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STREAMING AHEAD: TECHNOLOGICAL INNOVATIONS REDEFINING NEW PRODUCT DEVELOPMENT IN THE ENTERTAINMENT INDUSTRY

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Received 15 November 2023; accepted 18 February 2024; published 30 March 2024

Abstract. This article delves into the dynamic intersection of technology and innovation within the streaming industry, offering a comprehensive analysis of the evolving landscape of content creation, delivery, and consumption. By scrutinizing the integration of cutting-edge technologies such as artificial intelligence, augmented and virtual reality, and blockchain, the article elucidates how these innovations are revolutionizing the viewer experience. Additionally, exploring emerging trends, including metaverse integration and the increasing demand for live and interactive content, provides critical insights for industry practitioners. As the industry grapples with content overload and the intricacies of revenue models, this article propounds strategic considerations for navigating the evolving streaming landscape. Ultimately, this comprehensive examination illuminates the future trajectory of the streaming industry and underscores the imperative for innovative adaptation.

Keywords: streaming technology; innovation; content personalization; metaverse integration; monetization models

Reference to this paper should be made as follows: Iliescu, D., Ioanid, A. 2023. Streaming ahead: technological innovations redefining new product development in the entertainment industry. *Entrepreneurship and Sustainability Issues*, 11(3), 227-237. [http://doi.org/10.9770/jesi.2024.11.3\(15\)](http://doi.org/10.9770/jesi.2024.11.3(15))

JEL Classifications: M10, O30, M21

Additional discipline: information and communication

1. Introduction

The contemporary landscape of the entertainment industry is in the throes of a profound metamorphosis, propelled by the inexorable convergence of technological prowess and an insatiable consumer appetite for on-demand content developed in recent years (Lambrinos & Demetriou, 2010; Bampis & Bovik, 2018; Sliwa et al., 2021). Central to this paradigm shift is the ascendant dominion of streaming platforms, which have swiftly ascended to the vanguard of content consumption preferences and are leading the entertainment industry (Nguyen et al., 2023). Within this dynamic milieu, the perspective of transformation resides in the rapid evolution of streaming technologies, fundamentally redefining the contours of new product development strategies within the entertainment sector.

The present article thoroughly explores the intricate interplay between technological innovation and the genesis of novel products and services within the streaming industry. As the digital realm extends its pervasive influence, the previous boundaries delineating content dissemination are becoming a subject of history. In their stead, an array of state-of-the-art technologies are heralding an era marked by unparalleled ingenuity,

accessibility, and customization, while the expectations are that the growth projections are even more accentuated (da Silva & Lima, 2022; Tugui et al., 2022).

In seeking to explore this phenomenon, we endeavour to address pivotal ideas about the nature of these technological advancements and their impacts across the strategic landscape of industry stakeholders. What configurations do emergent technologies assume in shaping the expanse of content provisioning, and what ramifications do they portend for the trajectory of new offerings? What sagacity can be gathered from exemplary case studies wherein innovation has propelled streaming platforms to pinnacles of audience engagement (McKenzie et al., 2022; Shon et al., 2021)?

To address these epistemological imperatives, we comprehensively analyse the latest trends in streaming technology. Through a synthesis of knowledge encapsulated in academic treatises, industry dossiers, and exemplar manifestations, we elucidate the transformative potential encapsulated within these technological forays. The streaming technology has been extended on a global scale, with immersive experiences woven by augmented reality and prescient algorithms orchestrating content delivery, the arsenal at the disposal of content creators and disseminators standing as an assemblage of unprecedented diversity and potency (Awa et al., 2013, Wilbert, 2019).

Furthermore, as we navigate this digital frontier, the necessity to apprehend the stratagems imperative to this technological renaissance becomes manifest. How many enterprises efficaciously harness these innovations to not only sustain relevance but also to assume a pole position in steering the course of future entertainment paradigms? This article purports to proffer vital insights and prescriptive counsel for industry practitioners, constituting a compass for navigating this rapidly changing environment and implementing innovative solutions to the market needs (Greenwald, 2014).

In so doing, we underscore the importance of comprehending and leveraging the symbiotic interplay between technology and content creation. By foretelling this synergy, we forge a trajectory toward not merely adaptability, but mastery of the multifaceted landscape wherein the destiny of entertainment is irrevocably inscribed.

2. Literature Review

The contemporary entertainment landscape has undergone a radical transformation, primarily catalyzed by the development of streaming platforms as the dominant medium for content consumption and as the top preference for entertainment (Frade et al., 2021; Wilbert, 2019). In this dynamic milieu, the nexus of innovation, technology, and the development of new products assumes essential significance.

The evolution of technology has indelibly intertwined with shifts in content delivery mechanisms. The high-speed internet and the proliferation of mobile devices have catapulted streaming platforms to the forefront, fundamentally altering the dynamics of content accessibility (Farhand & Tsechpenakis, 2023; Wilbert, 2019). This paradigmatic shift, characterized by democratized access and changed consumer expectations, has dismantled erstwhile barriers to entry, contributing to the expansion of the industry (Darwich et al., 2020; Maia et al., 2015).

The fusion of diverse technological domains has engendered a proliferation of immersive experiences within the streaming ecosystem. In particular, augmented and virtual reality (AR/VR) technologies have emerged as transformative tools, enabling unprecedented levels of viewer engagement (Tingley et al., 2022; Jeon et al., 2020). Simultaneously, the integration of artificial intelligence (AI) and machine learning algorithms has ushered in an era of hyper-personalization, wherein content recommendations are tailored with precision to individual preferences (Mariani et al., 2023; Bahoo et al., 2023; Suárez-Cetrulo et al., 2023).

At the heart of contemporary streaming services lie sophisticated recommendation algorithms underpinned by machine learning and data analytics. These systems play a pivotal role in enhancing user satisfaction and retention, facilitating the promotion of content catalogues that resonate with individual tastes, thereby

augmenting user engagement and allowing users to create their preference lists (Shahraki et al., 2022; Aguiar et al., 2021).

Moreover, the evolution of monetization strategies within the streaming industry has been spurred by technological innovation. Subscription models, advertising-supported platforms, and hybrid approaches have proliferated, reflecting a nuanced response to market dynamics and constantly changing consumer preferences (Wu & Chiu, 2023; Haslam & Forster, 2022). This diversification of models has engendered a complex ecosystem, necessitating astute strategic insight from industry stakeholders.

However, the proliferation of technological innovations is accompanied by challenges and ethical considerations. Issues about data privacy, content moderation, and the ethical deployment of AI algorithms have garnered increasing scrutiny (Mariani et al., 2023; Bahoo et al., 2023). Navigating these ethical quandaries presents a formidable imperative for industry practitioners.

In synthesizing extant literature, it becomes evident that the nexus of innovation, technology, and new product development stands as the pivot upon which the future trajectory of the streaming industry develops. The advent of a digital frontier ushers forth an era not merely of adaptability but of mastery, wherein the destiny of entertainment is irrevocably inscribed.

The streaming area of the entertainment industry is an innovative way of transforming an existing industry. Due to the novelty of the domain, scientific literature finds itself in an initial stage, where the consistency of dedicated materials like articles, conferences or publications is not quite extensive. The industry has recently attracted the interest of business and technology professionals, investors, and academics. Moreover, another gap noticed is that the existent literature is mainly centred on the historical results obtained by the companies within the industry and on the state of the art of the technology; the present article aims to focus on the perspectives for the future and in which direction it will continue to develop.

3. Methodology

The paper aims to delve into the dynamic interplay of technological innovation and new product development within the streaming industry by contouring the perspective of scientific advancements. The main questions to be answered are related to the state-of-the-art technological developments, the innovations that are transforming the industry, and the implications for professionals and industry practitioners, with a focus on the importance of technological evolution and future tendencies.

This study employs a comprehensive mixed-methods approach, combining qualitative and quantitative methodologies to delve into the dynamic interplay of technological innovation and new product development within the streaming industry.

To garner deep-seated insights into the strategies and technologies underpinning new product development, a select group of prominent streaming platforms was purposively chosen for in-depth case study analysis. The criteria for selection encompassed market influence, innovative adoption, and content diversity. In tandem, an extensive archival analysis of company documents, press releases, and user feedback was undertaken to enrich and cross-verify the qualitative findings.

While this study endeavours to provide a comprehensive analysis, it is not devoid of potential limitations. Its focus primarily on English-language streaming platforms may need to be revised to capture the entire expanse of global innovations within the industry. Additionally, findings may be contingent on the specifics of the consumer habits and preferences, circumscribing their universal applicability within the broader streaming landscape.

4. Technological Innovations Shaping the Streaming Industry

The landscape of the streaming industry has been dynamically moulded by a continuous influx of technological innovations, revolutionizing content delivery and consumption paradigms. These advancements redefine the mode of entertainment dissemination and transmute the essence of modern entertainment itself (Blichfeldt & Faullant, 2021) while investments in technology offer a high return to their stakeholders (Brown et al., 2008).

Augmented Reality (AR) and Virtual Reality (VR) technologies exemplify this transformative wave. AR superimposes digital elements onto the physical world, while VR plunges users into entirely virtual environments. Within the realm of streaming, this translates into epochal experiences where users interact with content in unprecedented fashions. Noteworthy applications include AR-enhanced live sports broadcasts, furnishing real-time statistics and overlays, and VR-driven immersive storytelling experiences that immerse viewers within the narrative world (Felice et al., 2023; Liu & Wang, 2017).

Artificial Intelligence (AI) and Machine Learning (ML) have emerged as pivotal constituents of content recommendation systems. These technologies scrutinize user behaviour, preferences, and viewing history to furnish personalized content suggestions. The ramifications are profound, as viewers are presented with a curated selection aligned with their unique preferences, culminating in heightened engagement and satisfaction. Moreover, AI-driven algorithms optimize video quality and streaming efficiency, ensuring an uninterrupted viewing experience, even under fluctuating network conditions (Liang, 2023; Sutandijoa & Qomariyah, 2023; Shahraki et al., 2022).

The advent of 5G technology marks a monumental step forward in streaming capabilities. Endowed with ultra-high-speed data transmission, reduced latency, and augmented capacity, 5G unleashes many possibilities. Live streaming, for instance, achieves unparalleled interactivity and quality, while the potential for augmented reality experiences undergoes exponential expansion. This shift portends limiting the demarcations between physical and digital domains, announcing a new epoch of immersive entertainment (Fan, 2023; Taleb et al., 2023).

Blockchain technology surfaces as another disruptive force permeating the streaming industry. By furnishing transparent, decentralized ledger systems, blockchain holds the potential to revolutionize content distribution and copyright management. Smart contracts, underpinned by blockchain, might empower content creators to monetize their work directly, increasing flexibility and circumventing traditional intermediaries (Tapscott & Tapscott, 2018).

Additionally, voice and natural language processing loom large on the horizon, poised to redefine the user interface for streaming platforms. Voice-activated controls, synergistically integrated with AI, present an intuitive and seamless means for users to navigate content libraries and explore offerings (Sarmiento-Calisaya & Leite, 2024; Aydogmus et al., 2023).

In summation, the streaming industry stands on the cusp of a technological renaissance, where innovations in AR, VR, AI, 5G, blockchain, and voice technology are redefining the contours of entertainment consumption and interaction.

5. Case Studies

To gain deeper insights into the integration of technological innovations in new product development within the streaming industry, a selection of prominent leading platforms was chosen for detailed case studies. Each platform represents a unique approach to leveraging technology to enhance user experience and expand its content offerings.

Netflix: AI-Driven Content Recommendations

Netflix, a global leader in the streaming industry, has attached the power of artificial intelligence (AI) to revolutionize the way viewers discover and engage with content. Through a sophisticated machine learning algorithm, Netflix analyzes an extensive array of data points including viewing history, genre preferences, time of day, and user ratings (Netflix, 2023). This data-driven approach enables the platform to deliver highly personalized content recommendations tailored to each subscriber. The algorithm refines its suggestions, continuously adapting to changing viewing habits and preferences.

The core of Netflix's recommendation system lies in its collaborative filtering approach, which compares a user's behaviour and preferences with those of other viewers (Netflix, 2023). By identifying users with similar viewing patterns, the algorithm can recommend titles that align with the individual's taste. Additionally, Netflix incorporates content-based filtering, which analyzes the attributes of shows and movies (such as genre, cast, and director) to make suggestions based on thematic similarities (Fig. 1).

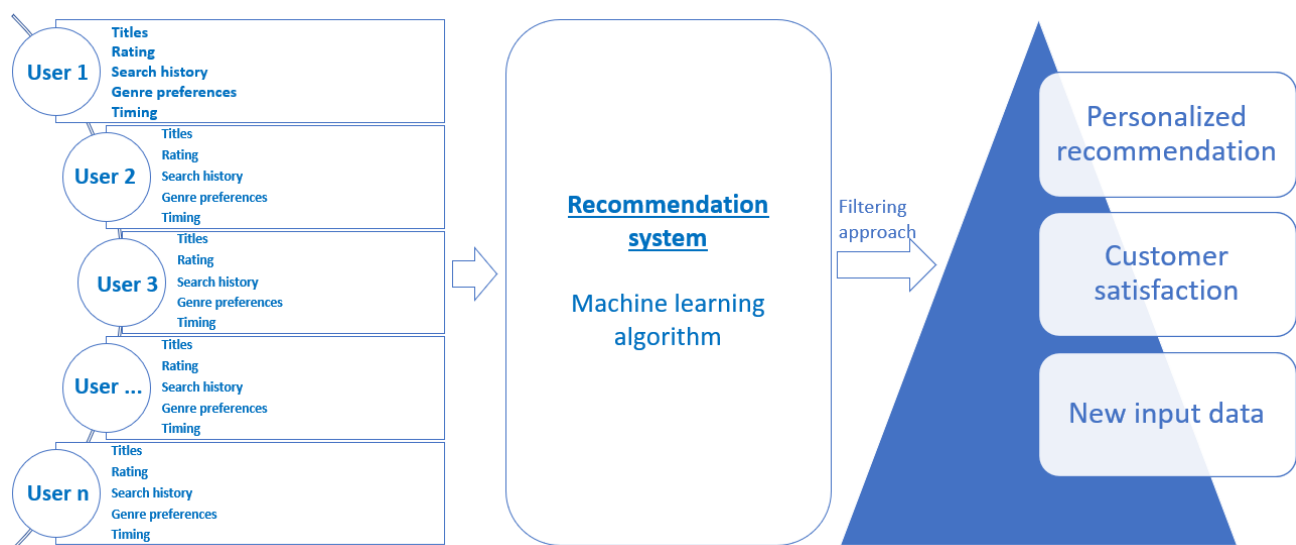


Fig. 1. User recommendations system

This AI-driven recommendation system has proven to be a pivotal factor in user engagement and satisfaction. Studies have shown that a significant portion of content consumed on Netflix results from these personalized recommendations. By tailoring content suggestions to each subscriber, Netflix enhances user experience and contributes to increased engagement (Netflix, 2023). Moreover, this data-driven approach has contributed to Netflix's status as a trendsetter in the industry, setting the standard for how streaming platforms curate and deliver content to their audiences.

In essence, Netflix's AI-driven content recommendation system exemplifies the power of data analytics and machine learning in shaping the future of entertainment consumption. By understanding the unique preferences of each subscriber, Netflix creates a more immersive and satisfying viewing experience, solidifying its position as a frontrunner in the global streaming landscape.

ESPN+: Augmented Reality Integration

ESPN+, a leading sports-centric streaming platform, has distinguished itself by seamlessly integrating augmented reality (AR) technology into its service. A dedicated mobile application gives users access to an enriched sports-watching experience (ESPN, 2023). During live sports events, ESPN+ overlays real-time statistics, player profiles, and interactive elements directly onto the screen. This integration of AR technology transcends traditional sports broadcasts, providing viewers with a wealth of additional information and interactivity.

The AR integration on ESPN+ enhances the viewing experience and redefines how sports enthusiasts engage with live events. Viewers gain a deeper understanding of the game, player performance, and crucial moments by overlaying statistics and additional insights. This technology caters to avid sports fans and acts as an educational tool, offering a more immersive and informative experience for both casual viewers and dedicated sports enthusiasts.

Furthermore, the integration of AR on ESPN+ sets a new standard for sports streaming platforms, demonstrating the potential for technology to augment how audiences engage with live events (ESPN, 2023). ESPN+ has created a more dynamic and interactive sports-watching experience by providing real-time, contextually relevant information.

In conclusion, ESPN+'s integration of augmented reality technology exemplifies the platform's commitment to providing innovative and immersive sports content. By leveraging AR, ESPN+ enhances viewer engagement, providing a more interactive and informative experience for sports enthusiasts across the globe.

Oculus TV: Virtual Reality Storytelling

Oculus TV, a leading platform specializing in virtual reality (VR) content, has redefined storytelling by immersing subscribers in fully realized virtual worlds. Leveraging VR headsets, users are transported into narrative experiences that transcend conventional viewing (Verhulst, 2021). This groundbreaking approach revolutionizes the way stories are consumed, offering an unparalleled level of immersion and interactivity. Through Oculus TV, subscribers can actively participate in the narrative, influencing the story's direction and creating a profoundly personalized viewing experience.

The innovative VR technology employed by Oculus TV allows for a level of immersion that was previously unimaginable in traditional media formats. Subscribers are not merely passive observers but active participants in the storytelling process. By providing users with agency within the virtual environment, Oculus TV blurs the boundaries between fiction and reality, offering an entirely new form of entertainment (Oculus, 2023). This transformative approach can potentially reshape the future of narrative content, heralding a new era of interactive storytelling.

Oculus TV's pioneering foray into VR-enhanced storytelling has garnered attention not only for its technical prowess but also for its potential to revolutionize the entertainment industry. By offering subscribers the opportunity to step into the narrative, Oculus TV has created a unique and immersive form of entertainment that pushes the boundaries of conventional storytelling (Oculus, 2023). As VR technology advances, Oculus TV stands at the forefront, paving the way for a new generation of interactive and personalized content experiences.

Audius: Blockchain-Powered Content Monetization

Audius, an innovative player in the streaming industry, has harnessed the potential of blockchain technology to revolutionize content distribution and monetization. By integrating smart contracts, Audius empowers content creators to monetize their work directly, sidestepping traditional intermediaries. This transformative approach ensures fair compensation for creators and establishes a transparent and secure ecosystem (Chalmers et al., 2021).

The utilization of blockchain in Audius' platform has far-reaching implications for content creators and the streaming industry as a whole. Audius empowers a new generation of creators to retain greater control over their content and earnings by providing a direct channel for artists to monetise their work. The transparency and security afforded by blockchain technology engender trust between creators and consumers, creating a more equitable and artist-centric streaming platform.

Audius' foray into blockchain-powered content monetization marks a significant advancement in the streaming industry. By embracing the decentralized nature of blockchain, Audius is at the forefront of reshaping how content is distributed and creators are compensated. This innovative approach not only disrupts existing models but also holds the potential to create a more sustainable and inclusive ecosystem for artists and content consumers alike.

Amazon Alexa-Natural Language Processing Interface

Amazon Alexa, a pioneering voice-activated virtual assistant, has revolutionized human-computer interaction by seamlessly integrating natural language processing (NLP) into its interface. This innovation marks a watershed moment in the evolution of user-friendly technology interfaces. By enabling users to interact with devices and content using voice commands, Amazon Alexa has transcended traditional modes of interaction (Amazon, 2023). Incorporating advanced NLP algorithms empowers Alexa to recognize and interpret user commands and comprehend context, tone, and intent, creating a deeply immersive and intuitive experience.

One of the transformative aspects of Amazon Alexa's NLP interface lies in its ability to understand and respond to natural language commands in real time. Users can engage with their devices conversationally, making the interaction more organic and dynamic. This shift towards natural language interaction has profound implications for accessibility, making technology more inclusive for individuals with limited experience with traditional interfaces. This inclusivity extends to individuals with disabilities, as voice-activated commands can be a game-changer for those with mobility challenges.

Furthermore, integrating NLP into Amazon Alexa has unlocked a new realm of possibilities for automation and personalization. Users can issue complex commands, ask questions, and even engage in multi-step interactions, creating a highly customized experience. The system's ability to learn and adapt to individual preferences and behaviours enhances the user experience, creating a more symbiotic relationship between humans and technology (Amazon, 2023). This personalisation level is convenient and sets the stage for a future where technology seamlessly integrates into our daily lives.

In addition to enhancing accessibility and personalization, the NLP interface in Amazon Alexa has implications for the broader ecosystem of smart homes and Internet of Things (IoT) devices. As more devices become interconnected, the ability to control and interact with them using natural language commands becomes increasingly valuable. This integration facilitates a more cohesive and connected living environment, where devices work in concert to anticipate and fulfil the needs and desires of users (Amazon, 2023). This seamless integration of technology into our living spaces represents a glimpse into the future of smart homes.

In conclusion, Amazon Alexa's NLP interface is a testament to the transformative potential of natural language processing in human-computer interaction. By enabling users to interact with technology conversationally and intuitively, Amazon Alexa has ushered in a new era of accessibility, personalization, and interconnectedness. This innovation augments the user experience and sets the stage for a future where technology seamlessly integrates into every facet of our lives.

6. Implications for Industry Practitioners

Integrating cutting-edge technologies in streaming platforms has far-reaching implications for industry practitioners across various domains. Here, we delineate vital insights and actionable takeaways for professionals in the streaming industry.

Professionals involved in content curation and recommendation systems should closely monitor AI and machine learning advancements. These technologies are instrumental in understanding viewer preferences and behaviour, ultimately leading to more accurate and personalized content recommendations. Embracing AI-driven algorithms can significantly enhance user engagement and satisfaction.

For those responsible for user experience (UX) and interaction design, prioritizing the integration of emerging technologies like AR, VR, and NLP is crucial. These innovations can potentially revolutionize how viewers interact with content, offering immersive and intuitive experiences. Designing interfaces seamlessly incorporating these technologies will be essential in staying at the forefront of user engagement.

Content creators and producers should consider the expanding landscape of VR-enhanced storytelling. Platforms like Oculus TV exemplify the potential for immersive experiences. Exploring narrative techniques

that leverage VR technology can open new avenues for storytelling, allowing creators to craft content that transcends traditional boundaries and captivates audiences in novel ways.

Professionals involved in monetization and copyright management should closely follow developments in blockchain technology. Platforms like Audius are pioneering the use of blockchain for fairer compensation and transparent copyright management. Understanding and adopting blockchain solutions can revolutionize how creators are compensated and how content rights are managed.

Focusing on scalable and adaptable infrastructures is imperative for those responsible for the technological backbone of streaming platforms. This includes investing in robust backend systems capable of handling the increasing demands of high-quality content delivery. Moreover, ensuring seamless integration of various technologies, from AI algorithms to AR interfaces, is imperative to provide a cohesive and cutting-edge user experience.

These implications underscore the dynamic nature of the streaming industry and the imperative for industry practitioners to remain agile and forward-thinking. Embracing these technological advancements enhances the user experience and positions professionals at the vanguard of an ever-evolving landscape, ultimately driving innovation and shaping the future of streaming entertainment.

7. Future Trends and Challenges

Many pivotal trends are significantly shaping the trajectory of the streaming industry, each exerting its influence on the future landscape. Concurrently, the industry grapples with substantial challenges that necessitate innovative strategies and a fast and dynamic approach to adaptation. The development of the metaverse, an immersive virtual universe, is gaining traction. Streaming platforms are expected to play a pivotal role in developing and applying the metaverse for content consumption, potentially giving rise to novel forms of interactive and social viewing experiences that blur the boundaries between virtual and physical reality.

The demand for live streaming and interactive content is surging. Viewers are increasingly drawn to real-time experiences, from live sports events to interactive gaming streams. Platforms that seamlessly incorporate interactive features, such as live chats, polls, and viewer engagement, are poised to capture a larger market share.

The advancement of AI-driven personalization is set to continue, allowing platforms to fine-tune content curation with greater precision. This encompasses recommendations and the personalization of user interfaces, advertising, and content creation tools.

The widespread adoption of 5G technology will profoundly impact streaming. The higher data speeds and lower latency offered by 5G will facilitate the seamless delivery of high-definition and immersive content, ushering in new possibilities for AR, VR, and other data-intensive experiences.

As streaming platforms expand their global reach, an increased emphasis on content localization is anticipated. This involves not only the translation of content but also a deep understanding of cultural nuances and preferences to deliver a truly immersive experience for viewers worldwide.

The immense volume of available content challenges viewers regarding content discovery. Platforms must continually refine their recommendation algorithms, and user interfaces to ensure viewers can easily locate content that aligns with their preferences.

Striking the right balance between ad-supported, subscription-based, and hybrid revenue models remains an ongoing challenge. Ensuring that creators receive fair compensation while providing a seamless viewing experience for users necessitates continual innovation and adaptation in revenue strategies.

Conclusions

The landscape of the streaming industry is poised for dynamic transformation, driven by a convergence of technological innovations and evolving viewer preferences. As the industry continues to evolve, several vital takeaways emerge:

Firstly, integrating advanced technologies such as AI, AR, VR, and blockchain is reshaping how content is created, curated, and consumed. These innovations have unlocked new dimensions of immersion, personalization, and monetization.

Secondly, the metaverse concept represents a potential paradigm shift in content consumption. Streaming platforms are at the forefront of this evolution, poised to redefine the boundaries between physical and virtual experiences.

Moreover, the rising demand for live streaming and interactive content underscores the importance of real-time engagement. Platforms that effectively integrate interactive features stand to capture a significant market share.

AI-driven personalization is poised to reach new heights, enabling platforms to offer tailored experiences that transcend mere content recommendations. This has profound implications for user satisfaction and retention. The expansion of 5G technology promises to revolutionize content delivery, offering higher quality and more immersive experiences. This technological leap opens up new opportunities for AR, VR, and other data-intensive applications.

Content localization and cultural adaptation will be increasingly vital as streaming platforms seek to reach global audiences. Understanding regional preferences and sensibilities is paramount to creating truly immersive experiences.

The article's novelty is given by the focus on the disruptive industry of streaming entertainment and the inclusion of the most performant modern technologies. The study's limitations are related to the need for a historical behaviour motivated by the recent appearance of the activity, the focus on English language-related platforms and the specificity of consumer habits. However, the study provides both a retrospective viewpoint and a future-oriented perspective, the practical value of the results benefiting academics by extending the knowledge base and professionals responsible for recommendation systems, user experiences and customer satisfaction, together with business and technology development.

In conclusion, the streaming industry is continually evolving, driven by technological innovation and dynamic shifts in viewer behaviour. Adapting to these trends while navigating various challenges, such as content overload and revenue models, will be critical to the sustained success of streaming platforms. By embracing innovation and understanding the evolving needs of viewers, the industry is on its way to shaping the future of entertainment consumption on a global scale.

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Funding: The publication of this article was funded by the National University of Science and Technology POLITEHNICA Bucharest (UPB), Romania.

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