

**THE PHILOSOPHICAL PERSPECTIVE, SUSTAINABILITY AND IMPLICATIONS OF G4
AND G5 COMMUNICATION TECHNOLOGIES IN THE HUMAN SOCIETY**

Charles B. Berebon
Rivers State University
Charles.berebon@ust.edu.ng

&

Cornelius Amadi
Rivers State University
Cornelius.amadi@ust.edu.ng

Abstract

The article mainly focuses on the development of 4G and 5G technology innovation which has inspired a philosophical discussion about its consequences and the society. The intriguing questions among philosophers are, the ethical, sustainability, and societal implication this innovation raises. The philosophical perspective of this innovation raises some concerns on data protection and surveillance. How can we safeguard individual privacy rights and connection security? On one hand, there are concerns about it fostering isolation and detachment due to over reliance on digital interface. The possible effects of the remote 4G and 5G on human health because of long term exposure to electromagnetic radiation is concerning. Are we exploring this innovation without considering the outcomes on the human health? The accessibility of the G4 and G5 technology to some areas and persons, raises worries and disparity, as a result of digital divide on the benefits of the innovation. The G4 and G5 technology has brought many wonders of major significance to our time. Even though the impact of this technological advancement can be worth and wonderful against human logic, it is of great importance to also consider compromise, the need for ethical consideration in the contemporary digital culture is essential. Utilitarianism, as an ethical theory proposes that benefits of a 4G and 5G technology should only be weighed against the harms it causes, and if the benefits are going to outweigh the harm, then it is morally permissible? The intervention of philosophy and critical reasoning must never be dim in the face of these innovations. This is because of its philosophical questions on the sustainability and environmental stewardship in the midst of this rising technological innovations. They also pose significant challenges that needs to be addressed through a combination of technological innovation, ethical consideration, and regulatory frameworks that prioritize the well-being of individuals and the environment. The clarion call now is, if we are not careful this technological advancement may either make or mar us. The environment will always outlive us.

Keywords: philosophy, G4 and G5, society, technology, human

Introduction

The improvement of G4 and G5 technology innovations has set out extraordinary open doors for correspondence, availability, and access to data. These advancements have empowered individuals from various regions of the planet to associate and communicate with one another in manners that were

previously unbelievable. In any case, similarly as with any mechanical development, there are likewise philosophical, moral, and enduring ramifications to consider. According to a philosophical viewpoint, the coming of G4 and G5 technology advancements brings up issues about the idea of correspondence, the job of innovation in human culture, and the effect of these advances on human connections. A few scholars contend that these innovations can encourage more noteworthy comprehension and sympathy between individuals, while others express worry about the effect of these advancements on imagination, decisive reasoning, and the capacity to frame significant connections. Notwithstanding these philosophical inquiries, there are likewise significant moral ramifications related to the turn of events and the utilisation of G4 and G5 interchange advancements. These incorporate issues connected with protection, security, and the utilisation of individual information, as well as worries about the capability of these advances to compound existing disparities and create new types of social rejection. At last, there are additionally maintainability ramifications related to the turn of events and utilisation of these advancements. The production and removal of electronic gadgets, the energy utilisation expected to control them, and the natural effect of e-squander are significant variables to consider while surveying the maintainability of G4 and G5 interchanges. Given these philosophical, moral, and reasonable ramifications, obviously the turn of events and utilisation of G4 and G5 technology advancements ought to be drawn closer with care and mindfulness. By taking part in smart and insightful conversations on these issues, we can attempt to make advances that are imaginative and productive, yet in addition moral, maintainable, and useful to all human cultures.

4G and 5G Mobile Communication Review

In a perfect world, each generation improves upon the best qualities of its predecessors and thrives in ways previous generations couldn't. In a way, new generations respond to the issues created by older generations. This is relevant for generations of mobile networks and cellular technology. In the case of fourth-generation wireless vs. fifth-generation wireless, 5G aims to not only surpass 4 network capabilities but also meet and exceed 4G's goals for general speeds, latency, and density. The 4G era saw the innovation of various networking trends, such as IoT growth, increasing numbers of smartphones, and remote and mobile workforces.

These trends advanced immensely throughout the 2010s, creating a need to support faster speeds and greater cell density. Enter 5G, which many pundits hope will address the issues 4G introduced. Before organisations jump on the 5G bandwagon, however, they must understand the differences between 4G and 5G network architectures and determine how both architectures could affect business operations. This feature dives deep into those differences and discusses what these key differentiators mean for organisations globally.

The 4G network sprang up around 2009 and was intended as a new innovation to replace and improve upon the 3G network. The key features of 4G network communication were high-speed data transmission, speedy connectivity, and low latency. There was a great improvement in streaming videos, games, and other internet-related applications. The 5G network seems to be the improved version of the latest technology in wireless communication; it came on board around the year 2019. It is intended to offer higher data speeds,

more stable connections, and improvements with low latency. The feature of the 5G network is an overall improvement on the Internet of Things. (IoT).

Features of a 4G Network

The main features of 4G services that are of interest to users are application adaptability, high dynamism user traffic, radio environment, air interfaces, and quality of services.

- support for interactive media, voice and video streaming, gaming, internet, and other broadband services.
- IP-based mobile system.
- high speed, high capacity, and low cost per bit.
- Global access, service portability, and scaling mobile services
- Avoidance of congestion
Seamless network of multiple protocols. Since 4G will be all IP, it will be compatible with all common network technologies. Infrastructure to handle pre-existing 3G systems, along with other analogy wireless. 1

The Fourth Era (4G) innovation, a portable correspondence standard, has given quicker information transfer rates than its ancestors. The 4G innovation utilizing advanced cell organization to send information, considers more excellent voice calls and decreases in dropped calls. 4G innovation utilizes long haul Development (LTE) innovation, which gives information move velocities of up to 100 megabits per second (Mbps) for downloads and 50 Mbps for transfers. It likewise offers better security highlights, like more grounded encryption and verification conventions, to safeguard client information and forestall unapproved access. Generally speaking, 4G innovation has quickened information dissemination, improved voice quality, and improved security.

1. Michaela Goss, eds., *5G and 4G: Learn the Key Differences Between Them*, <https://www.techtarget.com/searchnetworking/features/A-deep-dives-into-the-differences-between-4G-and-5G-networks> (accessed April 12, 2023)

Features of the 5G Network

The advanced billing interfaces of 5G technology make it more attractive and effective.

- 5G technology also provides subscriber supervision tools for fast action.
- The high-quality services of 5G technology are based on policy to avoid error.
- 5G technology is providing large broadcasting of data in Gigabit, which supports almost 65,000 connections.
- The traffic statistics on 5G make them more accurate.
- The remote diagnostics are also a great feature of 5G technology.
- The new 5G technology will take all delivery services out of business prospects.

With its unmatched network capacity, decreased latency, and faster data transfer rates, 5G technology generally represents a significant improvement in mobile communication technology. By making it possible to develop new services and apps that weren't before, technology has the power to alter how we work and live.

Philosophical Implications of G5 and G4 Communication Technologies

The improvement of 4G and 5G correspondence advancements has significant philosophical ramifications, especially as to the connection between innovation and society. Influence on power relations, the turn of events, and the execution of 4G and 5G advancements are not impartial cycles but rather mirror the interests and needs of explicit entertainers and organizations. This brings up issues about power relations and how much these innovations serve the interests of society overall. In general, the improvement of 4G and 5G correspondence advances brings up significant philosophical issues about the connection between innovation and society and highlights the requirement for smart reflection and a basic commitment to these issues. The turn of events and arrangement of G4 and G5 advancements, the up-and-coming age of cell organisations, raises a few crucial moral issues. A portion of these issues Protection: The speed and limit of the G4 and G5 organisations will consider the assortment and handling of immense amounts of information. This might conceivably disregard individual freedoms in the event that the information isn't adequately obtained. Security: G4 and G5 networks are defenceless against digital assaults. In this manner, it is vital to guarantee that these organisations are safeguarded from attacks that forestall the deficiency of basic information, disturbance of administrations, or the spread of deception.

2. S. Bhandarkar and R. Kammar, 4G Technology, *International Journal of Scientific Recharge and Modern Education (IJSRME)*, ISSN (online): 2544-5630, Volume 1, Issue 11, 2016.

3: *What is 5G Technology and Features?* <http://www.freewimaxinfo.com/5g-technology.html> (accessed April 13, 2023)

Accessibility: Similarly, as with every single innovative development, the execution of the G4 and G5 networks conveys the gamble of extending the computerised gap and abandoning a few networks or nations. Admission to these organisations should be fair and reasonable. Natural Effect: The execution of the G4 and G5 organisations will require huge framework advancements, including the establishment of thousands of new receiving wires and base stations. This can affect the climate and biodiversity. Value: There is a gamble that the execution of the G4 and G5 organisations will lopsidedly help a few gatherings or areas while abandoning others. Guaranteeing a fair conveyance of the advantages of these networks is significant. To resolve these moral issues, engineers and policymakers should cooperate to make strategies and guidelines that safeguard the freedoms and interests of people and networks. This incorporates focusing on protection and security, advancing availability and accommodation, decreasing ecological effects, and guaranteeing fair access and even-handed benefits.

The age of enlightenment was enshrined by empiricism, which has continued to influence science and technology in profound ways. Firstly, it allowed for more and more people to become engaged in science

and technology since dogmatism and forceful and personified authority-figure tendencies gradually began to die down. Facts were considered crucial to any proof or event, and all people, low or high in society, participated freely in the search for and defence of the truth. Secondly, methods of initiating, establishing, and sustaining the truth gradually began to improve, and these yielded more verifiable truth used for reinforcing the acceptance of science and technology. 4

With the improvements in the processes and products of science, occasioned by the supportive and nurturing role of philosophy, beginning mainly in the 17th century, technology began to emerge more rapidly and widely than was the case before. The desire to tame and exploit the physical environment for man's benefits, the desire to make away from stone age savagery, compelled the need for the increasing development of technology and the mastery of better, quicker, faster, and more reliable means of satisfying his urge for material comfort. The present technology now commonplace in the civilised world can be attributed to progress made in the technology of a wide variety of areas, not just in the emerging developing nations but also in the developed world. Such development was usually engineered and sustained by the desires of guilds, groups, unions, nations, and individuals to pass on new techniques to the next generation through formal and informal education. In the attempt to bequeath technology skills from one generation to another and determine the nature, scope, direction, and purposes of any such technology, each nation, nation-state, group, etc. was guided by its philosophy. 5

Reasoning essentially affects the advancement of science and innovation over the entire course of time. These are a portion of the ways in which reasoning has impacted these fields: Strategy: Theory has assisted with moulding the logical technique, which is utilised to create and test logical speculations. The logical technique underlines experimental proof, consistent thinking, and suspicion, all of which have been established in philosophical thought.

Moral contemplations: Logicians have investigated inquiries concerning the ethical ramifications of mechanical progressions, including issues connected with protection, security, and value. As 4G and 5G innovations keep on creating, it is essential to think about the moral ramifications of these innovations and to guarantee that they are planned and carried out in a manner that advances civil rights and human prosperity.

Epistemological contemplations: The advancement of 4G and 5G innovations depends on logical and specialised information. Scholars have investigated inquiries concerning what constitutes solid information and how logical and specialised information can be utilised to simply decide. It is vital to guarantee that the turn of events and execution of these Innovation depends on sound logical and specialised information, and that direction is educated by a thorough comprehension of the fundamental science. Ontological contemplations: Scholars have investigated inquiries concerning the idea of the real world and its presence, which can be applicable to the improvement of 4G and 5G advances. For instance, inquiries regarding the connection between advanced and actual reality, or the effect of innovation on human experience, can be applicable to the turn of events and execution of these advances.

Political contemplations: Thinkers have investigated inquiries concerning power and administration, which can be applicable to the turn of events and execution of 4G and 5G advances. As these advancements

become more common, it is vital to consider inquiries concerning who approaches these innovations, who controls them, and how they are managed.

In general, there are numerous philosophical contemplations that can be applied to the turn of events and execution of 4G and 5G advances. It is critical to consider these inquiries to guarantee that these advances are created and utilised in a manner that is reliable to our qualities and advances the prosperity of all citizens.

4. A. Ali, "Philosophy, Science, Technology, and Society: An African Perspective," in *Philosophy and Education A Book of Readings in Honour of Msgr. Prof. F.C. Okafor*; Anthony Ali and Beatrice A. Okeke, eds. (Enugu: Snaap Press Ltd., 2002), 361.

5 A. Ali, "Philosophy, Science, Technology, and Society: An African Perspective in Philosophy and Education," 362

Innovation depends on sound logical and specialised information, and that direction is educated by a thorough comprehension of the fundamental science. Ontological contemplations: Scholars have investigated inquiries concerning the idea of the real world and its presence, which can be applicable to the improvement of 4G and 5G advances. For instance, inquiries regarding the connection between advanced and actual reality, or the effect of innovation on human experience, can be applicable to the turn of events and execution of these advances.

Political contemplations: Thinkers have investigated inquiries concerning power and administration, which can be applicable to the turn of events and execution of 4G and 5G advances. As these advancements become more common, it is vital to consider inquiries concerning who approaches these innovations, who controls them, and how they are managed.

In general, there are numerous philosophical contemplations that can be applied to the turn of events and execution of 4G and 5G advances. It is critical to consider these inquiries to guarantee that these advances are created and utilised in a manner that is reliable to our qualities and advances the prosperity of all citizens.

Sustainability Implications of G4 and G5 Communication Technologies

The development and deployment of 4G and 5G communication technologies have sustainability implications that must be considered. Here are some ways in which these technologies can impact sustainability:

1. Energy consumption: 4G and 5G technologies require a significant amount of energy to operate. The increasing number of mobile devices and data usage can lead to a higher demand for energy, which can increase greenhouse gas emissions and contribute to climate change. It is important to consider energy-efficient alternatives and to ensure that energy consumption is minimised through the use of renewable energy sources.

2. E-waste: The proliferation of mobile devices and other connected devices associated with 4G and 5G technologies can lead to an increase in electronic waste. This waste can contain hazardous materials that are harmful to the environment and human health. It is important to consider recycling and disposal practices that minimise the environmental impact of e-waste. 3. Digital divide: The cost of 4G and 5G devices and data plans may limit access to these technologies, creating a digital divide. This can exacerbate existing social and economic inequalities and limit opportunities for education, employment, and participation in society. It is important to ensure that access to these technologies is equitable and affordable.

4. Infrastructure: The deployment of 4G and 5G technologies requires significant infrastructure investments, including the installation of new cellular towers and other equipment. This can have environmental impacts, such as habitat destruction and increased land use. It is important to consider the environmental impact of infrastructure development and to explore alternatives that minimise these impacts.

5. Privacy: The increasing use of connected devices associated with 4G and 5G technologies can lead to privacy concerns as personal data is collected and shared across networks. It is important to ensure that privacy is protected and that data is used ethically. Overall, the development and deployment of 4G and 5G communication technologies can have significant sustainability implications that must be considered. It is important to adopt a holistic approach to technology development that takes into account social, economic, and environmental considerations in order to ensure that these technologies are deployed in a way that promotes sustainability and benefits all members of society. 6

Implications of 4G and 5G Communication Technologies in Human Society

Our age is vigorously dependent on technological innovation, whether for recreation or for work. Phones and other remote gadgets are generally utilised around the world, and openness to radio-frequency radiation (RFR) is ordinary, even in open regions. Different perspectives on the possible unfortunate results of RFR openness from cell phones and other remote communicating gadgets, including cordless telephones and Wi-Fi, are communicated.

Current information gives legitimization to legislatures, general wellbeing specialists, and doctors/unified wellbeing experts to caution the populace that having personal digital assistance (PDA) close to the body is hurtful and to help measures to lessen all openings to RFR. Around 250 scientists from around the world signed a petition recently to the United Nations and World Health Organisation outlining their concerns that "cellular and cordless phones [2G, 3G, and 4G networks] ... and broadcast antennas," amongst other radio frequency emitting devices, may produce cancer risks due to the electromagnetic field (EMF) radio waves they produce. 7

There is progressing discussion and exploration about the expected symptoms of 4G and 5G correspondence on the two people and the climate. While 4G has been broadly taken on and utilised for quite a long time without huge negative wellbeing impacts, 5G is still in the beginning phases of organisation, and exploration is continuous to determine any possible dangers. A few worries have been raised about the effect of radiofrequency (RF) radiation produced by 4G and 5G correspondence on human wellbeing. RF radiation is a sort of non-ionising radiation that is utilised to send remote signals. While RF

radiation is by and large viewed as protected at low levels, a few examinations have proposed that drawn-out openness to elevated degrees of RF radiation could expand the risk of disease, neurological issues, and other medical conditions. There are likewise worries about the natural effects of 4G and 5G correspondence. The development of new cell towers and other correspondence foundations can affect the climate by upsetting normal natural surroundings, adding to air and noise contamination, and requiring the utilisation of energy-concentrated hardware.

6 Open AI. (2023). ChatGPT (Mar 23 version) [Large language model].
<https://chat.openai.com/chat>

Nonetheless, it's vital to take note that there is still a lot that isn't yet completely figured out about the possible symptoms of 4G and 5G correspondence. Progressing research is important to determine any expected dangers and foster methodologies to moderate them. Administrative organisations all over the planet are intently observing the arrangement of 5G and laying out rules for safe use. The implications of G4 and G5 communication technologies on human health have been a topic of concern. G5 is the latest generation of mobile communication that employs higher frequencies and bandwidth, enabling faster wireless data transfer. 8 The rapid development of wireless communication technology and the urgent need to develop it have led to an increase in public exposure to more radio spectrum frequencies. The mountain increases in terms of the damage caused by these wireless technologies from the 2G, 3G, and 4G generations, ending with the new technique, which is 5G. As a result of the urgent need for fast communications and wide packages of data, only a new generation of communications has emerged, which is 5G, which enjoys high speed and broadcasts in short waves at high frequency. There is great concern about the impact of these technologies on human health and safety. This technique works at relatively higher frequencies than the previously used technologies. This research sheds light on some of the expected harms of these technologies and the result of using these techniques, where the damages to the human body in general, the skin, and the human eye in particular are addressed, as well as their impact on the environment and plants in general.

5G communication elicits radiofrequency electromagnetic fields, which will compound those being emitted by 2G, 3G, and 4G, proving potentially harmful to humans and the environment. Radiofrequency electromagnetic fields stimulate and cause cancer in humans. Also, radiofrequency electromagnetic fields pose risks to the eyes, skin, reproductive and neurologic systems, gene expression, energy metabolism and protein synthesis (metabolic effects), cell membranes, and superficial tissues.⁹ They also cause nonspecific symptoms (such as headaches, insomnia, dizziness, nausea, lack of concentration, heart palpitations, depression, and sleep disturbances). Radiofrequency electromagnetic fields contribute to oxidative stress, increasing reactive oxygen species production and oxidative damage to DNA bases. The radiation attacks the superficial layers of the skin. Recognising the potential dangers and presumed adverse effects of 5G radiation, the World Health Organisation recommends setting exposure limits and drafting policies for reducing risk levels in the exposed population. Governments, militaries, and industries have been supporting rapid 5G implementation without, however, determining its safety and establishing preventive measures.¹⁰

7 Jessie Wingard, Is the new 5G network dangerous to our health? <https://www.dw.com/en/5g-networks-are-they-dangerous-to-our-health/a-47981285>

(accessed April 21, 2023)

8 Jessie Wingard, Is the new 5G network dangerous to our health? , <https://www.dw.com/en/5g-networks-are-they-dangerous-to-our-health/a-47981285>

(accessed April 21, 2023)

9 Jessie Wingard, Is the new 5G network dangerous to our health? , <https://www.dw.com/en/5g-networks-are-they-dangerous-to-our-health/a-47981285>

(accessed April 21, 2023)

10 H. J. Hasan, Ali J. Yosef, and Haider Abed Hachem, 5G Radiation and Potential Risks to the Environment and Human Health,doi:10.17762/turcomat.V12I6.3376Corpus ID: 236717201,

<https://www.semanticscholar.org/paper/5G-Radiation-and-Potential-Risks-to-the-Environment-Hasan-Yosef/692466d4d361a8c1e993f7e6caab87c1226c6f92> (accessed May 2, 2023)

There is presently no intelligent proof that 4G or 5G communications represent a prompt danger to human wellbeing or the environment. Both of these advances' work in the radio recurrence (RF) electromagnetic range, which has been the focal point of rationale social orders all over the planet for quite a while, be that as it may, a few people and affiliations have communicated worry about the likely effect of openness to RF radiation on prosperity through developments in significant distance correspondence, especially 4G and 5G. These worries are to a great extent founded on the speculative gamble of harmful developments and other unfriendly prosperity impacts from significant distance radiofrequency openness. While the likely impacts of significant distance 4G and 5G radiation on prosperity are as yet being investigated, there is in general agreement among the coherent affiliations that these advances will help human and normal prosperity as long as they work inside the laid-out security guideline. The World Health Organisation (WHO) and other health organisations have had various investigations and have shown that the radio frequency (RF) discharges transmitted by 4G and 5G networks have not reached the threshold of international safety standards. 11

The role that philosophy has played in inducing changes over time in the affairs of society has continued, but it too has generated its own arguments and debate. For instance, some people in the sciences and technology are of the opinion that philosophers cannot pontificate on issues they know very little about. They argue that for philosophers to be in a vantage position to reflect properly on scientific and technological issues, they need to be part of the content, processes, and products of science and technology. Even at the risk of sounding partisan in favour of philosophy, the above argument may be considered faulty. One does not need to be a part of something to be able to dispassionately reflect on it and have a position on it. I believe that the attitude scientists and technologists have towards philosophers is largely due to the feeling that philosophy has nothing to contribute in terms of shaping and influencing science, technology, and society. This is an unfortunate phenomenon that should not be so; philosophy and philosophers deserve respect from other disciplines and should recognise the complementary role of philosophy in man's understanding of forces and events in the world. 12

11 Nicholas A. Kerna and Uzoamaka Nwokorie, 5G: Probable and Possible Adverse Effects of Radiofrequency Electromagnetic Fields on Humans, Corpus ID: 23342051, [https://www.semanticscholar.org/paper/5G%3A-Probable-and-Possible-Adverse-Effects-of-Fields -Kerna-Nwokorie/941259d62fe86ab4ae6852cde80dd7b6add838ad](https://www.semanticscholar.org/paper/5G%3A-Probable-and-Possible-Adverse-Effects-of-Fields-Kerna-Nwokorie/941259d62fe86ab4ae6852cde80dd7b6add838ad). (accessed May 2, 2023)

12 A. Ali, "Philosophy, Science, Technology, and Society: An African Perspective in Philosophy and Education," 364

Conclusion

It's crucial to comprehend the potential difficulties and take the necessary precautions to tackle 4G and 5G communication concerns. Network blockage, online protection gambles, security challenges, and framework limitations are a couple of the serious issues that these innovations might cause. Network administrators and legislatures might set up arrangements to address these issues, including modernising the foundation, giving additional range, setting up encryption and other safety efforts, and raising public consciousness of security risks. To help the adequacy and security of these organisations, organisations can likewise contribute to the innovative work of new advancements.

Collaboration between many stakeholders, including governmental organisations, network operators, technological firms, and consumers, will ultimately be necessary for the proper management of 4G and 5G communication difficulties.

G4 and G5 communication technologies have fundamentally changed how individuals connect and communicate with one another, resulting in profound societal transformations. The philosophical viewpoint, sustainability, and effects of G4 and G5 technologies on human civilisation are all covered in this article. The G4 and G5 technologies present philosophical

These innovations engage individuals to control how they convey and interface with others; others argue that they lead to a deficiency of organisation and uniqueness. Furthermore, the creation and utilisation of these advances raises worries over their moral ramifications, including protection, security, and observation concerns.

The work of G4 and G5 innovations significantly affects supportability; by using brilliant frameworks and the Internet of Things (IoT), these advancements can possibly bring down fossil fuel by-products and lift energy productivity. However, the developing dependence on these advances likewise increments electronic waste and the interest in intriguing earth minerals, with adverse consequences for the climate and society. Because of what G4 and G5 advances mean for how individuals impart, team up, and draw in with each other, these innovations tremendously affect human progress. These advancements make it conceivable to convey all the more rapidly and really, which helps connectedness and efficiency. In any case, they likewise have an impact on the disintegration of laid-out normal practices and the mixing of lines, isolating public and confidential regions. Moreover, due to the potential for mechanisation and man-made reasoning to supplant human work, the utilisation of these advances has significant ramifications for business. The philosophical, ecological, and humanistic repercussions of G4 and G5 correspondence innovations are significant. While

These advancements enjoy many benefits, but they likewise raise critical moral and natural issues that should be settled to guarantee their drawn-out improvement and application.

Bibliography

- Ali, A. "Philosophy, Science, Technology, and Society: An African Perspective" in *Philosophy and Education: A Book of Readings in Honour of Msgr. Prof. F.C. Okafor*, Anthony Ali and Beatrice A. Okeke, eds., Enugu: Snaap Press Ltd., 2002.
- Bhandarkar, S., and Ranjana K., *4G Technology*, International Journal of Scientific Recharge and Modern Education (IJSRME), ISSN (online): 2544-5630, Volume 1, Issue 11, 2016.
- Goss, M.eds. *5G and 4G: Learn the key differences between them*, <https://www.techtarget.com/searchnetworking/features/A-deep-dives-into-the-differences-between-4G-and-5G-networks> (accessed April 12, 2023)
- Hasan H. J., Ali J. Yosef, and Haider Abed Hachem, 5G Radiation and Potential Risks to the Environment and Human Health,doi:10.17762/turcomat.V12I6.3376Corpus ID: 236717201, [https://www.semanticscholar.org/paper/5G-Radiation-and-Potential-Risks-to-the-Environment Hasan-Yosef/692466d4d361a8c1e993f7e6caab87c1226c6f92](https://www.semanticscholar.org/paper/5G-Radiation-and-Potential-Risks-to-the-Environment-Hasan-Yosef/692466d4d361a8c1e993f7e6caab87c1226c6f92) (accessed May 2, 2023)
- Kerna, A. N., and Uzoamaka Nwokorie 5G: Probable and Possible Adverse Effects of Radiofrequency Electromagnetic Fields on Humans, Corpus ID: 23342051, <https://www.semanticscholar.org/paper/5G%3A-Probable-and-Possible-Adverse-Effects-of-Fields-Kerna-Nwokorie/941259d62fe86ab4ae6852cde80dd7b6add838ad>. (accessed May 2, 2023)
- What is 5G Technology and Features?* <http://www.freewimaxinfo.com/5g-technology.html> (accessed April 13, 2023)
- Wingard Jessie, Is the new 5G network dangerous to our health? , <https://www.dw.com/en/5-networks-are-they-dangerous-to-our-health/a-47981285> (accessed April 21,2023)