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VOD IN POLAND. MARKET DYNAMICS AND DEVELOPMENT DIRECTIONS

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Abstract

In this article we try to understand the structure and dynamics of the Polish VOD market. An analysis of VOD consumption data provided by Gemius shows that Polish VOD market consists of both global and local players offering international and local productions. The number of viewers has flattened over time suggesting that in the future there will be less room for organic growth and the competition will likely shift to persuading users to spend more time watching videos by multiple attempts to make the library more sticky and interesting. The results of an additional technical analysis suggest that the top player is also the most technically advanced one and provides best experience, which might have an impact on the market performance.

Keywords: VOD, video, platform, streaming, television, viewership

Introduction

The concept of Video on Demand (VoD), or "video on demand", has its roots in the mid-1980s, when the first plans to create an integrated network of videos were born in Japan and when they were aimed at revolutionizing the video content (Lea 1994). Unfortunately, at that time, technological limitations prevented the implementation of this ambitious project. It was only in the 1990s that new innovations in the field of media coding and transmission appeared and there was a significant increase in the bandwidth of Internet connections. These infrastructure changes opened the door to the creation of the first experimental VoD networks. In the following decades, as the Internet developed and expanded, the popularity of video-on-demand services increased rapidly. They have become available at any time, for any number of recipients, and still continue their dynamic expansion. (Greece 2021). This phenomenon is an integral part of the broader changes taking place in the field of television as a result of the development of digital technologies and non-linear viewership patterns (Nowak, 2019, s. 245-274). These changes are not only revolutionizing the way video content is consumed, but also shaping the evolution of the entire television medium. They are sometimes referred to as "post-television", "post-network television" (Lotz 2011) or "hypertelevision" (Scolari 2009), emphasizing

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that these transformations go far beyond traditional television.

On the Polish market of VoD services (Video on Demand, video on demand), dynamic development and growing interest in this form of entertainment, which is confirmed by the data of the National Broadcasting Council from 2021 (KRRiT 2021) can be observed. Local viewers have wide access to a variety of VoD services nowadays. This includes domestic offers such as Player.pl, Polsat Go or TVP VoD, but also global giants such as Netflix, Amazon Prime and HBO Max, which provide their content to the Polish market (Interaktywnie 2022).

There are various business models on the VoD market. We can find services offering paid subscriptions (SVoD), free platforms financed by advertising (AVoD) and models where you only pay for specific content (pay-per-view).

This article has two main goals. Firstly, a better understanding of the current Polish VOD market, taking into account the dynamics and specificity of viewership, as well as the characteristics of providers and available content. Secondly, to identify potential directions of development of VoD services on the Polish market. By examining trends, business models, competition, consumer preferences and technological changes, the work aims to provide insight into what factors shape this market and what are the potential directions of its development. Previous literature focuses on general VoD trends in the global market or analyzes more developed markets such as the US market. However, there is a gap in the literature regarding a thorough analysis of the VoD market in Poland, which is a dynamically developing market with its specific characteristics. There is also a lack of research that combines technology analysis with market analysis, which can provide a more comprehensive understanding of this sector. This work aims to fill this gap, focusing on the specificity of the VoD market in Poland and combining market analysis with technological analysis.

The research methodology adopted consisted of an in-depth literature analysis, the analysis of market reports and a detailed consideration of data on VoD consumption on the Polish market provided to the authors by Gemius. Additionally, the authors conducted an in-depth technical analysis of VoD services. BuiltWith Technology Lookup tool (https://builtwith.com/) was used to identify technologies used in VoD services available on the Internet. In terms of mobile applications, they were downloaded from the Google Play platform and then decompiled in order to obtain a full picture of the technologies used in the process of building these applications.

The structure of the article is based on three main chapters. The first chapter presents an introduction to the VoD concept and the criteria for describing VoD service providers. The second chapter is devoted to a brief discussion of the structure of the American market, which is an important reference due to its maturity and developed technologies. The third chapter, which is the main part of the article, analyzes the Polish VoD market, taking into account research objectives and a detailed analysis of technologies used in Internet applications, using the BuiltWith Technology Lookup tool.

VoD - key characteristics

VoD, as a technology and form of video content distribution, is one of the evolutionary forms of television in the face of the development of digital technologies (Szkudlarek-Śmiechowicz 2022). These changes, however, go much deeper than just technical aspects, affecting various aspects of this medium. As Mirosław Filiciak (2013) points out, in addition to the technological revolution, the place of consumption is also changing, which can now take place outside home, on portable devices. The method of production is also changing, moving towards outsourcing, and the content is becoming more and more entertaining. Even the social aspect is being transformed due to the development of social media platforms.

Comparing VoD to traditional television based on a fixed program schedule, significant differences can be seen. The key difference is the non-linearity of VoD, which means that viewers can choose when and what they want to watch. Content is available anywhere and at any time, and its distribution takes place via various platforms, mainly online and on mobile devices (Jakubowicz 2011).

Amanda Lotz (2011) identifies similar changes in television and describes them using the "5C" model: Choice, Control, Convenience, Customization, and Community. It is worth noting that VoD television, compared to traditional television, remains popular, although its nature and consumption model differ significantly.

VoD platforms use various business models, the most common of which are (Grece 2021):

a. SVoD (Subscription Video on Demand) - An example of SVoD is, for instance, HBO Max. In this model, users pay a fixed monthly fee for access to the video library. In return, they receive high-quality video materials and an ad-free guarantee.
b. AVoD (Advertising Video on Demand) - This model works on the principle of free access to a video library, such as some of the content on TVP VOD. Users do not pay for access, but advertisements are displayed while watching videos or between them. In this case, the main source of revenue is advertising budgets, not subscriptions.
c. TVoD (Pay-per-view Video on Demand) - This model is relatively rare and involves charging for specific video materials. The users pay only for what they want to watch. The BVoD (Broadcaster Video on Demand) model, which refers to VoD platforms that are an extension of traditional television broadcasters is also worth mentioning.

Nowadays, we increasingly come across the concepts of VoD and OTT, which are often juxtaposed. OTT (Over the Top) technology allows users to access VoD video content and live TV broadcasts on any device and at any time. It is a new trend in the programming offer, combining live content with a VoD library. Unlike traditional distribution methods, OTT technology does not require signing contracts with cable or satellite operators, and the content is transmitted directly over the Internet.

VoD platforms give users the ability to play a selected collection of VoD video content at any time, as well as access to podcasts, music and many other media. When it comes to VoD, there are two main categories: VoD service, which requires a traditional cable connection, and VoD platform, which delivers content directly over the Internet.

The SVoD (Subscription Video on Demand) model allows users to access the entire library of multimedia content through a subscription that they pay periodically. In the AVoD (Advertising Video on Demand) model, the platform is financed by displaying advertisements before, during or after the video, and users do not pay for access directly. The TVoD (Pay-per-view Video on Demand) model allows users to purchase specific content by paying for it based on the "pay-per-view" model.

All these models are already available on platforms such as Netflix, Hulu, Amazon and Prime (Gudsho, 2022).

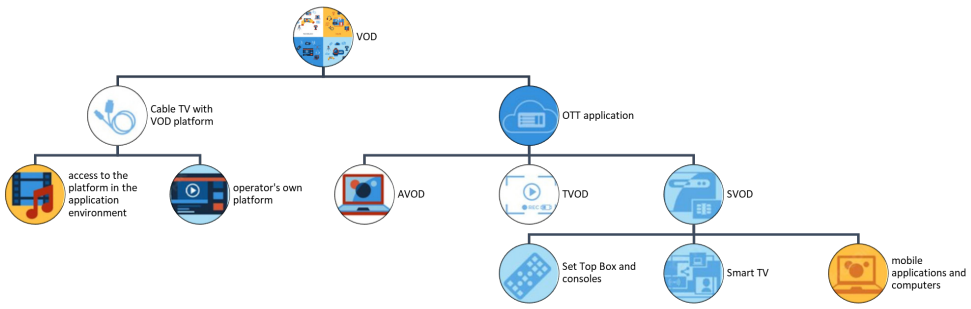

Fig. 1. VOD ecosystem. Source: the authors' study based on https://www.gudsho.com/blog/difference-between-vod-and-ott-platforms/, accessed on: March 11, 2023.

An interesting way of analyzing the differences between VoD services is presented by Amanda Lotz (2022). Looking at VoD from four perspectives: the number of markets in which they operate, the characteristics of their libraries, ownership of materials and connections with other media companies is suggested.

The first dimension is the geographical perspective. There are local VoD services operating only in one market, such as the Polish Player.pl. There are also international services that cover more than one market, e.g. Canal +, and global services that operate on a global scale, such as Netflix.

Another aspect is the characteristics of VoD libraries. They can be general and contain a variety of content that is not profiled for a specific group of viewers, as is the case of HBO Max. They can also be specific, consisting of material belonging only to a selected category, as, for example, Crunchyroll.

The third dimension is material ownership. Some films and content are owned by the respective VoD providers, as in the case of Disney+, while others have licenses from producers. Proprietary materials may be prepared specifically for the needs of a VoD service or may also be broadcast in other places, e.g. on linear television, if a given company owns this channel.

The last aspect of the analysis deals with possible ownership connections with larger organizations. Amanda Lotz distinguishes three main categories of players: specialized VoD providers such as Netflix; branches of large media and entertainment corporations, e.g. HBO Max and Disney+; and VoD services belonging to enterprises where the main business profile is related to a different industry, such as Amazon Prime.

The application of the above criteria facilitates the understanding of the scope of activities of various VoD providers and the strategies applied for building their libraries and competitive advantage. Thus, using these perspectives to analyze websites operating on the Polish market to understand their development dynamics seems worthwhile.

Global VOD market

In recent years, we have observed a dynamic increase in the popularity of VoD (Video on Demand) services on a global scale. Thanks to VoD, users gained access to a rich catalog of films, series and other television programs anywhere and at any time (Zing 2005).

Starting in 2011, American SVoD (Subscription Video on Demand) providers began to expand into international markets. Amazon Instant Watch SVoD has expanded its of-

fer beyond the US, reaching the UK, Germany and Austria. Unfortunately, the unsuccessful debut in Norway, Denmark and Sweden in 2012 was due to cultural differences and expectations regarding content. Nevertheless, in 2016, Amazon's video service became available worldwide.

In September 2013, Netflix debuted on the European market, and in the following years it expanded its services to most European countries. Although films and series from HBO were previously available, they were only available to subscribers of selected cable networks and satellite platforms. Only since 2016 have they become available online. Netflix has become the most popular VOD service in Europe, attracting more than half of users. Other services such as Amazon, Sky and Viaplay (which also offers access to HBO content) are the main competing options. In 2018, Amazon and Netflix dominated the VoD market, taking as much as 73% of the share, while other domestic services accounted for approximately 17% (KRRiT, 2021).

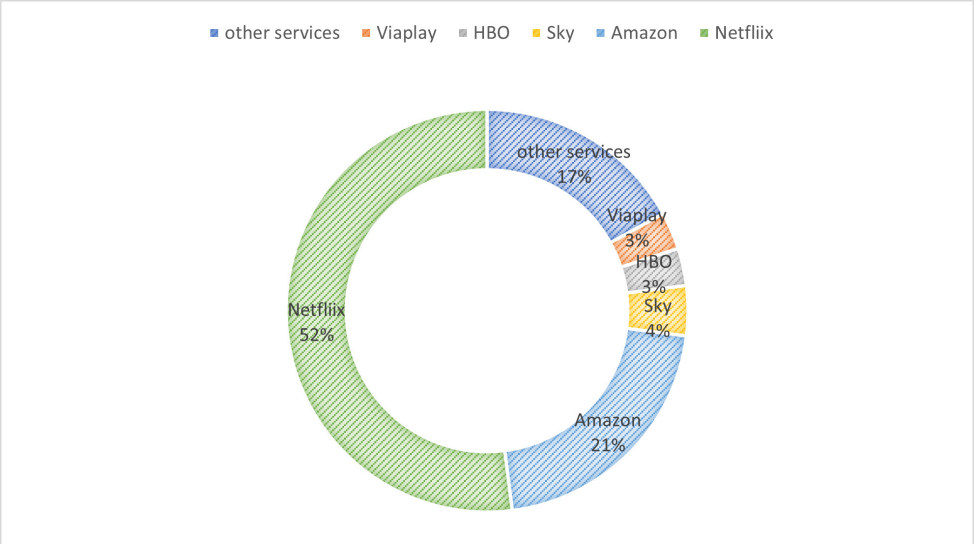

Fig. 2. Share of the largest services in the group of VoD audience. Source: the authors' study based on KRRiT 2021

The value of the VoD (Video on Demand) market on a global scale exceeded US$ 50 billion in 2021, and forecasts indicate that it will continue to grow at an annual rate of 12.5% in the period from 2021 to 2028. Over-the-top (OTT) TV and video services revenue is expected to reach over US$242 billion by 2028, almost doubling from 2021. The VoD market has experienced a huge boom in recent years, and its revenue has grown exponentially, from US$ 6.1 billion in 2010 to more than ten times that amount in 2021.

In the US alone, the OTT penetration rate was 85.6 percent in 2022. Many users use popular VOD platforms such as Netflix, Hulu, Amazon Prime and Disney+. Netflix, which has over 220 million paying subscribers worldwide, is the leader in the global VoD market. In 2021, US-based users of OTT services spent an average of more than two hours per week with them. As OTT services begin to replace traditional media such as television, these platforms have become attractive to both consumers and advertisers.

Users of OTT services are more receptive to advertising than TV viewers, and these platforms allow advertisers to target specific demographic groups or types of consumers who show greater interest in their products or services more precisely (Statista).

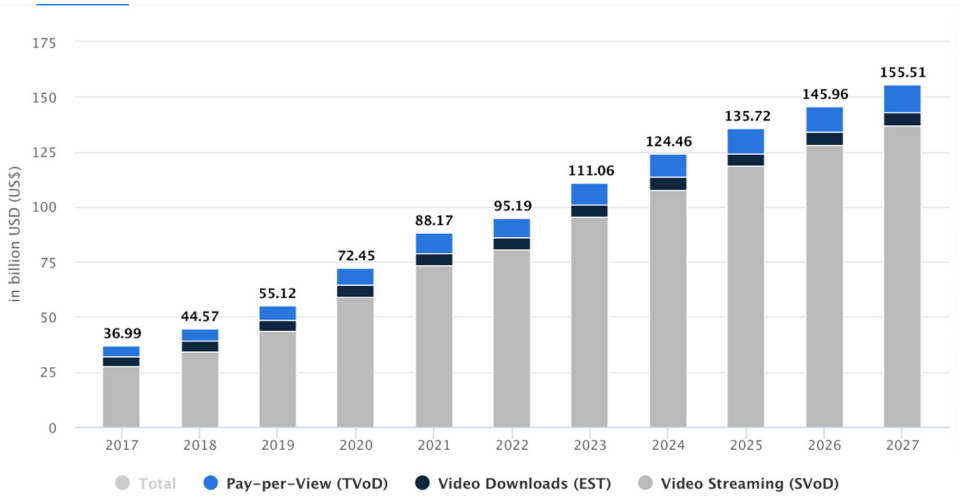

Fig. 3 Video on Demand - Worldwide. Source: https://www.statista.com/outlook/dmo/digital-media/video-on-demand/worldwide accessed on March 24, 2023

The Video-on-Demand (VoD) market is forecast to reach an impressive US$111.10 billion in 2023, with an annual growth rate of 8.77% over the period 2023 to 2027. This translates into a projected market size of US$155.50 billion by 2027. It is worth noting that the dominant segment of this market will be Video Streaming (SVoD), its market value will reach an impressive level of USD 95.35 billion in 2023. The largest share in this segment will be in the United States, where the value of the VoD market in 2023 will be US$ 43.39 billion.

Moreover, the number of Video-on-Demand users is expected to grow to 1.92 billion by 2027, with a user penetration of 21.0% in 2023 and is expected to reach 24.2% by 2027 (Statista).

It is also worth noting that this market is dominated by major players, including Netflix, Amazon Prime Video, Hulu, Disney+, HBO Max and Apple TV+. All of these platforms offer a variety of video content to their users and use business models based on subscriptions or fees for specific video content.

The name of the VOD service	Popularity 2022	Monthly subscription price	Library type	Ownership of materials
Netflix	70%	$15.15	Series, movies, documentaries	own and licensed
HBOmax	9.91%	$12.49	Series and movies	own
HULU	3,86%	$9.99	Series and movies	licensed from the DC Universe, Marvel, 21st Century Fox.
Amazon Prime video	19%	$14.99	Series and movies	own and licensed
Disney+	6,18%	$7.99	Series and movies	own
Paramount+	2,70%	$7.49	Series and movies	owned and licensed including Marvel, MGM EPIX.
AppleTV+	2,70%	$4.99	Series and movies	own and licensed
Peacock	4,25%	$7.49	Series and movies	own and licensed

Table 1. The most popular websites in the US in 2022. Source: the authors' study

Netflix is currently the undisputed leader in the global VoD services market, attracting over 200 million subscribers. In Western Europe, most people use this website. In addition to Netflix, other popular VoD services include Hulu and Amazon Prime Video, which offer access to the latest episodes of TV shows, and Disney+, which specializes in films and series for the whole family.

Polish VoD market analysis

The Polish VoD market has been growing fast over the last decade. However, it is still a part of a more complex television landscape with linear TV still playing a dominant role. As can be seen in the table and the chart below, the position of pay TV in Poland is extremely stable. Nevertheless, there is a noticeable subtle decline in the popularity of pay TV in favor of paid VoD services, the interest of which is constantly growing, with one exception - AVoD services (Video on Demand containing advertising).

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Pay TV	9,00	8,96	8,97	9,02	9,05	9	8,94	8,92	8,9
Pay VoD	1,18	1,63	2,18	2,9	3,66	4,59	5,69	6,91	7,93
SVoD	0,78	1,06	1,36	1,79	2,36	3,05	3,93	5,06	6,03
AVoD	3,58	3,74	4,13	4,41	4,62	4,69	4,46	4,33	4,27

Table 2. Number of households (in millions) with access to pay TV and paid VoD services, including SVoD and AVoD services in Poland, 2014-2022 Source: the authors' study based on the report of the television and VoD market in Poland PMR 2022

Research conducted by Gemius/PBI allows us to determine the most popular VoD services on the Polish media market. The results are presented in Table 3.

Media channel	Properties
Netflix	Netflix.com, Netflix app
Disney+	Disneyplus.com, Disney+ app
Player.pl	Player.pl, player.pl app
HBO Max	Hbomax.com, HBO Max app
Prime Video	Primevideo.com, Amazon Prime Video app
Canal Plus	Canalplus.com, Canal Plus app
TVP	Vod.tvp.pl, TVP Stream app, TVP Go app
Polsat Box Go	Polsatboxgo.pl, Polsat Box Go app
WP	Wp.pl, WP Pilot app

Table 3. The most popular OTT/VOD services in Poland. Source: Medaipanel Gemius/PBI

In December 2022, Netflix, although not audited by Gemius/PBI, maintained its leading position as the most popular VoD service. The average time users spent viewing content on this site was 7 hours and 10 minutes. This is almost three times more than the results achieved by Disney+, which took the second place in the VoD services ranking. HBO Max took the third place, and Player took the fourth place. The TVP VOD took the fifth place.

No.	Media channel	Real Users	Market Share	ATS
1	NETFLIX (www+app)	12 904 434	43.47%	7h 13m 51s
2	DISNEY+ (www+app)	4 159 350	14.01%	3h 6m 52s

3	HBO MAX (www+app)	4 024 242	13.56%	2h 31m 31s
4	PLAYER (www+app)	3 766 500	12.69%	2h 26m 52s
5	TVP (www+app)	3 166 128	10.67%	3h 21m 28s
6	PRIME VIDEO (www+app)	2 626 182	8.85%	1h 17m 53s
7	CANAL PLUS (www+app)	2 510 514	8.46%	2h 39m 17s
8	cda.pl / Serwisy VOD and OTT	2 414 124	8.13%	46m 5s
9	WP.PL (www+app)	1 960 362	6.60%	1h 1m 14s
10	POLSAT BOX GO (www+app)	1 841 292	6.20%	1h 28m 24s

***ATS - the average time that real users spend on a given media channel (real users' total watching time divided by the number of these users)**

Table 4. Leading VoD services in January 2023. Source: the authors' study based on Medaipanel Gemius/PBI

Customers expect an application that works flawlessly, is responsive devices, can handle heavy network loads, and works well even with poor Internet connection. To meet these expectations, it is necessary to test the application in many aspects namely: playback launch speeds, the amount of time it takes to load the content, the ability of the buffer to cope with momentary internet disruptions, and the ability of the application to resume operation after a connection loss.

To understand the results of manual testing fully, it is also necessary to understand the technologies used in VoD applications thoroughly. In order to do this, technical tests were carried out on OTT-VoD platforms such as Netflix, WP Pilot, VoD.pl, TVP VOD, Player, HBO GO, IPLA and CANAL+. The study was conducted on the Polish market in December 2022 and January 2023. The study included a technological analysis of the platforms, enabling verification of their technical aspects.

Additional conclusions can be reached by comparing the dynamics of the number of users of VoD services and the average monthly time spent on content consumption on these services in a slightly longer time frame - from July 2021 to January 2023.

The charts presenting both dimensions can be found in Figure 4 and Figure 5 below.

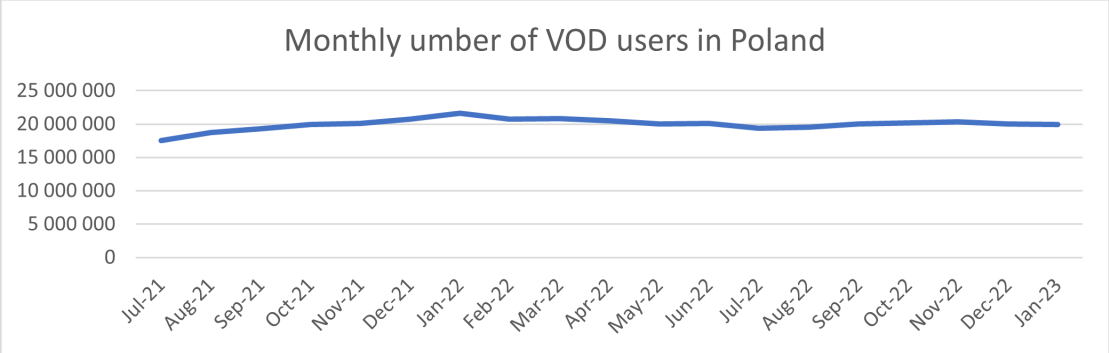

Fig. 4. Number of VoD users in Poland from July 2021 to January 2023. Source: the authors' study based on Medaipanel Gemius/PBI

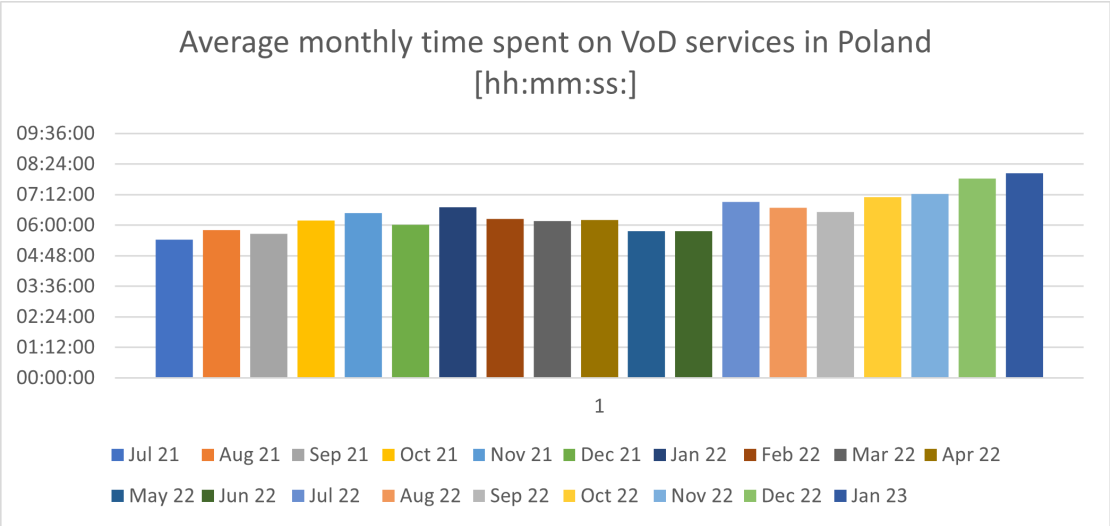

Fig. 5. Average monthly time spent on VoD services in Poland from July 2021 to January 2023. Source: the authors' study based on Mediapanel Gemius/PBI

The number of users did not change significantly in the analyzed period. Relatively intensive growth could be noticed only in the third quarter of 2021 and at the beginning of 2022, then the curve flattens out at the level of approximately 20 million. As for the average time spent on VoD services, it increases from July 2021 until January 2022, then decreases for several months and increases again from July 2022. This may result from a certain seasonality, greater propensity to watch video materials in the autumn and winter seasons and the greater intensity of premieres, however, comparing the corresponding periods in 2021 and 2022, an increase in the analyzed values is visible. Due to the limited scope of available data, it is difficult to draw clear conclusions, but it can be suspected that we are dealing with an upward trend when it comes to spending time on VoD services.

The relative stabilization of the number of users with the simultaneous increase in the average time spent on VoD services may be a sign of the maturing of the Polish market. It will be increasingly difficult for suppliers to rely on organic growth, as the number of potential new users has significantly decreased. Interestingly, the dynamics of the number of users represented by age group is more or less similar as all groups show similar upward trends at the beginning of the analyzed period and stabilize in its second half. Regardless of the month, the 35-49 age range is dominant, followed by 20-34. The details are presented in Figure 6.

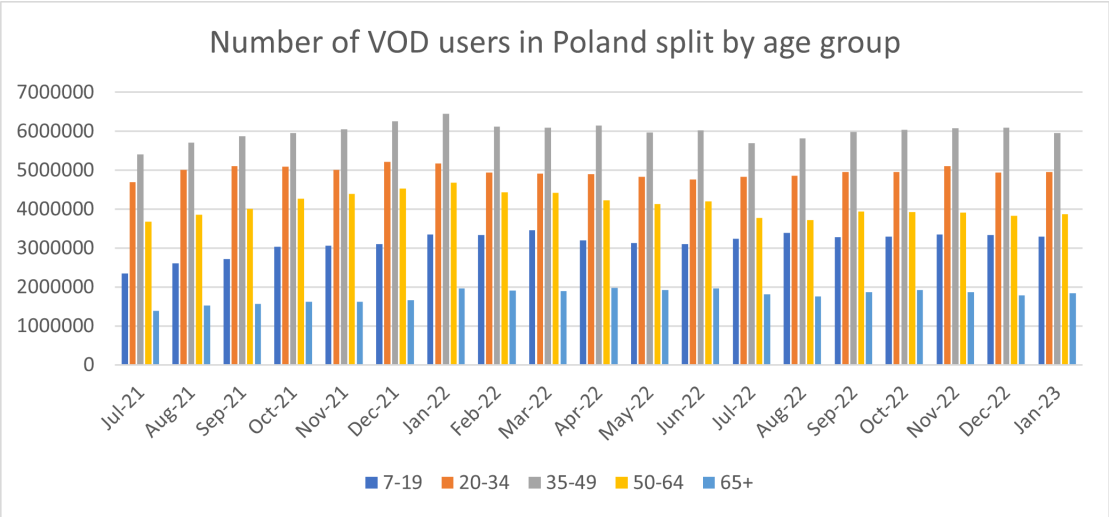

Fig. 6. Monthly number of VoD users in Poland by age from July 2021 to January 2023. Source: the authors' study based on Mediapanel Gemius/PBI

It seems that the efforts of providers should focus on extending the time spent on video content consumption, with a strong emphasis on building a competitive advantage through the uniqueness or size of the library. The attractiveness of Polish market can be implied by the investments of new (not yet operating) local platforms. SkyShowtime platform, which debuted in February 2023, shortly before the article had been written (Wirtualnemedia 2023b) serves as a good example.

Looking at the structure of the Polish VoD market through the prism of the dimensions proposed by A. Lotz, discussed in the first chapter, it should be noted that:

- Global platforms offering libraries of a general nature dominate – Netflix, HBO Max, Disney+, Prime Video, Canal Plus – their local competition with similar libraries are e.g. TVP, Player.pl, WP.pl and Polsat Go Box and cda.pl;
- They include both content licensing services (e.g. Netflix, HBO Max, cda.pl), with their own content (e.g. Disney+) and mixed content (e.g. Player.pl, TVP);
- Netflix and cda.pl are "pure" VoD platforms that operate exclusively in this sector; the others are either websites belonging to larger media companies (HBO Max, Canal Plus, Disney+, Player.pl, TVP, Polsat Go Box, WP.pl) or a branch of a company with its main activity not related to the media (Amazon Prime Video).

Therefore, Polish viewers are eager to watch diverse materials, both of local and foreign productions. The lack of even one specialist service among the top ten may be a bit shocking, but it should be remembered that some Polish providers also offer sports and news programs in packages - these are, for example, Player.pl and TVP. However, further research regarding the characteristics of the consumed content, requires additional study beyond the scope of this article.

At the end of this section, a technical analysis of the technologies used in the applications was carried out. Due to this, technological differences between suppliers that are large enough to affect their popularity, at least partially, can be verified. This analysis was performed in December 2022 and January 2023 and covered the following VoD platforms: Netflix, WP Pilot, vod.pl, TVP VOD, Player, HBO GO, IPLA and CANAL+. The comparison included technologies, frameworks, libraries and manifests of web and mobile applications. The tool used to analyze the technology of web applications was BuiltWith Technology Lookup (https://builtwith.com/), while mobile applications were downloaded from the Google Play store and decompiled to get a detailed picture of the technologies used to build them.

The details of the analysis are presented the Table 5 below.

Platform name	Description of content distribution technology
Netflix	Netflix used its own manifest implementation based on a JSON file, which was additionally extended by a list of available content distribution servers (CDNs) for video materials. This made it easy to switch between sources in the event of a failure of one of the sources. This also meant that Netflix had to adapt the players on each platform to interpret its own manifest implementation and handle these cases. The analysis of the manifest shows that it contains up to 9 video tracks, the smallest of which is adapted to connections with the lowest parameters, i.e. 100 kbps (320x240 resolution). Tests confirmed trouble-free playback of the material even at 80 kbps. The use of the CMAF standard seems to indicate the effectiveness of individual implementations. There are noticeable differences between the platforms. Android TV is largely based on "webview" and uses a modest number of libraries, while on the Android mobile platform the developers have largely used native technologies such as Kotlin and exoplayer. The code has been obfuscated, making it difficult to analyze.
HBO GO	The Smooth Streaming standard has been used by HBO GO to describe media delivery manifests. The lowest quality provided by the application was 482 kbps at 396x224 resolution. The VoD platform offered 8 levels of quality. The Android TV app, created using Apache Cordova, is only 7MB in size and uses Exoplayer version 2.0 for playback. On the other hand, the application for the Android mobile platform was created using native components, and the player created by the Korean company Inisoft is used for playback, instead of Google's exoplayer - which distinguishes it from other compared applications.
CANAL+	The application uses the Smooth Streaming standard to describe the delivered media. The quality of the delivered materials is 400Kbps with a resolution of 480x270, and 5 possible qualities are offered. Clean architecture and the Kotlin language were used to create the project, thanks to which the latest technologies and thoughtful programming practices were used. The code has been obfuscated, which is also an advantage of the application. The exoplayer 2.0 player library was used to support Android mobile and Android TV.
IPLA	IPLA uses the MPEG DASH standard to describe the delivered video media, using the CMAF extension. The platform for the tested material provides 4 different qualities, of which the lowest possible offers 128 kbps at a resolution of 384x216. It is the second platform to use the CMAF standard after Netflix. The developers used Java to a large extent in the development of the application, the code also mentions the use of Kotlin, but the obfuscation of the code does not allow for easy analysis. The player used in the application is the exoplayer library in version 2.0. Application developers maintain both platforms within one application: Android TV and Android mobile, which is a definite advantage.
TVP VOD	Video material provided by CDN servers is standardly described by HLS, and the VoD application offers 7 possible qualities for the tested video material, starting with a resolution of 400x224 and a bit rate of 528 kbps. The language used to create the application was Kotlin, however, the code is obfuscated, so it is difficult to make a more detailed analysis. Exoplayer version 2.0 was used to play the video, on Android TV and mobile platforms. With a limited connection, the application had problems with video playback, because the adaptation to the connection parameters did not work properly. Each time the player was restarted in poor quality, the application tried to load the material in a higher quality, which resulted in video pauses, which was not acceptable to the user.

VOD.PL	MPEG DASH is the standard that defines the content delivered for applications. The lowest quality level provided by the platform is 295 kbps at a resolution of 284x160, and the number of video quality levels available for testing was 7. Java is still used for application development, but in the future, it is worth considering a gradual migration to Kotlin, recommended by Google. As part of unifying the code in the application, the developers used it both on the Android TV platform and on mobile devices. Unfortunately, during the video playback, above-average CPU and memory usage was noticed, which may be the reason for the rapid consumption of power, which in turn negatively affects the overall reception of the application.
Player	The MPEG DASH standard was used to describe the delivered video media in the tested sample manifest. The VoD platform offered 7 possible video qualities, the weakest of which allowed a bit rate of 240 kbps and a resolution of 320x240. During the analysis, it was shown that the application is characterized by low CPU and memory consumption, which may result in lower energy consumption. However, there are also disadvantages such as delays when switching to the previous screen. Moreover, there are two versions of exoplayer: 1.5 and 2.0, it is also the only platform that still maintains them. The application is available for both the Android TV and mobile platforms, even if they are very similar. The programming languages used to create it are Java and Kotlin, but the developers did not obfuscate the code.
WP Pilot	WP Pilot uses the MPEG-DASH standard format, with which it offers 4 possible video qualities for the tested video material, starting with the lowest quality, which offers 150 kbps at a resolution of 262x144. To enable the application to work on different platforms, the developers used the Kotlin language and the "viper" architecture. The video is played using the exoplayer player library version 2.0.

Table 5. Technical analysis of selected applications on the Polish market. Source: the authors' study

Legend:

JSON - data exchange format

CDN - Content Delivery Network - a server or network of servers distributing content

Video content signal with audio

CMAF – Common Media Application Format for Segmented Media is an extensible standard for encoding and packaging segmented media objects for delivery and decoding on end-user devices.

Kotlin is a cross-platform, statically typed programming language

Apache Cordova is a mobile application development platform

Clean Architecture is an approach to application programming that assumes the separation of four main functional VoD modules in the project.

A standard for streaming video materials that allows you to adapt the displayed media to the capabilities of the player and connection, as well as the user's needs.

HTTP Live Streaming is an HTTP-based, adaptive bitrate communication protocol.

The technological analysis conducted on VoD as part of this project included a review of technologies, frameworks, libraries and manifests of web and mobile applications. The tool used to analyze the technology of web applications was BuiltWith Technology Lookup (https://builtwith.com/), and the mobile applications were downloaded from the Google Play store and decompiled to obtain a detailed picture of the technologies used to build them.

The VoD market in Poland is dynamic and developing at a fast pace. VoD is becoming more and more popular in Poland, as users value the convenience of watching their favorite video content, films and series anytime and anywhere, which favors the development of VoD platforms. The leading players on the Polish VoD market are platforms such as Netflix, HBO GO, IPLA, VOD.PL, Player, WP Pilot and TVP VOD. Each of these platforms offers a variety of content and subscription models.

The technical analysis shows that the leading VoD platforms differ significantly in the level of advancement of their technological infrastructure, which translates into the comfort of playing video content. The fact that Netflix is the best in this respect and is also the market leader seems to be a reason to hypothesize that this aspect of suppliers' operations may also have an impact on the potential success of a given supplier. VoD platforms in Poland use various content distribution technologies, such as MPEG DASH, Smooth Streaming, CMAF and others. The choice of technology may affect the quality of available video content. Personalization of content and high quality of materials are key factors that attract users. Offering multiple levels of video quality and tailoring content to viewer preferences are important strategies for VoD platforms.

Summary

The VoD market in Poland is developing dynamically, and competition between platforms leads to constant improvement of services. Users can enjoy access to a variety of video content and choose from a variety of subscription options, which is supporting the growth of this market.

Popularity of specific VoD platforms in Poland is the result of multiple factors. First of all, the variety of available video content plays an important role. Users expect access to a wide range of content, including films, series, television programs, as well as original productions. Video and sound quality, availability of subtitles and dubbing also influence user preferences. Additionally, personalization and recommendations tailored to the viewer's tastes are increasingly important. User preferences vary, which means that VoD platforms try to provide personalized content tailored to individual preferences. The price of subscriptions and the availability of promotional offers also have a significant impact on the popularity of VoD platforms.

Technological analysis and analysis of existing data suggest that content distribution technology is a key element of competition between VoD platforms in Poland. Platforms must adapt their applications and infrastructure to ensure smooth and high-quality video playback. The standards used, such as MPEG-DASH, CMAF or Smooth Streaming, affect the quality of the delivered video materials and the ability to adapt to the changing parameters of the user's Internet connection. Differences in the technologies used may affect the efficiency of content delivery and the user experience.

The challenges and opportunities for the development of the VoD market in Poland are related to the evolution of the way media content is consumed. More and more people use VOD services on various mobile devices, which requires adapting the platforms to different screen sizes and connection parameters. At the same time, content providers must pay attention to aspects related to copyright and content licensing. As internet access becomes more widespread in rural areas, there is potential for the VoD market to expand there. However, the challenge is to adapt offers to different demographic groups and cultural preferences. Building user trust is also crucial for the VoD market in Poland, especially in the context of personal data protection and the security of online transactions.

Changes in consumer behavior and the development of technology have led to the emergence of a new form of VoD video content consumption in the form of VoD platforms. More and more people choose digital video content providers that offer the ability to access live and on-demand programs on any device, anytime and anywhere.

The use of the VoD model in hybrid offers is clearly visible among Polish operators and television broadcasters. However, competition from global suppliers is very strong, and global platforms offering subject libraries occupy a dominant position in the local market. This increases the pressure to constantly improve the quality of material reproduction and the attractiveness of the library.

The plethora of the Polish market includes both standalone VoD services and those belonging to media industry tycoons. There is both licensed content and content produced for VoD – both local and international. The dynamics of this market indicate slow maturation. The number of users of VoD services has recently stabilized, but the time they spend watching video content is constantly growing. This means that companies can no longer benefit from the wave of organic growth typical to technological innovations, but must focus on acquiring viewers from competitors and attracting their attention for longer by appropriately shaping the programming offer.

The VoD market in Poland is competitive, and platforms compete with each other for users' attention. This leads to continuous improvement of services and offering attractive subscription prices. VoD is impacting traditional television and changing the way consumers consume media content. It also offers the opportunity to access international content in the original language versions.

However, the challenges related to the quality of Internet access, both in cities and rural areas should be addressed too. Providers of the services must ensure smooth content streaming even in difficult network conditions.

Finally, the directions for further possible VoD scientific research in the VoD area should be mentioned. It seems that a particularly important topic of VoD as the market matures is a better understanding of viewers' preferences and the scale of meeting their VoD needs in the current balance of power. This would allow for a better understanding not only of the perspective of VoD service users, but also of suppliers, because a natural effect of in-depth VoD research in this area would be the identification of the factors most important for the attractiveness of VoD services.

The use of OTT services will continue to increase VoD in the television industry. Transmitting video content is moving VoD towards mobile devices and streaming. Transforming television does not mean eliminating live broadcasts. Broadcasting VoD video in real time is essential because it provides viewers with completely unparalleled engagement. When this type of communication is supplemented with social media, real-time VoD interaction and advanced data, the Internet becomes an excellent platform for many industries, including VoD for sports. As technology develops and viewers' perceptions change, the relationship between sports and OTT will become stronger.

The analysis of reports and existing data indicates that the popularity of VoD services will continue to grow. There will be a growing pressure on providers in terms of content quality, the wide range of available options and the speed and technical quality of the application. To meet these demands, VoD platforms will need to invest in VoD global and local content and advanced technologies such as lossless systems, multi-CDN, and hybrid content distribution solutions.

References

AVCAESAR. (2023). *SVOD market: Two years of decline for Netflix.* Retrieved from https://www.avcaesar.com/news/3543/svod-market-two-years-of-decline-for-netflix (Accessed: 04/05/2023).

FILICIAK, M. (2013). *Media, wersja beta. Film i telewizja w czasach gier komputerowych i internetu.* Wydawnictwo Naukowe Katedra.

GRECE, CH. (2021). *Trends in the VOD market in EU28.* European Audiovisual Observatory.

GUDSHO. *Difference between VOD and OTT platforms.* Retrieved from https://www.gudsho.com/blog/difference-between-vod-and-ott-platforms/ (Accessed: 11/05/23).

INTERAKTYWNIE. (2022). *Ranking serwisów streamingowych i VOD w Polsce. Zwycięzcy nie zaskakują.* Retrieved from https://interaktywnie.com/biznes/newsy/biznes/ranking-serwisow-streamingowych-i-vod-w-polsce-zwyciezcy-nie-zaskakuja-261876 (Accessed: 28/05/2023).

JAKUBOWICZ, K. (2011). *Nowa ekologia mediów. Konwergencja a metamorfoza.* Poltext.

KHAN, M.L. (2017). Social media engagement: What motivates user participation and consumption on YouTube? *Computers in Human Behavior, 66*, 236-247.

KRRIT. (2021). *Europejski i krajowy rynek audiowizualnych usług medialnych na żądanie (VoD).* Krajowa Rada Radiofonii i Telewizji.

LEA, W. (1994). *Video on Demand. Research Paper 94/68, House of Commons Library.* Retrieved from https://researchbriefings.files.parliament.uk/documents/RP94-68/RP94-68.pdf (Accessed: 11/05/2023).

LOTZ, A. (2011). Zrozumieć telewizję u progu ery postsieci (postnetwork era). In T. Bielak, M. Filiciak, & G. Ptaszek (Eds.), *Zmierzch telewizji? Przemiany medium. Antologia.* Scholar.

LOTZ, A. (2022). *Netflix and Streaming Video: The Business of Subscriber-Funded Video on Demand.* Polity Press.

MARKETS AND MARKETS. (2023). *Audio Video on Demand (AVOD) market.* Retrieved from https://www.marketsandmarkets.com/Market-Reports/audio-video-on-demand-avod-market-1046.html (Accessed: 23/04/2023).

MEDIAPANEL. (2023). *SkyShowtime vs Disney+ - analiza porównawcza.* Retrieved from https://media-panel.pl/pl/aktualnosci/skyshowtime-vs-disney-analiza-porownawcza/ (Accessed: 04/05/2023).

MORDOR INTELLIGENCE. (2023). *Video on Demand Market.* Retrieved from https://www.mordorintelligence.com/industry-reports/video-on-demand-market (Accessed: 14/05/2023).

NOWAK, P. (2019). *Television of the 90s vs. Television of the 21st century. Dynamics of Changes in the Media,* Institute of Journalism, Media and Social Communication of the Jagiellonian University.

SCOLAR, C.A. (2009). The Grammar of Hypertelevision: An Identikit of Convergence-Age Fiction Television (Or, How Televison Simulates New Interactive Media). *Journal of Visual Literacy, 28*(1), p. 28-49.

STATISTA. (2023). *Video-on-Demand worldwide.* Retrieved from https://www.statista.com/outlook/dmo/digital-media/video-on-demand/worldwide (Accessed: 24/05/2023).

SZKUDLAREK-ŚMIECHOWICZ, E. (2022). *Telewizja: polityka i rozrywka. O współczesnych dyskursach telewizyjnych.* Wydawnictwo Uniwersytetu Łódzkiego, Łódź.

WIRTUALNEMEDIA (2023a). *OTT: oferta, ceny, przychody.* Retrieved from https://www.wirtualnemedia.pl/artykul/ott-oferta-ceny-przychody (Accessed: 11/02/23).

WIRTUALNEMEDIA (2023b). *Jak odbierać SkyShowtime: promocja, ceny, oferta.* Retrieved from https://www.wirtualnemedia.pl/artykul/jak-odbierac-skyshowtime-promocja-ceny-oferta-jak-ogladac-jak-pobrac-aplikacje (Accessed: 25/05/2023).

WOLSKA ZOGATA, I. (2022). Zróbmy sobie telewizję. Komercjalizacja polskiego YouTube'a, *Media i Społeczeństwo 16*, 193-210.