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Perception of Science Communication Culture by Communication Scholars in a Periphery Nation

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Abstract

The gap in science communication culture between the world's centre and peripheral nations is large. Rofals *et al.* (2016) notion of peripheries informs the study's recognition of Nigeria as a geographic periphery, science communication research as a cognitive periphery, and communication scholar research as a social periphery. Little or nothing is known about the perception of science communication culture among communication scholars in Nigeria but the European Commission (2012) spells out key parameters for gauging science culture in society. Based on these parameters, this study interrogates the perception of science communication studies and research, science content in the Nigerian media, political attention accorded science communication, stakeholder/actor diversity, means of disseminating science matters, and public interest in science issues among Nigerians. Predicating the discourse on world's systems and perception theories, the study uses the survey design to gather data from the Nigeria Chapter of the African Council for Communication Education in its 2017 National Conference held in Jos, Plateau State, Nigeria. Of the 350 members in attendance at the 2017 Conference, 120 voluntarily accepted to participate in the survey. The results of the study show that 49% of the respondents reported that the science content in the media was inadequate, 65% reported a meagre/political attention to science communication, and 63% reported a low diversity of actors/stakeholders in science communication among others. Based on these findings, it is recommended among others that government, the

industry, politicians, indeed all stakeholders should strive to invest heavily in primary, secondary, and tertiary science education, science communication, science communication legislation, and budgeting to increase the diversity of science communication stake holding, improve science journalism in Nigeria, and promote science communication research.

Keywords: Survey Research, Peripheral Science, World Systems Theory, Fragile Science Communication Culture, Nigeria.

Introduction/Background

The agency, relevance, urgency and significance of science and technology in the modern world cannot be overstated. Whether for the first, second, or third world, the utility of science and technology is a given. However, science is not created equal for the three worlds. Given the uneven and unequal distribution of wealth, power and knowledge around the world, science tends also to follow the centre, semi-periphery and periphery configurations.

The issue of peripheral science has received quite some attention in the works of Subbiah Arunachalam since the early 1990s. In 1992, Arunachalam examined the problem of periphery in science and wondered what should be done to help peripheral science get assimilated into mainstream science. Also, Arunachalam (1995) asked if science on the periphery can contribute to mainstream science. Again, Arunachalam (1996) concluded that science on the periphery does enrich mainstream science but wonders, at what cost? Later, Arunachalan (2004) again examined science on the periphery particularly science research in the developing world and interrogates how to harness the new information/communication technologies to achieve equity in information.

To fully understand the notion or nature of peripherality in science, Arunachalan (1991, p. 31) outlines the characteristics of peripheral science as follows:

> i) absence of viable scientific community (ii) an insularity resulting from inadequate access to relevant information and inadequate communication within the local scientific community and with international invisible colleagues; (iii) an unduly long time lag before participants in peripheral societies can take part in hot/emerging research fronts, (iv) weak institutional

infrastructures (in, for example, academics, research journals, and more importantly, peer review system), (v) an excessive dependence on science done in the centre, the source from which influence radiates, for its growth and sustenance; and (vi) negligible contribution to the world's pool of knowledge, as seen from publication citation and impact data.

These observed problems underscore the need for a concerted action on the part of various stakeholders. Two of such stakeholders at the global and continental levels, namely: the national academies of the 98 nations, and the network of African Science Academies in 2005; in a move to consolidate the theoretical contextualisation of science and technology for Africa's development; issued a joint statement around these lofty ideas:

1. Science, Technology, Innovation are crucial solutions to Africa's problem notably poverty, disease, illiteracy, food insecurity, and environmental degradation and thus, sustainable development.
2. National investment and funding are essential to Science, Technology and Innovation development and policy making.
3. Science knowledge production and science communication must be based on needs of African nations.
4. Serious efforts must be directed at the development of excellence in Science, Technology, Engineering and Mathematics.
5. Africa's development should be hinged on the sharing and transfer of Science, Technology and Innovation between the global North and South.

In Nigeria, the science and technology situation is grim. This is why the fate of science communication is a serious cause to worry about, for science without science communication is obscure science. Science and technology research and practice in Nigeria are evidenced in the preponderance of science courses in institutions of learning, the surfeit of science and technology institutes, agencies and organisations; and the occurrence of science, technology and innovation content in the media particularly national newspapers.

More importantly, peering into the places where journalists are trained - communication/journalism academies in tertiary institutions; the key question would be: do we know how communication academics apprehend science communication study and practice? Do we know their attitudes, opinions, and perceptions? We ask these questions because the answers are critical to determining whether there is a future for science journalism if we take for granted that the academy feeds the industry.

Let's turn our attention to the state of science and technology in Nigeria,

Africa and to some extent, the world. Along with this, it would be apposite to examine the status of science communication if we are to situate this study in its proper perspective. First, Agbakwuru (2017) reported very recently in the *Vanguard* (August 3) that Nigeria, through its Federal Executive Council (FEC) declared a state of emergency on science and technology in order to boost technological acquisition for the industrial growth of the country. This entailed banning unregistered and uncertified foreign professionals from practicing unless the regulatory bodies gave them permit; as well as approving tax rebate to attract foreign investment which would give incentives to the operations of pioneer industries in Nigeria.

Another sign that the state of science and technology in Nigeria is in dire situation, is reflected in Kalu's (2017) advocacy for the establishment of science and technology parks in Nigeria. Kalu, a specialist at National Biotechnology Development Agency (NABDA) stated in the *Vanguard* (July 1) that the absence of science and technology parks in Nigeria (the one commenced in Uyo, Akwa Ibom in between 2003 and 2007 had been abandoned) means lack of exposure for Nigerian scientists, absence of international collaboration and the lack of platform to showcase research results and compete with others. Link & Scott (2011) see S &T parks as those public-private partnerships that engender knowledge flows - involving firms, academic researchers, innovators, and shrewd entrepreneurs - with a view to fostering regional economic growth and development.

In the age of open innovation, according to Bellini, Teras, & Ylineupáá (2012), the factors that make S&T parks succeed include favourable image associated with the park, proximity to local market for park-produced products and services, access to regional component suppliers, co-operative enterprising and innovation-friendly local culture, access to highly skilled/qualified employees, access to venture capital and communication facilities as well as a conducive working and living condition. The authors add that S&T parks adopt two strategies namely: the incubator strategy which focuses on, "creating ... favourable conditions... for commercialisation of research-based ideas in the form of spin-out companies from universities ... Alternatively, another strategy ... attraction strategy can be to attract established and large corporations to locate knowledge-intensive divisions or units in a park and close to the expertise and the recruitment base that a university represents" (p. 27). However, Villa & Pages (2015) observe that there is a lack of consensus as to what the success of an S&T park means as it could be financial as in the case of investments and turnover; innovation patterns as in the quantity of new businesses , patents, new products created by park firms, etc.

Sadly, Nigeria has no meaningful investment in S&T parks. So are countries such as Kenya, Cote d'Ivoire, Namibia, Madagascar, Zimbabwe, and Botswana.

Tavares (2009, p. 211) revealed that, "the functioning eight STP are located in five countries which have more resources and thus able to afford more investments in knowledge development infrastructure: Egypt, Mauritius, Morocco, South Africa and Tunisia." Taveras adds that, in some sub-Saharan countries, new STPs have been established. In Nigeria and the Akwa Ibom, Science and Technology Parks are, "still in the construction phase or in a so-called market positioning phase (when the mission of the centre has still to be refined" (p. 215). In 2017, eleven years after, that Nigerian initiative has made no progress.

The most glaring picture of the dismal state of Nigerian Science, Technology, Engineering, and Mathematics (STEM) situation is painted by Mailafia (2017). In his *Vanguard* article (July 18), he defines STEM as disciplines requiring skills such as numeracy, and the ability to generate, understand and analyse empirical data including critical analysis, an understanding of scientific and mathematical principles, ability to apply a system and critical assessment of complex problems with the emphasis on solving them and applying the theoretical knowledge of the subject to practical problems. He further states that STEM entails the ability to communicate scientific issues to stakeholders and others, ingenuity, logical reasoning and practical intelligence.

Mailafia states that China leads the world in the annual production of STEM graduates (4.7 million), India (2.6 million), USA (568,000), Russia (561,000), Iran (335, 000), Indonesia (206,000), and Japan (195,000). Regrettably, Nigeria he noted, "by contrast, out of the 1.8million graduates that enter the market annually in Nigeria, only 20% (360,000) are from STEM disciplines" He adds that there is a backlog of 5.3 million unemployed and "unemployable" graduates; and that almost an overwhelming 70% of higher education enrolment in Nigeria is in the social sciences and humanities. He concludes that Nigeria's future lies in STEM.

In unequivocal agreement, Khumbah (2016) states, "Africa's failure to re-balance its educational offerings from humanities and social sciences, towards STEM subjects constitute the most serious challenge to its ability to sustain its current economic growth and be one of the world's leading continents in manufacturing and exports" (p. 2). Khumbah upholds that, "if Africa is to realise its aspirations contained in the African Union's continental agenda 2030 and Science, Technology, Innovation Strategy for Africa (STISA), its governments have to forcefully revitalise their higher education system towards STEM education, as the next – even pivotal – frontier in the continent's historical evolution."

Statement of the Problem

Nigeria in lay discourses has often been regarded by those inside and outside of it as a

less-developed country, a third world nation, a soft-currency state, in other words, a periphery nation. The country is richly endowed in terms of oil/gas and other mineral/non mineral resources, a vibrant and large population, a generally arable land and congenial weather conditions. However, in spite of these enormous advantages, Nigeria's economy is largely dependent on oil and gas exports. Apart from its mono-cultural economy, the thick population is only about 55 per cent literate, the manufacturing sector is comatose, agriculture is mainly subsistent, the poverty and unemployment rates are escalating and the status of science education, innovation, research and development is parlous. And because Nigeria depends in great measure on core nations of Euro-America for knowledge, information, technology, innovation and products, Nigeria has undeniably earned the appellation of a peripheral state in the geographic sense. This is the primary problem.

In the cognitive sense, Nigeria's inputs and outputs or what is better described as knowledge production in the area of science, science education and science communication have equally been seen in the position of the periphery. Nigeria's Science, Technology, Engineering and Mathematics research and education are also regarded as dismal. The same can be said about science communication scholarship and practice. How much of science communication is going on in Nigeria? How much of research has been executed to answer this question? This is the second problem. The third problem touches those who teach or practice science communication. In Nigeria, this group can confidently be described as a social periphery. What is their numerical strength? What voice do they muster within the science community? How frequently is this group researched on, and what are the outcomes of such studies? We are not in a position to answer these questions because of the paucity of research in these areas.

To fill this research gap, or at least, to initiate investigation that would help provide some answers to one of the problems, this study poses the question: what is the perception of science communication culture among communication scholars in a peripheral nation such as Nigeria?

Objectives of the Study

The overarching purpose of this study is to determine the perception of science communication culture among communication scholars in Nigeria. The specific objectives of this study are to:

1. ascertain the awareness of science content in the Nigerian media among select communication scholars in Nigeria;
2. determine the impression of the political attention accorded science communication among select communication scholars in Nigeria;

3. find out the conception of the diversity of actors/stakeholders in science communication among select communication scholars in Nigeria;
4. evaluate the discernment of the main channels of distributing science knowledge to the target audience among select communication scholars in Nigeria;
5. verify the insights into the interest in science matters among Nigerians in the minds of select communication scholars in the nation;
6. discover the understanding of science journalism situation in Nigeria among communication scholars therein; and,
7. Detect the sentiment about science communication studies/research among select communication scholars in the country.

Research Questions

This study seeks answers to the following research questions:

1. How do communication scholars in Nigeria gauge the science content of the Nigeria media?
2. What is the impression of communication scholars in Nigeria about the political attention accorded science communication in the country?
3. What do communication scholars in Nigeria conceive of the diversity of actors/stakeholders in science communication in Nigeria?
4. What is the main channel of disseminating science matters to the target audience in Nigeria in the discernment of communication scholars there?
5. What insights do Nigerian communication scholars provide into the interest in science matters among Nigerians?
6. How do communication scholars in Nigeria understand the science journalism situation in the country?
7. What do communication scholars in Nigeria feel about science communication studies/research in the nation?

Literature Review

This section on literature review centres on science communication culture in core countries, science communication in peripheral nations as well as science communication in semi-periphery nations.

Science Communication Culture: What it is in Core Countries

First of all, science communication is defined as, "the use of appropriate skills, media, activities and dialogue to produce one or more of the following personal responses to science: awareness, enjoyment, interest, opinion forming, and understanding" (Ausiello, 2017, p. 3150). However, beyond the personal approach to science in

society, Fischhoff (2013) underscores the fact that there are the sciences of science communication which accommodate both applied basic science and basic applied science meaning, examining the extent theories explain practical issues as well as targeting fresh problems that emanate from those applied situations. He explains that for science communication to realise this objective it must (a) identify the science most relevant to the decisions that people face, (b) determine what people already know, (c) design communications to fill the critical gaps between what people know and need to know; and evaluate the adequacy of these communications.

According to the European Union (2012), in its *Final synthesis report on monitoring policy research activities in science in society in Europe* (MASIS), priorities in science in society studies involve public understanding of science, governance of science, science education, science communication, equality/social inclusion in science and ethics in science and technology. While zeroing in on science communication, the report carefully identifies the major indicators of science communication culture. The six parameters include:

(a) **The national science communication infrastructure.** This refers to how solid or institutionalised the science communication infrastructure is. Components of this infrastructure include the quantum and standard of science content in the electronic media, the quantity and frequency of science content in the print media, the number of national scientific journals, etc.

(b) **Political attention**. This refers to the extent of interest and support accorded science education, science infrastructure, science legislation and policy formulation, as well as science communication by politicians, legislators, bureaucrats, technocrats in government, etc.

(c) **Actors involved**. The numbers and diversity of people i.e. stakeholders involved in science communication i.e. the dissemination of science and technology knowledge, advances and risks outside the political system. These actors include scientists, science teachers, science journalists, community actors, science activists, women, youths, etc. The more their number, and the more diverse they are, the more entrenched the science culture is.

(d) **Academic tradition** refers to the system of disseminating and popularising science knowledge whether through the academic system or science community-public exchanges. Where either of these systems is deeply engrained in society, the more widespread the science communication culture is.

(e) **Attitude towards science and science knowledge acquisition by the public**. This point underlines the fact that where the public has a positive attitude and high interest in science as well as in obtaining information about science, the science communication culture in such a society is solid.

(f) **Science journalism situation**. A country with a reasonable number of well-trained science journalists as well as institutions, organisations and fora that are widely available for science journalism practice is said to be have a remarkable science communication culture (European Commission, 2012. p. 67-70).

From these parameters therefore, it becomes easy to judge the science communication cultures in given countries. Countries that are strong in all six parameters – mostly North American and Western European countries and other core nations of the world such as Australia, New Zealand, Japan, etc are said to have consolidated science communication culture.

However, countries that are strong in three or so of the parameters such as Latin American countries, some Asian, Middle East and eastern European countries operate a developing science communication culture. Interestingly, these countries are also regarded as semi-periphery nations of the world.

Sadly, countries that are weak in the six parameters mostly countries in North Africa, and sub-Saharan Africa and other small and poor nations scattered around the world operate a fragile science communication culture. Indeed, these countries are also known as periphery nations. In the following section, a more detailed look at science communication in periphery countries is undertaken.

Science Communication Culture in Periphery Countries

A substantial corpus of literature exists that allows us to gauge the science communication culture in periphery countries. These exist as opinions, reports, and articles in the popular press as well as empirical researches in reputable journals. Khumbah (2016) for example examines Science, Technology, Engineering and Mathematics (STEM) in African higher education and connects it to development. He notes, "Inter-African collaborations (collaborations without any South-African or international collaborator) comprise just 2%, 0.9%, of Southern and West African total research output" (p. 5).

If this is true of the sciences, is it any different for the social sciences and communication research? Holloran (undated) who investigated social science and communication research and the third world commented thus: "when we examine social science research within the international context over the past thirty years, and take into account exports and imports of textbooks, articles and journals; citations, reference, planning and execution of research, then it becomes clear that we have yet another example of a dependency situation." Dependency is a cardinal feature of the core-periphery relationship. It is right to say that several factors are responsible for

this dependency. Failure by periphery countries such as Nigeria to invest heavily in qualitative science education is one. Another is low rate of science literacy.

Chetty (2012) is of the view that science and technology are prominent spurs of development because advances in the economy, improvements in healthcare, education and infrastructure are hinged on them. This underscores why science literacy must be given premium attention. Davies & Priestley (2017) in their landscape survey of science literacy in developing countries observe that, "there is a strong need for improved science literacy in developing countries where recognition and adoption of coherent policies and actions remain sporadic and lacking cohesion..." They added, "there are numerous aspects of life in developing countries upon which science literacy could have a beneficial impact including: food security, food safety, disease prevention, maternal health, water management, safety and sanitation in urban environment; agriculture, and rural development; diet and nutrition" (p. IV). These issues are pertinent to a very large extent in Nigeria.

In the aspect of science communication research, Guenther & Joubert (2017) provide a clear idea of the nature of science communication research culture in periphery nations. They note that Africa is poorly represented even when attempts are made to reflect even representations of national science communication reviews. They equally note that science communication research literature is skewed towards Western/English-speaking countries. In their research to identify trends, challenges, and gaps in science communication as a field of research, Guenther & Joubert found out that a large majority of researchers (83.3%) published a lone article in the major journals of the field meaning that science communication research was engaged in fleetingly. They equally discovered that 28 researchers published consistently (more than five times) in all three journals from 1979 meaning again that the field does not have many leading research lights.

These authors equally report that in their study, Africa obtained a mere 1.1% of the entire research papers under study with 12 papers from South Africa, 2 from Botswana, 1 each from Ghana, Kenya, Nigeria, Tunisia and Zimbabwe out of 1803 publication. And of course, the top ten countries were all core nations of USA, UK, Canada, Netherlands, Australia, Germany, Spain, Italy, Japan, and Brazil. The three science communication journals investigated were: *Science Communication, Public Understanding of Science,* and *JCOM – Journal of Science Communication.*

In their conclusion, Guenther & Joubert pointed out the factors that constrained science communication in Africa to include historical/colonial suppression, cultural and language barriers, poor access to science news, lack of institutional support, funding, and infrastructure for science education/native cultures, dearth of science academies, institutes, societies, etc. as well as corruption, poverty, famine, wars and science journalism deficits.

Similarly, Karikari, Yawson, & Quansah (2016) lament that, "scientific outreach training efforts are particularly lacking in developing countries, where public engagement suffers from multiple, often-peculiar challenges" (p. 327). And in a related study of public science communication in Africa with particular reference to the views and practices of academics in a Zimbabwean university, Ndlovu, Joubert, & Boshoff (2016) note that literature on science communication research in the developing world was rare and that research in Africa in this area was circumscribed to the studies of the practice of science communication. This is true, some examples are:

1. S&T coverage in English language Indian Dailies (Dutt & Garg, 2012).
2. Coverage of climate change in Nigeria (Batta, Ashong, & Bashir, 2013).
3. Public communication of aesthetic genital surgery (Ashong & Batta, 2013).
4. Techno-scientific temper of three Nigerian newspaper (Batta, Ekanem, & Udousoro, 2014)
5. Science, Nano-science and nano-technology content in Nigeria's press (Batta, Ashong, & Obot, 2014).
6. Science reporting in Accra, Ghana (Appiah, Gastel, Burdine & Russel, 2015).
7. Communicating science information in a science unfriendly environment (Ekanem, 2003).

Therefore, Ndlovu, Joubert, & Boshoff's (2016) study on Zimbabwean scientists' public science communication practice filled a research gap. They found out that 5% of the respondents were aware of the term science communication while 36% and 14% were unaware and unsure respectively.

The authors identified a number of challenges militating against public science communication in a Zimbabwean university to include unstable research funding, political sensitivities, low public science literacy, low status of public communication and time constraints. The study provided a clear direction as to the practice of science communication among science academics in a Zimbabwean academy.

Moving away from how scientists in a Zimbabwean tertiary institution apprehended their science communication culture to how the South African public viewed science, Reddy, Gastrow, Juan, & Robert's (2013) research further elucidates the science communication culture in South Africa. This is so because public attitude to science and the interest in the acquisition of science knowledge are a key parameter in gauging the science communication culture in a given country. Reddy *et al* trace a 30 year history of surveys of the public attitude to science and technology which are important aspects of public-science relationship. They observe that the discourse has departed from science literacy to issues bordering on how the public understood science and lately to how science related with the society.

By piecing together survey data spanning decades, Reddy *et al* conclude that,

the majority of South Africans believed that science and technology made their lives easier, healthier, and more comfortable, made their work more interesting; and provided more opportunities for the future. Conversely, a significant majority of the population expressed concern that science made their life change too fast, and that they depended too much on science and not on faith.

Science Communication in Semi-Periphery Countries

In this section, focus is on science communication culture in three semi-periphery countries of Brazil, Venezuela and Croatia. While the Brazilian case is that of a generalised look, those of Venezuela and Croatia pertain principally to the production and dissemination of science issues in scholarly journals – what communication scholars do by the nature of their professional calling besides teaching.

In Brazil, Barata, Caldas, & Gascoigne (2017) studied the national and international dimensions of Brazilian science communication research. Their article mapped the progress, trends, and issues in science communication, took the history of science communication in Brazil, examined the public perception of science in Brazil and provided details of government action to guide science communication. Barata *et al.'s* article equally reviewed Brazilian science communication research, whether as dissertations and theses, or published papers, in the leading science communication journals both in Brazil and in the world. Some of the notable facts to be noted about Brazilian science communication according to the authors include:

i) A very strong interest in science, technology and innovation in Brazil. When people were asked what media stories interested then in the most recent survey on public perception of S&T science and technology, "came ahead of politics, fashion, sports and culture" (p.8).

ii) "Despite the increased interest in science and technology, research on media coverage of science presents discouraging results ... most news (86.4%) is decontextualised ... 50% ... has only one source; with ... 51.2% coming from universities and research institutes." (p.8).

iii) "Brazil has grown its scientific research production globally from 0.8% in the 1990's to 2% in 2015 and figures as the 13th nation in rank" (p.9).

iv) "Over the last 40 years, the United States (39%) has been the main producer of science communication papers indexed in the WoS (Web of Science) database followed by the UK (18.7%). Brazil ranks 9-10th together with Italy" (p.14)

This research shows the strident effort Brazil has invested in science communication even as the core nations of the world, incidentally, English speaking countries, of USA and UK are dominant.

In Croatia, a Croatian speaking European country of 4.5 million people, Hebrang Grgic (2014) content analysed 231 open access, peer-reviewed scientific journals available on the Croatian national platform – the Hrcak Portal. He defined peripheral scientific communities by two factors – language other than English and countries that lack strong publishing industry or those unable, to spend as much on research and scientific data acquisition.

Hebrang Grgic points out that of the 231 journals studied, 42.4% focused on Science, Technology and Medicine (STM) while 57.6% dealt with Social Sciences and Humanities (SSH) and that universities accounted for 44.2%, professional bodies 27.7% and scientific institutes, 25.5% of the journals even as all of them are funded by the government. Of these journals, 40.3% publish articles in Croatian, 29.9% publish all articles in English, and 6.5% do so in both English and Croatian while 23.4% come in English, Croatian or another language. The authors also note that, Croatian journals do not have high impact factor. While it is higher for STM journals (0.536), it is lower for SSH journals (0.268).

What this study has shown is that as long as the majority of Croatian journals continue to be published in Croatian, more nationals would continue to have access to science knowledge in Croatia. However, this might also account for their low impact factor because much of the world is not able to cite those works because of the language barrier – further deepening the core – periphery divide. This conundrum appears to be the rationale behind the next reviewed article from a Venezuelan scholar.

From Venezuela, Salagez-Meyer (2015) noted that the mantra of "publish or perish" has led to the pressure to publish in "high-ranking" or "reputable" scientific journals published mainly in the core countries of the world in the English language over the past thirty years. He added that, "this prevalent worship of centre-based publications is evident for example, from the promotion and monetary compensation researchers receive" (p.18).

Relying principally on extensive literature review of academic publishing in peripheral and semi-peripheral countries and his personal experience, Salager-Meyer identified the damaging impact of the, "publish or perish culture" to include drain on publications, i.e. out-flow of indigenous research from peripheral countries to centre nations. The second problem that is created is that, to make their studies published in core journals, periphery country researchers use local resources to embark on researches that are more relevant to core rather than peripheral spaces.

Under contextual and intrinsic factors, the author lists problems that include shortage of funds and poor infrastructure; a limited pool of authors capable of delivering suitable and original articles, the problem of quality articles, the nagging

issue of rigorous peer reviews and the dearth of professionally qualified journal editors. Other cogent problems that peripheral journals face are the inability to adhere to international guidelines and best practices, and some excellent authors' unwillingness to submit articles to peripheral journals that would aid their indexing in global bibliographic databases.

To assist peripheral journals break out of this vicious cycle of inadequacy, Salagar-Meyer suggests serious work on quality, journal editors' training, resource to open access, resort to regional sciento-metric tools of electronic databases for indexing and bibliodiversity as well as redesigning an evaluation system for peripheral researches more appropriate than the impact factors system.

Theoretical Framework

This study sits comfortably well within the framework of the World's Systems Theory as well as the Attitude Change Theory. According to the framework that Rafols, Molas-Gallazt, Woolley, & Chavano (2016) outline, Nigeria being a developing nation in the southern hemisphere is seen as a periphery country in the geographical sense. Also, in terms of the relative invisibility of science communication as a scholastic discipline in Nigeria, the field could be interpreted as a cognitive periphery. And yet, as a social group (of people) in society, communication scholars in Nigeria, who have not themselves been widely studied and reported upon, may be regarded as a social periphery.

The World Systems Theory is traced to Immanuel Wallerstein (Moyer, 2016) and is seen as, "the social reality within which we live and which determines what our options are has not been the multiple national states of which we are citizens, but something larger, which we call a world system" (par 1.). To Martinez-Vela (2001) this theory, "emphasises development and unequal opportunities across nations," (p.1) and that, "among the most important structures of the current world-system is a power hierarchy between core and periphery, in which powerful and wealthy core societies dominate and exploit weak and poor peripheral societies (p.4). The world system theory may thus help explain the difference in science communication culture between core and periphery countries as well the difference in science communication research and the research involving communication scholars between core and periphery nations.

Another theory that also helps us understand the perception of science communication culture among communication scholars in Nigeria is the Attitude Change Theory. This theory covers several ideas: first is that of cognitive consistency which according to Baran & Davis (2006) conveys the idea that humans internally and externally work to preserve their existing views of say science communication

culture in a given country. Second, the idea of cognitive dissonance emphasises the thinking that information about say, the science communication culture of a country that is not consistent with an already held disposition causes unease. For these reasons, people including communication scholars are bound to selectively attend to or expose themselves to messages that sync with their pre-existing dispositions towards science communication culture. Likewise, they tend to retain more of those messages that make the most meaning to them concerning science communication culture.

There is need to add that people in core and periphery nations tend to perceive science communication culture differently. The Futures Centre (2018) has noted that 77% of EU residents think science and technology have a positive impact on society while 74% agree that they could pose dangers on health and the environment. Also, in South Africa, 70% of the residents are reported to believe that science make live generally better while the majority view science as causing changes that are too fast and less dependent on faith. And in Kenya, genetically modified organisms have been banned because policy makers, farmers, and consumers do not believe their so-called benefits.

Method

This study adopted the survey method to investigate the perception of Nigerian communication scholars concerning science communication culture in Nigeria. The population consisted of members of the Nigerian Chapter of the African Council for Communication Education – a professional body of communication academics in Nigeria's tertiary institutions. The members of the Association meet annually around Nigeria for their annual conferences and general meetings. During the 19th Annual General Meeting of the Association held at the National Institute of Policy and Strategic Study (NIPSS) in Jos, about 350 members were present but only 120 were willing and able to participate in the survey. Therefore, the sample size for the study was 120.

A 12-item questionnaire was administered on the sample between October 31 to November 3, 2017 principally to find out from the respondents their perception of (a) science content in the Nigerian media, (b) political attention accorded science communication in Nigeria, (c) the diversity of actors/stakeholders in science communication in Nigeria, (d) the key channels of disseminating science matters to targets in Nigeria, (e) interest in science matters among Nigerians (f) science journalism situation in Nigeria, and (g) science communication scholarship and research.

A total of 120 copies of the questionnaire were personally distributed along

with one assistant and 110 copies were retrieved out of which 105 were useful for analysis. Analysis of the demographics of the respondents showed that 17 were professors, 32 senior lecturers, 42 lecturers, and 14 were beginner communication scholars. There were 83 males and 22 females out of which, 56 had doctoral degrees, 43 possessed master's degrees while six were bachelor degree holders. Eighty seven (87) of the respondents belonged to the communication arts, seven to other arts, 10 to the social sciences and one belonged elsewhere. Also, 71 of the respondents worked in public universities; eight were employees of public polytechnics, 10 worked for private universities while 16 worked for other entities. Importantly, the advantage of studying this population was that it consisted of that group of scholars who network with other scholars, and were willing to share their ideas and research outputs with others.

Results and Discussion of Findings

The results and data obtained from the study are presented here and the ensuing discussions are based on the research objectives and research questions earlier outlined.

i) Perception of Science Content in the Nigerian Media

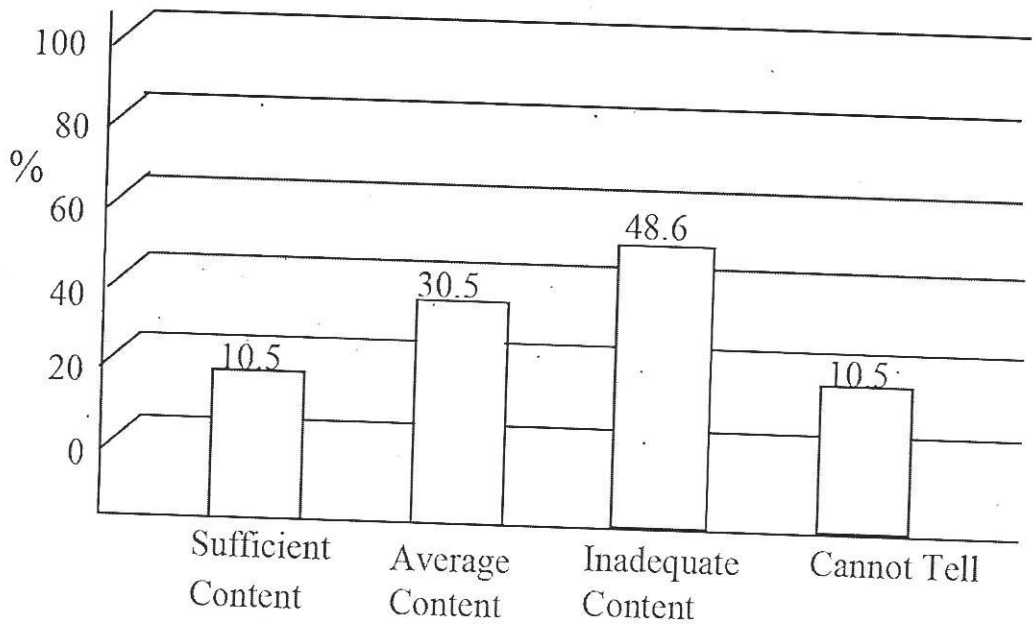

Fig. 1 Science Content in the Nigerian Media

Figure 1 shows that the majority of respondents (48.6%) perceived science content in the Nigeria media to be inadequate. In line with this finding, Lucibella (2009) observed that American news firms have been closing down their science desks and that science often goes to the bottom of the priority list. In India, Dutt & Garg (2012) equally noted that science rarely obtains coverage in prominent pages. In Brazil, Massarani (2004) stated that prominent press organisations have become erratic in their coverage of science, and indeed, science has been relegated to the background. In South East Europe, *Sunday's Zaman* (2002) pointed out that the quality of science reporting was seriously below Western European media standard.

In Ghana, Appiah, Gastel, Burdine & Russel (2012) noted that about 81 per cent of the journalists they surveyed were of the impression that science reporting in Ghana was inadequate. Again, in India, Patairiya (2002) had observed that there was a dwindling interest in science communication in the print media and that science then attracted 3% coverage of energy issues that people attended to science articles the way they did political stories but rated them less interesting than political news. In Nigeria, Batta, Ashong, & Obot (2014) noted that science coverage concentrated on health, medical, and information/communication technology issues. Likewise, Batta, Ekanem, & Udousoro (2014) reported that techno-scientific articles in three Nigerian newspapers were mostly treated superficially.

I) Perception of Political Attention Accorded Science Communication in Nigeria

ii) **Perception of Political Attention Accorded Science Communication in Nigeria**

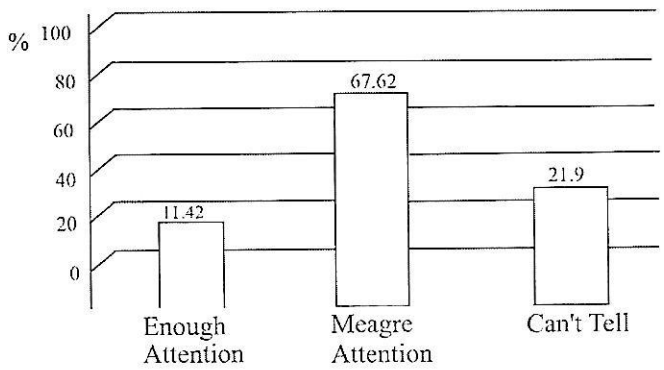

Fig. 2 Political Attention Accorded Science Communication

Figure 2 indicates that communication scholars in Nigeria (67.62%) perceived that the political attention accorded science communication in Nigeria was

meagre. The European Commission (2012) affirmed that it is important for the legislature and executive branches of government as well as ministries, department and agencies to support science communication given that the policy formulation, legislation, and funding necessary for science communication to thrive would have to come from them. The Federal Ministry of Science and Technology (2012) in Nigeria had formulated the National Science Technology and Innovation Policy but mention science communication marginally. Khumbah (2016) observed that the political leadership in Africa has not embraced Science, Technology, Engineering, and Mathematics education that are critical to Africa's transformation.

In Nigeria, Mailafia (2017) lamented about the undue emphasis that places humanities and social sciences over the sciences in the school curriculum. This present study has therefore demonstrated that the respondents are correct in their perception that in Nigeria, the political attention accorded science communication was dismal.

iii) Perception of the Diversity of Actors/Stakeholders in Science Communication in Nigeria

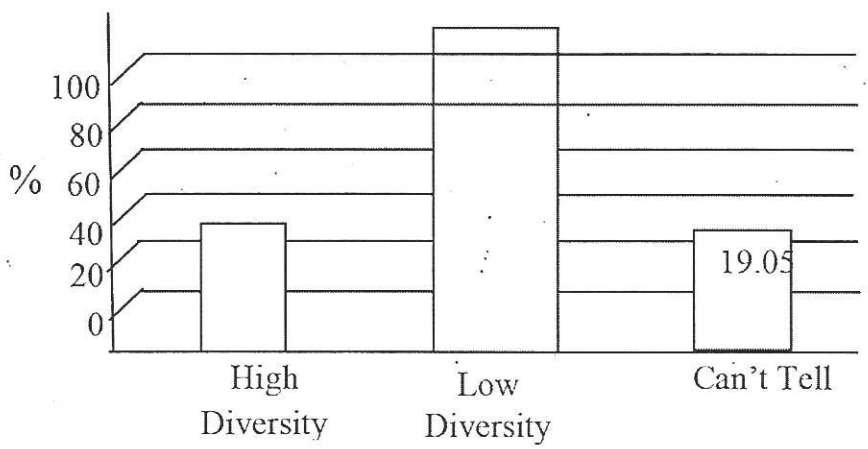

Fig. 3 Diversity of Actors/Stakeholders in Science Communication

Figure 3 shows that in the estimation of the respondents, 62.85 per cent of them reckoned that the diversity of actors and stakeholders in science communication in Nigeria was low. According to the European Commission (2012), diverse actors and stakeholders - science teachers, scientists, researchers, actors, politicians, ethicists, activists, consultants, etc. - are a strong indicator of a consolidated science communication culture.

To buttress this finding, Khumbah (2016) stated that the population of African

students in STEM is less than 25percent. Perhaps it was the need to broaden the actor /stakeholder base of science communication that in Australia, according to Gascoigne & Metcalfe (2017) a major target of government's S&T awareness programme in the 1990s targeted youth, teachers, women, industry and business leaders, scientists and journalists.

iv) Perception of the Major Means of Disseminating Science Knowledge to the Target Audience in Nigeria

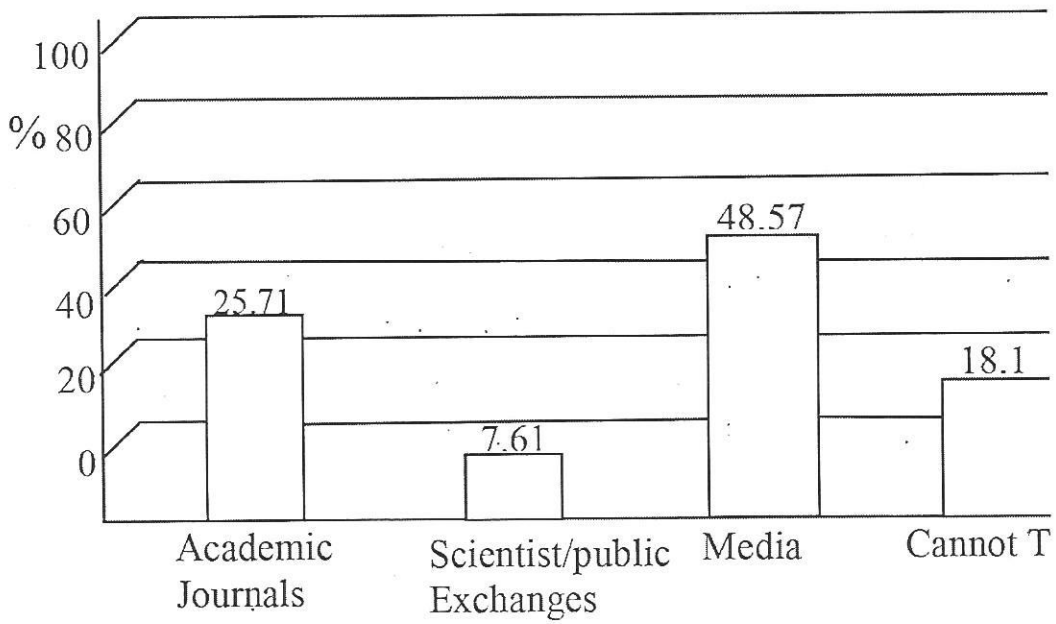

Fig. 4: Means of Disseminating Science knowledge in Nigeria

Fig 4 illustrates that, in the discernment of the respondents, 48.57 per cent of them reported that science issues were mainly disseminated to the target audience though the media followed by academic journals (27.71%). This finding can be checked against the European Commission's (2012) position that there is a convention or tradition that sees the primary means of distributing science issues to the target groups though scientific journals while other countries adopt an alternate route of integrating the science community with the public.

To drive home this point, Gascoigne & Metcalfe (2017) stated that, "a recent study of the three international journals devoted to science communication found that Australians were placed fourth in producing peer reviewed papers, behind USA, UK and Canada"(p.11). Also, Brownell, Price, & Steinman (2013) were of the view that,

"incorporating formal training in science communication to the layperson audience ... will promote a culture of communication with the general public within scientific disciplines" (p.E9).

Again, underscoring the relevance of the media in the dissemination of science, Knowledge Base (2016) stated that, "studies find that heavier attention to this genre (science journalism) at newspapers, magazines, and on television is correlated with a more positive view of science" (p.2). To understand why about 26percent of the respondents saw academic journals as the means of disseminating science knowledge, Guenther & Joubert's (2017) study revealed that research from Africa – in large part South Africa, and an insignificant number from Botswana, Ghana, Kenya, Nigeria, Tunisia, and Zimbabwe added up to a mere 1.1%: from a total of over 1800 articles in three leading science communication journals.

v) Perception of Interest in Science Issues in Nigeria Among Communication Scholars

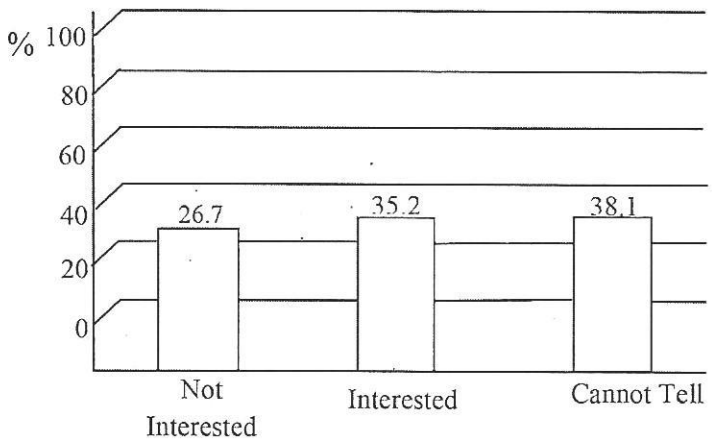

Fig 5: Interest in science Issues in Nigeria

The data in Figure 5 illustrate that the majority of respondents (38.1%) reported that they were not in a position to tell the extent to which Nigerians were interested in science. It is the belief of the European Commission (2012) that the, "public's interest in science and ability to acquire knowledge has significant impact on the success or lack thereof of the communication efforts" (p.68).

If we add the percentage of respondents who reported that Nigerians lacked interest in science to those who were not able to tell, we end up with a percentage above 60. This coincides with Potvin & Hasni's (2014) observation that in Canada "S&T professions are less attractive and the share of S&T students in higher education

has been decreasing considerably" (p. 85). In South Africa, Reddy, Gastrow, Juan, & Roberts (2013) who examined the public attitudes to science in South Africa concluded that, "the majority of South Africans believed that science and technology made their lives easier, healthier, and more comfortable; made their work more interesting; and provided more opportunities for the future. However, a significant majority of the population expresses concern that science made their way of life change too fast, and that they depended too much on science and not enough on faith. It follows therefore that, to have a consolidated science culture in a given nation, the interest of the public in science and knowledge acquisition must be high.

vi) Perception of Science Journalism Situation in Nigeria by Communication Scholars

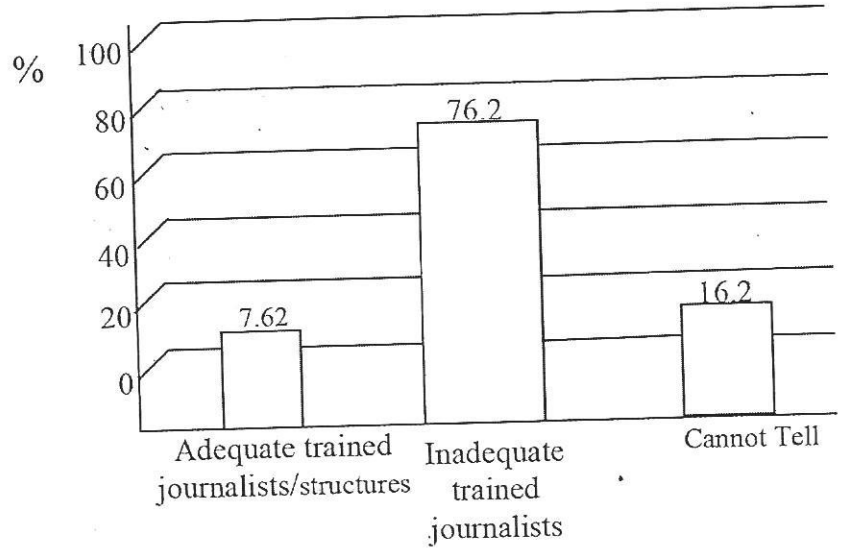

Fig 6: Science Journalism Situation in Nigeria

Figure 6 bears the data that indicate the understanding of the respondents of the science journalism situation. The majority of respondents (76.2%) felt that in Nigeria; the number and quality of science journalists as well as the structures meant for the organisation of journalism are inadequate. In line with this finding, the European Commission (2012) recognised the fact that countries that lack science journalists and the structures and institutions that make journalists put in their best are better described as operating a fragile communication culture.

Science journalism is critical to the public understanding of science. Indeed, Knowledge Base (2016) affirmed that attending to media science correlates positively

with several forms of knowledge. Likewise, Fischhoff (2013) agreed that science communications informs the public about, "the benefits, risks, and other costs of their decisions, thereby allowing them to make sound choices" (p.14033). Unfortunately, Lucibella (2009) observed that, "science journalists are an endangered breed," and that, "the tumultuous and uncertain state of science journalism today could jeopardise public science literacy in the coming years" (p.1).

vii) Perception of Communication Scholars Concerning Science Communication Studies/Research in Nigeria

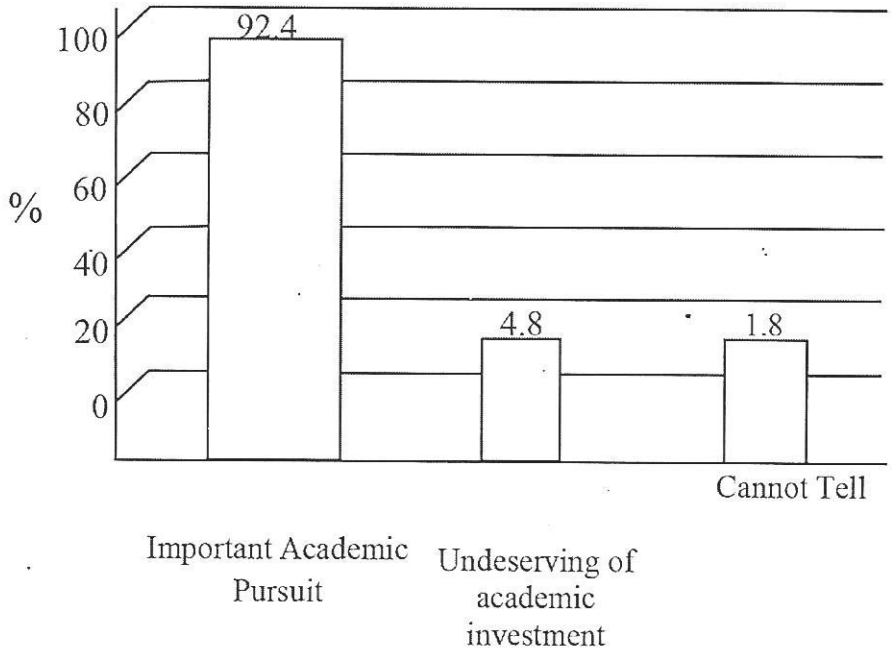

Fig. 7 Attitude to Science Communication Studies/Research

The data presented in Figure 7 illustrate communication scholars' attitude to science communication studies and research in Nigeria. The figure indicates that 92.4% of the respondents evaluated science communication scholarship as important whereas a very insignificant percentage felt it was undeserving of academic attention or could not express a position on it. This finding is indicative of the relevance of science communication research in society. In the UK, Holliman (2016) stated that, science communication research helps to draw us close to a research culture in which various interested groups prioritise frames, practice and govern research as well as share research results. Concerning advances in African and Arab science journalism,

Lublinski, Reichert, Denis, Fleury, Labassi & Spark (2014) observed that science, health, and environment journalists face several difficulties including the dearth of primary resources for research and environments that may not be conducive to specialised journalism. Earlier, Nakkazi (2012) concluded that Africa is largely accepting the relevance of science and communication in economic development as well as the constraints that follow.

Summary of Findings/Conclusion

This study has shown that:

1. Approximately 49% of the respondents reported that they felt the science content of the Nigerian media was inadequate.
2. Regarding the extent of political attention accorded science communication in Nigeria, about 68% of the respondents said that the attention was meagre.
3. Pertaining to the diversity of actors/stakeholders in science communication in Nigeria, about 63% of the respondents stated that the diversity was low.
4. With reference to the main means of disseminating science knowledge in Nigeria, 49% of the respondents mentioned the mass media while 26% pointed to academic journals.
5. On the interest in science issues among Nigerians, 38% of the respondents said they had no idea while 35% reported that they thought Nigerians were interested and 27% felt they were not interested in science.
6. Lastly, when asked to gauge the science journalism situation in Nigeria, 76% of the respondents reported that science journalists were not enough and the structures to train them were inadequate in Nigeria.

The conclusion of this study therefore is that the majority of communication scholar members of the Nigeria Chapter of the African Council for Communication Education perceived the science communication culture in Nigeria as fragile based on the European Commission parameters for measuring science communication culture. This may have been due to inadequate media coverage of science, poor diversity of science communication stake holding, insufficient national science communication infrastructure, a less salutary science journalism situation and the lack of political stakeholder attention to science in the country.

Recommendations

For Nigeria to improve its science communication culture, the following measures are suggested:

First, the communication component of Nigeria's National Policy on Science,

Technology and Innovation should be deepened. At present, it is mentioned in passing. Specifically, the Policy document which is 37 pages long, makes only two sentences in its policy strategy and policy objective, the popularisation of STI through the mass media, etc. and promotion of activities to inculcate STI culture in Nigeria. Detailed plans, actions, strategies are not spelled out as seen with other components.

Second, schools of journalism and communication studies should include compulsory courses (not electives) in science, health, environment and technology considering their importance to periphery nations. The capacity of the faculty to provide graduates in these areas should be built through funding, training and equipment.

Third, the traditional and new media operators should be encouraged by scientists, science activists, science communicators, scholars and the industry to beef up their science, health, environment and technology content so as to help popularise and secure the public understanding of science. The capacity of reporters, correspondents, editors and proprietors to understand, appreciate, and project science should be boosted by all stakeholders.

Fourth, government, the industry, politicians, indeed all stakeholders should strive to invest heavily in primary, secondary, and tertiary science education, science communication, serious implementation of science policy, science communication legislation, science communication funding and budgeting to increase the diversity of science communication stake holding, stimulate the interest of Nigerians in science, improve science journalism in Nigeria, and promote science communication research.

Fifth, Nigeria needs to take science, technology, and innovation much more seriously by deliberately investing in science and technology parks, science centres for citizens, science museums and science festivals. At the moment, these avenues for science incubation and science dissemination/popularisation are non-existent.

By doing these, Nigeria would gradually move away from being dependent on core countries for science ideas, products and knowledge. The journey from the periphery through the semi-periphery to the centre of science and technology knowledge production is long, tortuous and arduous. However, the journey should be undertaken with depth and persistence.

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