

Development Trends and Challenges of the Animation Film Industry in the context of Information Technology

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Abstract. With the rapid advancement of information technology in this new era, artificial intelligence has become increasingly prominent. The creative industry, including the animation film sector, heavily relies on this development. In light of the emerging technologies, such as artificial intelligence, what are the current and future trends shaping the business models of the film and television animation industry? This paper examines the use and impact of information technology in the animation film industry, analyzing both the advantages and disadvantages of artificial intelligence in shaping the creative industry and business models, and exploring emerging trends in animation film as a creative medium. After reviewing existing scholarly conclusions and literature, a comprehensive analysis was conducted on the artificial intelligence industry's scope, the correlation between information technology and film and television animation, and the future prospects for the said industry. It can be inferred that the advancement of information technology enhances the efficacy of film and television animation production and project advancement. Through data analysis, comprehension of the audience's preferences and acceptance of animation styles can be gained, which is crucial for subsequent content creation and production. Based on the discovered contents, the animation film industry can achieve sustainable development, create higher quality and more popular projects, and set a positive trend for related industries in the new era.

Keywords: Artificial intelligence, animation film, information technology.

1. Introduction

Information technology development and artificial intelligence will undoubtedly have a significant impact on the future of animation film. From 2013 to 2022, there has been a noticeable uptick in the development of artificial intelligence (AI); however, this trend prompts concerns within society.

What impact will the development of information technology have on the future of the animation film industry? In the last decade, papers regarding artificial intelligence have experienced tremendous growth, with global AI paper publications increasing from 162,444 in 2010 to 334,497 in 2021. While numerous articles examine the relationship between AI and various industries, research on the correlation between the development of the film, television, and animation industry and artificial intelligence is scarce. This lack of knowledge warrants further investigation. The impact of information technology and artificial intelligence on the film and television animation industry encompasses multiple factors. As technology continuously matures, its development trend in this industry remains a crucial element to explore. Furthermore, understanding its role in the business model of film and television animation is of utmost importance. The examination of these aspects elucidates the future relationship between film and television animation and information technology.

2. The Development of Information Technology and AI

According to the "2022 The AI Index Report", published by Stanford University's Artificial Intelligence Research Institute, it is evident (Figure 1) that the demand for AI workforce has significantly grown globally in the past nine years, with AI market revenues exceeding \$200 billion as per the data (Figure 2). As information technology continues to evolve, more industries are being impacted. 3D engines, VR, XR, and other aspects of spatial computing have influenced not only the lifestyles, gaming, film, and television industries, but also social media, 5G, and 6G industries. The

animation film industry shows a need for software technology and information technology support, indicating that artificial intelligence plays a critical role in developing trends for these industries [1]. Since the 21st century, the gradual advancement of information technology has advanced the technology and production level of film and television animation creation. This improvement better meets audience needs and produces more refined project content. As a creative industry, animation film has become pillar industries in many countries. Creative industries and other sectors integrate to form an expanded creative industry, which includes tourism, theme parks, and more. To establish a distinct business model, this study aims to examine the business model of the animation film industry, which is a significant part of the overall business model. Therefore, this study will investigate the animation film industry's business model and its related industries.

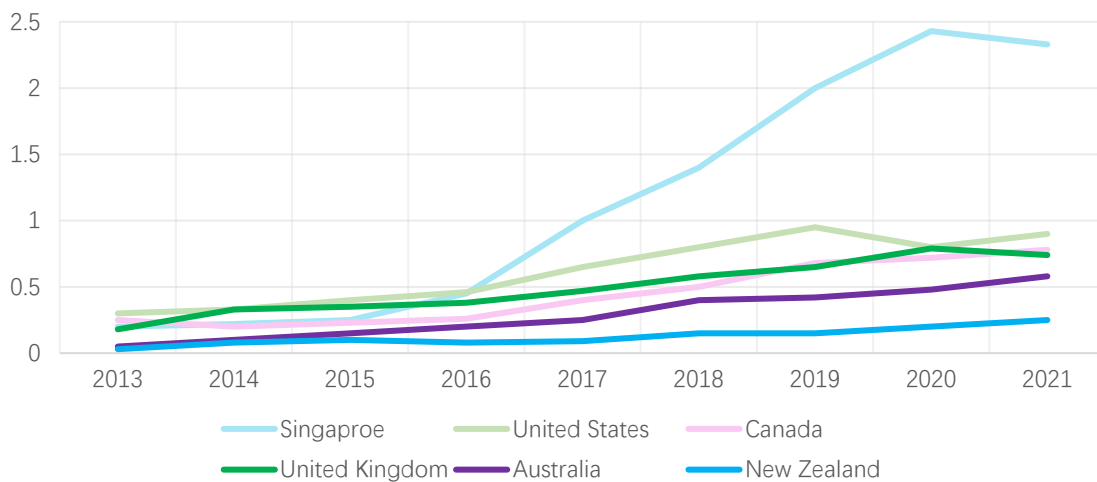


Figure 1. AI job postings (% of all) by geographic area (Photo credit: Original)

Data source: <https://aiindex.stanford.edu/ai-index-report-2022/>

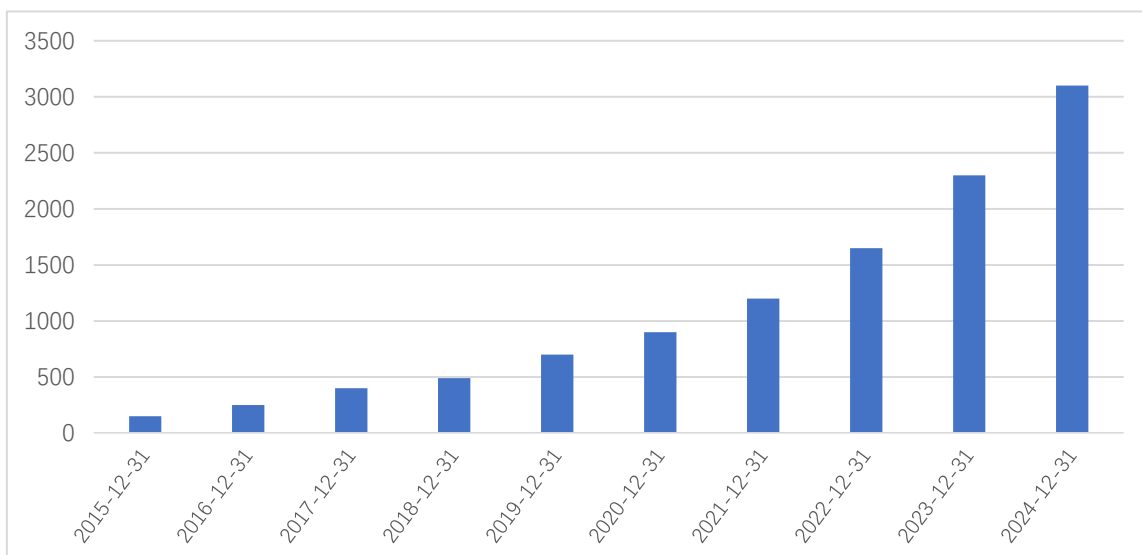


Figure 2. Global AI market revenue and forecast (billion dollars) (Photo credit: Original)

Source: iiMedia Research

3. The Relationship of Information Technology and Animation Film Industry

3.1. Development Trend of Animation Film Industry

animation film, as components of the creative industry, have experienced a distinct increase in the utilization of tools such as information technology in projects over recent years [2]. These tools are typically employed to facilitate collaboration and project completion, enhance the quality of creative work through statistical analysis, and optimize post-production workflows. So the growth in productivity within the animation film industry coincides with the advancements in information technology. Mostly embodied in CGI technology, computer-generated images (CGI) is a computer graphics technique extensively used in the film and television sector. As an illustration, CGI played a crucial role in the movie Avatar, released on December 16, 2022. It is primarily employed during post-production, comprising 70% of the total production time and costs of the film. Architecture, interior design, scientific computing, industrial design, computer games, advertising, and education are just a few areas where CGI digital technology is widely utilized. It can effectively create memorable scenes in movies and TV shows, for instance, the war scenes in The Avengers, and has a prominent role in the animation industry.

Since 1995, when "Toy Story" has become the most profitable film of the year, animation production companies are increasingly concentrating on the development of CGI films. According to Sun's research using Box Office Mojo data, only 9 out of 58 films in the global box office top 10 animated films from 1977 to 2022 were non-CGI productions. Table 1 presents these findings. This demonstrates that the majority of the animation film industry depend on CGI technology to produce projects. Further advancements and updates to digital technology can allow the creative culture industry to generate higher quality content. The film and television industry, as a critical part of this sector, should expect a transformation toward digitalization.

Table 1. Summary of animated movies of top 10 at the global box office (1977-2022) [3]

sum	CGI animation	Non-CGI animation
58	49	9

With the gradual growth of the IT and AI industries, the animation film sectors, as components of the creative industry, will encounter great challenges. This paper explores the development trends of related business models in the future and discusses their implications.

3.2. Business Model of Animation Film

The creative and media market in Asia is currently the third largest in the world, with China being one of the fastest-growing markets in the region. Figure 3 shows that China's total animation output value reached 25 billion RMB in 2022, which indicates a rapid advancement in the creative industry. As the animation industry continues to evolve and expand, outsourcing has become a popular business profit model among domestic and foreign animation film companies. This is due to two primary reasons. The demand for projects seems to have increased significantly, likely due to the rising cost of animated films. The industry is rapidly expanding, driven primarily by an increased demand for entertainment, video games, animated films, and visual effects (VFX) [4]. As a result of this growth, the demand for outsourcing has also increased. The production process for a film or television commercial animation is highly intricate. For instance, commercial 3D animation production requires involvement in character design, modeling, scene design, script, footage, and other elements. The animation producer lacks the capacity to complete the entire film's production. As such, the project is outsourced to other companies for completion. In China, the General Office of the State Council issued the "14th Five-Year Plan for Cultural Development." Following this, numerous new network animation projects have emerged in recent years with the goal of establishing China's own brand of animation film and creative industries. Many firms opt to outsource production.

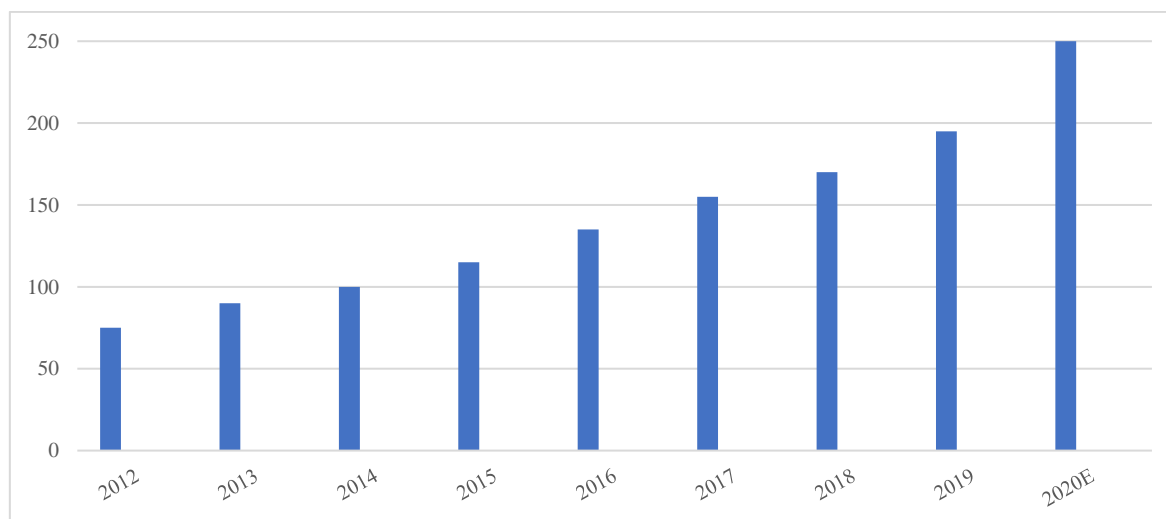


Figure 3. Statistical overview of the total output value of China's animation industry in the past ten years (CNY 100 million) [4]

With the development of artificial intelligence and the information age, this paper argues that the business model of animation film companies will undergo transformation as the creative industry experiences economic growth and the production process and operation of animation film gradually mature. Digital technology has brought about a new cultural experience marked by creative digital displays, particularly due to the impact of big data technology, network audiovisual, animation, video games, mobile gaming, and other emerging industries [5]. The advancement of information technology has had a favorable impact on the film and television animation industry, facilitated by the use of artificial intelligence technology to enhance production efficiency and technique. In the past, OEM outsourcing was the primary method used by many producers to create animated projects. However, most domestic outsourcing companies are currently transitioning to the co-production model. This model involves outsourcing service providers participating in the creation of the movie as a producer and co-investing with the IP producer to share the copyright revenue. On one hand, due to the maturation of technology, it is necessary to present more sophisticated content to the audience. On the other hand, by incorporating information technology into the creative industry, producers can actively participate in project production, contributing input to film and television animation production to create superior works.

Along with the improvement of people's living standards, it has a great impact not only on the economy, but also on all aspects of life, which brings social development into a new era [6]. Artificial Intelligence has brought revolutionary results in creating new work demands, improving workforce efficiency, optimizing human resource structure, and reducing labor costs. In the past two years, various AI paintings and AI-assisted creative software have appeared, which have a great impact on the animation film industry, but also a breakthrough of AI in animation film. Due to the economy of creative industry and the good development trend of AI and information technology, most of the animation film industry transforms to co-production, perfects the business profit model, and participates in the production content of the project, grasps the production quality and details of the project, and considers for the later marketing communication of the project as well as profitability, and expands the diversity of the business of animation film industry, which is no longer confined to one field and module.

3.3. The Impact of Information Technology on the Animation Film Industry

Information technology serves as a tool to aid individuals in both personal and professional settings. Similar to manual labor, information systems and technologies have become largely commoditized [7]. In the realm of artificial intelligence, the information industry has been a driving force behind the implementation of AI across various industries. The study of Artificial Intelligence is based on the investigation and development of theories, methods, technologies, and application systems that are

used to simulate, extend, and expand human intelligence. The growth of information technology and AI has undoubtedly enhanced the production capacity and efficiency of numerous industries. The rational and effective use of artificial intelligence provides a high level of value creation and competitive advantage, as this technology transforms numerous fields [8]. The mature utilization of information technology has rendered production processes in the animation industry more efficient and convenient, thereby augmenting the industry's competitiveness.

However, prior to the swift advancement of artificial intelligence and information technology, animation is increasingly supplanting comics, thanks to novel computer technologies and software that materialized in the mid to late 1990s [9]. The manga industry's publishing and dissemination of manga magazines and other paper-based content is being replaced by animated content production technology due to the advancement of computer animation technology. The manga industry is facing a significant threat from animated content producers as technology advances. This is due to the loss of core competencies that the manga industry previously held, such as human resources and paper distribution. If computer animation contestants can develop their own distribution channels, such as through TV or other media, to reach their intended audience, then companies in the cartoon industry will likely lose their market share. It is evident that the evolution of computer technology has fostered auspicious growth in animation, highlighting the crucial role of information technology in the animation film industry. This industry not only boasts unique cultural innovation qualities, but also depends on sophisticated high-tech resources and intensive intellectual investment, hence, it garners the reputation of a "smoke-free heavy industry" in the global economic system. The advancement of information technology has the potential to advance the animation film industry, yielding benefits. However, it is crucial to consider the impacts of technological advancements, such as the advent of AI-generated art on creativity and originality. In the animation industry, the main drivers of innovation and added value are the development of new character designs, the ideation of fresh storylines, and the production of distinct visual images, which primarily take place during the initial phases of a project, specifically planning and pre-production stages [10]. In the animation industry, the main drivers of innovation and added value are the development of new character designs, the ideation of fresh storylines, and the production of distinct visual images, which primarily take place during the initial phases of a project, specifically planning and pre-production stages [10]. As AI painting becomes more prevalent, it has the potential to transform the business framework for creating original films and animation. The film "Rock Paper Scissors," produced by Corridor Studio, showcases the role of AI in animation for film and television. AI painting has facilitated efficient generation of high-quality images, yet the unpredictable nature of AI prohibits creation of commercially viable animation for film and television, even with the aid of motion capture and real-life references. This has been one of the technical difficulties in rendering 2D in 3D in the past. Early findings have shown that AI and robotics do contribute to productivity growth, and preliminary studies have shown that robotics and AI technologies do increase productivity [9].

On one hand, animation distinguishes itself from other media industries by being a global field that involves a significant workforce shared between countries and continents [11]. Film and television animation production relies heavily on computer technology in most of its processes. The animation production process comprises five primary steps: pre-planning and the creative stage, pre-production, actual production, post-production and optimization, and release and promotion of the work (shown in Figure 4), which involves numerous sub-processes. These stages demand extensive expertise, time, and resources from industry professionals. With the rise of new technologies, many animation film companies have opted to research and analyze their impact. The commercial profits of animated films have grown with the advancement of digital technology, bolstering the industry's market position. Moreover, this technology enhances the diversity and competitive edge of animated films, providing a stable basis for the sector's sustained growth.

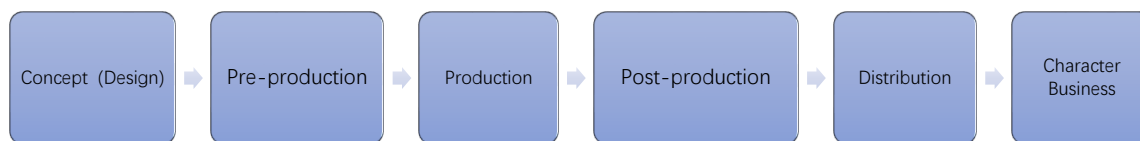


Figure 4. Commercial animation production process [4]

On the other hand, animation is the carrier of culture, and culture is the kernel of animation; excellent animation content makes the content profound and attractive, and the revitalization of animation promotes the dissemination and infiltration of culture, both of which complement each other and prosper together. Compared with other fields, although film and television animation belong to part of the creative industry, its production process, however, shows remarkable globalization characteristics. With the increasing interaction between regions and continents, this trend of globalization is being strengthened. The trend of globalization is driving the production process of animated films. This phenomenon is mainly reflected in the fact that interactions between regions as well as continents, both internal and external, are becoming more frequent [10]. The development of information technology has brought about techniques such as data analysis, which plays an important role in the animation film industry in terms of audience surveys and individual case studies. Content creation and marketing communication, as an indispensable part of animation film, can bring about losses for the entire project if mistakes are made. The new technology can solve the problem as efficiently as possible, such as: the audience's favorite degree, the audience's regional distribution, cultural differences, and reasonable publicity methods.

4. Suggestion

The intersection of technology and culture is integral to the digital creative industry, allowing it to unlock immense potential. Newly emerging industries are showing strong potential [12]. As a subset of the overall creative industry, the animation film industry is experiencing new trends in economic and social development that are being driven by governmental industrial policies, amidst the current backdrop of Informa ionization, and intelligence. This has compelled the traditional animation film industry model to undergo a crucial transformation and upgrade.

In this paper, the study argues that by utilizing the superior performance of artificial intelligence, the governments can significantly enhance the visual effect of animation, thus strongly promoting the development and innovation of animation production technology [13]. By reducing the time-consuming production process, the quality of animation works can be improved. In addition, this approach can also satisfy the demand for the pursuit of animation authenticity, thus bringing an immersive viewing experience to the audience. This not only helps to enhance the overall quality of the animation, but also further strengthens the viewing experience of the audience. Products and services provided by the creative industry, they not only have simplified cultural connotation or entertainment characteristics, but also have significant economic benefits [14]. People's cultural needs are expanding as the economy and living standards improve. The animation film industry, which is a cultural and creative industry, has become a driving factor for economic development. It is suggested that the animation film industry absorbs learning, for the benefits brought by technology, expanding the diversification of business, adapting to the trend of the development of information technology, and bringing sustainability to the animation film industry in the new era.

One distinguishing feature of AI, relative to other digital technologies, is its ability to effectively reduce design and development costs and timeframes [15]. While society often perceives AI as a labor-replacing technology, its underlying goal is to emphasize the significance of human-computer collaboration, using it as a basis for innovating new modes of cooperation. AI technology, therefore,

is not aiming to completely replace human teams. The animation film industry operates as a closely connected and inseparable system [16]. The downstream sector of the industry chain, production and sale of animation film derivatives, presents an opportunity. China's market for movie derivatives is showing a positive development trend, and the public's attentiveness to them is increasing [17]. There are several factors that lead to audience appreciation of derivatives such as income level, regional culture, types of derivatives, and personality differences. However, the critical step in expanding the derivatives market in the animation film industry is to increase the audience's enthusiasm for the film, and subsequently stimulate their purchasing behavior. In the modern age, applying information technology to enhance the convenience of the animation film industry, improve animation quality and style, implementing data and information tools, conducting audience group research, and enhance the appeal of animation film, can generate a more favorable market for animation film derivatives.

5. Conclusion

It is acknowledged according to existing literature that the advancement of information technology has a favorable influence on the animation film industry. It can aid in the production of higher-quality works and meeting the requirements and desires of the audience. As a sector of creativity, the animation film industry has encountered considerable progress in the current year, and many countries have introduced policy programs to facilitate the progress of creative industries. Take China, for example. In order to cultivate its own cultural brands and creative industries, China has published the "14th Quinquennial Plan" for cultural development. This provides a promising opportunity for the animation film industry, which is facing significant challenges brought on by new technologies. The application of technology and the updating and iteration of auxiliary tools greatly impact the animation film industry. In the current era, the rapid advancement of information technology necessitates the film and television animation industry to actively embrace transformation brought about by new technology. In light of the rise of artificial intelligence, it is imperative to quickly familiarize oneself with and learn how to apply its tools in various aspects of the film and television animation processes.

The creative and artificial intelligence industries have become indispensable components of each country's economy, with annual growth on the rise. This establishes a favorable setting for the expansion of the animation film sectors.

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