

Impact of Digital Technologies on the Development of Modern Film Production and Television

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Abstract

The popularity of streaming services has been steadily growing over the past 5 years, and the number of subscribers is increasing. This study was conducted to find out how the popularisation of streaming services affects filmmaking. The history of cinema is inextricably linked with the development of technology. It should be noted that each new page in the history of the film industry began with the invention of new innovations. During the digital age, a rapid leap forward in the television and film industry was also inevitable. Digital cinema is a format that has virtually left film and analogue cinema technology behind. Each revolution in the film industry has been a new step towards providing audiences with a new experience and an even more vivid film experience. Streaming services are one of the innovations that have emerged thanks to the development of digital technologies. They allow viewers to receive content for a fixed price. Streaming guarantees quality and availability with minimal technical support. For this study, theoretical materials on the impact of digital technologies on changes in cinema were investigated. The study analyses data on changes in the audience of the most popular streaming services over the past 10 years. The results of the study showed that the increase in demand for streaming and online cinemas affects the audience's requirements for the genres and format of cinema. To satisfy audiences, filmmakers are constantly modernising the industry. It can be concluded that the tastes of the audience are changing and the workers of the film industry should be guided by this. In the future, global and Ukrainian streaming services will be able to create original content that will meet the requirements of viewers.

Keywords: film industry, digital era, streaming services, online cinemas, video content

Introduction

Along with the development of digital technologies, the development of cinema and television is taking place. The use of new tools is necessary to attract viewers and develop the industry. The main milestones in the history of the development and modernization of film and television production fall on those periods when technical innovations appeared in the world (Gumenyuk et al., 2021). The first step towards the birth of cinematography was the invention

of the camera obscura, phenakistiscope and chronophotography. Together, these devices are the progenitors of the camera. The first film made with a camera obscura is called "The Arrival of a Train at La Ciotat Station". It was black and white, it lasted 50 seconds, but the creation of this short film was the impetus for the development of cinema. At this stage, there was no sound in the films. Only music and lines of some characters that were inserted in text form between frames. One of the most striking examples of silent cinema is films with the participation of Charlie Chaplin. The use of sound in movies was not possible due to an array of problems. Among them were the difficulties of synchronising video and audio footage and its insufficient volume.

A low frequency amplifier was developed in the 1920s. This allowed to cope with the problem of low sound volume. In 1925, the then little-known studio Warner Brothers, which was on the verge of bankruptcy, took a risk and decided to invest the rest of its funds in sound films. The release of their "Jazz Singer" is considered the beginning of the era of full-length sound films. Further, film and television production developed thanks to the emergence of new transmission channels. New cameras were created that improved the quality of the captured image, new methods of development and editing. Technique was improved in cinemas. Apart from the usual filming of real objects and people, work began on special effects. Regardless of how the source material was filmed, digital post-production techniques were increasingly used in making films. Special effects are now available even to the most mid-budget producers. Perhaps the forerunners of any digital special effect can be found in traditional cinematography and animation, both hand-drawn and puppet. Most clearly the development of special effects can be observed in the first six films of George Lucas' space epic "Star Wars", which continued its development and improvement for 30 years, starting in 1977. It was then that Episode IV "A New Hope" was released – the first one, where aircraft flight paths from the military chronicle of World War II were used to create "drawn" ships flying in space.

The next technological breakthrough in the creation of visual materials was stereo cinematography – 3D filming. This is a shooting method with the use of two cameras, the images from which are then laid over each other. When using glasses with special light filters, the illusion of a three-dimensional image appears. The era of stereo imaging began at the beginning of the last century, evolving from a fantastic idea to reality. Apart from the many experimental tapes previously filmed, *Bwana Devil*, 1952, directed by Arch Oboler, is considered the first 3D colour film. After its release, the technology began to develop rapidly and be used by large film companies.

Each revolution in the film industry has become a new step towards ensuring that viewers receive an even more vivid experience from watching films in cinemas. As early as the beginning of this century, film distributors favoured the traditional rules for distributing feature films. The focus was on analogue technology. However, recent advances in digital technology are changing the way audiences consume media, putting pressure on traditional film production models. The value chain concept (Porter, 1985) is used as a framework to study the impact of new technologies on film distribution and consumption. The key argument is that the single value chain that has dominated traditional film distribution is being replaced by individual business strategies that can be tailored to the needs of each individual film. This represents a potentially significant change for independent cinema as it moves from a supply-driven to a demand-driven market (Ahmed and Sinha, 2016).

In 1995, the internet started making a huge profit. More importantly, information processing has become more accessible and improved: a modern mobile phone does this 30 times faster than the on-board computer that controlled the first manned landing on the moon (Biswal, 2019; Ezdina, 2021). As a result, content began to be produced and stored digitally. It was at this point that the film industry changed. Movies and TV shows have become more than just movies and TV shows. They started looking like streams of information. The first smartphones appeared in the 1990s, and in the 2000s – tablets (Elberse and Eliashberg, 2003). At the same time, plasma TVs entered the market, which nowadays virtually gave way to the thinnest OLED screens. The infinite number of screens has given rise to a variety of viewing practices. Visual content, be it a movie, TV series, or news release, can be watched at any time of the day without being tied to the airwaves. Internet companies have embraced the omnivorous audience and started shaping a new daily information ecosystem (Panda, 2019; Volkova et al., 2020). And they entered the race for content. The main condition for diversity is the symbiosis of television and the Internet (Patynkova et al., 2018). Televisions finally became smart, and it was already possible to view Internet content on their screens. By 2020, almost all major media companies have announced the creation of their online cinemas and streaming services. The growing popularity of streaming services, where movies and TV shows can be viewed in the best possible quality, affects the development of the film industry in general. The purpose of the study is to find out exactly how the use of digital technologies in the creation and distribution of films affects the development of the film and television industry.

Materials and methods

The theoretical basis of the research was the work on the development of digital technologies in the world, the history of their implementation in the process of creating film and television programmes. The study was carried out based on the historical method in order to identify the features of cinematography, its place in modern culture and its modernisation thanks to new tools. So far, research on the interrelation between film and technology, including digital, is focusing on technological change and film advancement, i.e. how digitisation is transforming the way of production. The study investigates methods of production and distribution of films in the era of analogue technologies and in the present. A separate block in the course of studying theoretical material is information about the industry of Ukrainian cinema and television production. The stages of the development of genres and forms of Ukrainian cinema over the past 100 years were studied. This information helped to define a clear purpose of the study.

This research is based on the method of analysis – a way of knowing an object by studying its parts and properties. The authors analysed data on the creation of digital screen cinemas around the world from 2006 to 2019. Furthermore, the study analyses the change in the quality of digital films that were shot with the help of new technologies. The number of digital films released from 2000 to 2015 were analysed along with films shot with the use of analogue technologies. Another important point for analysis was data on streaming services for watching movies. The following international services were selected for the study: Netflix, Amazon, YouTube. The study also analysed the use of more local services for Ukraine – Megogo and Takflix. The latter service is interesting in that it was established with the purpose of popularising Ukrainian independent cinema. Netflix streaming service audience growth data

from 2012 to 2019 was studied. This service was chosen as the main one for comparison, as it is on the market longer than others and has the largest audience in the world. It is currently used by more than 190 million people around the world, although initially Netflix only worked in the US. The data obtained about the audience of the mentioned services is compared. The content of these streaming platforms is compared according to genres, availability of adapted content, etc.

Another research method used in the study is the method of synthesis. Synthesis is a way of studying an object by combining parts and properties, which were identified upon analysis, into a single whole. The data obtained through the analysis was examined, compared, and collated to create an overall picture of the impact of digital technology on the film industry and visual content production. Both general data obtained during the study and the results of the impact of streaming services on film production in Ukraine were synthesised. A forecast was made on the development of narrow-genre cinema in the country. Based on this information, recommendations were made for the further development of Ukrainian cinematography with the use of digital technologies and showing films, serials, and TV shows through streaming services and online cinemas.

Results and discussion

The impact of digital technology on filmmaking is undeniable. With the advent of new methods of filming, editing, distribution, and screening of films, the number and ways of creating products have changed. Thus, it can be traced that digital films have become the main form of production of the film industry products. Back in 2000, all films made by studios and independent directors were shot with the use of analogue technology. Film cameras were the only way to capture images. In recent years, after the advent of digital cameras, a reverse trend can be observed in the world (Fig. 1).

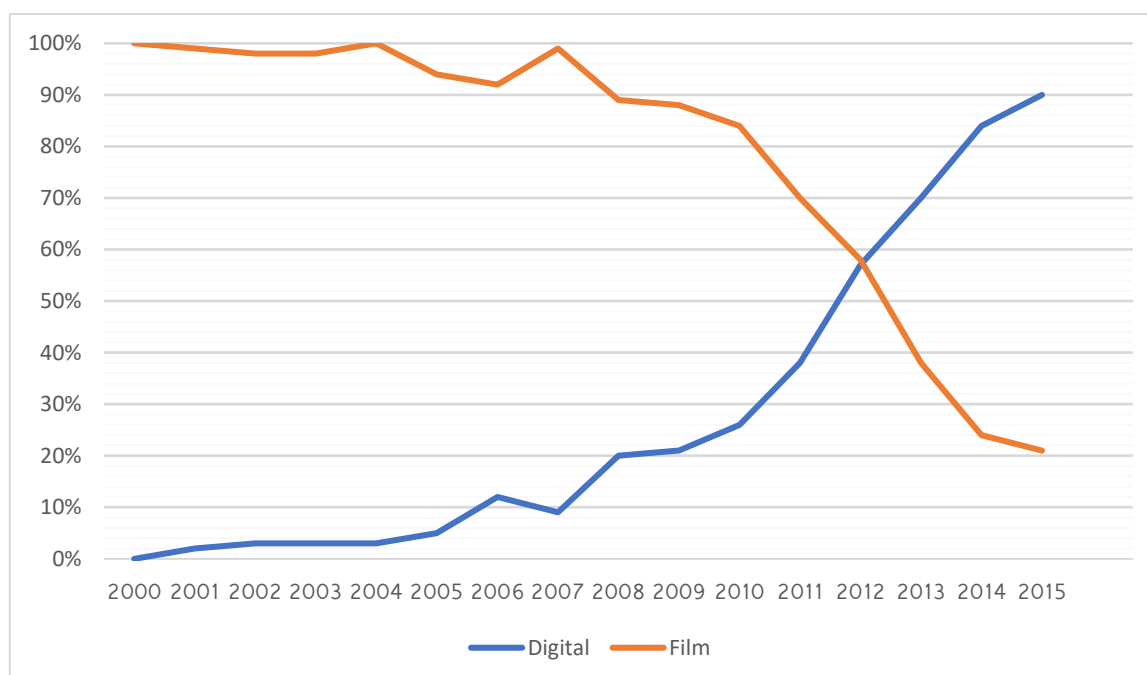


Figure 1. The total number of films shot worldwide with the use of digital and analogue technologies

The result of complex scientific and technical research and development was the creation of a system for shooting and reproducing moving images with the use of electronic media – video recording. It has infinitely expanded the channels and methods of distributing audio-visual products, and in the field of production has paved the way for computer technologies, including the possibility of synthesising virtual images, which significantly increased the entertainment potential of cinema. While fundamental cinematographic developments resulted in new types of on-screen performances, applied developments allowed to solve specific problems, such as improving the quality of the image and sound, creating new models with improved technical features, and expanding their range. This ultimately helped speed up and reduce the cost of all stages of production and gave the filmmakers more freedom in the implementation of their creative ideas. The growth in the number of films shot with digital cameras has influenced the modernisation of cinemas. To show such films, new media, equipment, and special screens were required. In 2006, the number of such screens in cinemas around the world was 2,991. By now, this figure has significantly increased (Fig. 2).

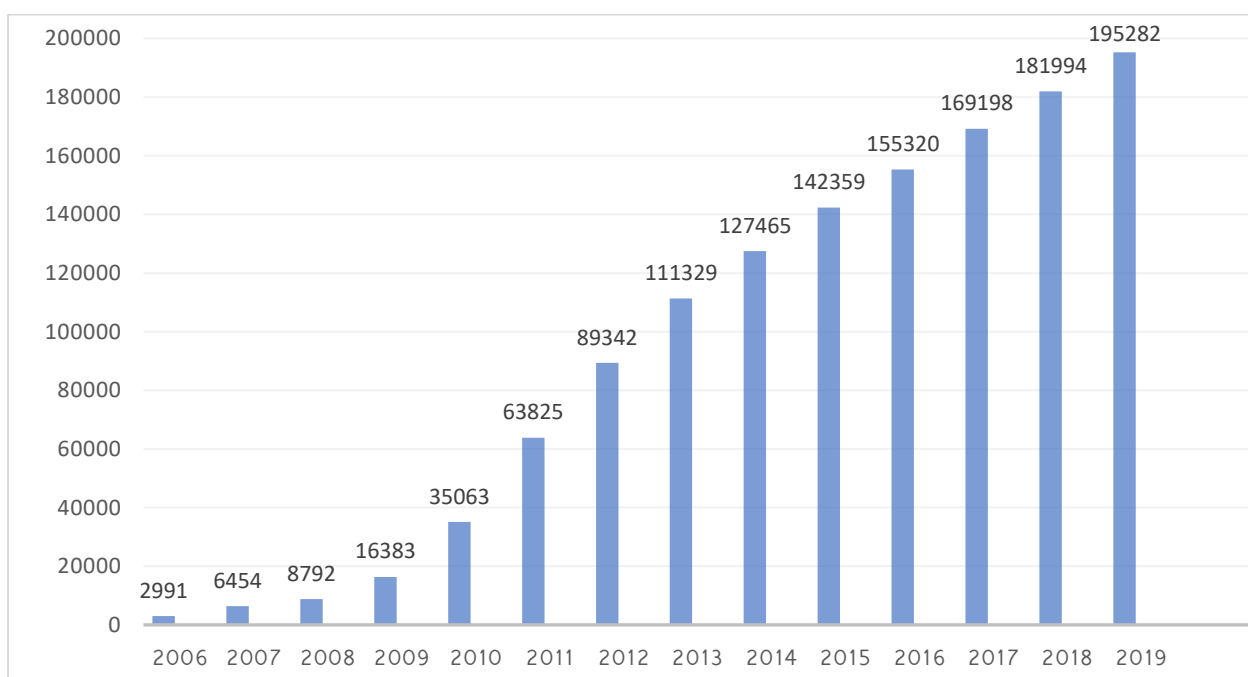


Figure 2. The number of digital cinema screens in the world from 2006 to 2019

As a result of the spread of digital technologies, the emergence of streaming services has become inevitable (Prokopenko et al., 2019). Their mission is to deliver high quality content to consumers with the use of technology that everyone has at their fingertips. The number of subscribers to streaming video services grew and in 2018, for the first time, became more than cable TV subscribers. Streaming sites were used by 613 million people worldwide, while cable TV was used by 556 million people. This is evidenced by the data of the report of the Motion Picture Association (MPA). According to the report, the global entertainment market as a whole reached a new high in 2018, earning 96.8 billion US dollars. The number of users of streaming services grew by 27% compared to 2017. The streaming market has grown significantly due to companies such as Amazon, CBS, Hulu, and Netflix. They were soon joined by Apple, Disney, and NBCUniversal. Global digital distribution revenue grew 34%, while physical media sales declined 14%. Obviously, more and more people are choosing to buy films digitally rather than on disc. Data from the Netflix streaming service also attest to this

fact. For 7 years, the number of their subscribers increased from 33.3 million to 192.9 million (Fig. 3).

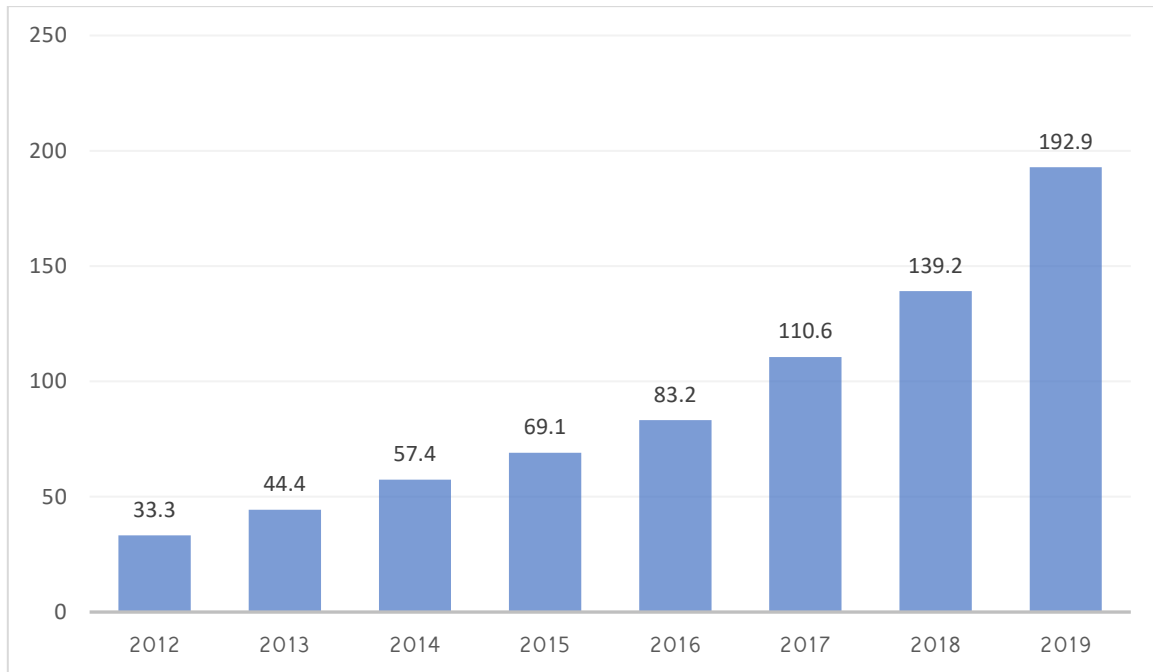


Figure 3. Netflix streaming service audience (million)

In 2018, Netflix accounted for 14.9% of global app traffic, followed by HTTP MEDIA STREAM and YouTube (Figure 4). Therewith, by 2018, Ukraine accounted for 47,000 Netflix subscribers (Online Video..., 2020). The number of people using the services to watch movies and TV series has significantly increased. The viewer currently has a huge amount of video product at their disposal. Therewith, they pay a fixed price per month.

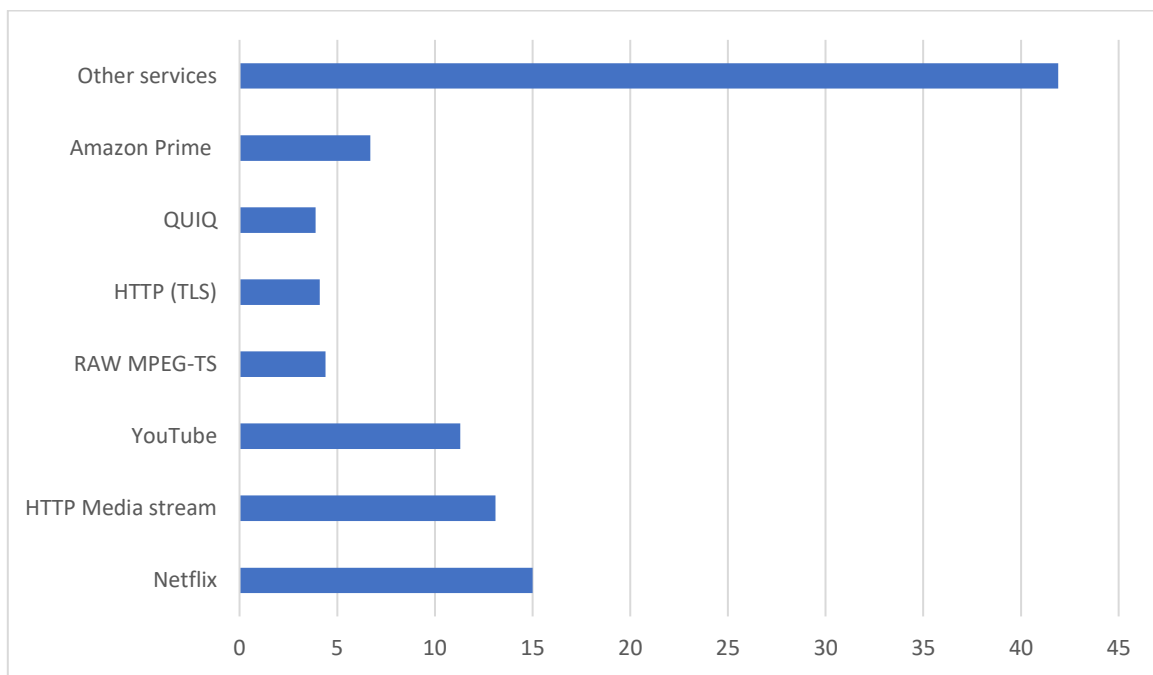


Figure 4. Subscribers to various services to consume video content (in %)

As for the impact of digital technologies and the popularisation of streaming services on filmmaking, the companies that own streaming services have notably started producing and

shooting their own films and TV series. For example, Amazon spent 6 billion US dollars in 2018 on original content, which includes movies, videos, and music. Apple, which launched the Apple TV, also spent 6 billion US dollars on original content for its streaming. Disney has invested 23.8 billion US dollars in video filming and production, but not all for streaming (1 billion US dollars for Disney + originals). Netflix's original content budget was 12 billion US dollars for the year (Table 1).

Table 1. Streaming services budget for original content

| Streaming service | Budget (billion dollars) |
|--------------------------|---------------------------------|
| Netflix | 12 |
| Apple TV | 6 |
| Disney | 23.8 |
| Amazon | 6 |

Notably, there is little adapted content on streaming services in Ukrainian. There are no available foreign films, TV series, and shows with Ukrainian subtitles or dubbed in Ukrainian. This problem forces users to approach services that are more adapted to Ukraine. For example, the online service Megogo allows watching films and TV series in Ukrainian. The number of subscribers to this service is more than 800,000 people. The service is a kind of replacement for cable, analogue television. Another Ukrainian service that appeared in 2020 is Takflix. Takflix will operate as a streaming platform for the legal viewing of Ukrainian films. At the initial stage, the curators of the platform focused on authors and independent films of Ukrainian production in recent years. Therewith, the streaming service differs from other online cinemas. It has a special payment system – for each separate film, and not for services provided over a certain period of time. The viewer will be able to buy a separate online ticket for the selected film without a subscription or registration. This approach is conditioned by the small assortment of films on the service. Currently, only 15.50% of the profits from ticket sales go to directors and filmmakers, and in the future curators plan to create a separate section on Takflix for crowdfunding campaigns in support of film production.

The development and use of streaming services leave its mark on the film industry. The greater number of films and TV series with high-quality images, the use of special effects, and the creation of technology that is capable of transmitting them through the screen – all this affects the person's choice of the content they are going to watch. Filmmakers experiment with genres, timing, and visuals to meet the demands of the viewer and stay relevant. It may seem that the techno-cultural breakthrough in the video content market has not affected the position of cinemas in the overall film market. The consumption of films in cinemas has remained stable throughout the period of instability in the film markets. However, stable overall sales figures can hide important micro adjustments to a changing market. The impact of digitisation on the cinema repertoire includes both the blockbuster effect, with the most popular films taking a larger share of the overall market than before, and the long tail effect, as the number of unique titles released has significantly increased (Gaustad, 2017). Therewith, cinemas dictate certain conditions to the filmmakers, because their audience already has developed demands. At the same time, streaming that allows home viewing is an open field

for experimenting with forms and content. Income from home viewing generated by a particular distributor's films, compared to their theatre revenues invested in cinema maintenance and upgrades, has been growing over the past 5 years.

Information lighting tools are associated, first of all, with an impending information event. G.V. Kiuru defines an information event as an element in the structure of information exchange through which information demands of the audience are manifested and fulfilled (Fritzschea and Dürrbeck, 2019). Naturally, considering the multidisciplinary nature of digital transformation and the interdependencies that exist in business models, it is imperative that researchers from different fields work together to not only broaden our knowledge, but also actively link these topics and disciplines so as to develop a holistic understanding of why, how, and when digital transformation works (Atton, 2008). Such interdisciplinary research helps practitioners make informed strategic decisions about how to respond to digital technology and drive digital change. Considering the latest developments in digital technology, some scholars believe that digital transformation will become a very relevant interdisciplinary area for future research (Verhoefa et al., 2019). Indeed, digital transformation provides new opportunities for the development of established areas of our lives (Bondarenko et al., 2021). This study looks at a narrower aspect of this transformation. In the context of cinema, it can be stated that digital transformation gives rise to new forms and genres, allowing culture to change and meet the needs of the time.

At present, the parties have not reached an agreement on further actions. Technology companies cannot push this evolution forward without the approval of studios and exhibitors (Culkin and Randle, 2003). This is because, unlike previous film innovations such as SRD sound, acetate/cellulose film, or 35- and 70-mm formats, digital cinema is incompatible with traditional cinema technology. Both are mutually exclusive (Fair, 2006). No dual-use projector is planned, and even though flagship cinemas have the option of two projectors working side-by-side, most cinemas no longer have it. This means that before digital cinema is deployed to more screens, it will have to be fully supported by all studios in order for them to deliver the product to cinemas. Global standards will be set, and will come from the US unless other territories are funding the conversion themselves. Unlike technologies such as television or computers, the digital cinema market is not large enough to support more than one standard.

Furthermore, multiple standards will require multiple inventories, and the main advantage of the film – one standard, namely 35 mm – will be lost. As a source of funding in the industry, some studios were involved early on, and their decisions are likely to be significant. Territories like Europe that try to follow their own path will be forced to change direction as their position becomes increasingly untenable without direct government intervention (Aveyard, 2016; Lebedyuk, 2021). The research data show that the era of analogue cinema is becoming a remnant of the past. Films shot with analogue technology are more of a tribute to the classic methods of filmmaking than a convenient, deliberate choice of directors. Digital cinema is not only more convenient for all the people working on it. Its post-production and distribution costs are significantly less than they used to be. Undoubtedly, technology will evolve, allowing to shoot films even more efficiently and less costly.

As the way people consume films changes, feedback effects can also cause changes in the films people choose to watch and, ultimately, in the films that are produced themselves. These cultural effects of disruptive technology and innovation are best defined as technocultural, describing the interaction between technology and culture (Verhoefa et al., 2019). In the context of this technocultural shift, experts investigate the impact of market

changes on the supply of local films. This suggests that streaming services are making cinemas more important because they generate little revenue for local films and therefore make the providers of those films more dependent on cinema revenues. In the home video market, streaming services for buying and renting movies (EST and TVOD) have emerged as the most important source of revenue for local films, while audiences have largely shifted to subscription-based services (SVOD). The low cost that makes SVOD services attractive to consumers makes them economically insignificant for local film providers when their content does not support the strategic core and brand of these services. Local content from small markets like Norway usually has a potential audience limited by language and culture, making it particularly sensitive to the low value created per viewer by SVOD. In most cases it will not benefit from the economies of scale offered by global SVOD services.

Thus, to support local films, policymakers and industry participants can maximise their efficiencies by focusing on film and EST/TVOD services, market channels that appear to better match the film format and business models. However, this can lead to a paradoxical political trade-off between competing goals of affordability and economy (Gaustad, 2019). In contrast to the authors of the previous study, it shows the role of digital technologies in the evolution of cinema. Streaming services are capable of creating a broadcasting network that the users themselves have set up based on their tastes and preferences. Focusing on it, filmmakers will modify their content, creating more requested films, series, and TV shows.

The study by researchers of an open set of practices related to or oriented towards cinemas provides a starting point for understanding how cinemas continue to be popular (Hu, 2016). Even if the films can be accessed through a variety of distribution platforms in an increasingly simple way from virtually any desired place. This is, at least in theory, due to the fact that going to the movies still satisfies a very clear set of needs that cannot be replaced by other ways of watching. The technical superiority of cinema seems to persist, but it is secondary to the general "special feeling" of going to the cinema. It should be noted, however, that this special feeling is not only conditioned by the technical features or the atmosphere in the cinema. The discovery that going to the movies is perceived as a social thing is unlikely to be a new discovery. However, the social nature of going to movies and watching movies in general currently has more layers than it may have had before.

Apart from the fact that going to the cinema is a social event, either because of going to the cinema with friends, family, or simply because there are other people in the same room. Then the viewers discuss their experience with the film in the immediate social circles, for example, at work or in their hobby clubs. The discussion for many of the interviewees took place on the Internet. Either with friends, family, or even people they don't really know in the conventional meaning, where they know someone personally in the physical world. Discussion space can be as much based on a shared hashtag, commenting on other people's public posts, or belonging to a common interest group like Facebook (Andryeyeva et al., 2019; Fadeeva, 2020). As far as going to the cinema only, the expanded social focus of going to the cinema can be boiled down to a Facebook location announcement supplemented by the movie title. The impact of social media on the sociality of movie attendance offers interesting grounds for further research (Grundström, 2018). Again, noteworthy that the experience of going to the cinema can fade over time against the background of the experience that the viewer can gain from new technologies and the use of streaming services. Additional devices and technologies such as virtual and augmented reality will allow streaming to improve their experience.

Conclusions

The development of technology has a huge impact on the development of new ways and forms of filmmaking. It is safe to say that the digital era has already changed our perception of cinema. Over the past 15 years, film production opportunities have taken on unprecedented proportions. The quality of shooting and the resulting image, the capabilities of technology that almost every resident of the city has, allow to freely watch movies and TV programmes anytime, anywhere. Cinemas are still popular, but the ability to connect to the internet and select acceptable content in a few minutes is changing the viewer experience.

The rise of streaming services can both hinder and help filmmakers. For example, the Netflix service started buying the rights to broadcast films participating in the Sundance festival. Previously, these films were released exclusively under the "festival cinema" label, they were played by several cinemas and none of the distributors was eager to release them. At present, the creators of auteur cinema have the opportunity to reach out to their viewers directly, without counting on the cinemas to help with distribution. The rise of streaming services in the digital world is likely to save these genres from extinction. Therewith, the development of other genres is also evident. Series and TV shows have become more popular, because streaming is an opportunity to watch a series in good quality without violating copyright. This also changed the quality of shooting in this format. All sorts of blockbusters remain the prerogative of cinemas, leaving room for quieter genres.

Targeting the viewer and creating films that can become popular on streaming services are the main challenges for film companies today. The transformation of classic television into a digital broadcasting network with features individual for each user is possible due to technical progress. However, Ukraine lacks its authentic content that could compete with foreign films. The development of Ukrainian streaming services can certainly help in this matter. However, it is important to not only broadcast, but also to strive to create original content.

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