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# DEPLOYMENT OF 5G TECHNOLOGY IN THE UNITED ARAB EMIRATES: PERSPECTIVES AND INSIGHTS

## Birleşik Arap Emirlikleri'nde 5G Teknolojisine Geçilmesi: Perspektifler ve Öngörüler

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## Abstract

This study outlines the 5G technology from the evolving global perspectives and provides a special focus on its insights and policy landscape in the United Arab Emirates (UAE) that includes state functionaries and other relevant stakeholders. Based on primary data through Key Informant Interviews of seven top-level policy makers and relevant secondary data, this study highlights the deployment experiences of 5G technology in various leading and developed countries in the world, as well as findings and analysis from the secondary resources towards the deployment activities performed by the UAE. The study finds that urgency of 5G in the UAE is high and successful deployment of 5G technology shall contribute to significant changes in various sectors and industries in the UAE.

**Anahtar Kelimeler: 5G technology, Network, Deployment, Stakeholders, TRA, UAE**

## Öz

Bu çalışma, gelişen küresel perspektif üzerinden 5G teknolojisini ana hatları ile özetlemek, devlet görevlileri ve diğer ilgili paydaşları dahil Birleşik Arap Emirlikleri'ndeki (BAE) 5G teknolojisi anlayışı ve politikalarına özel olarak odaklanmaktadır. Yedi üst düzey politika belirleyicisi ile Anahtar Kişi Görüşmeleri yoluyla elde edilen birincil verilere ve ilgili ikincil verilere dayanan bu çalışma, dünyanın çeşitli önde gelen ve gelişmiş ülkelerindeki 5G teknolojisi deneyimlerinin yanı sıra ikincil kaynaklardan BAE tarafından gerçekleştirilen geçiş faaliyetlerine yönelik bulguları ve analizleri içermektedir. Çalışma, BAE'de 5G teknolojisine geçme zorunluluğunun yüksek olduğunu ve 5G teknolojisinin başarılı bir şekilde kullanılmasının BAE'deki çeşitli sektörlerde ve endüstrilerde önemli değişikliklere katkıda bulunacağını vurgulamaktadır.

**Keywords: 5G Teknoloji, Ağ, Teknoloji, Geçmesi, Paydaşlar, TRA, BAE**

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# 1. INTRODUCTION

Introducing modern state-of-art means of communication is characterised by how fast the technology is and how reliable for customer use. High-speed computerised technologies provide an opportunity in practical work with the progress achievements (Tu, Wang & Wu, 2018). The Fifth Generation (called as 5G) wireless connection is determined its vision by the International Telecommunication Union-Radiocommunication Sector (ITU-R) in 2012 (Rommer, 2019). It is the latest mobile internet technology that can connect around 10 times more devices than 4G as per square kilometer. It uses high radio frequencies (mostly between 2 and 4 gigahertz) by transmitting data more or less 1Gbps that means 100 times faster than current speeds. Ahmed et. al. cited from Qualcomm's prediction in 2013 that the 5G will provide 1000 times higher capacity than system in 2013 (Ahmed et al., 2018). This new way of high-speed technology offers new ways of communication, data transfer and advanced works.

Previous versions such as 3G or 4G had undeniable merits; however, the updated speedy system, so-called "superfast" system containing better performance with more advanced features. Therefore, the comprehensive implementation covering socio-economic, political, environmental, technological aspects of 5G technology requires proper optimisation strategies (Basharat et al., 2018). The network also facing some significant complexities to meet all the modern requirements and satisfy the needs of the people and governing boards (Huawei Technologies, 2013). Generally, the introduction of new technologies in the world is attention is paid to the development of the technology industry and updating the digital base, focusing on several peculiarities, threats, challenges, and opportunities. In respect of 5G technologies, countries in the world are much attention is paid to deploy 5G technology due to its threats, challenges, and opportunities. In respect of UAE, the digital competitiveness success in the past years is admirable, and for instance, according to the IMD World Digital Competitiveness Ranking 2019, the UAE ranked 1$^{st}$ in the Arab Region and 12$^{th}$ in the globe (IMD, 2019). In particular, the UAE government, spearheaded by the Telecommunications Regulatory Authority (TRA) as ICT sector regulator. The TRA established a number of relevant committees that are responsible for the planning, management, and implementation of 5G in various sectors. A specific roadmap has also drawn where planning, implementation has delineated according to various programs in order to gradual introduction of this new, innovative communication system.

This study attempts to explain the factors that affect the deployment of 5G technology in the world and, more specifically, in the UAE. The purpose of this study is to evaluate the existing practices adopted by the UAE to support policies and strategies towards modernising the digital sphere and introducing a new state-of-art communication system. With literature support and empirical investigation amongst the key policy stakeholders, the study describes the government strategies on 5G, assess the status of implementation, evaluate the problems, prospects, and challenges of the 5G initiative by the UAE government, and provide recommendations from the standpoint of development and readiness for deploying the new technology in the UAE. This study attempts to provide insights from the UAE perspectives when some developed and developing countries alike have started fully or partially deploying the 5G technology.

## 2. RESEARCH METHODOLOGY

The study attempts to explore the deployment of 5G technology within the perspective of the UAE's efforts led by the TRA and how these efforts are felt and evaluated by the key stakeholders. Its data sources stem from secondary (i.e. literature) and primary (interviews with the key stakeholders). Consequently, findings and analysis are drawn from the secondary information from peer-reviewed journal articles, government policy and strategy documents, government, and non-governmental reports, newspaper documents etc., covering a brief perspective from the world and UAE in particular. Primary data from the perspectives and experiences of policy stakeholders, obtained through seven interviews. Both sources of data aim at discussing the potentials, possible challenges and opportunities related to the deployment of 5G technology in the country.

The primary sources of data, providing qualitative analysis, is the main pillar of the research method in this study that helped obtain reliable facts, experiences, and opinions directly from the stakeholders. To this end, a questionnaire containing 7 questions in semi-structured format was prepared to conduct interviews with those stakeholders. The interview protocol included questions that are related to the aim of the study. The questions are: (i) Does an innovative 5G technology support program/initiative have an impact on various sectors of life, or will only mobile communications be affected? (ii) Are the roadmap and the mandates of the UAE's 5G committee and working groups appropriately comprehensive to be proactive for technology deployment? (iii) Is the country well prepared for upgrading the main wireless network (cellular network) or is there much to do to achieve the desired level? (iv) What are the most likely prospects for the introduction and development

of the 5G technology in the UAE, and what recommendations can be given to its developers at this stage? (v) In your opinion, what are the main challenges faced when working on the UAE 5G initiative? (vi)What are the existing/anticipated impediments in fulfilling the technical and other requirements impinging on the 5G networks' early deployment? (vii) Please make recommendations to overcome such challenges as listed in question 5 and 6.

Accordingly, the UAE 5G committee representing three main players of the sector (regulator, service provider and 5G technology vendor) were selected for interviews. Consequently, the study interviewed seven selected respondents - two representing the regulator (i.e., TRA), four from service providers and a technology vendor. The informants were: (1) the Executive Director of Spectrum Affairs Department at the TRA, who is also the member of UAE 5G Initiative Steering Committee, (2) UAE 5G Initiative Manager at the TRA (3) Director of Technology Standardization & Spectrum Management at Emirates Telecommunications Group Company (Etisalat), (4) Manager Technology Development at Etisalat, (5) Engineer Technology and Spectrum Management at Etisalat, (6) Manager Technology Planning at Emirates Integrated Telecommunications Company (EITC) and (7) Regional Manager of Government and Industry Relations at Ericsson. These interviewees are closely engaged in the development and deployment process of the 5G technology in the UAE. After the interviews were undertaken, the respondent's answers were summarised and thematically presented in the Findings and Analysis section of this paper.

# 3. FINDINGS AND ANALYSIS

The findings and analysis have provided two significant parts of this study. In the first part, a literature review is performed on the deployment of 5G technology in the global perspectives and the aspects related to challenges in the implementation process which are followed by the UAE's perspectives and the governmental activities towards the pathway of deployment have focused. The second part of the findings and analysis is to highlight the interview session with Key Informants. In this respect, the opinion, experiences and insights of the 5G policy stakeholders are focused.

## 3.1 Perspectives from Literature Review

### 3.1.1 5G Deployment in the World

Technological innovations are a critical driver of a government which impacts the context of how government operates, works and possible actions are taken in a timely manner, can operate and function their technologies (Stephens et al., 2019). Of late, more than 30 countries, from the developed and developing countries alike, have started fully or partially deploying the 5G technology. But the transition process is different in some countries and the required work is distinctive, as seen in the USA, Germany, China, and Japan (Deloitte, 2018). Some countries such as South Korea, the USA, and China have begun robust deployment, while other countries (including those in European Union) have been moving slowly. This section provides a brief on how some of the world's leading and advanced countries such as USA, South Korea, Japan and China have deployed 5G in their respective spheres.

South Korea has witnessed the world's first widespread deployment of 5G technology as early as 3 April 2019 (Al-Absi, Al-Absi, Sain & Lee, 2020) to accelerate economic growth, faster service delivers, change in economic and industrial structure, advancement of national infrastructure, increase quality of life, creation of large market and so on (Ministry of Science, ICT and Future Planning, 2020). Three South Korean mobile carriers such as SK Telecom, KT and LGU+ actively have participated in 5G deployment. The Korean government had formed 5G Strategy Promotion Committee, formulated in 2015, did early spectrum auction, completed the tender process in June 2018 in 3.5 GHz and 28 GHz bands (Rommer, 2019). The key success factors behind the 5G launching in South Korea attributed to the close tripartite cooperation among government, carriers and vendors.

China started its journey in 2015 through three state-owned mobile operators including China Mobile, China Unicom and China Telecom, seeking to become a global technology leader in the current competitive world. These companies rolled out 5G services to consumers on 31 October 2019 (Blackman & Forge, 2019). To gain extraordinary and new services, revolutionary applications, endless business opportunities, China and the USA have been fighting for leadership in the technology sector. The US has blacklisted Huawei Technologies Co. Ltd. (Chla, 2019) arguing national security risk and has lobbied allies to shun Huawei from their 5G networks. However, Huawei refused this, which can be seen as a result of trade war between the US and China. Japan has started its pilot trials of 5G in 2014 and adopted a 5G roadmap in 2016. Japan government started to accept applications

for licenses to operate 'local 5G' services in December 2019. The Mobile Network Operators are focused on widespread deployment ahead of the 2020 Olympics in July (Milne, 2019). Japan approved a bill to support companies to develop secure 5G networks. Boosting international competitiveness and taking a step further, Japan is preparing a detailed blueprint focusing on 6G wireless communications network and expects to have 6G up and running by 2030 (Wray, 2020).

The USA started limited 5G service in selected cities began rolling out in 2018, despite a group of anti-5G activists campaigning its negative effects (Decker, 2019) but it has fully adopted 5G wireless networks in early February 2020. The four Mobile Network Operators (AT&T, Sprint, T-Mobile and Verizon) work on determining the USA's progress in 5G for the next five years by gaining its faster speed services, reduced response times allowing for new services, and cloud computing not previously available (Blackman & Forge, 2019, Rommer et al., 2019). However, UK is moving unsteadily and collaborating with South Korea for progressing growth of 5G technologies to create new opportunities in business and investment. It has launched Enhanced Mobile Broadband (eMBB) services in the first half of 2019 (Rommer et al., 2019).

The European Union formed 'European 5G Observatory' for providing updates of latest market developments, including actions undertaken in 5G field by the private and public sectors. The European Commission launched its "5G Action Plan" in September 2016 to boost investments and rollout efforts for 5G infrastructure and services by 2020 (European Union, 2020). Only nine member states (Austria, France, Finland, Germany, Luxembourg, Netherlands, Spain, Sweden, and the UK) have published their 5G action plans (European Union, 2020). Europe has been prominent in the number of 5G trials, some 138 trials across all member states were recorded by early 2019 and some countries are planning to roll out from 2021.

### 3.1.2. Perspectives from UAE

The UAE's role is considered the position of one of the Middle Eastern flagships in the process of introducing current changes. The UAE's capacity to avail digital equipment, willingness of the competent authorities, availability of supporting resources all make favourable 5G technology deployment (GSMA, 2018a). According to the roadmap of 5G technology and the mandates of the committee, significant progress has been made not only in the Middle East and North Africa (MENA) region but also in the world. The TRA infographic and roadmap in

2018 confirms that the UAE is the leading country of the GCC region in terms of the favourable environment for the implementation of 5G, and this fact proves that the correct preparatory work has been performed in the state (Telecommunications Regulatory Authority, 2018). As per WAM in 2019, the UAE is making top position in the world and ranked 1st in the MENA Region and 4th in the globe in terms of 5G deployment (WAM, 2019). Presently 80% of in the populated areas of main cities are under coverage in UAE. As per development roadmap network expansion is a mature stage now. But still the coverage of availability depending on a number of factors, such as device compatibility, subscription plan and so on. With partnership of Huawei, TRA is trying to create new digital age; therefore, they launched the 5G & IoT OpenLab in Dubai in partnership with Huawei in December 2019 as well as collaborative effort with the government, non-government and academic institutions that will help to serve the community, grow awareness, expand competencies through joint projects and implement future plans in order to contribute to achieve the UAE vision 2021 (WAM, 2019a). By this way a joint platform of operators, parties and vertical industries to innovate 5G arena will bring sustainable and happy future for the society through the development and deployment of 5G technology.

With mobile phone penetration in excess of 200% (WAM, 2018) and smartphone use driving increasing mobile data consumption (GSMA, 2018), the UAE mirrors and in part exceeds the trends of other leading nations globally and current 4G networks are starting to become congested particularly in dense urban areas. Further, the increasing demand for low latency services and emerging demand for massive connectivity across various business and vertical sectors is also beyond the capabilities of existing 4G networks. These, in turn, present major drivers for the emergence of 5G technology and raised the requirement for a national 5G strategy which responds to and recognizes:

1. The growing demand for mobile data everywhere;
2. User expectations for increased mobile data speeds;
3. The increasing need for low latency services across multiple applications;
4. The growing demand for massive device connectivity;
5. The requirement to deliver more services and to do so efficiently and cost-effectively; and

6. That 5G will evolve and future technologies (e.g., 6G) will start to be developed

The figure 1 below maps the use cases that will require 5G technology and those which can be supported by legacy networks. 5G networks will need to evolve in such a way that the required throughput and latency are available – with the appropriate level of coverage – so that the various use cases are enabled.

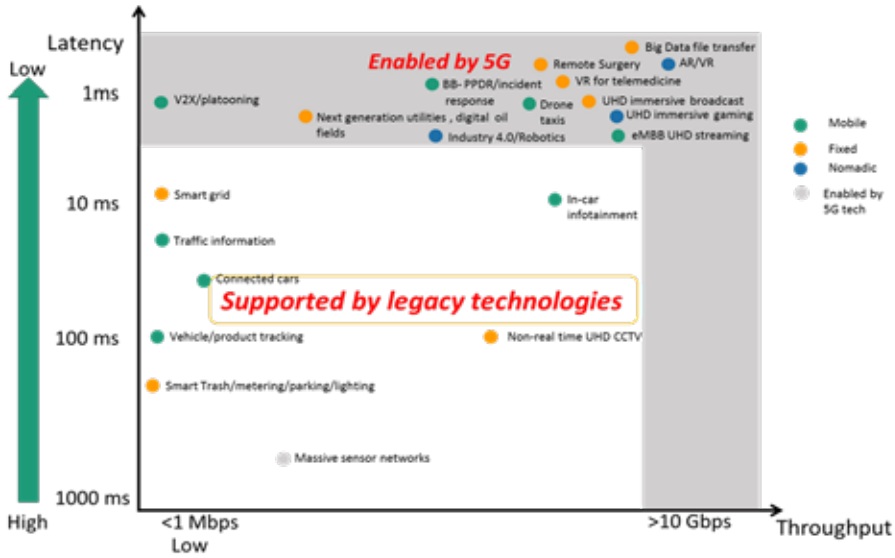


**Figure 1:** Technical mapping of legacy network and 5G characteristics against use case

The TRA has therefore produced this 5G strategy and launched it as "UAE Strategy for 5G and beyond (2020-2025)" (Telecommunications Regulatory Authority, 2020) during UAE 5G Forum in December 2019. Currently, 5G network is covering 14% of the UAE populated areas with more than 3000 sites by the two service providers in the UAE as of the end of Quarter 1 in 2020. This network provides the capabilities of deploying several use cases, the current use cases are: Ultra-High speed data throughput, high-resolution camera surveillance, and drones. As for the short-term use cases, the examples include 5G in-car entertainment, Holograms, diorama and events, AR/VR gaming, health wearables and sensor devices, etc. Those use cases fall under different sectors such as Automotive, Health, Retail, Smart Homes, and Entertainment.

The TRA, in collaboration with their partners and stakeholders, is currently aiming to undertake the following initiatives to achieve the 5G aspirations:

a. Develop an innovation sandbox and support engagement between innovators and the telecommunications industry;

b. Develop new use case focused clusters based on existing 5G committees, government, industry related verticals, and academia

c. Support the ICT sector to use the UAE Lab for relevant 5G testbeds and trials;

d. Set out fresh roadmap of actions for the new use case clusters;

e. Review and learn lessons from new and emerging use cases and 5G related projects around the world that could benefit UAE

f. Participate and contribute to testing and trials of 5G

In summary, a small number of Asian countries such as China, Japan and South Korea; as well as USA are championing the 5G technology while the rest of the world including European Union member countries are moving somewhat slowly. As the competitiveness is increasing in the contemporary globalised world, adopting 5G technology seems highly important in a developed Middle Eastern country like the UAE because increased digital opportunities in the UAE will enhance various sector more specifically tourism, health care, education, transport, logistics etc. Therefore, preparing a development plan and setting a pre-infrastructure of each country requires for the updated version of the wireless connection to interoperate with other platforms, in particular, the Internet of Things (IoT) (GSMA, 2017).

## 3.2 Interview Results and Analysis

During each interview session with selected respondents, this study attempted to understand the opinion, experiences and insights of 5G policy stakeholders. A semi-structured interview protocol, with seven questions, was used. The synopsis of answers with analytical discussion to each of the seven question areas is presented below:

*Impact of 5G technology on multiple sectors of life vis-à-vis mobile communications*

There is no doubt among the seven informants that the introduction of the 5G technology, with secured connections, will be the facilitate industry usage and usage of technology beyond standard mobile communication. It will have impact on sectors such as health, education, industry, transportation, games, manufacturing,

media and entertainment, AR/VR, insurance etc. The respondents also observe that the 5G will make life easier, safer, and healthier, facilitating the existing smart cities program. It has different business plan than previous version of mobile technology such as 3G, 4G and it will enhance other business sectors too.

*The effectiveness of 5G roadmap and the 5G Committee*

The informants positively responded that the UAE has developed a roadmap for 5G together with all stakeholders such as government regulatory authority, operators (telecom and satellite), vendors, mobile industry etc. who are involved in this committee. This roadmap has been approved by high level management at the TRA and it helped achieve a number of milestones and pioneering the 5G commercially in the region. They also informed that the progress is remarkable and can be considered as a "model" in the MENA region. The respondent from Ericsson added that the 5G technology, by its nature, is collaborative and not operator-centric.

*Preparedness for upgrading the wireless network*

All interviewees emphasized that the UAE, as the most advanced country in the GCC region and with its digital database, will successfully implement the 5G network. As the global mobile data traffic is growing therefore there is a need for more efficient networks, higher data rates, and improved spectrum utilization and in that context the UAE operators are always ahead of the competition in upgrading the networks. The TRA informants viewed that the UAE telecom operators are always upgrading their networks in order to meet the new technology and the demand for having high traffic. The Manager of Technology Development at Etisalat observed that an area that needs more focus is allocation and usage of mm Wave spectrum for 5G deployments. Again, the Engineer of Technology and Spectrum Management at Etisalat added that UAE had proven 5G role in the current COVID-19 situation also. The Manager of Technology Planning at EITC emphasized some preparedness for upgrading the main wireless network are required and highlighted that the main cellular network has somewhat peaked in its capabilities and has become mainstream enough to become a normal aspect of consumers' daily lives.

*Future prospects for 5G technology*

There was a consensus by all respondents that if all the provisions of the implementation plan are realised, wireless communication in the UAE will reach a new level of development and a significant number of areas will benefit from increased

productivity. The UAE 5G Initiative Manager at the TRA mentioned that that a study which forecasts that the 5G-enabled solutions will present a 10-year cumulative USD60 billion revenue opportunity for ICT providers in the UAE. The biggest potential support will go to the "smart city" where monitoring real-time data to monitor events and facilities in public services such as road accident in a part of the city, the data could be used to control traffic lights and divert cars, enabling emergency management more quickly.

As different 5G services will improve people's lifestyles and contribute to the UAE economy, therefore, successive improvement is necessary in order to expand across all key verticals, avoid fragmentation and achieve consolidation through collaboration and coherent communication among all players. Again, the first introduction of 5G will be for eMBB and fixed wireless and then immediately will come the virtual reality. Transportation, education and health sector will need to approach with Artificial Intelligence. It was mentioned by one of the respondents representing service providers that the 5G technology will be initially used for "traditional" use cases as mobile broadband and fixed wireless access. However, main focus should be on next stage where 5G technology should be seen as one of engines for industry digitalization, i.e. 4th Industrial Revolution.

*Main challenges*

There was a shared view that the main challenge is that not many 5G business cases and revenue streams are there yet. Convincing the stakeholders to plan their applications on a network that is projected to bring certain features is the key challenge. There are many challenges for introducing 5G e.g. installing new base stations, international standard for the devices, backbone availability for handling big data, legislations and regulations for data protection when it will be used at other sector, data privacy and cyber security attack and spectrum availability and cross boarder compatibility etc. One respondent see the need for effective bridge between industry needs and 5G offerings. The 5G offerings need to meet industry needs and take advantages. Therefore, creating an environment where mobile industry and other industries that are potential technology user will meet and drive 5G enabled invocations is an important step in right direction. It was also specified that harmonization for spectrum, standards and certifications will impact the economies of scale. It is indicated that the decision makers in the UAE are eager to fulfil the vision for being in the lead for 5G deployment.

There is a strong dilemma arises in the deployment of 5G technology due to potential human health security and environment. It has an impact on various se-

ctors of life assuming that IoT in UAE will make human future smarter and new window will open for existing and potential customers through enhanced mobile AI, visualisation, edge computing and and virtual reality. Comments from the Executive Director of Spectrum at TRA addressed that the term '5G' has now become the source of many scenarios, warnings, opportunities. The exiting corona virus outbreak is causing delay in equipment delivery, handsets availability and site installations. The respondent from EITC is worried about the present global pandemic issue. He added that the rollout of 5G will be slow due to rising concerns that the technology is responsible for certain health issues from the public, as well as the COVID-19 which has been a major obstacle to all industries worldwide. Therefore, the public's lack of acceptance and low current demand for a 5G technology may pose a significant challenge.

*Other impediments in technical requirements*

Interviewees have indicated that complexities would always arise, in particular, the difficulty of combining all the spectra into a single whole and a prerequisite for avoiding fragmentation in order to do a smooth implementation. The views from representatives from operators and vendor was that these challenges would differ from one market to another due to the different aspect such as availability of resources, costs of building the network and technical challenges associated with small cells and backhauling as well as the current COVID-19 issue which is causing multiple challenges to operators such as the availability of resources and delay in site installation due to access limitation. Operators are facing other challenges such as costs of building the network, the number of connected devices and finding optimum use cases. Respondent from EITC added that the 5G at the moment seems to be more of a premium service, with the high cost of 5G phones, the need for a plethora of "smart" devices within one's immediate day-to-day vicinity to truly take advantage of the possibilities, as well as the limited number of areas which have a deployed 5G RAN. Until the technology becomes more widespread and the price of equipment drops with greater production and demand, it seems that the starting road for 5G will be slow in any case. Again, handset availability, number of connected devices, cybersecurity and data privacy are remains challenges for the UAE but major challenges identified that devices are not ready except CPE for MBB only though telecom operators have already deployed their network.

However, the informants mentioned that partnership with Ericsson and Etisalat will further extend 5G opportunities and expand 5G coverage, both mobile and fixed wireless, and market to gain benefits to UAE businesses and consumers where UAE businesses man can explore automation and artificial intelligence to

improve productivity and service provision. The respondents from Etisalat added that Etisalat are now constructing more than 1,000 5G towers in the UAE in order to support all 5G devices launched by renowned mobile device manufacturers such as ZTE, Huawei, Ericsson, Nokia and Samsung. It plans to spend Dh4 billion on "digital transformation" and improving the mobile and fiber network this year and claimed that Etisalat Metro Station in Dubai is the first 5G-enabled metro in the MENA region. They are optimistic that there are no major obstructions in deploying 5G technology for "traditional" use cases i.e. mobile broadband and fixed wireless access. However, the goal is usage of 5G technologies for new industry related use cases. This is new area for mobile industry and number of, primarily organizational and goes to market, hurdles need to be overcome.

*Recommendations to overcome challenges*

A list of recommendations has been provided by the respondents. These include (a) adopting a pro-active approach, (b) institutional and stakeholder collaborate to bring all stakeholders together, (c) educating people on the benefits of 5G, (d) finding the optimum use cases, new business models through network slicing, (e) updating regulatory frameworks, (f) accelerating standards development, (g) regional harmonization for economies of scale and (g) incentivise deployments. They also added that the current initiative of introducing the 5G technology as a key wireless network in the UAE is successful at this stage of implementation with enormous anticipated impacts on various sectors and life.

The TRA informants recommended that venders have to expedite their work at those international organizations (ITU, 3GPP) for finalizing the standard for 5G devices, vacating the spectrum from other radio services for 5G; develop policies, regulations and other for Data Protection and should be done in collaboration with the government, regulator, telecom operators, and the relevant sector and give support to telecom operators to install their stations. The Etisalat representatives recommended that creating channels for the creative interaction between mobile and other industries and stimulating innovation would use more benefits of 5G technology.

From the literature review from a number of countries in the world and UAE perspectives and the interviews with key stakeholders, it can be summarised that the since the launch date, strategic initiatives, key players were able to participate with their inputs to the works of the UAE 5G Committee. This proactive approach of the UAE helped increase the country's readiness by providing the necessary resources. The stakeholders are aware of the problems and prospects for introdu-

ction, and possible consequences are proposed in order to fulfil the roadmap successfully. The deployment of 5G technology will make positive impact on various sectors of life in the UAE. It will make life easier, safer, and healthier including connecting 5G will make smart cities, smart buildings, smart metro stations and so on. The UAE government has prepared a roadmap and the mandates of the UAE's 5G committee and working groups show comprehensive and proactive technology deployment for a smooth 5G implementation. In many respect, the UAE is playing as a 'role model 'among the MENA countries as well as making a mark in digital world. All respondents made a positive opinion that that the present plans and actions will bring a new level of development in the UAE and improve people's lifestyles and contribute to the country's economy. However, there are still rooms for improvement in various areas including the aspects of business cases and flexibility in regulations.

# 4. RECOMMENDATIONS AND CONCLUSION

From the global perspective, more than 30 countries have deployed or started to deploy 5G technology to gain technological benefits. The North-East Asian countries are more active but Middle East Asian Countries like the UAE is measuring it as a relevant task and preparing it for the launch. The other Arabian countries such as Bahrain, Kuwait, Saudi Arabia and United Arab Emirates who lunched their initial 5G services in 2019 but among them UAE is more active and both national and local level are taking proactive approaches to implement 5G technology comprehensively. The UAE's movement can be considered one of the Middle Eastern flagships in the development and deployment process of introducing on 5G technology. Continuing the successful implementation of the 5G technology in the UAE it has been noted that various sectors such as healthcare, transportation, tourism etc. will benefit remarkably. To make the 5G strategy more effective, there is a need to further develop the 5G approach in different areas, including new business models. Updating the regulatory frameworks and harmonization of economies of scale are also critical success factors.

This study also recommends the following:

1. Though UAE has prepared 5G strategy (a roadmap) for the next 5 years, action plans are needed to prepare the country to perform better in a competitive world and a risk plan is needed to tackle possible threats and uncertainties.

2. Implementation initiatives should take into account potential challenges – more specifically health and environmental risks.

3. More base stations are inevitable in order to develop speed and to enhance greater network availability as a leader in the MENA region.

4. From a short-term perspective, more attention should be given to strengthen network virtualisation and to enhance digital experience of the leading developed countries who have already deployed 5G.

5. Develop an innovation sandbox and support engagement between the innovators and the telecommunications industry.

6. Develop new use case focused clusters based on existing 5G committees, government, industry related verticals and the academia in a quadruple-helix nexus.

7. Review and learn lessons from new and emerging use cases and 5G related projects around the world to draw lessons for the UAE.

In this study, various notions have underpinned on this 5G wireless network, described the stakeholders involvement, and highlighted the deployment experience of 5G Technology briefly in different countries of the world. A primary potential limitation of this study is the use of a large number of sampling and focus group discussions, which may lead to self-selection bias that limits the generalization of our research to all citizens. However, based on the literature review and KII, it can be concluded that following specific strategies and principles of implementation may help to realise the potential of the innovation and deployment program. It is also found that the readiness of the UAE government to implement 5G is at a high level. The UAE Strategy for 5G and beyond (2020-2025) provides the framework for the TRA's support of the continued development and successful uptake of 5G in the UAE. It also results in the proactive approach taken by the relevant organizations aiming to make the 5G network ready in 2020. The TRA and in collaboration with their partners and stakeholders are aiming to undertake the following to achieve the 5G aspirations for partnerships and collaboration such as: Develop new use case focused clusters based on existing 5G committees, government, industry-related verticals, and academia (Telecommunications Regulatory Authority, 2020).

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