Deployment of 5G Wireless Mobile Network: Economic Opportunities for Key Sectors in Nigeria

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ABSTRACT
The introduction of 5G wireless mobile networks opens enormous economic prospects for Nigeria's core industries. This research intends to illustrate the potential advantages of 5G in a variety of industries, including telecommunications, healthcare, transportation, agriculture, and education. The study's target population consists of 94 full-time employees of telecommunications companies operating in Nigeria's South-South region. However, the accessible population consists of 385 sample components drawn from 94 MTN, Globacom, Airtel, and 9Mobile locations, based on information given by the Human Resources (HR) Departments of these telecommunications companies. MTN received 118, Globacom received 96, Airtel received 92, and 9Mobile received 79. Data was examined for descriptive statistics using mean and standard deviation using Analysis of Moment Structure (AMOS). It was discovered that 5G may promote the creation of new apps and services that can boost efficiency, productivity, and innovation in several areas due to faster speeds, reduced latency, and larger capacity.

Keywords: *5G Wireless Mobile Networks, and Economic Opportunities.*

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Introduction

The insatiable search for information and new knowledge has increased exponentially today, resulting in a knowledge explosion that has led to inventions, innovation, and novel technological creations. One such technological creation is the 5th Generation's wireless mobile network. In this

sense, Bakare *et al*. (2021), Marzel *et al*. (2018), Salam et al. (2019), and Shi *et al*. (2019) noted that the ever-increasing number of connected devices and the necessity to accommodate cutting-edge technology are two major drivers behind the push for a 5G network. Some of the most important arguments in favour of a 5G network include the following: (1). 5G networks are expected to provide data transfer rates that are several times faster than those of earlier mobile network generations. High-bandwidth data transmission applications like virtual reality, augmented reality, and video streaming benefit greatly from this. (2). The time it takes for a server to process a request and give back an answer, known as latency, should be minimized. For time-sensitive uses like remote surgery, driverless cars, and gaming, the anticipated reduction in latency offered by 5G networks over 4G networks is crucial. (3). To accommodate the growing number of users and linked devices, 5G networks will provide more bandwidth. In the case of IoT (Internet of Things) devices, which need constant communication and may generate massive volumes of data, this is of paramount importance. (4). Improved signal strength and coverage are only two ways in which 5G networks are predicted to be more dependable than their mobile network predecessors. This is crucial for uses like driverless cars, which always need continual and dependable connectivity. (5). Facilitate the development of cutting-edge applications and technologies: 5G networks will pave the way for the creation of cutting-edge applications and technologies like driverless cars, smart cities, and telemedicine.

In recent years, there has been a lot of interest in the empirical overview of 5G wireless mobile network deployment and challenges in Nigeria's communication market. Even though there is more and more written about 5G technology, there are still some gaps, especially when it comes to how it is used and the problems it faces in Nigeria's communications market. Few studies (Adegbenga *et al.*, 2019; Lee *et al.*, 2018; Salami *et al*., 2019) have been done on how ready Nigeria's communication market is for 5G technology. This is one of the gaps in the research. There is a need for empirical studies that look at the infrastructure, policy environment, and investment landscape of the Nigerian communication market as it is now. These studies would tell us a lot about the challenges and opportunities for putting 5G technology to use in Nigeria. The lack of research on how 5G technology might affect Nigeria's economy and society is another gap in the research. Some research has been done (Adegbenga *et al*., 2019) on the possible economic and social benefits of 5G technology, but more research is needed to look at how it might affect key areas like healthcare, education, agriculture, and transportation. Such studies would tell us a lot about the possible benefits and problems of putting 5G technology into use in Nigeria.

Literature Review

Literature was reviewed extensively on 5G Wireless Mobile Network

5G Wireless Mobile Network

5G Wireless Mobile Network is the fifth generation of mobile network technology. It allows for faster data transfer speeds, less delay, and more space to connect more devices. It is meant to improve connectivity, reliability, and coverage for IoT, smart cities, autonomous vehicles, and telemedicine, among other things. 5G networks use advanced technologies like millimeter-wave frequency bands, Massive MIMO (Multiple-Input Multiple-Output), and Network Slicing to allow faster data transfer rates and lower latency (Hoffman, 2018; Kelechi et al., 2019). This makes it easier for devices to connect and talk to each other.

Abecassis *et al.* (2018), Kelechi *et al*. (2019), and Lee, *et al*. (2018) noted that Fifth-generation (5G) wireless mobile networks will change how people access and use mobile technology. Here are some of the ways that 5G helps people: (1). Faster Internet Speeds: 5G promises to make the internet faster, so people will be able to stream high-quality videos, download large files, and play online games without any problems. This faster speed will get rid of buffering and lag, making the experience more enjoyable. (2). Better connectivity: 5G technology lets more devices connect to the network, so people can connect more devices to their mobile network without losing speed or connection quality. This increased connectivity will also make connections more stable and reliable, which is good for things like video conferencing and online gaming. (3). Better User Experience: New applications and services will be made possible by 5G technology, which will make the user experience better. Applications like augmented reality and virtual reality will become more immersive, letting people experience things like live concerts, sports games, and travel in a more real way. (4). Better health care: 5G technology is going to change the way people get health care by making remote patient monitoring and telemedicine more common. With 5G, doctors will be able to check on and track the health of their patients without having to visit them in person. This will make health care more accessible to people who live in remote areas. (5). Productivity: With faster internet speeds and better connections, people can work more quickly and efficiently, whether they are at home or on the go. 5G technology also lets us use more advanced software, which can make us more productive and help us work together better. (6). Integration of Smart Home Devices: 5G will make it easier to connect smart home devices like smart speakers, thermostats, and security cameras. With this integration, people will be able to control their home devices from their mobile devices. This will make their homes easier to use and safer. (7). Less energy used: 5G technology is made to use less energy than 4G technology, so mobile devices' batteries will last longer. This will let people use their mobile devices for longer periods of time without having to charge them as often.

Again, the advent of the 5G (Fifth-Generation) wireless mobile network has caused a lot of excitement in the business world because it promises speed, capacity, and reliability that have never been seen before. This technology could change how organizations work, making them more productive, efficient, and competitive (Arias *et al*., 2020; Idowu-Bismark *et al*., 2019). Here are some ways in which 5G wireless mobile networks can help businesses. (1). High-speed connections: One of the most important things about 5G technology is how fast it can connect devices. 5G networks can send data at up to 10 Gbps, which is 100 times faster than 4G LTE networks. This means that businesses can quickly download and upload large files, stream high-quality videos, and run complicated programs. High-speed connectivity helps businesses run more smoothly by giving decision-makers data and information in real-time, reducing latency, and increasing overall productivity. (2). Better capacity and bandwidth: 5G technology could allow a huge number of connected devices to work at the same time. As the Internet of Things (IoT) becomes more common, organizations are looking for ways to connect a growing number of devices, sensors, and machines. 5G networks can support up to a million IoT devices per square kilometre. This means that organizations can manage and monitor large-scale deployments of IoT devices. With more capacity and bandwidth, organizations can work more efficiently, making it easier to track inventory, keep an eye on production, and streamline operations in the supply chain. (3). Improved reliability: A network's reliability is important for businesses, and 5G technology makes big improvements in this area. The new technology makes networks more available, has a

stronger signal, and has less latency. This means that organizations can expect better connectivity, fewer calls that get dropped, and smoother streaming. Because 5G networks are more reliable, organizations can also use new technologies like self-driving cars, remote surgery, and real-time monitoring of critical infrastructure. (4). Employees can work from anywhere, at any time, thanks to 5G networks. With 5G, employees in different locations can join video conferences, use company resources, and work together in real-time. Also, 5G technology can make field workers more productive by letting them access important data and apps while they're on the move. This makes people more mobile, which can help them be more productive, make decisions faster, and be happier at work. (5). More innovation and new business models: The new 5G technology will also give businesses new chances. Because the technology is fast, has a lot of storage space, and is reliable, it can be used to make new apps and services, like augmented reality, virtual reality, and mixed reality. These new technologies can be used in fields like healthcare, education, and entertainment to create new business models, boost profits, and improve the customer experience. (6). Cost savings: Finally, 5G networks could help organizations save money on costs. With 5G networks' increased speed and capacity, businesses can rely less on expensive wired connections and infrastructure and more on cheaper wireless options. Also, 5G networks can make it possible to run things from afar, which cuts down on the need for staff and real estate costs.

Interestingly, the benefits of the 5G (Fifth-Generation) wireless mobile network go beyond the business world and affect society as a whole. Technology has the potential to completely change the way we live, work, and talk to each other, making many parts of our lives much better (Arias *et al.*, 2020; Brown et al., 2020; Idowu-Bismark *et al*., 2019). Here are a couple of ways 5G technology will help society. (1). Communication that is faster and more reliable: 5G technology promises to make communication much faster and more reliable than ever before. With download speeds of up to 10 Gbps and latency as low as one millisecond, 5G networks will allow for instant communication, seamless video conferencing, and immersive virtual and augmented reality experiences. These improvements will make it easier for us to connect with each other in real-time and make it easier for us to talk to each other more quickly. (2). Better access to information: 5G technology can make it easier for everyone, no matter where they are, to get information. People can get a lot of data and resources no matter where they are because 5G networks are fast and have a lot of space. This will make it possible for students in remote areas to get access to educational resources, for doctors and nurses to get real-time medical data and patient records, and for businesses to run smoothly from anywhere in the world. (3). More people using the Internet of Things: The introduction of 5G technology could lead to a big rise in the number of people using the Internet of Things (IoT). Because 5G networks are faster, have more capacity, and are more reliable, they will make it possible to set up huge networks of connected devices and sensors that can collect and analyze data in real-time. This will lead to improvements in many areas, such as energy efficiency, public safety, and transportation. (4). Improved public safety: 5G technology can also improve public safety by letting emergency situations be watched and analyzed in real time. 5G networks can support real-time streaming of video feeds because they are fast and have low latency. This lets first responders make quick decisions based on the situation at hand. Also, 5G technology can make it possible to control important infrastructure from afar, which can lower the risk of accidents and improve public safety. (5). Benefits for the environment: The high speeds and reliability of 5G networks can also have big benefits for the environment. 5G technology can help reduce carbon emissions and improve air quality by letting people work from home and

reducing the need to travel. Also, the Internet of Things (IoT) sensors made possible by 5G technology can help monitor and manage resources like energy and water more efficiently. This means less waste and a better environment. (6). Economic benefits: Finally, putting 5G networks in place can be good for the economy in a big way. The technology can make new business models possible, make more jobs available, and help the economy grow. To set up 5G networks, a lot of money will need to be spent on infrastructure and technology, which will create jobs and help the economy.

Nevertheless, using a 5G mobile network in an economy that is still growing can have a big impact and present both challenges and opportunities for growth. Here are a few important points: (1). Better communication and connections: Using a 5G mobile network in a developing economy can make a big difference in how well people can talk and connect with each other. With faster download and upload speeds, less latency, and more reliable connections, 5G networks can make it easier for businesses and people to communicate, get information, and do things online. This can lead to more work being done, better access to education, and better health care. (2). More people will be able to use digital services if 5G networks are put in place. This can happen in a developing economy where 5G networks are put in place. With faster speeds and more storage space, 5G networks can help digital services like mobile banking, e-commerce, and online education spread. This can help businesses grow their markets and find new ways to make money, and it can also make it easier for people in remote areas to get services. (3). A boost to economic growth: Using a 5G mobile network can help an economy that is still growing. When 5G infrastructure and technology are put into place, they can help create new jobs, spur innovation, and bring in investment. 5G networks can help businesses run more efficiently, cut costs, and become more competitive on the global market because they are faster and can handle more data. This can help boost exports and make the economy stronger. (4). Smart cities can be built with the help of 5G mobile networks in economies that are still growing. With the help of Internet of Things (IoT) sensors and connected devices, 5G networks can help monitor and manage things like traffic, energy use, and waste management. This can lead to a better use of resources, a safer community, and a higher quality of life for the people who live there. (5). Problems with deployment: There are also problems with putting 5G networks in place in a country that is still developing. The high cost of infrastructure and equipment, the difficulty of getting money, and the lack of skilled workers can all make deployment much harder. Also, the digital divide, which means that some places don't have as much access to the internet as others, can make it harder for people to get the same benefits and make the gap between urban and rural areas even bigger. (6). Concerns about cybersecurity: Putting 5G networks in place also raises concerns about cybersecurity. As more connected devices and sensors are used, cyber-attacks and data breaches are more likely to happen. Economies that are still growing may not have as much money to put into cybersecurity, which makes them more likely to be attacked (Brown *et al*., 2020; Idowu-Bismark *et al*., 2019).

Theoretical Foundation of 5G Wireless Mobile Network

Thomas L. Marzetta, a researcher at Bell Laboratories, was the first to propose the theoretical underpinning of Massive MIMO (Multiple-Input, Multiple-Output) in a significant article that was published in 2010. The research that Marzetta conducted centered on increasing the capacity and spectral efficiency of wireless communication networks via the use of massive antenna arrays at the base station. Massive MIMO is an expansion of the existing MIMO technology, which makes

use of many antennas at both the transmitter and the receiver to increase signal quality and minimize interference. Massive MIMO is built on the foundation of this technology. Massive MIMO, on the other hand, makes use of hundreds or even thousands of antennas to connect with a huge number of users concurrently. This contrasts with standard MIMO, which normally makes use of just a limited number of antennas (such as 2-4). Massive MIMO has the potential to dramatically enhance the performance of wireless communication systems. These improvements might include an increase in spectral efficiency, an improvement in coverage and dependability, and a reduction in the amount of energy that is used. Massive MIMO has gone a long way since it was first proposed by Marzetta; it is now a significant area of research and development in the field of wireless communication, and it is a technology that is essential to the construction of 5G wireless networks (Basnayaka *et al*., 2013; Kupper *et al*., 2022; Shi *et al*., 2019).

Basnayaka *et al*. (2013) noted that massive MIMO (Multiple-Input, Multiple-Output) is a wireless communication technology that uses a lot of antennas at the base station to serve a lot of user terminals at the same time. Massive MIMO theory is based on the following basic ideas: (1). Channel hardening: As the number of antennas at the base station goes up, the channel between the base station and the user terminals gets more stable. This means that the channel is less likely to fade, which could make communication more reliable. (2). Spatial multiplexing: The system can send different data streams to different user terminals at the same time by using multiple antennas at the base station. This lets data rates go up and makes better use of the spectrum. (3). Interference averaging: Using a lot of antennas at the base station can help reduce interference between user terminals. The interference can be averaged out by the base station using signal processing, which can improve the quality of the signal. (4). Energy efficiency: Massive MIMO can use less energy than traditional wireless systems because it uses spatial processing techniques to send the power only to the user terminals that need it instead of sending it everywhere. (5). Pilot interference: In massive MIMO, the base station estimates the channels to the user terminals by using pilot signals. But if different user terminals use the same pilot signals, it can change how well the estimates are made. This is called "pilot contamination," and it can hurt how well the system works.

Massive MIMO (Multiple-Input, Multiple-Output) technology is a key part of 5G wireless mobile networks. In fact, it is one of the main technologies that makes 5G possible. Massive MIMO is related to 5G in the following ways: (1). Higher data rates: By using spatial multiplexing to send multiple independent data streams to multiple user terminals at the same time, Massive MIMO can increase the data rates of wireless networks. This means that 5G networks that use Massive MIMO can send and receive data at a faster rate than networks from earlier generations. (2). Better coverage and capacity: Massive MIMO can improve the coverage and capacity of wireless networks by putting a lot of antennas at the base station. This means that 5G networks can support more user terminals and have a wider range than wireless networks of the past. (3). Lower latency: 5G networks that use Massive MIMO can also have less latency than networks from earlier generations. This is because using multiple antennas makes signal processing more efficient, which can cut down on the time it takes to send and receive signals. (4). Energy efficiency: Massive MIMO can use less energy than traditional wireless systems, which is important for 5G networks that will need to support a lot of devices and services. Massive MIMO can cut down on energy use by using spatial processing techniques to focus the transmitted power on the user terminals instead of sending it out in all directions (Basnayaka *et al*., 2013).

Empirical Review

Al-Namari (2017) noted that soon, the new technology of the fifth generation of wireless mobile networks will give everyone, everywhere, and for everything lightning-fast internet. Many things are being worked on and researched, such as millimetre wave (mmW) radio transmission, massive multiple input and multiple output (Massive-MIMO) new antenna technology, the promising technique of SDN architecture, the Internet of Things (IoT), and many more. In this short overview, we'll talk about some of the latest steps toward the 5G mobile network. Kupper et al (2022) opined that successful system design to achieve optimization and control in industrial production relies heavily on the digitization of processes and the incorporation of a digital twin. Accessing real-time information on the location of equipment, goods, and parts is crucial to achieving this aim. It paves the way for smart, automated, and recorded procedures across the board in manufacturing. Ultra-wideband (UWB) solutions are often used in today's radio real-time locating systems (RTLS) in manufacturing; nevertheless, these systems need separate, expensive infrastructure. High-precision positioning is being added as 5G technology shifts its emphasis from mobile communication to becoming a globally standardized industrial solution. Research demonstrates the feasibility of using existing communication infrastructure for location purposes. This contribution conducts guided empirical expert interviews based on a systematic literature review with 28 experts to ascertain the level of development in 5G positioning at the industry level. State-of-the-art, UWB-RTLS comparisons, and security are among of the topics covered. The findings demonstrate a significant interest from the business sector in 5G positioning and a need for centimetre-level accuracy. Nevertheless, field tests reveal that the hardware is still in its early stages of development and that testing is still limited to lab settings. In conclusion, 5G positioning has a lot of promise, but it has to be tested in real-world, complicated settings through industrial pilots. Agubor *et al*. (2021) noted that the rollout of 5G mobile wireless communication technology is hampered in many ways around the world. All these obstacles have slowed down the implementation of this technology in these nations. Like with any nation, Nigeria's unique challenges have slowed the spread of this technology there. The article offers solutions to these problems and other issues that may arise during the rollout of 5G networks. To conduct this research, we visited two industry leaders and collected data from them, as well as studied the approaches other countries have taken to solving difficulties associated with the rollout of 5G networks. Some helpful recommendations were made for moving forward with the full implementation and operation of 5G technology in Nigeria, based on data gleaned from the industry and related literature. These included things like enhancing the country's fibre infrastructure and lowering regulatory barriers to attracting investors.

Research Hypotheses

The following research hypotheses were formulated and texted in a null form:

$H0_1$ There is no correlation between economic opportunities and the advancement of the healthcare sector in Nigeria.

$H0_2$ There is no correlation between economic opportunities and the advancement of the education sector in Nigeria.

$H0_3$ There is no correlation between economic opportunities and the advancement of the agricultural sector in Nigeria.

$H0_4$ There is no correlation between economic opportunities and the advancement of the transportation sector in Nigeria.

Methodology

The descriptive research method is used in this study because; (1). It describes the features of a population under study (2). It is an observational research approach since no variables in the study are modified throughout the research process (3). It entails the use of quantitative instruments like as surveys, experiments, interviews, focus groups, field observation, and data mining. This study's target group consists of 94 full-time workers of telecommunication enterprises operating in Nigeria's South-South area. Nevertheless, the available population is 385 sample elements chosen from 94 MTN, Globacom, Airtel, and 9Mobile locations, based on information provided by these telecommunication businesses' Human Resources (HR) Departments. MTN had 118, Globacom had 96, Airtel had 92, and 9Mobile had 79. For descriptive statistics, data was analyzed using mean and standard deviation with the help of Analysis of Moment Structure (AMOS).

Test of Hypotheses

To test the bivariate hypotheses via the SEM, the bootstrap method was applied. Path coefficients (β values) of .10 to 0.29, .30 to .49 and .50 to 1.0 are weak, moderate, and strong correlations, respectively. Also, for a two-tailed test, t values greater than 1.96 are significant, while t values less than 1.96 are non-significant (Hair *et al.*, 2014). Furthermore, hypotheses with p-values less than 0.05 level of significance were accepted, while those above 0.05 were rejected. The coefficients of determination (R^2 or coefficient of determination) were identified. R^2 values for endogenous variables are assessed as: 0.00 to 0.25 (weak), 0.26 to 0.50 (moderate), $\geq$ 0.75 (substantial). The effect size (f^2) of each path in the model by means of Cohen's (Cohen, 1988). Values for $f^2 \geq 0.020$ and < 0.15 are small, values ≥ 0.15 and < 0.35 are medium, while values $\geq$ 0.35 are large (Cohen, 1988).

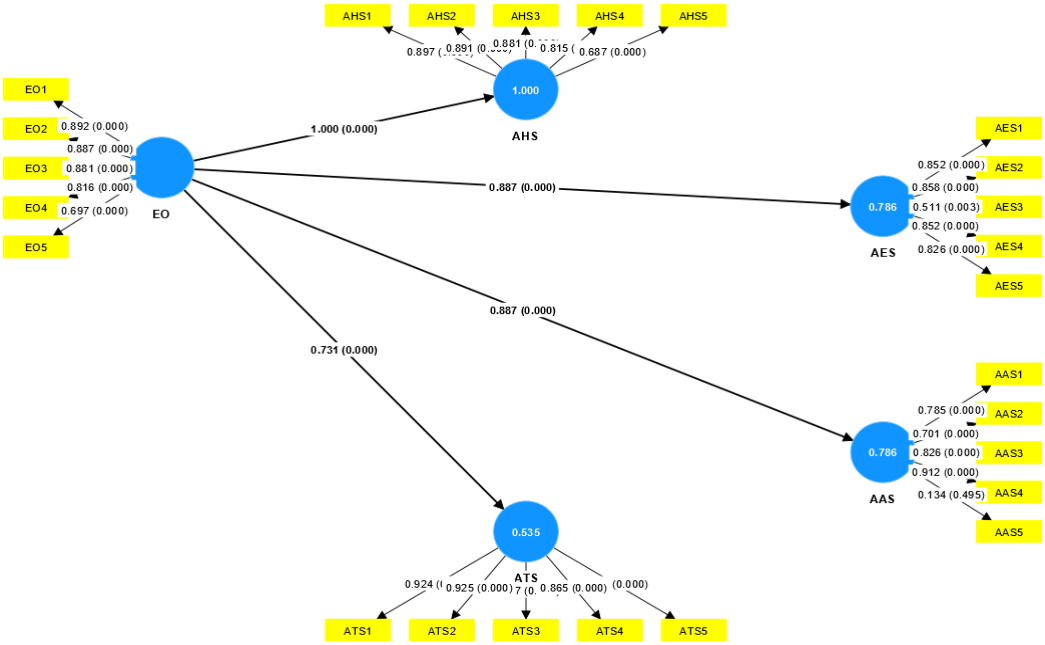

Figure 1: Tree Test of Bivariate Hypothesis

Results of Hypotheses Testing

Null Hypothe	Path Coefficient (β)	P Values (p)	Coefficient of Determination (R^2)	T Statistics (t)	Effect size (f^2)	Decision on Hypothesis
H_{O1}	1.000 (Strong)	0.000 (Accepted)	1.000 (Strong)	14.820 (Significant)	0.725 (Large)	Rejected
H_{O2}	0.887 (Strong)	0.000 (Accepted)	0.786 (Strong)	29.732 (Significant)	0.454 (Large)	Rejected
H_{O3}	0.887 (Strong)	0.000 (Accepted)	0.786 (Strong)	2609.554 (Significant)	0.193 (Medium)	Rejected
H_{O4}	0.731 (Strong)	0.000 (Accepted)	0.535 (Moderate)	5.728 (Significant)	0.533 (Large)	Rejected

Findings

i. It was found that the 5G mobile network can enhance telemedicine, remote monitoring, data collection, patient experience, and cost reduction.

ii. The 5G mobile network has the potential to considerably assist the education industry by increasing access to education, improving learning experiences, lowering costs, and boosting learning results.
iii. The agricultural industry may profit considerably from the 5G mobile network by increasing production, lowering costs, improving supply chain management, increasing farm safety, and allowing precision agriculture.
iv. The 5G mobile network has the potential to considerably help the transportation industry by allowing linked cars, boosting traffic flow, strengthening fleet management, supporting the development of smart infrastructure, and improving logistics and supply chain management.

Discussions on Findings

5G technology may improve telemedicine services by delivering a dependable and quicker network capable of transmitting video and audio in real time without lag. This allows physicians and healthcare workers to remotely diagnose and treat patients, decreasing the need for in-person consultations and enhancing access to healthcare in distant and rural locations. The 5G network supports the use of wearable gadgets, sensors, and other medical equipment that may remotely monitor the vital signs and health problems of patients. This enables healthcare practitioners to monitor the health state of patients in real time, spot any irregularities, and take immediate corrective action, hence minimizing the need for hospital admissions and readmissions. 5G can facilitate the capture, processing, and analysis of massive amounts of data. This lets healthcare practitioners gather and analyze vast quantities of health data, such as patient records, clinical trials, and research data, resulting in more accurate diagnoses, individualized treatments, and improved patient outcomes. The 5G network may improve the patient experience by facilitating quicker and more dependable access to healthcare services (Agubor *et al*., 2021). Mobile apps allow patients to effortlessly schedule appointments, obtain test results, and connect with healthcare practitioners, therefore lowering wait times and enhancing patient convenience. By using 5G technology, healthcare practitioners may cut expenses related with in-person consultations, hospital hospitalizations, and readmissions. Telemedicine services, remote monitoring, and better data collecting may also lower healthcare costs by enhancing the accuracy of diagnoses, decreasing the likelihood of medical mistakes, and enhancing patient outcomes.

5G technology may provide quicker and more dependable communication, enabling real-time video and audio streaming, which can improve remote learning. Instructors and students may engage in virtual courses and communicate in real-time regardless of their physical location, increasing access to education and lowering expenses. 5G can help educators employ augmented and virtual reality. Technology may improve the learning process by giving students interactive and immersive experiences, making complicated topics simpler to comprehend. Students and instructors may use 5G technology to access online educational materials such as e-books, research papers, and online libraries. This may eliminate the need for actual textbooks and other materials, lowering printing and shipping expenses. The 5G network can help teachers, students, and other educational stakeholders communicate and collaborate more quickly and reliably. This may result in more efficient information exchange, increased cooperation, and better learning results. Educational institutions may cut expenditures connected with physical classrooms, such as maintenance, utilities, and other related fees, by using 5G technology (Agubor *et al*., 2021).

Moreover, remote learning may eliminate the requirement for costly campus infrastructure, which can result in cost savings.

Precision agriculture, which entails employing sensors, drones, and other technologies to gather real-time data on crops, soil, and weather conditions, may be facilitated by 5G technology. This information may be provided in real-time to farmers and agricultural specialists, allowing them to make educated choices and maximize crop yields, resulting in cost savings and enhanced production. The 5G network may enable quicker and more reliable communication and data transfer among farmers, distributors, and retailers, hence boosting supply chain management. This may minimize waste and enhance efficiency, saving farmers and other stakeholders money. The 5G network can allow farmers to deploy automation and robots, lowering labour costs and enhancing efficiency. Planting, harvesting, and sorting crops, for example, may be performed by robots, eliminating the need for human labour, and increasing output. Farmers may employ remote sensors and cameras using 5G technology to monitor their farms, identify possible threats, and react to crises swiftly. This may increase farm safety by lowering the chance of accidents and injuries, resulting in cost savings and better worker well-being. The 5G network may help farmers run their activities more effectively by supporting the usage of digital platforms and solutions (Al-Namari, 2017). This includes crop planning, inventory management, and financial monitoring technologies, all of which help enhance decision-making and save expenses.

5G technology may enable connected and autonomous automobiles by facilitating communication between vehicles, infrastructure, and other devices. This has the potential to minimize accidents, enhance traffic flow, and lower transportation costs, resulting in economic advantages. 5G can help with ITS, which includes collecting and transmitting real-time data on traffic conditions, weather, and other elements using sensors and other technologies. This information may be utilized to enhance traffic flow, decrease congestion, and increase transportation efficiency, all of which will result in economic gains. The 5G network can facilitate the usage of digital fleet management systems and solutions, allowing transportation businesses to run their operations more effectively. This includes route planning, vehicle tracking, and driver performance monitoring systems, all of which may help to decrease expenses and increase productivity. The 5G network has the potential to allow the development of smart infrastructure, such as smart traffic lights, intelligent road signs, and other technologies that increase transportation safety and efficiency. This may lead to cost savings by reducing the requirement for physical infrastructure (Shi *et al.*, 2019). Transportation businesses may employ 5G technology to enhance logistics and supply chain management, lowering costs and increasing efficiency. This includes real-time monitoring of items, inventory management, and shipping tracking, resulting in cost savings and increased productivity.

Conclusions

Conclusively, the research on the economic importance of 5G wireless mobile networks to healthcare, education, agriculture, and transportation sectors highlighted the technology's enormous potential to modernize these important industries. The implementation of 5G networks across the healthcare, education, agricultural, and transportation sectors has the potential to dramatically increase their efficiency and effectiveness. The improved speed and capacity of 5G networks in healthcare might allow remote patient monitoring, virtual consultations, and real-time access to medical data, resulting in better patient outcomes and lower healthcare expenditures. 5G networks in education might allow immersive learning experiences, remote education delivery,

and collaboration, resulting in enhanced education results and expanded access to excellent education for students in distant places.

In agriculture, 5G networks might boost agricultural efficiency by monitoring crop growth, weather conditions, and soil moisture levels in real-time, resulting in higher crop yields and lower expenses. 5G networks in transportation might allow the development of self-driving cars, real-time traffic monitoring, and intelligent transportation systems, resulting in increased road safety and decreased traffic congestion. Notwithstanding the potential advantages of 5G networks to these vital industries, the report also identifies some of the hurdles to 5G network adoption in these sectors, such as high infrastructure costs and restricted spectrum availability. To enable the effective implementation of 5G networks in various industries, governments, industry actors, and other stakeholders must work together to overcome these problems. According to the report, the introduction of 5G wireless mobile networks has the potential to alter the healthcare, education, agricultural, and transportation sectors. To achieve the full potential of this technology, governments and industry participants should take proactive actions to overcome the problems and promote the development of 5G networks in various industries. Lastly, the report sheds light on the economic significance of 5G wireless mobile networks in the healthcare, education, agricultural, and transportation sectors. The results of this study are expected to motivate additional research in this field and guide policy choices that will support the effective deployment of 5G networks in these industries, resulting in major improvements in people's quality of life and economic development.

Practical Implications of Massive MIMO (Multiple-Input, Multiple-Output):

Here are some real-world effects of putting Massive MIMO theory to use: (1). Increased Spectral Efficiency: Massive MIMO technology makes it possible to send and receive multiple data streams at the same time. This makes spectral efficiency go up a lot. This means that more data can be sent at the same time. This makes wireless communication faster and more reliable. (2). Increased Network Capacity: Since Massive MIMO systems use many antennas, the network capacity can be increased. With more antennas, you can serve more users at the same time without lowering the quality of service. (3). Better Signal Quality: When multiple antennas are used in Massive MIMO systems, multipath fading, which can cause signal degradation and interference, is lessened. Spatial diversity is used by technology to get around these problems and improve the quality of the signal that is received. (4). Increased energy efficiency: Using Massive MIMO can also help save energy because it lets signals be sent to specific users more precisely. This makes it less important to send signals in every direction, which can waste energy. (5). Massive MIMO is a key technology in the development of 5G wireless networks, so it should work with them. Massive MIMO helps 5G networks in sending and receiving data much faster and better.

Recommendations

The following recommendations were made:

i. When applied to the healthcare industry, 5G has the potential to increase communication and the exchange of information, ultimately leading to improved patient outcomes and lower overall costs. It is possible to do real-time monitoring of patient's vital signs using

remote monitoring equipment; however, investments in infrastructure, as well as training for medical personnel, are required.

ii. The use of 5G in the educational sector would boost both online and remote learning platforms. It enables students with learning experiences that are both immersive and participatory, which ultimately leads to enhanced results. The federal government of Nigeria has to make investments in the country's infrastructure and come up with laws that promote the use of 5G technology.

iii. When it comes to farming, 5G improves food security and farmers' yields by giving them access to real-time data and letting them farm more precisely. Drones with 5G connections can watch farms from a distance and help farmers get the most out of their crops. Farmers need money to be put into infrastructure and training.

iv. The use of intelligent traffic control systems and autonomous cars made possible by 5G will make transportation more efficient and safer. It is essential to make investments in both infrastructure and policy.

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