Development Opportunities and Innovation Exploration for Broadcast Television Media in the 5G Era: Postprint

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Abstract

With the continuous optimization of mobile information and communication technologies and the in-depth advancement of national 5G deployment, residents' quality of life and convenience have been qualitatively enhanced. Meanwhile, under the influence of technological innovation, various industries are encountering tremendous transformation, and broadcasting is no exception. Leveraging its technological leadership advantages of faster speed, greater stability, and superior quality, 5G is forcefully driving the restructuring and adjustment of the broadcasting industry model, creating broader business development space and greater room for innovative imagination for broadcasting media, and exerting non-negligible influence across multiple dimensions including communication paths, methods, content, and experience. This enables broadcasting media, which have been severely impacted by new media, to embrace new development opportunities and critical breakthrough windows, while also presenting them with entirely new historic challenges. Against this backdrop, how to seize the moment, grasp opportunities, and address challenges, and to harness the tailwind of 5G technological advantages to facilitate the expansion of broadcasting media layout toward deeper integration and greater diversification, requires careful discussion and deliberation. This paper will proceed from the development background of 5G technology, investigate the opportunities and challenges in broadcasting media development within this context, and propose targeted innovative development directions.

Full Text

Development Opportunities and Innovation Strategies for Broadcasting Media Under 5G Technology

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Abstract

With the continuous optimization of mobile information and communication technologies and the deepening of China' s national 5G deployment, residents' quality of life and convenience have been substantially improved. Meanwhile, technological innovation has brought transformative changes across industries, broadcasting and television included. Leveraging its superior technical advantages in speed, stability, and performance, 5G is powerfully driving the reconstruction and adjustment of broadcasting business models, creating broader spaces for business development and innovation in broadcasting media. This has introduced multifaceted impacts on transmission paths, dissemination methods, content varieties, and audience experiences, presenting traditional broadcasting media—long challenged by new media—with new development opportunities and critical breakthrough windows, alongside unprecedented historical challenges. In this context, exploring how to seize the moment, grasp opportunities, and address challenges to harness 5G's technological advantages for advancing broadcasting media toward deeper convergence and greater diversification is a subject requiring careful consideration. This paper examines the development opportunities and challenges facing broadcasting media within the 5G technological landscape, and proposes targeted innovation strategies.

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1. Overview and Functional Characteristics of 5G Technology

1.1 Overview of 5G Technology

5G technology represents the fifth generation of mobile communications. Unlike previous generations that constituted entirely new types of wireless access technologies, 5G represents an evolution of existing communication technologies supplemented by additional wireless access technologies to achieve multi-technology

integration. It encompasses three application scenarios: high-speed, stable, low-latency communication; large-capacity information and machine-type communication; and enhanced mobile broadband. High-speed, stable, low-latency communication offers significant advantages for automation solutions in production and daily life, enhanced mobile broadband can substantially improve transmission rates, and large-capacity information and machine-type communication can strengthen connectivity capabilities to cover all scenarios in production and life. The emergence and popularization of 5G technology have provided modern society with more efficient, higher-quality, simpler, more comprehensive, and more diverse communication services, enabling deep integration among various networks and technologies and facilitating secure, free connectivity for all things.

1.2 Functional Characteristics of 5G Technology

Mobile communications have now entered a new era dominated by 5G technology. Compared with 3G and 4G, 5G offers faster, more stable, larger-capacity, lower-cost, and more convenient interconnectivity. From a functional characteristics perspective, its technical advantages are mainly manifested in transmission rate, transmission time, operational efficiency, system capacity, and data connectivity. First, in terms of transmission rate, 5G enables high-speed data transmission with a peak speed of 20Gb/s—nearly a hundred times faster than 4G—providing users with an intuitive experience of ultra-fast internet access with clear and smooth audio and video, where downloads can be completed in as little as one second, greatly enhancing the user experience. Second, 5G achieves low-latency transmission [2]. While 3G had a latency of approximately 100 milliseconds and 4G about 20-30 milliseconds, 5G reduces this to around 1 millisecond, significantly minimizing data transmission errors. Moreover, 5G features ultra-low power consumption, effectively reducing costs. In previous applications, rapid battery drain was a major concern for users of IoT products, but 5G' s ultra-low energy consumption can effectively reduce power consumption and save costs. In terms of system capacity and data connectivity, 5G enhances information carrying capacity and data volume while supporting massive machine connections to achieve universal interconnection among all things.

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2. Development Opportunities for Broadcasting Media in the 5G Era

Every technological revolution has facilitated transformation and upgrading in broadcasting media, such as on-demand viewing and loop playback based on network capabilities. This time, leveraging 5G' s technological advantages, broadcasting media will usher in historic development opportunities. 5G' s high transmission rate facilitates optimization of broadcasting media transmission paths, universal interconnection drives diversified extension of broadcasting information transmission platforms, personalized services enhance user experi-

ences, and multi-technology integration promotes intelligent development of the broadcasting industry [1]. While 5G creates favorable conditions for broadcasting media breakthroughs, it also provides greater convenience for online self-media development, meaning broadcasting media faces both opportunities and more intense competitive and survival pressures. Those who keep pace with technological innovation and apply it appropriately will thrive, while those who remain stagnant and resist change will perish. Therefore, actively exploring innovation directions to effectively address transformation pains and positively harness technology to create artistic vitality is crucial for broadcasting media to achieve breakthrough development.

2.1 Optimization of Broadcasting Content Transmission Through High-Speed Rates

"Fast"and "stable"are among 5G's most prominent technical features. A transmission rate of 20Gb/s can download high-definition films and television programs in seconds, delivering high-quality viewing experiences to users through smooth and convenient transmission of broadcasting information. Simultaneously, leveraging 5G' s high-speed transmission advantages, program transmission delays and errors will be minimized, enabling producers to rapidly broadcast uncompressed, real-time productions with greater news immediacy. News production spaces such as studios and editorial departments will also shift more toward live field reporting. Furthermore, 5G will completely transform traditional live broadcasting methods that relied on transmission vehicles—multiple systems and devices required for live broadcasting can now be connected in real-time through high-speed 5G networks with multi-signal real-time return, while cameras and other live equipment become wireless, greatly increasing filming flexibility and coverage. Television broadcasting becomes more convenient, immediate, immersive, and "present" [3]. As 5G technology application deepens, broadcasting content transmission paths will be further optimized.

2.2 Diversified Extension of Broadcasting Platforms Through Universal Interconnection

5G technology can achieve high-density connections in the hundreds of billions, making universal interconnection a reality. In this interconnected environment, "sensor journalism"emerges through IoT, big data, and cloud computing, characterized by greater precision, breadth, and depth. Simultaneously, broadcasting breaks through previous output port limitations of traditional media such as print, television, and radio, expanding information dissemination platforms—every smart terminal can become a medium for broadcasting media reception and output, realizing the concept of "everything is media, everything is a platform." Against this backdrop, the enrichment of transmission terminal platforms drives broadcasting media toward greater diversification in material collection and information distribution, as well as more varied content presentation. With the deepening application of 5G technology and the widespread adoption of

IoT, broadcasting information transmission will enjoy more diversified extension spaces.

2.3 Enhanced User Experience Through Personalized Support

Contemporary media users, influenced by the internet environment, demand greater personalization in broadcasting content, making customized content support an inevitable development trend for broadcasting media. Before 5G' s widespread application, broadcasting media conducted considerable experimentation and exploration in personalized content and customized services, primarily based on matching user interests with massive information to meet individual needs. However, constrained by technological limitations, results in customized content, personalized recommendations, and resource matching were not entirely satisfactory and could not truly meet diverse media user demands. 5G technology enables real-time analysis and capture of user media contexts and needs by collecting massive amounts of basic user information—including gender, age, educational background, professional background, and behavioral preferences—through big data, thereby pushing targeted customized information services. Through 5G' s high-speed, low-latency, ultra-high-definition live broadcasting and smart wearable viewing devices, broadcasting media can also create multi-angle, more three-dimensional live scene experiences for users, creating an immersive news presence. Additionally, personalized services can be provided for user media consumption content ordering and usage through intelligent search, voice interaction, multi-screen interaction, and live shopping, optimizing broadcasting media user viewing and usage experiences.

2.4 Intelligent Development of Broadcasting Industry Through Multi-Technology Integration

In a universally interconnected environment, all social structures are connected to some degree, greatly reducing sense of distance and enabling tighter technological connections. 5G' s enhanced mobile broadband and ultra-strong carrying capacity advantages allow massive data transmission to be completed in ultra-short time, achieving deep integration of multiple new technologies including blockchain, big data, and cloud computing [4]. Therefore, as 5G becomes the basic transmission technology for broadcasting media and integrates with blockchain, big data, artificial intelligence, cloud storage, cloud computing, and other high-tech developments for broadcasting business and content integration and distribution, 5G's ultra-large broadband will drive the broadcasting industry toward more intelligent development. Additionally, relying on multi-technology integrated applications based on 5G, blockchain and artificial intelligence will provide more significant protection for broadcasting media user privacy and copyright.

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3. Challenges Facing Broadcasting Media in the 5G Era

3.1 Intensified Competition from Online Media Platforms

The application of 5G not only brings breakthrough development opportunities for broadcasting media but also creates vast development platforms for online media, lowering industry entry barriers. In recent years, national policy has provided more support for content creation rights on small and micro platforms, leading to the mass emergence of online self-media. From a user perspective, the current main media user demographic—young people raised in the internet environment, the "internet generation" —prefer obtaining media information from mobile network platforms over broadcasting media. New media such as social networking media, video self-media, and UGC have aggressively diverted broadcasting media' s audience [5]. These online media platforms, equipped with 5G technology and relying on mobile smart tools for dissemination, greatly facilitate user access to information, far surpassing broadcasting media in convenience and immediacy. With a smartphone and a few apps, users can listen to radio, watch videos, obtain information, socialize, entertain, learn, and shop anytime, anywhere. Radio' s market share is being captured by audio apps, and television' s share by video apps. Mobile platform user numbers are increasingly surpassing those of broadcasting and television platforms, to some extent shaking the mainstream media status of broadcasting.

3.2 Higher Demands for Professional and Comprehensive Talent Qualities

Although 5G technology has been applied across various industries and life scenarios, current research on this technology remains in its preliminary stages, and the technology itself continues to develop and improve. Consequently, both theoretical mastery and practical application still have significant gaps, facing a massive talent shortage. The broadcasting and television industry in the 5G era requires more professionals who master high-tech technologies to integrate artificial intelligence, virtual reality, IoT, and other technologies into broadcasting business expansion, allowing technology to stimulate artistic vitality. In reality, 5G technology talent currently circulates mainly among large telecommunications network operators, while talent proficient in 5G technology in the broadcasting industry remains extremely scarce. Without strengthening the cultivation of professional technical talent and increasing the introduction of composite talents, and instead relying long-term on external talent, the industry will find its talent gap widening, placing it in a passive competitive position and missing critical development opportunities.

3.3 Stricter Real-Time Monitoring and Regulatory Requirements

Driven by 5G technology, many broadcasting programs and live broadcasts have begun adopting 4K and even 8K high-definition technologies, placing higher demands on data transmission networks and data collection methods for broad-

casting monitoring and regulation. Previously, broadcasting data transmission volumes were relatively small, so compressing and converting formats when retrieving programs and analyzing faults would not significantly affect material content. However, continuing to use such methods under 5G would cause playback stuttering and real-time pausing, meaning the 5G era demands higher broadband network resources for broadcasting monitoring and regulation. Additionally, in terms of broadcast safety monitoring and early warning, the long-used SMS text warning methods can no longer meet the high transmission rate safety warning needs of the 5G era, requiring optimization toward more effective, accurate, and targeted warning approaches [6]. Moreover, due to technological optimization reducing program production difficulty and costs, large quantities of reality shows and live content will be produced. Some producers, seeking profit and attention, may generate content with uneven quality and biased value orientation. If such content spreads unchecked due to inadequate regulation, it will negatively impact social morals and values.

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4. Innovation Directions for Broadcasting Media Under 5G Technology

4.1 Deepening AI Application to Build Smart Broadcasting

The application of 5G plus artificial intelligence in broadcasting media is not uncommon; this technology combination has been widely applied in broadcasting businesses such as news gathering and editing, and voice command control. Increasing AI deployment in the broadcasting field and promoting its transformation toward strong application has become a major trend in broadcasting development. AI technology can create virtual TV personalities to participate in news and television programs, enabling intelligent program production while refreshing user perceptions. It can also be applied to broadcasting image, content, and scene recognition and processing to enhance backstage content compilation efficiency. In the storage phase, leveraging AI advantages can enable intelligent management of media resources, improving the scientificity and effectiveness of resource utilization and management. Additionally, building virtual AI information assistants can enhance interactive service experiences. Through AI deployment and strengthening AI technology application depth in broadcasting businesses, injecting new vitality into media in the new era is essential for long-term survival and development.

4.2 Expanding IoT to Innovate Broadcasting Service Ecosystem

Smart broadcasting has gained broader attention and development space with the deepening of 5G strategic layout and application expansion. Among these, upgrading the broadcasting service ecosystem through integrating "5G+" IoT technology represents an important innovation direction for future development [7]. To this end, broadcasting and television must accelerate business develop-

ment in the smart home sector and promote the construction of smart home platforms, enabling interconnected home appliances and different living space scenarios under IoT and smart broadcasting. For example, expanding traditional audio transmission unit businesses into multiple dimensions can drive IP-based broadcasting management. Simultaneously connecting program platforms with home appliances and mobile applications can achieve multi-screen interconnection such as "TV screen + appliance screen + mobile screen," providing not only smart home functionality but also higher-quality personalized information services and interactive services to meet user needs in news information acquisition and life consumption, thereby enhancing the quality and intelligence of home life and media life. Simultaneously, from a long-term strategic and developmental perspective, the broadcasting industry should leverage 5G and IoT technology integration to actively deploy in smart cities, smart villages, and other fields, providing more intelligent value-added services for residents' lives and social construction.

4.3 Integrating VR, AR, and MR Technologies to Enhance User Experience

Before 5G technology application, VR (virtual reality), AR (augmented reality), and MR (mixed reality) were limited by low network transmission rates and small bandwidth, often causing user dizziness due to latency, low fidelity, and memory space issues where seconds of video required hundreds of megabytes, resulting in poor technical experiences and preventing market explosion in the 4G era. The advent of 5G has substantially upgraded network performance, breaking this technical barrier and creating more room for virtual technology applications in broadcasting businesses. Broadcasting should actively develop application pathways for these technologies in its business, leveraging their strong simulation capabilities in human visual, auditory, and tactile perception to integrate them into broadcasting program production. For example, combining VR technology with live broadcasting can give users an immersive sense of presence and participation. Through virtual reality, augmented reality, and mixed reality technologies, broadcasting can enhance realism, provide users with stronger immersion, enable comprehensive information acquisition from multi-dimensional perception, and improve interactive experiences.

4.4 Expanding Mobile Layout to Advance Internet-Based Development

Since its birth in the 20th century, broadcasting media has undergone decades of development and accumulation, possessing unique content and resource advantages as mainstream media. Under the 5G technology wave, broadcasting faces both innovation opportunities and challenges from online media platforms that have aggressively captured market share and drastically reduced user numbers [8]. Confronted with these impacts, broadcasting media should adopt proactive strategies, maintaining its characteristics and advantages while actively mov-

ing toward mobile and internet-based layout. While leveraging 5G to broaden content transmission and technology application dimensions, broadcasting must also expand online dissemination channels and actively secure a position in the online discourse field by learning from leading internet communication media. Successful examples include CCTV's "Yangshipin,"People's Daily's official Weibo account, and Sichuan Radio and Television' s official Douyin account "Sichuan Observation,"all demonstrating effective internet integration by mainstream media. Through networked convergence, injecting new vitality into media in the new era is essential for long-term survival and development.

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Note: Figure translations are in progress. See original paper for figures.