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## **5G RADIO ACCESS NETWORK (RAN) AND THE SUSTAINABILITY CONCERNS.**

This article is on 5G RAN project; emphasizing on health implications of the project asset with respect to COVID-19 written by Project Management Office (PMO) of Systemtronix Solutions Limited and the IT Technical Support Team of Computronix Technologies; the IT subsidiary company of this unique project organisation.

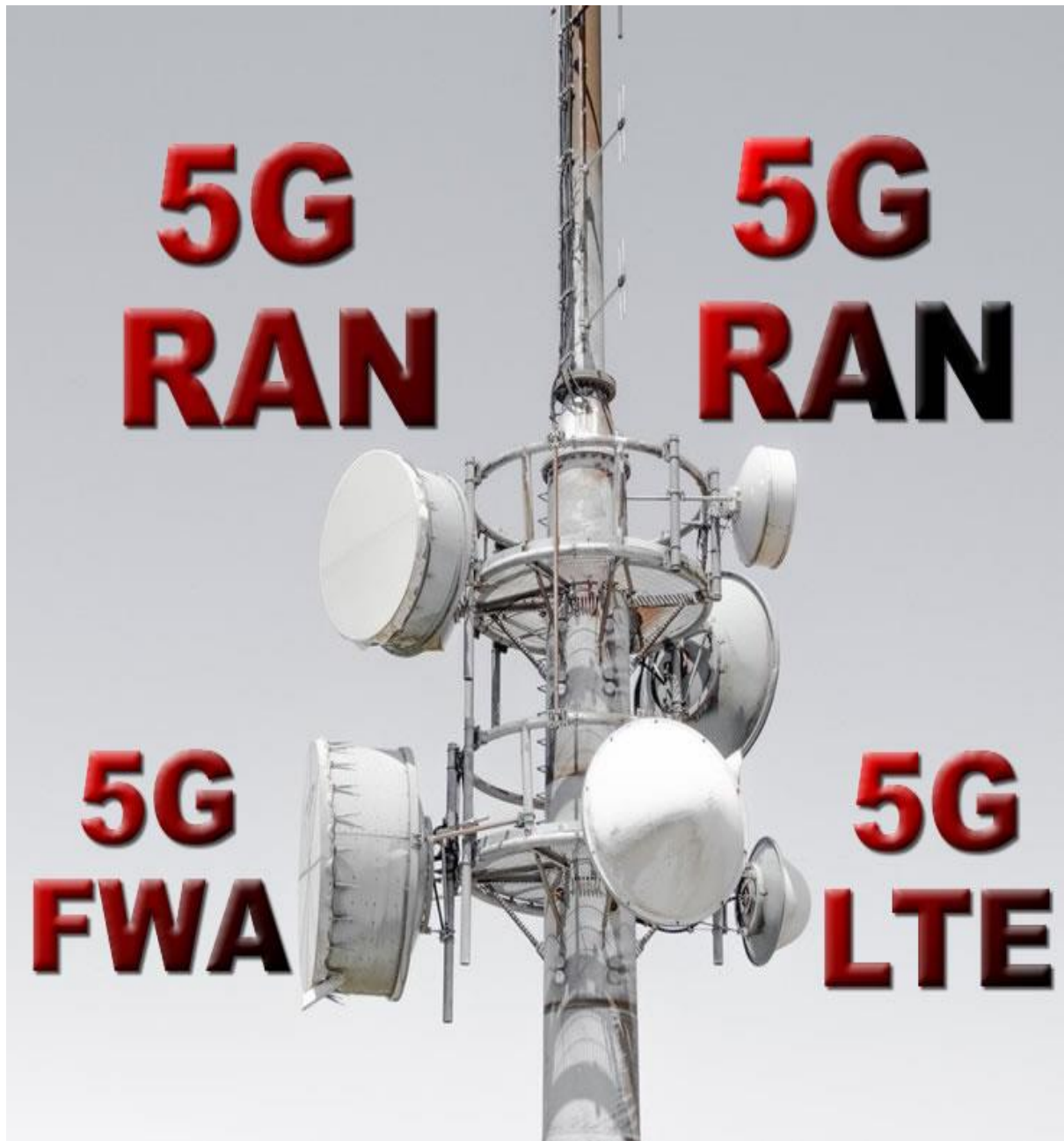
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### **OVERVIEW**

This is matters arising for 5G RAN and the sustainability concerns with respect to profit, people and planet within Nigeria and the global economy as contained in this article. The health threatening questions, arguments and submissions; especially on COVID-19 has been deeply debated on. Some of the technical details of 5G RAN have been specified for further debate and discussion with well analyzed business case. Excerpts from the White paper and Blue paper of 5G RAN were not included.



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## 5G RADIO ACCESS NETWORK (RAN) AND THE SUSTAINABILITY CONCERNS

### INTRODUCTION

Systemtronix Solutions (STS) is a unique project organisation with core services in project management, contract management, contracting, supply chain projects, sustainability consulting, construction management, project integration management, project production management, competency development trainings, business and management consulting. Systemtronix Solutions (STS) do not only sees innovation and sustainability as a business strategy but imbibes them as corporate culture. STS strongly believes in the principles of sustainability and innovation, and has been working very hard to accommodate these bottom-line of 21<sup>st</sup> century business into client organisations strategy both at business level and project level. We promote sustainability ideals without fear or favour, as our total commitment towards running a green organisation and realization of the United Nations Sustainable Development Goals (SDGs). Recent argument and occurrences around the world since the outbreak of the coronavirus (COVID-19) have drawn the attention of the project management office (PMO) of Systemtronix Solutions Limited and her subsidiary IT Company known as Computronix Technologies, which specializes in IT Technical Support, IT Consulting, IT Procurement and Web Services in writing this article.

### 5G RADIO ACCESS NETWORK (5G RAN)

Radio Access Network (RAN) has been in existence as cellular technology for some time now. Presently, it is now at 5<sup>th</sup> Generation known as 5G RAN; and it can support multiple-Input multiple-Output (MIMO) antennas, wide spectrum bandwidths, multi-band carrier aggregation, and etcetera. 5G RAN will impact heavily on wireless technologies and will enable Mobile Edge Computing (MEC) and network slicing. It is quite powerful with its low latency and high throughput. It is a constituent of the mobile telecommunication system; which actualizes radio access technology (RAT) existing between devices like mobile phones, computer or any machine that is being manipulated from remote location. Connection is normally established with its core network (CN).

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## **THE 5G STRATEGIES AND NETWORK SECURITY PROTECTION**

5G strategy could consist of mobile 5G, fixed wireless and Edge Computing. RAN components include Base Transmission Station (BTS) and antennas; with specified capacity to cover specific zone. RAN evolution started from 1G before reaching to 5G. 5G RAN to homes and offices will provide internet with no long-term contracts, equipment and installation fees. Telecommunication Networks comprises of four parts named as RAN, Core Networks (CN), Transport Network and Interconnect Network. 5G networks are responsible to realization of digitalization and machine-to-machine (M2M) connectivity. Disruptive technologies such as Internet-of-things (IoT), Robotics (BOT), Machine Learning (ML), Artificial Intelligence (AI), and etcetera that are the future powers of industries are bound to pose greater challenges of security risks irrespective of the great business values of these listed disruptive innovations. Network security and privacy protection will be enhanced with 5G; especially with the initiation of international mobile subscriber identity (IMSI) encryption. This accords great protection for all the data of users passing through 5G networks with hop-by-hop integrity protection.

### **5G DEPLOYMENT AND THE SECURITY IN RADIO ACCESS NETWORK (RAN)**

5G can be rolled out with either a 5G core network (CN) or by connecting 5G RAN to 4G network. In this scenario, 4G is normally termed as Long Term Evolution (LTE). Presently, the deployment of 5G is normally with the second option of connecting 5G RAN to 4G network; in example: 4G LTE. This will not require many resources as it is simply an upgrade of 4G networks; which will not require the building of new cell towers and BTS, ground breaking and wall drilling since everything will be wirelessly deployed. The only shortcoming is that 5G with higher frequencies will cover shorter distances, as it travels faster compared to 4G with lower frequencies that will cover longer distances at slower speed. This implies that 5G networks will need the erection of more cell towers at shorter distances to extend the 5G network coverage. Hence, 3GPP 5G standards permit physical and virtual intersection between RAN and core networks (CN) in deployed networks.

### **INTERNETWORKING WITH LTE NETWORKS IN DEPLOYMENT OF 5G RAN.**

5G RAN will not be a complete replacement of LTE networks. The design of 5G networks is based on seamless internetworking between the two radio access technologies (RATs). There is adequate integration of the individual strengths of both 5G RAN and LTE; in which LTE provides the base support for general connectivity layer that is analogous to 2G and 3G networks. This takes charge of functions like

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voice service (VoLTE) and messaging. Since 5G is not a replacement for LTE, both LTE and 5G technology will work together for long time to come. 5G LTE will be extremely faster than 4G LTE. Theoretically, 4G gives about 100Mbps while 5G delivers about 10Gbps. This implies that 5G is hundred times (100x) faster than 4G technology based on theoretical assumptions. This is yet to be experienced in practical terms.

## **DEBATE ON 5G RAN AS HEALTH THREATENING PROJECT ASSET**

We jointly condemn any act of violence that may be incited against any telecom company for fear of the supposedly wrong notion that 5G cell towers have been responsible for the spread of COVID-19 around the world. China invented 5G and rolled out its 5G national network which started commercial operation on 1st November, 2019. Since then, 5G RAN has spread in some Asia, European countries and America. There have been argument, concerns and questions on the sustainability of 5G Radio Access Network (RAN). Environmentalists and healthcare workers raised argument on the radio frequency spectrum of 5G RAN and the possible radiations that will be emitting from the antennas at the cell towers of 5G Base Transmission Stations (BTS). There have been objections against the use of the higher energy millimetre wave radiation by 5G network and its ionizing radiation which is claimed by the Antagonists to be dangerous because of its ability in breaking chemical bonds? Some of the scientists postulate that cancer and other factors are linked to mobile phone radiation in its development. Most mobile operators use radio frequency (RF) waves within the range of 300MHz to 3GHz that can be harmful for harmful to human health. Another school of thought posits that radio frequency (RF) radiation, comprising of radio waves and microwaves, lies within the low-energy frequency end of the electromagnetic spectrum and insisted that if RF radiation is absorbed vast quantity by materials with water content such as body tissues, fluids, food, and etcetera, there will be tendency to produce heat which has the propensity of burning and damaging tissues. Some other Analysts uphold that electromagnetic waves (EM) which exceeds certain threshold value are potentially harmful to living beings on planet. This risky threshold is somewhat above 30, or even 300 GHz. Federal Communication Commission (FCC) opined that the most restrictive levels on full body exposure falls within the frequency range of 30-300MHz for efficient absorption of RF energy by the human body once fully exposed. This is in response to the question on the level of radio frequency spectrum that could be harmful to the human body. ARPANSA, collaborated FCC argument with submission that maximum exposure levels to radio frequency fields lies within the range of 3KHz to 300GHz; with standard limits set for human exposure to radio

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frequency (RF) electromagnetic radiation (EMR) valued to fall between the frequency range of 3KHz to 300GHz. There have been arguments, concerns and questions raised since the project initiation stage of 5G RAN before ever the project completion and rolling out of the project product which is 5G Network. The question is: Can 5G really kill? Submissions made by (wired.co.uk), frowned against this question; by stating that there is absolutely no concrete evidence that 5G or any mobile communication network can have deadly effect on human health. Furtherance to the fact that the upgrade is relying on similar technology to preceding mobile networks, with no study yet to prove any connection between mobile phones and cancer, although research remains continuous on this subject matter. On 20<sup>th</sup> June, 2019, the Consensus of the International Scientific Commission (CTIA) argued that RF energy from wireless devices and networks, including 5G has not been proven to cause health problems.

### **RADIO FREQUENCY SPECTRUM FOR 5G NETWORKS**

According to Signalbooster of AFC, LLC, radio wave frequencies fall within the range of Extremely Low Frequencies (ELF) of 3 KHz to Extremely High Frequencies (EHF) of 300 GHz. It is worthy to note the denotation of EHF as the millimetre band due to its wavelengths range falling between 1 to 10mm, prompting the naming of wavelengths within this band as millimetre waves (mmW). It is noted that 5G will use spectrum in the available 4G LTE frequency range falling within the Ultra High Frequency (UHF) range of 600MHz to 3GHz. This could go up to 6GHz plus millimetre wave bands of 24 to 86 GHz Super High Frequency (SHF) to Extremely High Frequency (EHF). Findings on some telecom operators for 5G, reveals the use of UHF spectrum. The frequency range of UHF band fall within 300MHz to 3GHz. This range has been in use several years back in many other telecommunication applications like TV broadcasting, GPS, cordless phones, and Wi-Fi. It is now left for Observers to compare and contrast this submission by Signalbooster of AFC, LLC with the argument raised earlier in this article by ARPANSA, which sets RF standard for human tolerant limits to RF EMR to exist between 3KHz to 300GHz. Observers should judge if this is a safe or dangerous limit for humans?

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## WAVE PROPAGATION: THE WAVELENGTH OF 5G RAN

In radio wave propagation, Period (T) is the time it takes to make one full oscillation. It is mathematically represented with simple equation,  $T = \text{Wavelength} / \text{Velocity}$ . Therefore,  $\text{Velocity} = \text{Wavelength} / \text{Period}$ . Since Period (T) is the reciprocal of frequency, in example:  $(T = 1 / f)$ . Wavelength ( $\lambda$ ) is the inverse of frequency (f), by substituting the value of T in the Velocity equation,  $V = \text{Wavelength} (\lambda) / 1/f = \text{Wavelength} (\lambda) \times f$ . Therefore, Velocity (V) is represented mathematically as,  $V = f \times \text{Wavelength} (\lambda) = f\lambda$

It can be deduced from the above equation that high frequencies travel at FASTER speeds (velocity), but covers SHORTER distances while low frequencies travel at SLOWER speeds (velocity), but covers LONGER distances. This implies that 5G Networks and devices will travel at faster speed, but will cover shorter distances whereas 4G networks and devices will travel at slower speeds, but will cover longer distances. 5G will suffer shorter lag time than the current 4G standard. This gives concern on the 5G cell tower broadcast radius, which is shorter and may require telecom operators to erect more proximity masts with signal booster to boost the emitting radio signals customers will be receiving. There is on-going effort to improve on these lapses observed with the shorter distance travelled by 5G signals.

## IMPROVING SIGNAL STRENGTH OF THE RADIO WAVES PROPAGATED

The propagation of radio waves from 5G RAN will be delivered in such a manner that the signal quality will not be weakened by maximizing the signal speed within the target with avoidance of noise interference from surroundings using **Beam-forming**. Secondly, **MIMO** can be adopted to utilize advanced signal processing to permit the propagation of multiple radios that is full of support abilities and lacks interference with each other. Generated signals can serve a single user MIMO or multiple user MIMO with an overall enhancement of the capacity and signal quality of a cell usually in areas with high population density.

## SUSTAINABILITY QUESTIONS ON 5G RAN

The truth is that coronavirus (COVID-19) remains real and very contagious. It does not move. People move the virus by contact with one another or with objects, surfaces; such as table, rails, chairs, walls, door handles, and etcetera. Once people stop moving about, the virus will find no host to transport it, and will subsequently die. We are not Epidemiologist and Virologists to discuss on multiplication of viruses on host cells they infect or outside host cells as protein coat or capsid which enclose

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either DNA or RNA that code for virus elements. It has become pertinent to this down owing to some postulations that COVID-19 is biologically synthesized and multiplied in human host cells by radiations from 5G RAN cell tower. Every telecom company subscribes for frequency spectrum from national regulatory authorities to enable propagation of radio waves by military or corporate bodies. It is a well regulated subscription process. Any illegal radio wave being propagated within the radio frequency spectrum of any nation must be shot down by the regulatory authorities. This helps in avoiding illicit usage of radio waves in the frequency spectrum. In Nigeria, NCC is the regulatory agency for frequency spectrum subscription. The Chinese company that pioneered the 5G RAN is a multinational company with great revenue and Equity around several economies of the world. Their management will never not be stupid in rolling out a project product that has not been fully tested and certified safe to human health and the planet especially before thinking of profit since the 5G Innovator knows very well that their new product; 5G RAN must undergo certification test across other Hi-tech countries before they will allow the project delivery for 5G RAN to commence. Sustainability now reigns supreme both at the business level and project level for many companies and government around the world. The sustainability factors comprising of profit, people and planet must be balanced and kept in equilibrium before any project is implemented anywhere across the world nowadays. Therefore, in some of those EU countries where 5G RAN was rolled out, why did they approve the project in the first place if they are uncertain of the friendliness of the project product to people and planet? Which authorities certified the sustainability impact assessment (SIA) and environmental impact assessment (EIA) for the 5G RAN project commencement? What was the reaction of countries regulatory authorities to the White paper and Blue paper submitted for the 5G RAN projects across the 5G antagonising countries? We refuse to accept that such countries were not aware of the technical specifications of 5G RAN. The radiation cannot be ten (10x) times higher than 4G network with respect to the technical specification of the antennas at the cell towers of 5G RAN and the radio frequency spectrum under which it propagates. 5G RAN product owner, Huawei cannot hide the 5G Blue paper for no reason whatsoever for these other hi-tech countries where the 5G RAN will be delivered or already have been rolled out because it is never a hidden document for such infrastructure project that is capital intensive. Regulatory bodies with great expertise in professional fields saddled with the responsibilities of scrutinizing the technical details of the project product and material before its full implementation. Nowadays, there is clarion call

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for sustainability in all spheres of human endeavour, supply chain and value chain. Every country is afraid of high radiations, radioactive materials and other environmental degradation effects from all quarters. Therefore, no country will allow such 5G project to roll out without following due diligence and protocol. If other EU countries that have rolled out the 5G RAN are now beginning to decommission the 5G RAN, it could be because it may have failed to conform to sustainability guidelines after implementation because greater percentage of people refused to endorse it as end-users; which is a necessary component of the project success criteria. A sustainability pass certificate must certify all the three major components of "triple P of sustainability", comprising of people, planet and profit in order to measure up to the project success criteria. All these objections and razzmatazz about 5G RAN are the handiworks of the project antagonists and the conspiracy theorists. They have no evidence to back up their claims. It is a shame! Telecom industry is a very competitive marketplace. STS posits that most of the competitors in EU and America are not comfortable with the exploits of Huawei on 5G RAN. It is a very big competitive advantage for the multinational company. Destructive competitive advantage supposedly created by entry of 5G RAN into the telecom marketplace by competitors cannot subdue the tremendous strides of the product owner: A scenario fuelled by pricing, new technology, customer focus and power enthronement, and barriers to entry. If the destructive nature of competition is sustained by competitors, this will likely impact negatively on the profitability of the 5G RAN product owner, Huawei, in various markets across the world. Most of the competitors have come to realize that the paradigm shift in knowledge economy and service economy are now severely been developed within the emerging economies comprising of Brazil, Russia, India and China (BRIC). They must assimilate the paradox of cooperation and competition for global economic growth to strive; rather than embracing destructive competition, the competitors should accommodate cooperative competition. This will eliminate fear, hostility, and anger and enhance respect and teamwork. These are required sustainable competition and global growth in economy worldwide. Furtherance to this, Systemtronix Solutions (STS) analyzes the worldwide condemnation and rejection of 5G RAN as a case of "crushing the competition". There are several well known cases to support this proposition during the dot-com era without mentioning the names of blue chip companies involved in such unfair competitive strategy. HS2 project in England; which is the construction of railway from Birmingham to London for super high speed train transportation network was tackled by project antagonists that condemned the project; rising issues on sustainability of the project without any respect to the strong business case of the project. Majority of the project antagonists have little or no clues

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on the subject they were debating on. A lot was achieved in the conflict resolution on the project and it received green light for commencement back then. The same scenario is now occurring with rolling out and sustaining of 5G RAN.

### **5G FIXED WIRELESS ACCESS (5G FWA) AND THE BUSINESS VALUES.**

5G is permitting mobile technology to mingle with the demands for fixed line services and price points. FWA empowers network operators to deliver ultra-high speed broadband to suburban and rural areas; connecting homes and offices for business applications demanding high bandwidths in areas where fibre-optics internet has been expensive to implement and maintain. WiMAX initially attempted to overcome the difficulties faced by fibre-optic in bringing internet access to remote areas, but failed due to the demand for new infrastructure and costly proprietary equipment. 5G FWA filled this gap by adopting standardized 3GPP architectures and simple mobile elements to give out ultra-high-speed or UHF broadband services to homes and offices subscribers. 5G FWA has a competitive edge over fixed-line DSL, cable and fibre across all marketplace; which allows rural and suburban dwellers to enjoy high speed internet access. FWA is becoming a competitive force in markets where fixed broadband is not available at present. FWA will also subdue expensive wire line options in developed countries. It is becoming a competitive internet access for office connectivity around the world. 5G FWA will promote economic growth potential inhibited by other internet access in the market. 5G FWA does not need the IT support services of a network Technician at any customer end point because once the CPE for wirelessly establishing network connection between a network carrier or telecom operator Base Transmission Station (BTS) and subscriber's homes or offices is supplied, customers can easily connect the CPE themselves with just little IT knowledge. 5G FWA will definitely bridge the "digital divides" that is having widespread economic, social and environmental consequences in developing and underdeveloped countries of the world nowadays. 5G FWA will cut down the number of people living around the world without broadband internet at their homes and offices, which currently stood at over 5 billion across the world. 5G FWA will shred the cost of reaching "Last Mile" by nearly 50%. Antagonists of 5G networks will begin to embrace this 5G technology when they compare it to the cost of fibre-based broadband network connectivity. 5G FWA will deliver analogous services to fibre-based broadband network. The 5G signals cannot be obstructed by tall buildings, objects and trees. Hence, there is no need for Line-of-Sight (LOS). 5G FWA can also compete strongly in marketplaces with areas of high population density and functional fixed broadband network, and not just an option for only developing and rural areas.

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## THE BUSINESS CASE FOR 5G RADIO ACCESS NETWORKS (5G RAN)

The business case for 5G RAN is tremendous. It will leverage the 4<sup>th</sup> industrial revolution and its disruptive technologies, which will stimulate sustainable development and accelerate the realization of the United Nations sustainable development goals (SDGs) by 2030. Systemtronix Solutions (STS) and Computronix Technologies hereby posits and opines that 5G RAN does not cause coronavirus (COVID-19) and could have radiation limits within the radio frequency spectrum that could be tolerable to human health since sustainability impact assessment (SIA) and environmental impact assessment (EIA) must have been certified by most of these hi-tech countries in EU and America that seem to be decommissioning the project recently certainly due to widespread condemnation by the supposedly end-users. This entails that the “people” component in the sustainability wheel is neither balanced nor kept in equilibrium with other sustainability factors. The hi-tech countries have Physicists and telecom experts with great expertise in radio wave propagation and must have in-depth knowledge of the 5G RAN technologies, antennas, cell towers, CPE and BTS. These professionals cannot be stupid in allowing the rolling out of 5G RAN without conducting adequate tests and experiments over the years before the project approval. The 5G RAN Innovator, Huawei on the other hand, will definitely not be complacent in bringing a new product such as 5G RAN into telecom marketplace with increasing competitiveness; that is already saturated with other brands of high speed internet access and mobile connectivity. It is the Innovator Company competitive advantage in the telecom market. It is very possible that other market challengers, leaders and pioneers could be attacking them with any known strategy. The conspiracy theorists and project antagonists are scaring people and winning more support of end-users with photo and video gimmicks of the normal radio waves that will be emitting from the antennas in the cell towers at the BTS; which will be received by 2.4GHZ to 5.8GHZ customer premise equipment (CPE) panel Wi-Fi antenna installed at homes/houses/offices/buildings before the radio signals are disseminated to computing devices and other internet-of-things (IoT) devices in the interior of homes/houses/offices/buildings by wireless networking. Direct satellite link (DSL), Fibre optic network, 4G fixed wireless access (4G FWA), 4G Long Term Evolution (4G LTE) are all good networks with quality features, but 5G RAN is the game-changer! It has no religious connotation. Hence, It is not anti- religious. It is not the cause of COVID-19; otherwise other disruptive technologies should be disabled and the global economy will then put industry 4.0 to rest.

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5G RAN will open up new business cases for SMEs and fuel entrepreneurship, break down the monopoly of most telecom operators across the world on internet access and reduce the cost of data, voice and video over IP-based networks and cellular networks. It will empower individuals, businesses or corporate organisations within the private and public sectors of many countries economy to own private networks without the rigours posed by telecom operators. It has incredible speed with high throughput. It has high speed mobile broadband as much as 10-20 Gbps for Download link and 5-10 Gbps for Upload link. 5G RAN has low latency of up to 1 millisecond (ms), low energy consumption and maintenance costs, wireless seamless solution provider to "Last Mile" problems, provides digital connectivity from telecom operators to the customers without breaking ground or drilling wall and 5G technology will definitely fill the deficiencies inherent in 4G networks.

## **RECOMMENDATIONS**

Systemtronix Solutions Limited in collaboration with her subsidiary IT Company; Computronix Technologies is recommending to Federal Government of Nigeria (FGN) and other concerned regulatory authorities in governments of various other countries of the world to ensure that 5G equipment makers and project delivery team adhere strictly to Nigeria Communication Commission (NCC) set standards while other countries of the world should follow stipulated standards operational in their own countries in rolling out 5G RAN. In Nigeria, NCC should exercise her right and onerous responsibilities in the deployment of 5G RAN to ensure conformity to standard specifications and criteria. Those standards must include the "triple P of sustainability (Profit, People, Planet) and other known conditions well set out in the sustainability impact assessment (SIA) and environmental impact assessment (EIA).

## **CONCLUSION: BENEFITS OF 5G RAN**

5G networks will cover the increasing demands for network connectivity in the world today. There is absolute need for the flexibility of 5G RAN in such a way that it can adapt to numerous service requirements so that networks and other service Providers will have the ability of launching applications, services and devices in a seamless and sustainable manner. 5G RAN will ensure high level of openness, credibility and sincerity in connectivity for a new generation of users and industries that are piloted by information.

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