



TANQIDIY NAZAR, TAHLILY TAFAKKUR VA INNOVATSION G'UYALAR



ECONOMIC OPPORTUNITIES OF 5G TECHNOLOGY

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Annotatsiya. *Ushbu maqola 5G texnologiyasining iqtisodiy rivojlanish, xalqaro savdo, ta'lim va xavfsizlik sohasidagi o'rni va ta'sirini tahlil qiladi. 5G texnologiyasining asosiy afzalliklari – yuqori tezlik, past kechikish va keng qamrov – uni zamonaviy raqamli infratuzilmaning ajralmas qismiga aylantiradi.*

Maqolada Bharatda 5G tarmog'ini joriy etishning muhim ahamiyati ta'kidlangan bo'lib, bu texnologiya mamlakat iqtisodiyotiga milliardlab dollarlik qo'shilgan qiymat va millionlab ish o'rinlarini olib kelishi mumkinligi qayd etilgan. Shu bilan birga, 5G ta'limni immersiv va interaktiv holga keltirish, xalqaro savdoda logistika va avtomatlashtirishni takomillashtirish imkonini beradi. Shu bilan birga, maqolada 5G tarmoqlarining xavfsizlikka oid murakkabliklari, ayniqsa Radio Access Networks (RAN) va yadro tarmoqlari bilan bog'liq xavfsizlik masalalari yoritilgan. ITU-T tomonidan belgilangan xavfsizlik choralari bunday muammolarni hal qilishga yordam beradi. Ushbu tadqiqot 5G texnologiyasining turli sohalarda inqilobiy o'zgarishlar keltirishi mumkinligini ko'rsatadi.

Kalit so'zlar: *5G texnologiyasi, iqtisodiy rivojlanish, xalqaro savdo, ta'lim, xavfsizlik, raqamli transformatsiya, Bharat, yuqori tezlik, past kechikish, raqamli xizmatlar.*

Abstract. *This article analyzes the role and impact of 5G technology in the fields of economic development, international trade, education, and security. The key advantages of 5G technology-high speed, low latency, and wide coverage-make it an integral part of modern digital infrastructure.*





The article emphasizes the importance of implementing 5G networks in Bharat, highlighting its potential to contribute billions of dollars in added value to the national economy and create millions of new jobs. Additionally, 5G offers the potential to transform education by enabling immersive and interactive learning experiences and to enhance international trade through improved logistics and automation. The article also addresses the complexities of security challenges associated with 5G networks, particularly those related to Radio Access Networks (RAN) and core network infrastructures. The ITU-T's proposed security measures are discussed as a means to address these challenges effectively. This study demonstrates that 5G technology has the potential to bring revolutionary changes across various sectors.

Keywords: 5G technology, economic development, international trade, education, security, digital transformation, Bharat, high speed, low latency, digital services.

INTRODUCTION

Economic policymakers and empirical researchers alike strive to answer how crucial the availability and adoption of fast broadband internet has been for the economic development of regions and entire countries. In this context, the European Commission (2022a) has emphasized the importance of economic policy measures to "enable access to digital services for all citizens and to maintain its prosperity." As one of the European Union's most important economic policy agendas is cohesion, ensuring full coverage of broadband internet for all citizens, regardless of their socio-economic background and location, is essential. To promote competitiveness and economic development, "the European Union needs a digital connectivity infrastructure with top performance, security, and sustainability, optimized to leverage the latest optical fiber technologies in fixed networks and to connect innovative wireless systems such as 5G, 6G, and Wi-Fi".[1]

Bharat aspires to become a leading economic superpower and a knowledge-based economy. According to a recent report by the Bharat Cellular and Electronics Association (ICEA), the deployment of 5G in Bharat could lead to the creation of over 22 million jobs in the country. The report also predicts that the rollout of 5G could contribute approximately \$1 trillion to Bharat's GDP by 2035. 5G services are expected to drive significant advancements in the digital economy, healthcare, education, and other sectors, ushering in a transformative change in the country's economic and social landscape.[2]

5G Requirements

The requirements for 5G reflect the end-user needs and the upper-band availability in both spectrum and technology. Considering user experience, 5G will offer new user experience packages tailored to meet user-specific requirements rather than merely guaranteeing the quality of service for existing services. To achieve this, 5G will employ a variety of radio interface technologies operating across different spectrum bands, enabling ubiquitous connectivity for both humans and devices. The overarching goal is to





design a network capable of accommodating the rapid growth of devices and applications for years to come. To meet these objectives, 5G must provide the following: [3]

1. Enhanced User Experience: Delivering ultra-reliable and high-speed internet services.
2. Ubiquitous Connectivity: Ensuring seamless network access across urban and rural areas.
3. Scalability: Supporting an increasing number of devices and applications over time.
4. Security and Sustainability: Building a robust, secure, and environmentally sustainable infrastructure.

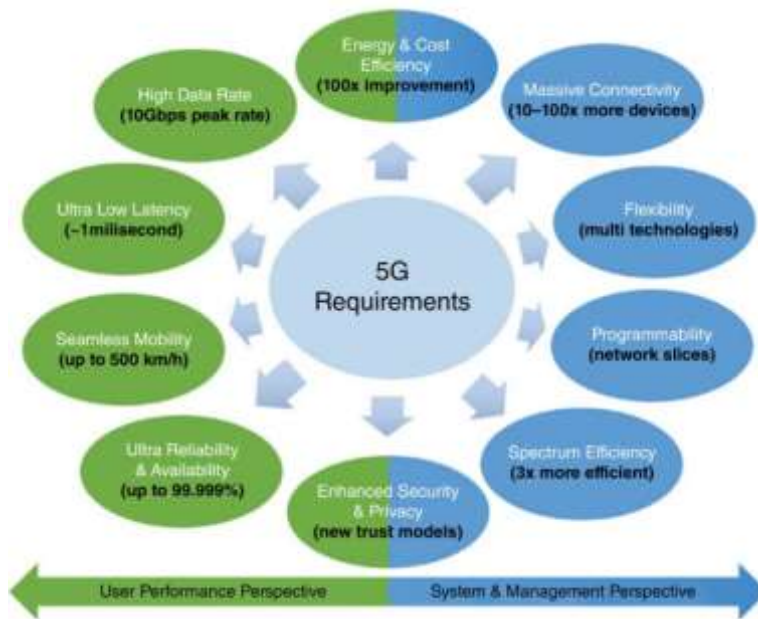


Figure 1.1 5G key requirements and some example values.

Overviews of Security Recommendations and Challenges

The security threat vectors in 5G will be multi-dimensional, spanning from physical interfaces to application interfaces, services in the cloud, and user information. 5G networks will connect critical infrastructures, interlink societies and industries, provide anything-as-a-service, and integrate new models of service delivery. The 5G ecosystem cannot be fully visualized at this moment due to the rapid development and integration of new devices and services. However, the main attractions of 5G-beyond extended connectivity, higher data rates, and lower latencies-will include the ease of deploying and utilizing new services and functions. This, however, will also complicate the security landscape.

To simplify the understanding of this security landscape, we discuss security in two domains:

1. Security of Access Networks: For example, Radio Access Networks (RAN), which can be a composite of multiple access technologies such as cellular network Radio Access Networks comprising small and large base stations, WiFi, and more.





2. Security of the Core Network: This is where the network control resides, with operator and vendor-specific services.

The International Telecommunication Union's Telecommunication Standardization Sector (ITU-T) has proposed dimensions of security for telecommunication networks that address all aspects of security. [4].

The Future of 5G Technology in International Trade.

The rapid evolution of technology has significantly impacted various facets of human life, particularly international trade. Advances in digital infrastructure, artificial intelligence, blockchain, and other innovations have systematically redefined how trade transactions are executed, monitored, and regulated. As we navigate the 21st century, the future of technology in international trade appears both promising and complex, bringing forth opportunities and challenges that stakeholders must address comprehensively.

Moreover, the adoption of 5G technology is set to accelerate digital transformation in international trade. With its superior speed and low latency, 5G can facilitate real-time communication and data transfer, optimizing logistics and warehousing operations. Enhanced connectivity will support advanced robotics and automation in ports and warehouses, increasing productivity and reducing human error. Improved communication networks will also enable more reliable cross-border digital services, such as remote inspections and certifications, making the global trade process more seamless.[5]

POTENTIAL BENEFITS OF 5G IN EDUCATION

The deployment of 5G networks in Bharat presents a significant opportunity to revolutionize education and learning in the country. 5G is expected to offer several benefits over existing 4G networks, including faster speeds, lower latency, and increased capacity, enabling a range of new educational applications and services. Some potential benefits of 5G in education are discussed below: [6]

1. Enhanced access to interactive and immersive learning experiences through technologies like augmented reality (AR) and virtual reality (VR).
2. Seamless delivery of online classes, even in remote areas, due to improved connectivity.
3. Support for large-scale collaboration tools and cloud-based applications for students and teachers.

Conclusion

The implementation of 5G technology represents not only a significant milestone in technological development but also a transformative shift across sectors such as the economy, international trade, education, and security. This article examines the economic opportunities provided by 5G technology and its impact on various fields.

The high speed, low latency, and wide coverage offered by 5G enable numerous new services and functions. Specifically, the widespread deployment of 5G technology in Bharat is projected to contribute approximately \$1 trillion to the country's GDP by 2035 and create over 22 million new jobs. In education, 5G supports interactive learning processes through





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technologies like virtual reality (VR) and augmented reality (AR), promotes the growth of remote education, and ensures equal opportunities for all.

Moreover, 5G accelerates digital transformation in international trade. High-speed communication and data transfer capabilities enhance efficiency by fostering robotics and automation in ports and warehouses, which improves productivity and minimizes human errors. Additionally, advancements in remote inspections and certification services further streamline global trade processes, making them more convenient and reliable.

5G also introduces significant security challenges as it connects a vast number of devices and creates complex infrastructures. The article discusses security issues from the perspectives of Radio Access Networks (RAN) and core network security, with a focus on dimensions of security proposed by the ITU-T for telecommunications networks.

Sources

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