the transformation of the film industry from the physical space to the virtual space[3]. The development of virtual film technology is reflected in its wide and deep application. Since the promotion of Avatar in 2010, virtual production has become the production method of many mainstream blockbusters. It is not only used in creative rehearsal, technical rehearsal, but also involves many links such as stunt rehearsal, post-rehearsal, on-site synthesis, virtual scene prospecting, which makes the whole production process more iterative, collaborative and non-linear. The future development trend of virtual film technology is also reflected in its integration of different media forms. With the rise of the concept of metacomes, virtual production technology has been applied in many fields such as film, game, augmented reality (AR) and virtual reality (VR), constantly expanding its possibilities in visual media production, distribution and interaction. The progress of virtual production technology is also reflected in

the innovation of technology itself. For example, the recently announced Unreal Engine 5 and other advanced technologies reveal the new direction of virtual production technology, such as Nanite virtual geometry and Lumen full dynamic global lighting, which will further promote the development of virtual production.

3. Analysis of Current Situation of Cost Control of Film and Television Works

3.1. Cost Composition and Influencing Factors of Film and Television Works

The cost composition and influencing factors of film and television works are the basis of the cost control strategy of film and television industry[4]. The cost of film and television works mainly consists of the following parts:

The cost of human resources is an important part of the cost of film and television works. This includes the salaries of all employees involved in the production, including actors, directors, writers, cinematographers, lighting artists, art directors, prop artists, costume designers, makeup artists and post-production staff. Among them, especially the remuneration of star actors and well-known directors, often occupy the majority of human resource costs, and have a significant impact on the overall cost.

The production cost covers the whole process from preparation to completion of the film and television work. The cost of the script development phase includes the purchase of the rights, the adaptation of the script, and the writing fees. The cost of setting up involves venue rental, set and prop production. Shooting costs include the use of photography equipment, lighting equipment, recording equipment, etc. The post-production cost includes editing, color blending, sound production and special effects production, among which the complexity and precision of special effects production have a particularly significant impact on the post-production cost.

The cost of publicity and distribution is the key to successful listing of film and television works. This includes production fees for trailers and commercials, online and offline marketing campaigns, media promotions, and distribution fees for theaters or online platforms. Effective publicity and distribution strategy can improve the popularity and market acceptance of the work, thus affecting the box office revenue and return on investment.

There are many factors affecting the cost of film and television works, mainly including:

Content quality: High-quality content often requires more sophisticated production and more post-processing, which directly leads to higher costs.

Cast: Although the joining of star actors can enhance the market appeal of the work, it also means higher remuneration costs.

Technical requirements: As the audience's requirements for visual effects continue to increase, the complexity and technical difficulty of special effects will also increase, which will affect the cost.

Market positioning: The target market and audience positioning of film and television works will also affect the production cost, such as films for the international market may require higher production standards.

Therefore, the cost control of film and television works needs to realize effective cost management and control on the premise of ensuring the quality of works and comprehensively considering various factors such as human resources, production, publicity and distribution

3.2. The Main Means and Shortcomings of the Current Cost Control of Film and Television Works

At present, the main means of cost control of film and television works include three stages: pre-control, in-process control and post-control[5]. The prior control mainly involves the control of the profit model of the undertaking, the control of the payment rhythm of the payment model and the overspending management. The

purpose is to plan and limit the cost before the project starts. In-process control focuses on financial management to ensure that the cost of the shooting process is controlled within the predetermined range. Ex post control includes the exercise of audit rights to ensure transparency and compliance in the use of costs. However, these methods have some shortcomings in practice. First of all, the budget planning in the prior control stage often results in a large deviation between the budget and the actual cost due to the insufficient estimation of the market dynamics and project needs. Secondly, although the financial management in the control stage can monitor the cost, it is difficult to completely avoid cost overruns due to the complexity and uncertainty of film and television production. Finally, although the audit in the post-control stage can find problems, it is often wise after the fact, and it is difficult to effectively intervene in the cost overruns that have already occurred. In addition, corruption, waste, dishonesty, dishonesty and other irregularities in the film and television industry also pose serious challenges to cost control. The existence of these problems is not only due to market reasons, but also related to the non-standard operation of production companies in the era of the explosion of film and television industry. Therefore, although major producers have begun to self-correct and promote the healthy development of the industry from their own point of view, the effective management and control of costs is still a long-term and arduous task.

3.3. The Potential Value of Virtual Production Technology in the Cost Control of Film and Television Works

Virtual production technology, as a new method of film and television production, has an increasingly prominent potential value in cost control. First, virtual production technology effectively optimizes the film and television production process by integrating multiple digital technologies such as virtual reality (VR), augmented reality (AR) and game engine technology. This optimization is not only reflected in the improvement of production efficiency, but also in the substantial reduction of costs. For example, during the pandemic, the application of virtual production technology has optimized film production costs by 50-70%. In addition, the core advantage of virtual production technology is that it can realize the digitalization of creative rehearsal, technical rehearsal, stunt rehearsal and other aspects, thus greatly reducing the cost of physical construction and post-production. By blurring the line between pre-production and the final product, this technology allows directors, cinematographers and producers to see the finished product much earlier in the production process, reducing the time and cost of iterations. Another important value of virtual production technology lies in its innovation of the entire film and television production process. It not only changed the traditional way of making films, but also redefined the responsibilities and working boundaries of each line of filmmaking. For example, directors can design low-cost and efficient shots in a virtual environment, and photographers and artists can simultaneously create and adjust scenes and render displays in real time. This kind of iterative parallel production method greatly improves the cooperation of production links and reduces the cost of secondary creation.

4. Cost Control Strategy Based on Virtual Production Technology

4.1. Creative Stage: Use Virtual Production Technology for Script Preview and Optimizatio

In the creative stage of film and television production, the application of virtual production technology is mainly reflected in script preview and optimization. By creating a virtual environment, this technology allows the production team to perform a 3D virtual preview of the script in advance, allowing for a more precise grasp of the story, character dynamics, and scene layout. This approach not only improves creative efficiency, but also

helps to identify and solve potential problems early in the project, thereby reducing the cost and cycle time of post-production. The core of virtual production technology lies in data iteration and real-time preview (Previz). By introducing Gpus and engines into the production process, the creative team can view and adjust the preview effects in real time, making the script writing and revision process more flexible and efficient. This method breaks the boundaries of traditional pre-post production, and advances the deadline of the creation stage to the end of real-time preview, achieving "post-lead". In addition, the predecessor of virtual preview technology is the story board, but with the development of the film industry, the 2D storyboard picture is gradually replaced by 3D animation preview. This virtual preview model not only meets the needs of industrialization, but also helps the production team to predict the technical problems and investment costs that may occur during filming, providing a basis for decision-making..

4.2. Production Stage: Application of Virtual Production Technology in Scene Construction, Special Effects Production, Etc

In the production stage of film and television works, the application of virtual production technology has greatly changed the traditional production process and provided a new cost control strategy. Virtual production technology through the integration of CG (computer generation) and VR (virtual reality) technology, the scene is visualized before shooting, the virtual shooting set is constructed, and real-time special effects and performance capture are realized, as well as virtual post-production and other links. The application of these technologies not only improves the production efficiency, but also significantly reduces the cost. Specifically, the application of virtual production technology in scene construction mainly includes the following aspects:

Visualization of virtual scenes: Before shooting, the production team can use virtual film technology to visualize the scene in 3D, which helps to identify and solve potential problems in advance, thus reducing the cost and cycle of post-production.

The use of LED virtual studio: Compared with the traditional blue and green screen shooting process, the "post-production" process used in virtual production makes the scene requiring special effects completed before shooting. In the actual shooting, the real scene can be quickly rolled out through the LED screen, and the actor can more easily enter the scene. At the same time, through real-time calculation and rendering, the scene on the screen can change in real time with the movement of the camera, and the director can directly see the special effect picture after the fusion of virtual and real from the monitor, so as to quickly optimize the shooting plan.

Application of real-time special effects: virtual production technology makes the realization of special effects no longer limited to post-production, but can see the final special effects in real time on the shooting scene, which greatly improves the shooting efficiency and reduces the cost of post-production.

4.3. Post-Production: Virtual Production Technology in Editing, Color and other Links of Cost Control

In the post-production stage of film and television works, the application of virtual production technology also provides a new strategy for cost control. Virtual filmmaking technology makes post-production more efficient and flexible through real-time rendering and interactivity. For example, in the shooting of the Mandalorian, through an LED screen, the actors were able to see the final image on the set, which not only improved shooting efficiency, but also reduced the amount of work in post-production. The application of virtual film technology in post-production mainly includes the following aspects:

Application of real-time rendering technology: Real-time rendering technology enables post-production personnel to preview and manipulate digital assets in a scene in real time, without waiting for the rendering process to complete. This greatly improves the efficiency of post-production and reduces the time cost.

Use of virtual environments: Virtual production provides a fully controlled digital space in which producers can create and edit realistic environments and objects. The use of this virtual environment reduces the reliance on traditional expensive physical sets and improves production efficiency and flexibility.

Increased interactivity: Virtual production allows multiple team members to work in the same virtual environment at the same time, improving efficiency and communication. This collaborative approach helps producers make adjustments faster, reducing costs.

The application of virtual production technology in post-production has realized effective cost control and production efficiency improvement through real-time rendering, virtual environment and interaction, and provided a solid foundation for the later stage of film and television production..

5. General Junction

As an innovative means of film and television production, virtual production technology has significant potential and advantages in cost control. Through the use of virtual production technology in the creative stage for script rehearsal and optimization, in the production stage for scene construction and special effects production, as well as in the post-production of editing and color adjustment, virtual production technology effectively reduces the production cost of film and television works and improves the production efficiency. The application of virtual production technology is not only limited to the technical level, but also has a profound impact on the entire process and industry chain of film and television production. It changes the traditional production mode, promotes the collaboration between production teams, and provides greater flexibility and freedom for film and television creation. Although virtual production technology shows great potential in cost control, its wide application still faces certain challenges, such as technology maturity, talent training and industry norms. Therefore, in the future, the film and television industry should continue to explore the deep integration of virtual production technology, improve relevant technical standards, and train professional talents to achieve continuous optimization of the cost control of film and television works.

References

[1] Chen Y. Real-time visualization of the whole process: Innovation and breakthrough of digital virtual film production [J]. Film Arts, 2022(3):116-124.

[2] Zhang Rui, Zhang Xiaopei. Technology driven and art Empowered: Artificial Intelligence reshapes the ecological pattern of film and television [J]. Modern Film Technology, 2023(10):27-33.

[3] Li Xiang, Zhao Jianjun, Chen Jun. Research on camera tracking technology in Film Virtualization Production based on LED Background wall [J]. Modern Film Technology, 2022(1):10-19.

[4] Li Jinlin. The current situation and development opportunity of Chinese film virtual production [J]. Film Literature, 2023(5):18-24. (in Chinese)

[5] Zheng Yue Yang. Research on film visual modeling narrative from the perspective of modern “virtual production” technology [J]. Film Literature, 2023(23):124-127.