

5G Infrastructure Network in Libya

Younis E. Abdalla

Literature & Applied Science Faculty of Ubari, Sebha University, Libya.

ABSTRACT

The stages of Planning and Design play a pivotal role in the successful adoption of any new technology. The transition to (Fifth Generation) 5G is expected to be quite different and complex from the previous generations of wireless technologies. Along with the deployment challenges, business leaders are also perplexed by the economic uncertainties that 5G brings, given the uncertainty around regulatory issues such as which spectrum will be released first viz lower band (700 MHz) or the mid to high band (3-4 GHz), or the mm band (24- 39 GHz) and the lack of proven use-cases. Because of this ambiguity, CEOs across industries are treading the path of adopting 5G cautiously.

Keywords: 5G Infrastructure, Telecommunication.

INTRODUCTION

5G is perhaps more easily defined by what it will replace than its received goals. The current ITU-R (International Telecommunication Union - Telecommunication Standardization Sector) working definition for IMT-2020 (5G) is in terms of a "global standard for the air interface of wireless communication systems to its user equipment and for the core network. This should be capable of providing a behaviorally and performance dynamic infrastructure, which has the ability to provide communication needs and data storage capabilities that are excellent in their provision yet economic to use". This is fuzzy, and giving these definitions tangible form is likely to be an ongoing process beyond 2020. However, it is widely believed that 5G will achieve its purpose through greatly expanded IoT scenarios, covering both enhanced services for traditional mobile devices and nodes specifically for "Internet of Things" IoT endpoints. This fact will occur through a migration to higher frequencies of radio wave propagation and data transfer, inferred complex network architecture and repeater nodes, and new signaling protocols primitive models for the latter two can already be seen in 4G LTE-A. High hopes for 5G include a new age of ubiquitous, high-speed, high-dependability wireless network that will act as the replacement for landline infrastructure at a cost competitive with today's wireless. On the mobile end devices mobility would merge the seamless handover.

The fifth generation of mobile phone networks promises a step-change in performance, an (IoT) revolution, and the potential for new digital industries. There is, inevitably, a significant global effort to win the race to define the standard for 5G. Much of the discussion is focused on the current frontrunners of Europe, South Korea, and the United States. The European Commission and national governments, concerned to with ensuring that the digital economy and IoT are built on European-held technologies, have been pressuring the industry to consolidate their efforts. South Korea already has ambitious plans to showcase a 5G network at the 2018 Winter Olympics. China is not standing still, of course, with a range of projects and its companies jockeying for position. One of the often-overlooked aspects of the race to 5G is its relevance to the developing world [3]. In this article, we focus on Libya as a case study; critically appraising the objective and its potential benefits as well as the feasibility of implementation at both the interim LTE and subsequent 5G phase.

The existing telecommunication system in Libya is the fourth generation and is restored in different areas: Satellite phone work. Local mobile coverage returned to 80% in many areas and full coverage of Almadar and Libyana. Table [1]. The infrastructure of this network in main cities is quite good, and poor in the south [10].

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Existing UN Telecommunication Systems			
	UNDP	WFP	UNSMIL
Locations of Repeaters		Benghazi	Corinthia Hotel/Tripoli
VHF Frequencies		Benghazi	Oea/Tripoli
HF Frequencies		-	Oea/Tripoli
VSAT		-	Oea Tripoli

Table [1]: Existing Humanitarian Telecommunication System

2. Overview of 5G Technology

The 5G technology itself is planned to be officially used around the year 2020, coinciding with the end of the era of LTE technology and its variants [4]. But it is very likely there will be some pre-5G technologies at the LTE evolution level that will be called Pro LTE, Pro LTE+, or similar before the 5G officially released, it will be included in the 5G coverage area.

At the beginning of 2017, 3GPP consortium which is a specification organization of mobile telecommunication technologies has determined the name for technology that meets the requirements of International Telecommunication Union's (ITU) for IMT-2020 (International Mobile Telecommunication 2020), will officially use the term "5G" [4].

With 5th generation or 5G technology, it can be said that it is no longer just the latest generation of mobile telecommunication technology. "A digital age" with wireless broadband system that has a very reliable performance and span. With various predictions and promises of user experience that is significantly different from previous generations. The words that stand out the most are about the "very low delay" and "very high data rates" which correlate with user experience that is different than ever before.

3. Importance of 5G Infrastructure in Libya

The importance of implementing 5G network in Libya is a challenging and priority issue. Implementing the 5G network will increase the capabilities of the LTT in Libya and provide better services to the people. It is because LTT has a vision to change the current network setting and increase the broadband and mobile communication across the country. It will be difficult to implement the 5G network if we do not have a fast or ultra-speed broadband. The ultra-speed broadband can only be achieved using the fiber optic and wireless network integration. Since the

implementation of the 5G network is primarily using the wireless or mobile radio access, this will open up new opportunities for all mobile and smart device manufacturers or operators to better utilize and run their inventions. By implementing the 5G network, this can also increase new investments in mobile technologies and increase the mobile operator services with the coverage of seamless high-speed mobile internet access, wider mobile broadband coverage, and more advanced user equipment. This type of investment can also reduce the issue of the digital divide in Libya between rural and urban communities. It is because the mobile operator will always give better services in urban areas, but with the wider mobile broadband coverage, more rural areas can also enjoy the same services as urban areas. This will help a lot towards Libya's community to change and better utilize the mobile services into the higher mobile internet connection and become a new ecosystem of mobile technology. This will also open new opportunities for all mobile researchers to better develop and run their applications with more advanced mobile technologies. With the advanced mobile technologies, these researchers can find more useful information and can give better benefits in mobile technologies with high speed and low latency applications.

4. Objectives of The Study

The study will also aim to provide a roadmap for the implementation of 5G technology in Libya. This will include various suggestions, proposed strategies, and the steps that need to be taken by the Libyan government and telecommunication authorities of Libya. For this purpose, a review of existing resources will be conducted to ascertain the capabilities and the level of preparedness of Libya to adopt this technology. This can help identify the gap between the present status and the intended future of telecommunication in Libya. This will also help identify the areas and regions where 5G technology can be implemented in the initial phase. An understanding of the current and the forecasted future trends of the telecommunication industry will also help identify the level of dependency of Libya on foreign providers for telecommunication services.

The primary aim of this study is to underscore the importance of 5G technology for the social and economic progression of Libya. It will attempt to highlight the benefits and positive impact that this

technology can have on various sectors such as education, health, oil and gas industry, and public sector of Libya. This study will also identify the risks and hazards that can lead to security issues and increase in the rate of cybercrime.

5. Infrastructure 5G Investment and Funding Opportunities.

The deployment of 5G infrastructure requires substantial investment in physical network components, including base stations, small cells, and fiber-optic backhaul. Furthermore, the transition to 5G entails the modernization of existing telecommunications infrastructure to support the higher data rates and increased network capacity of 5G networks [5].

Globally, 5G coverage increased from 25% in 2021 to 32% in 2022, meaning 2.6 billion people are now covered by a 5G network (see Figure 1). Of the 600 million additional people covered by 5G in 2023 than 2022, almost three quarters were in Asia Pacific [1].

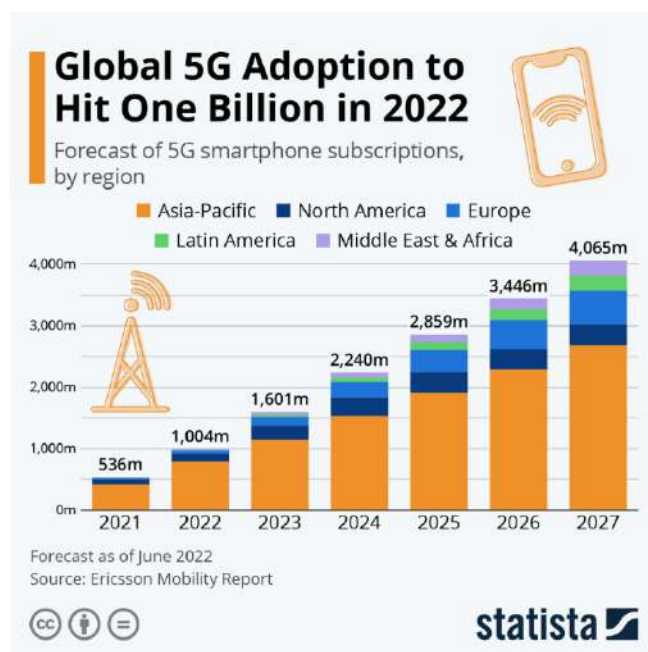


Figure 1

In Libya, the collaboration between government entities, telecommunications operators (LPTIC) Libyan International Telecommunication Company, and infrastructure providers is instrumental in mobilizing the necessary resources for 5G deployment. Public-private partnerships can play a pivotal role in driving infrastructure investment and accelerating the pace of 5G rollout, particularly in underserved or remote areas where connectivity gaps exist.

Prioritizing the areas with higher population densities in the first phase, the resources investment will move on to the areas based on the population densities [6], as indicated in the following figure 2.

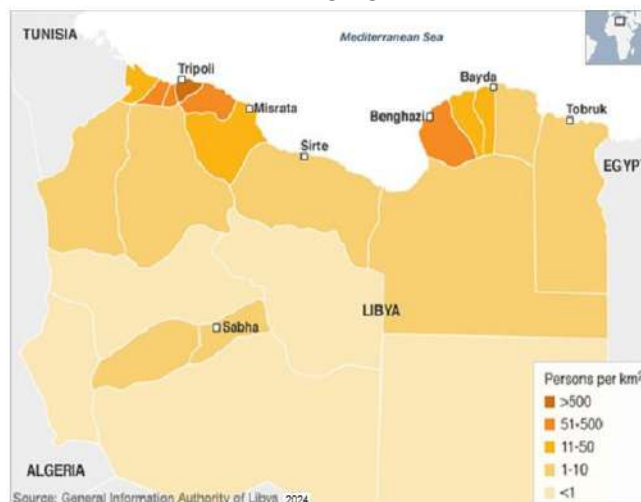


Figure 2. Population density map persons per square kilometer

6. Socio-Economic Impact

The introduction of 5G infrastructure in Libya has the potential to have a profound socio-economic impact, influencing various aspects of daily life, business operations, and national development. From an economic perspective, 5G networks can stimulate job creation, foster innovation, and attract foreign investment in the telecommunications and technology sectors. The enhanced connectivity and digital capabilities offered by 5G can empower businesses to adopt advanced technologies, improve operational efficiency, and explore new market opportunities. Moreover, 5G infrastructure can contribute to the advancement of smart cities and sustainable urban development in Libya. The integration of 5G-enabled smart city solutions, such as IoT (Internet of Things) sensors, intelligent traffic management, and environmental monitoring systems, can enhance the quality of life for citizens and support environmental sustainability initiatives.

7. Technological Innovation and Digital Transformation

The deployment of 5G infrastructure serves as a catalyst for technological innovation and digital transformation across various industries. In Libya, the advent of 5G networks can drive the development of new applications and services, particularly in areas such as e-commerce, e-government, and digital entertainment. The high-speed, low-latency nature of 5G connectivity creates opportunities for immersive

multimedia experiences, real-time collaboration tools, and advanced cloud-based services.

Furthermore, 5G infrastructure can facilitate the proliferation of IoT devices and solutions, enabling the interconnectedness of smart devices, wearables, and industrial sensors. This interconnected ecosystem has implications for sectors such as agriculture, energy, and environmental monitoring, where the deployment of IoT-enabled 5G solutions can optimize resource utilization, improve decision-making processes, and drive sustainable practices.

8. 5th G Infrastructure Marketing

The 5G Infrastructure Market is experiencing a rapid surge in growth as the deployment of fifth-generation (5G) wireless technology gains momentum worldwide. The market is driven by the increasing demand for faster data speeds, enhanced network capacity, and improved connectivity to support emerging technologies like the Internet of Things (IoT), autonomous vehicles, and virtual reality. With its potential to revolutionize various industries, including healthcare, manufacturing, transportation, and entertainment, the 5G Infrastructure Market is expected to witness significant growth in the coming years, as network operators and technology providers invest in expanding and upgrading their infrastructure to meet the demands of the digital age [7][9].

Looking ahead, the future of the 5G Infrastructure Market holds immense potential for innovation and transformative capabilities. As 5G technology continues to evolve, the market is likely to witness advancements in network architecture and deployment models. Moreover, as 5G networks become more prevalent, there will be a focus on expanding coverage and capacity to accommodate the growing number of connected devices and data-intensive applications. The market will also see increased collaboration between network operators, equipment manufacturers, and other stakeholders to develop standardized solutions and interoperability, ensuring seamless connectivity across different regions and ecosystems. With its potential to unlock transformative technologies and empower industries, the 5G Infrastructure Market is poised for remarkable growth and disruption in the global telecommunications landscape [8].

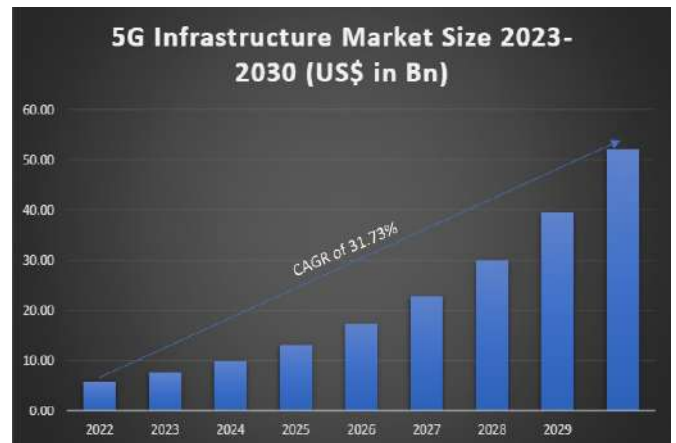


Figure 3. 5G Infrastructure Market Size.

CONCLUSION

In conclusion, the implementation of 5G infrastructure in Libya represents a pivotal opportunity to transform the country's telecommunications landscape, drive economic growth, and foster technological innovation. While the deployment of 5G networks presents challenges related to infrastructure, regulation, and investment, the potential benefits across sectors such as healthcare, transportation, and manufacturing are substantial. To realize the full potential of 5G infrastructure, concerted efforts from government, regulatory bodies, telecommunications operators, and industry stakeholders are essential. By addressing the challenges and considerations associated with 5G deployment and establishing a conducive regulatory framework, Libya can position itself at the forefront of the digital revolution, reaping the rewards of enhanced connectivity, technological advancement, and sustainable development.

REFERENCE

1. Forecast number of 5G mobile subscriptions worldwide from 2019 to 2029, by region, <https://www.statista.com/statistics/521598/5g-mobile-subscriptions-worldwide/>, Acc 2024.
2. (PDF) 5G Infrastructure Market Size, Growth & Trends Report 2023. Available from: https://www.researchgate.net/publication/371043766_5G_Infrastructure_Market_Size_Growth_Trends_Report_2023 [accessed Mar 20 2024].
3. NSF Efforts to Achieve the Nation's Vision for the Materials Genome Initiative: Designing Materials to Revolutionize and Engineer Our Future (DMREF) (2023)
4. 5G - Fifth generation of mobile technologies, <https://www.itu.int/en/mediacentre/backgrounder>

- s/Pages/5G-fifth-generation-of-mobile-technologies.aspx
5. Marat Nuriev, Anna Kalyashina, Yuri Smirnov, Guzel Gumerova, and Gulaybat Gadzhieva, The 5G revolution transforming connectivity and powering innovations, International Scientific Conference Transport Technologies in the 21. TT21C-2024.
 6. Huiyuan Lu, Zhengyong Shang, Yanling Ruan and Linlin Jiang, Study on Urban Expansion and Population Density Changes Based on the Inverse S-Shaped Function. Sustainability MDPI 2023. 15(13), 10464.
 7. Report ID: FBI100869. 5G INFRASTRUCTURE MARKET ANALYSIS- 2026. Source: Source: <https://www.fortunebusinessinsights.com/industry-reports/5g-infrastructure-market-100869>
 8. Information & Technology Market Research Report. Smart Strategies, Giving Speed to Your Growth Trajectory. The U.S. cyber security market size 2023.
 9. R. M. Petrova, E. Gracheva, 2023 5th International Conference on Control Systems, Mathematical Modeling, Automation and Energy Efficiency (SUMMA), Lipetsk, Russian Federation, 1049-1055 (2023)
 10. Aceces Aug 13/2024. <https://lca.logcluster.org/libya-34-libya-telecommunications>.

HOW TO CITE: Younis E. Abdalla, 5G Infrastructure Network in Libya, *Int. J. Sci. R. Tech.*, 2024, 1 (11), 247-251. <https://doi.org/10.5281/zenodo.14249401>