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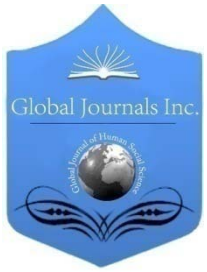

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The Political Dimensions of Science Consciousness in Africa

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Keywords: science consciousness, scientism, democratization of science, domestication of science, technological independence, public engagement with science and technology, anticipatory regime.

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The Political Dimensions of Science Consciousness in Africa

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Abstract- This paper explores the concept of science consciousness in the national life of African states. The publics in African states interact with new creations of science in the form of products imported from the developed countries, yet no one cares to communicate to these publics how such artefacts were arrived at – the science in simplified language behind such products as well as the intrigues (political, social, and even religious) that played out before such artifacts became reality. In this way, the general public in Africa does not flow with the science and politics of science behind the emergence of technological artefacts and new inventions which are sold to them as finished products. Each artifact of science tells a story that expands our science awareness and inspires the average mind. More rudimentarily, African governments have weak institutions that promote the knowledge of some science among the public or the masses and where private organizations which can perform this function exist the governments do not know what to do with them. In Africa today, science still exists only in the laboratory. For science to get into the cultures of African societies, it must first get into the everyday language of the people through whatever means. For science to take proper root in Africa, it must stop being a 'government thing' in every instance and must get into the common language and conversation of the people. This way the people will own science. The best root is the deepest root which science will develop in Africa through the masses. Building the science consciousness quotient of the African masses amounts to building the foundation for the emergence of technological African states. Science fiction is the simplest method to penetrate the intelligence of the masses to achieve the critical mass of science-thinking and science consciousness required to propel African countries unto the path of the scientific state. The paper invokes and thereon adopts Snow's scientism – that is scientism as formulated by C.P. Snow in his discourses on the Scientific Revolution.

Keywords: *science consciousness, scientism, democratization of science, domestication of science, technological independence, public engagement with science and technology, anticipatory regime.*

I. Locating the Problem

In Nigeria today, in the age of AI, quantum computers, and postmodernism – in a word, the age of the scientific state – there remains a marked total absence of science and technology agendas in the people's political and social engagements. In public conversations on radio and television, on social media, in the newspapers and popular press, there is a resounding absence of science agendas, whether for entertainment or for public enlightenment and engagement. Even if one blindly admits that some form of social engagement with science and technology agendas could be found upon closer investigation, it would be a near-impossibility to locate some local content in the said science and technology agendas.

The Nigerian story resonates Africa's story, except South Africa. Science is presently locked up – caged and chained as it were – in the laboratory in African political systems. The Nigerian scenario does not even reach the laboratory and depicts Nigerian science and technology scholars as textbook scientists and engineers. These experts neglect their work in science-consciousness enrichment. But this may be far from the truth. Where is science done in Nigeria and why is the public completely unaware of it and thus completely unable to contribute to it? Why does the Nigerian public place no demands on their science and technology sectors?

In the southeast of Nigeria, break-up politics dominates the political consciousness of the vast majority. Millions here do not admit that they are Nigerians. The quest for the realization of the sovereign state of Biafra has eaten so deep into the mental fabric of the Igbo collectivity that nothing else is worth considering. There is however no indication that if granted political independence by some arrangement this area can produce a better country than Nigeria in terms of achieving technological independence. Present indications that the area can achieve a technological-state status are about negative. The science consciousness quotient of the collectivity of the southeast of Nigeria is just about the same as the rest of the country, which is near zero. The countrymen and women seem to be happy to be technologically dependent on even fellow developing countries – countries a few years back could be rated as far less prosperous than Nigeria.

The extremely low level of science awareness among Nigerian citizens suites the country's political gladiators very well, because this backwardness in the population facilitates the government's practice of corruption. There are practically no demands from the population to make the production and deployment of science the foundation of the Nigerian economy. Huge

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capital budgets are made that have zero impact on the science system of the Nigerian state. It is as though hard and deliberate efforts are made by the government planners to skew the development of the state's science system. Whereas intelligent governments use capital budgets great and small to target a stimulating impact on the state's science system, whether as catching-up regimes or comprador regimes or scientific leadership/ surprise regimes, Nigerian and other African governments deliberately ignore such science system targets by carefully avoiding the setting of such targets. Nigerian political 'rulers' whether in power or behind power are very much aware that increasing the state's science capability amounts to shooting themselves in the leg as the expanding production and deployment of technology would eradicate their ability to loot public funds and can entirely cut off their largesse networks, and so their political domain would be defined by a low net worth value. At the moment, the masses (the 99%, the vast majority) are blind, and their blindness defines the states democracy such that the people are very comfortable with annual zero growth of the state's scientific enterprise. This blindness, occasioned by the near-absent science consciousness among the vast majority, is the stock-in-trade of the Nigerian political class. The more blind the vast majority is, the easier it is for *incredible corruption* to continue among the political elite, the ruling class. Who then will bail the cat? The scenario in Nigeria is not different in the rest of Black Africa, except South Africa, which itself cannot be categorized among Black African states.

Ghana's independence came in 1957 and Nigeria became 'free' in 1960. The 1960s is known as Africa's decolonization decade. It is obvious that nationalist leaders of African states that became decolonized in the 1960s were not aware of the 1959 Rede lecture or ever heard of the name C. P. Snow who introduced what can be labeled scientific (or technological) republicanism or technological nationalism (to use a more common parlance) which are anecdotes that build upon and are in turn nourished by the selfsame science awareness regime. The first generation of Black Africa's Ph.Ds in science and mathematics, who incidentally emerged in the 1950s and 1960s, were trained in Europe (especially the UK) and North America (especially the United States). It is obvious that political leaders that ruled independent Black Africa from inception had no confidence in their countrymen scientists and engineers, albeit their world-class training in the UK and the US. For instance, the Nigerian political leaders may have imagined that a car put together by a group of these US-trained scientists and engineers (but who were nevertheless Africans and not Whites) would simply fall apart on the road and kill everybody on board! Incidentally the political leaders who negotiated Black Africa's independence and became the first leaders of their countries were men of letters and not men of science. They could not understand that science could dwell in the Black African's soul and manifest through his skin, much as it did among their colleagues in their colonial-master countries. African politics then could not connect with the science industry – which was at that time rudimentarily composed of the science and technology intellectuals and negligible science infrastructure. The government leaders, both civilian and military, could not complete the domestication process of science from whence a burgeoning science consciousness regime could be established in African societies by the full engagement of science and technology in the Blackman – that is Black African scientists. Till today, African political leaders and governments are yet to properly understand the notion of scientific republicanism and the concomitant notion of technological nationalism as offshoots of a science-conscious political identity regime.

II. The Meaning of Science Consciousness

Science consciousness is the relative quantification of information possessed by a people on science issues, which includes traditional science knowledge available through science textbooks and information on scientific and technological break-throughs and imaginations on how contemporary society will live with such technological advances, such that one political society can be said to be more 'science aware' than another. I deploy the term *science consciousness* then to refer to the notion of public awareness of science in a political state.

Science consciousness therefore is the information-quotient about the possibilities of technological advance in the world and how the individual's specific society could relate with such possibilities. Science consciousness equips citizens of a state to analyze and tell where the policies of government are heading. The individual can easily read and measure the science component of government policy and determine whether it falls in the direction he desires. Science consciousness in this way shapes political expectations of the citizen in democratic societies.

Seeing through science, thinking through science, imagining through science are aptitudes developed in citizens with a certain measure of science consciousness. If per capita quotient of science consciousness in a political society is high enough, the entire society will evaluate the performance of government based predominantly on this parameter, and this too will determine their choice of leaders.

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Science consciousness connects the average citizen of a political state with her scientists and inventors in a passionate way, such that the citizen is ready to make sacrifices where necessary to ensure that the work of the inventor is made manifest and mass-produced for the benefit of the entire polity. Science consciousness therefore has great impact on the political system through the quality of the citizens' inputs and demands on the system. For instance in Nigeria, the average citizen still lives in the erroneous belief that it is only a professor of science or technology that can call for the governments' increased attention to science and technology, such that even ordinary citizens who have through their lifework achieved high political capital do not have the mentation to use this leverage to direct mass attention to the government's inattentiveness and lip service to science and technology development.

Again, science consciousness is an autogenic force in the citizens which creates high confidence in their ability to create and recreate science and to use this tool to drive their own economy by themselves. Science consciousness therefore manifests in a do-it-yourself sense which itself produces an export-oriented economic mind. By deduction therefore, a political system with a high import economic system is extremely low on science consciousness quotient of her people.

Science consciousness affects the character of heterogeneous and deeply divided societies in an unprecedented manner. In one scenario it can become a unifying force in societies deeply divided along ethno-religious lines; in another scenario it can deepen these divisions and ethnic cleavages but to an advantage.

Where science consciousness is not able to diffuse ethnic consciousness and ethnic solidarity, it fuses with this and other consciousnesses and will now be coloured and energized by same. So where science consciousness fuses with ethnic consciousness the result will be a further deepening of the lines of division to the point where the various ethno-nationalities will begin to compete for scientific and technological supremacy which all-in-all is very healthy for the emerging scientific state regime.

As science consciousness deepens among the ethnic nationalities in a state, all other lines of division that may exist, such as culture, ideology, etc, will be eroded, leaving only language and territorial identity (or ethnic homeland) as the remaining significant lines of division. As science consciousness pushes science among the ethnic identities, their cultures will become more and more homogenous as science itself begins to get into their various cultures and common conversations and becomes or assumes the common denominator.

III. Conceptual Configurations

a) Science consciousness and development consciousness

Science consciousness rightly should be the fundamental consciousness which defines and drives development consciousness. The two are not synonymous. One is and ought to be the root of the other. Development consciousness is a quick-fix consciousness recommended by Western countries for backward countries instead of emphasis on the underlying science behind development. Sustainable development must focus first on science. This is because what constitutes 'development' will always be defined by where science is at any point in time. Development therefore is a *fluid concept* and depends on the relative stage of science in the world as defined by the science-focused states. Therefore development consciousness will always trail behind science consciousness and the two concepts are not the same. One is a cause while the other is an effect.

African states are defined by their high development consciousness, which is rather retrogressive. African states in the twenty-first century should change their consciousness driver from 'development' to 'science'. Development is not science and cannot always produce science. Science should be the real goal of development. In other words, science will always produce development – sustained and perpetual development.

Africa's high development consciousness is a post-colonial and neo-colonial orientation designed and propagated by the erstwhile colonialists in order to draw the attention of the newly decolonized states away from focusing on their real goal which is the emergence of a high science consciousness regime, such that these states will for hundreds of years to come serve as extensions of their markets and no more. The neo-colonizers have consolidated their grip on the control of Africa's consciousness by churning out certain development targets tagged Millennium Development Goals which all-in-all further deepen these states' attention on *development paradigms* rather than focus their attention on *science and technology paradigms.*

The fluidity of development is defined by the super-dynamism of science. Again the super-dynamism of science gives science the power to define time, that is eras or epochs. So in each era, science defines what constitutes development and countries that are focused on development agendas are forever going back to the drawing board in an effort to 'catch up' with the contemporary development regime instead of themselves defining such agendas by being in control of the cause.

Development as a quick-fix consciousness creates disarticulated and subservient economies. For

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instance, in Nigeria the telecommunications subsector was liberalized in 2001 and private GSM operators joined the sector and between 2001 and 2014 telephone lines increased from less than 400,000 to over 120 million. This means that as at the close of 2014 there were at least 100 million telephone handsets in use in the country. Yet the country does not manufacture telephones or sim cards. The country imports at least 15 million telephones and accessories every year through hundreds of importers, adding their own quota to the demand for scarce foreign exchange which in turn contributes its own bit towards weakening the exchange value of the naira. If the country's science consciousness was high enough, the planners would have designed a compulsory programme for the telephone companies to set up local manufacturing plants within at most one year of their operations in the country to produce telephones and sim cards. The mentality of the Nigerian planners in this instance is not to acquire the underlying science and technology in GSM handset design and manufacturing, but simply to 'develop' by getting everybody to communicate and own mobile telephones and to expand employment in the sector. Driven by this quick-fix thinking, the development-conscious Nigerian leaders failed to plan how the technology could be domesticated such that even more employment could have been generated and today the country could be Africa's largest exporter of mobile telephones and accessories. A Nigerian telephone brand could today have been a household name in Nigeria, the way every Nigerian knows Nokia, Samsung, and Techno.

Development consciousness is merely an adjustment mechanism. Development consciousness only generates adjustment techniques. Adjustment techniques only adapt to the problem but do not solve it. This is because development consciousness cannot create anticipatory regimes which build local capacity for technoscientific transformations. Development consciousness regimes are quick-fix regimes that predominantly skew over domestic technoscientific capability consolidation agendas. Development consciousness is inferior to science consciousness which itself creates anticipatory regimes as an aspect of technological independence regime.

b) Science consciousness and political consciousness

In order of precedence, science consciousness should come before, or develop ahead of, political consciousness. Political consciousness if not backed by the right measure of science consciousness creates political leaders and followers who are completely incapable of initiating technological advance of their states. Political consciousness is very high in African states as a consequence of the very high value attached to political power through primitive accumulation. In heterogeneous African states such as Nigeria, political consciousness mixes with ethno-religious consciousness and is driven by it to dangerous levels. Science consciousness is the substructure consciousness upon which the superstructure consciousness (being political consciousness) may be safely built. All other forms of consciousness, be it ethnic, religious, political, are inappropriate and in fact dangerous to constitute the base consciousness of citizens of a state. These elements operating as the base consciousness or consciousness driver or substructure consciousness easily produce religious riots and genocides, ethnic cleansing, political insurgency and civil wars, terrorism, ethnic politics, etc.

Science consciousness should be developed in the citizens of a state well ahead of political consciousness. This is necessary in order to direct and control the force of political consciousness which could easily run out of order and become counter-productive when it is not shaped by science consciousness. This is especially so in countries deeply divided along ethno-religious lines such as Nigeria, Uganda, Kenya, Rwanda, Sudan, Democratic Republic of Congo, Somalia, and a score other African countries.

High political consciousness in African states has created two regimes in the political sphere. One regime is composed of typical African politicians and political activists and other politically conscious groups whose sole interest is the perpetuation of African style of politics characterized by looting of public treasury and the transformation of political actor into dollar millionaires. Another regime is composed of younger people in the form of interest groups who call themselves reformers of the political order but who are very readily subservient to manipulation by the first group through money offerings and acculturation. This second group cannot stand on their own and their members are one by one recruited into the regime of the typical African politicians. The regime of African politicians is an oligarchic group whose interest is the complete subjugation of the masses by owning and controlling the entire economy with the funds they looted from public treasuries. This group's interest is to completely impoverish the people while deceiving them to believing that they are working hard for their survival by showcasing peanut 'developmental projects'. Both regimes – the younger and the older – have one thing in common: They are extremely low on science consciousness. The political gladiators who specialize in looting government funds and impoverishing their people have no interest in investing these stolen funds in their country's science sector to get their people out of the dependency trap. They are incapable of doing this because they lack the requisite science consciousness.

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In summary, to get the best from political consciousness in African societies, an underlying science consciousness must begin to crystallize in both the older and the younger political actors and their audience or spectators represented by the masses.

c) Science consciousness and political leadership in Africa

In international relations and exchanges, African political leaders do not negotiate for science domestication in their states. They rather negotiate for stomach security which ultimately translates to their private pocket security. They are driven by other consciousnesses that do not encourage science-thinking. The critical mass of science consciousness in political leaders in Africa would create in them the appetite for science-thinking. This appetite may not convert political leaders and stop them from looting government funds, but it will determine what they will do with the many billions stolen. The crop of Africa's leaders who have been stealing the continent's money for the past fifty years seem to have sworn an oath sometime in the past never to invest in technology and science and to always ignore their inventors, especially when the politicians are in control of political power.

Prior to independence many African nationalist leaders all but failed to negotiate with the "colonialists to teach [their] people the system of discovery, the system of invention, the system of science," for this would have been more uppermost in their minds than anything else. By this estimation it does appear that every African state negotiated for political independence twenty years earlier than it was mature and ready for, and by this error, Africa's nationalist leaders ushered in an era of darkness after the Whiteman left. And they sold their people to slavery for probably a hundred years, the slavery of technological dependence.

Soon after independence, ethnic consciousness grew unrestrained as an inheritance from the nationalist leaders. The nationalist leaders who negotiated Africa's decolonization were characterized by a marked absence of science consciousness in their personalities. They bequeathed to their children the younger generation ethnic infighting and the struggle for ethnic dominance which are very fertile grounds for corruption and poor governance.

Political leaders in Africa from the post-colonial era up till the 21st Century seem to have sworn an oath never to develop the science sector of their economies. *Africa's political leaders are doing all other things but science*. Africa's political leadership, driven by zero science consciousness for at least the first fifty years of decolonization, has produced the reality better known as Africa's technology gap. Africa's political leaders hide under neocolonialism to explain their weakness and failure and consequent inability to convert their populations into an army of scientist, engineers, and inventors. Africa's political leaders, lacking completely in science consciousness, have done everything to destroy the spirit of invention among Africans. There are no government policies to harness and recognize inventors and mass-produce their inventions. The inventors are simply not known, and the governments have no plans to popularize them anytime soon. Some African inventors and scientists have revolutionized science, yet the political leaders have done everything to ensure that these captains of science remain unsung. African politics destroys science and invention and the causative factor is the marked absence of science consciousness in the political leaders. This cannot be overemphasized. Men behave the way they are raised and the way they are continually nourished.

d) Science consciousness and good governance

Since the dawn of the 21st Century there has been unprecedented sing-song in Africa about good governance especially since the creation of the New Partnership for Africa's Development (NEPAD) in 2001 and the emergence of the Africa Peer Review Mechanism (APRM) out of the instrumentality of NEPAD. The science and technology goals of NEPAD are bogus and the APRM does not include them as part of their review parameters. Granted that good governance includes the deepening of democracy and the increasing supremacy of the law such that all persons high and mighty can feel the bite of the law when they run against it, good governance in 21st Century Africa would flourish in its truest sense in societies nourished by a high science consciousness. This is because science has proved to be the best instrument to deepen democracy and accountability in governance and guarantee man's freedoms, including freedom from governmental corruption. For instance, primitive accumulation, which is a major characteristic of African politics, can be completely eradicated with e-government. In e-governance, government accounts and expenditures can be viewed and queried by the public. Government incomes from taxes and other sources (in Nigeria this includes the monthly allocation from the Federation Account to the various states) can be viewed and analyzed by the financially literate members of the public. Government expenditures, which include contracts for road constructions and rehabilitations which in Nigeria represents the highest single object of expenditure regime after regime and which are usually delivered to the people without any guarantees, can be made open to the public in e-governance. The fear that technology may one day put an end to their ability to steal public funds may be the real reason why African political leaders are not interested in raising to any significant level the science consciousness quotient of their populations. In this way,

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the longer the science consciousness quotient of the people remains at the level near zero, the longer the political elite can continue their public looting spree and the more they can continue to impoverish the masses, the vast majority.

If change in the consciousness driver of the average African shifts away from all other elements and moves towards science, the political behaviour of man in Africa will change towards *emphasis on appropriating the powers of science to deliver the best justice and accountability in the political system.* The attendant increasing demands for science in the political system will then constitute an input which the government can only respond to in the form of political imaginations on science as an output.

Therefore the bearing of science consciousness on good governance is not just on the delivery of public goods and services to the people, but essentially on how monies are spent in their delivery and how much access the public has to oversee and assess these deliveries, as well as how much of these resources are committed to developing the state's science capabilities. Essentially too, the bearing of science consciousness on good governance includes assessments of how much science the government employs in the delivery of public goods and services. Public services include of course the justice system. How much available technology (and the knowledge of the underlying science) is brought to bear on the delivery of justice to guarantee maximum speed and accuracy of judgements is also a focus created by the requisite quotient of science consciousness. According to a popular adage, "justice delayed is justice denied." Similarly, and especially in cases that involve those in control of political power, the law must be able to operate as a respecter of no persons and must bite quickly and decisively where applicable, no matter whose ox is gored. Electronic judiciary, electronic courts whose proceedings and pronouncements are accessible to the public will materialize in African societies driven by a high quotient of science consciousness. A high science-conscious regime is the best enhancer of good governance since it shapes political consciousness towards a science-regime state, and of course a science-regime state is the best facilitator of the democratic state.

Therefore the best "good governance" is only possible in socio-political environments characterized by a predominantly high quotient of science consciousness. This is the best antidote to the negative peculiarities of African politics which all-in-all make a caricature of the noble concept of good governance and democracy.

IV. Review of Related Concepts

Science consciousness may not be confused with 'science of consciousness' which the web is replete with. Science consciousness simply means 'awareness of science' and the word 'consciousness' can readily be juxtaposed with awareness without distorting our meaning. Science awareness is a more direct synonym for science consciousness. Other related concepts include *public awareness of science, public understanding of science, public engagement with science and technology, scientific citizenship, science for citizenship, science or scientific literacy,* and *citizen science*.

Science consciousness in my formulation is meta-concept which embeds all the aforementioned notions of science and the citizen or citizen engagement with science.

a) Public awareness of science

Science awareness is popularly referred to as *public awareness of science (PAWS)*. However, according to Wikipedia (Wikipedia [1]) the terms 'public understanding of science (PUS) and *public engagement with science and technology' (PEST)* are concepts that define "the attitudes, behaviours, opinions and activities that comprise the relations between the general public or lay society… to scientific knowledge.."

b) Public understanding of science

This notion explores the multitudinal relations between science, technology innovation, and the lay society (ibid.) in terms of information flows from the scientists to the public. Initial trends in PAWS, PUS and PEST (expressions of science awareness) were traditionally built on the information deficit model of science communication (ibid.), but later trends have rejected this model and emphasized on "the development of interfaces to mediate between expert and lay understanding of [a scientific] issue" (ibid.). Historically, the Bodmer Report initiated the establishment of the Committee on the Public Understanding of Science (COPUS) in 1985 by the British Association for the Advancement of Science (BAAS, but known as British Science Association since 2009), the Royal Institution, and the Royal Society whose objective was "to interpret scientific advances and make them more accessible to non-scientists" (Wikipedia [2]). This body played a strong role in developing the public understanding of science regime through "establishing standards for communicating science and technology" to the lay society (ibid.).

In the same vein, "How to raise public awareness and public understanding of science and technology, and… [What] the public feels and knows about science in general… are important lines of research in this area" (Wikipedia [1]).

Moving away from the deficit model, the contextualist model, leaveraging on the sociology of scientific knowledge, "focuses on the social impediments in the bidirectional flow of scientific

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knowledge between experts and laypersons/ communities" (ibid.).

The emergence of deliberative democracy theory as a new movement or school of thought in political philosophy had a catalytic effect on the Public Understanding of Science movement. Taking science and technology as a public good, deliberative democracy demands that "citizens exchange arguments and consider different claims that are designed to secure the public good. Through this conversation, citizens can come to an agreement about what procedure, action, or policy will best produce the public good" (Eagan). An agreement on what constitutes public good or common good is itself a precondition for deliberation. Inherent in this is an understanding (through reason) of what constitutes public good and the best process of securing such good in the best interest of the citizens. As such, "citizens' preferences should be shaped by deliberation in advance of decision making, rather than by self-interest" (ibid.). With deliberation as a fundamental requirement for democratic political decisions to be considered legitimate, "deliberative democracy claims that citizens should arrive at political decisions through reason and the collection of competing arguments and viewpoints instead of taking "political decision as the aggregate of citizens' preferences…" (ibid.).

Deliberative democracy which took root in advanced democratic political states shaped the emergence of the *democratization of science* regime which finds expression in public understanding of science and technology movements. Eagan's (ibid.) concluding remarks buttress this connection:

Deliberation in democratic processes generates outcomes that secure the public or common good through reason rather than through political power. Deliberative democracy is based not on a competition between conflicting interests but on an exchange of information and justifications supporting varying perspectives on the public good. Ultimately, citizens should be swayed by the force of the better argument rather than by private concerns, biases, or views that are not publicly justifiable to their fellow deliberators.

In deliberative democracy then emphasis shifts from the decision-outcome to "the quality of the process" of that decision (ibid.) in terms of its all-inclusiveness. Influenced by the theory of deliberative democracy, "Public deliberation of and participation in science practiced through public spheres became a major emphasis" (Wikipedia [1]). As such, scholarly debate on public understanding of science expanded to include the notion of public engagement with science, for 'understanding' naturally precedes 'engagement'.

"The deliberative turn" in the public understanding of science movement "attempts to develop more inclusive participatory models of technological governance in the form of consensus conferences, citizen juries, extended peer reviews, and deliberative mapping" (ibid.).

Public awareness of science according to Wikipedia (ibid.) embeds a number of themes and genres which include:

- Science communication in the mass media, Internet radio and television programmes.
- Science museums, aquaria, planetaria, zoological parks, botanical gardens, etc.
- Public controversies cover science and technology.
- Fixed and mobile science exhibits.
- Science fairs in schools and social groups.
- Science education for adults.
- Science and social movements.
- Media and science (medialisation of science).
- Consumer education.
- Citizen science.
- Public tours of research and development (R & D) parks, manufacturing companies, etc [and I may add here that this is a way to attract human masses to form the engine to push the technological take-off aircraft to lift off].
- Science in popular culture.
- Science in textbooks and classrooms.
- Science and art.

c) Scientific citizenship or scientific citizen

Quoting Alan Irwin, Brigitte Nerlich (2014) identifies this notion as coming from Science and Technology Studies. Thus ,

> Scientific citizenship is the active and aware participation of citizens in the democratic process in the knowledge society. Public decisions are more and more complex and involve highly specialized knowledge. To achieve better outcome in decision making processes it is necessary to combine the knowledge of the experts with citizens' knowledge and values. Scientific citizenship requires an open dialogue between science and citizens and transparency in information and knowledge exchange.

Melissa Leach (in Brigitte) further defines the implicit background of scientific citizenship as one core issue in STS scholarship, which includes "how citizens mobilize to claim rights around knowledge and expertise in relationship to science," as well as "citizen participation in S&T policy-making." Brigitte sums up this notion of scientific citizenship and the scientific citizen in the caption, "citizens are scientists too," which views citizens as scientists.

Similarly, "Scientists are citizens too" is another caption in Brigitte's treatise which defines another "framing" of the notion of the scientific citizen and scientific citizenship. Brigitte examines Beverly Gibbs' thesis which she claims "… uncovered various as yet under-explored aspects of scientific citizenship, focusing in particular on membership, rights and responsibilities and participation…" This has to do with

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the obligation of scientists as citizens of the state whose expert knowledge is acutely needed in formulating public policies. However, the "choices" available to policy-makers "should be part of a wide public debate, and such debate must be leveraged by 'scientific citizens' – engaging from all political perspectives, with the media, and with a public attuned to the scope and limit of science" This framing of the scientific citizen implies the scientist- citizen whose expert advice is a compulsory input in forming public policies in any modern state. Implicit in this type of citizenship then is the onerous responsibility upon the scientist-citizen to communicate science to the society, not just as science experts but must also enframe into their arguments political, philosophical, and social dimensions of their scientific knowledge. Implicit in this framing too is that the public has already achieved some appreciable level of science awareness as a necessary backdrop.

The third 'framing' of scientific citizenship in Brigitte's treatment of *Beverly Gibbs thesis* is considered to be of a US persuasion. "Scientists are political…" and "the focus is …not on citizens acting with or as scientists but on scientists acting as citizens" (ibid.). For American Physicists, "we are dealing with the issue of 'civic scientists' " which "range from scientists engaging in outreach and public engagement activities, to scientists in government, to scientists as political dissidents and even revolutionaries" (ibid.). Civic scientists then are not aloof in their laboratories but can be involved in local and national politics as they throw their support on socio-political causes, as well as scientific issues which may have heavy political undertones.

Brigitte however draws attention to the intellectual history of the notion of scientific citizenship and states its origin as the publication of an article in 1857 captioned "The Relations of Science and the Scientific Citizen to the General Government" (now available on the Internet) which scholars with keen interest in science and politics will find worthy of note.

For Anna Pellizzone (2018), scientific citizenship is predominantly about citizens' involvement in the creation and management of science. She quotes Bruno Latour (2004) to paint a vivid picture of the old system:

> Once upon a time, scientists conducted their experiments, formulated their theories and made their products inside their laboratories. They shared their results, models and theories with other experts before making them known to the rest of society. They played an undisputed leading role in technological and scientific development. Citizens were not part of the research and innovation process; they did not have a say and could not contribute to the results of science.

The scenario is different today because citizens' active role in the innovation process has become necessary and acceptable. Citizens are tax payers and aspire to have a voice in state-funded technological innovation. Citizens too are the very consumers of such technological developments and their viewpoint is deemed essential by both public and private research because a thorough understanding of their needs translates to a thorough understanding of market needs (Pellizzone, 2018). Scientific citizenship then "is what experts call bottom-up innovation, an approach that makes it possible to intercept the collective intelligence distributed through society and put it at the service of the community (ibid.). Similarly, the era of scientific citizenship is a "knowledge era" defined by "both … the irruption of science in society and by the irruption of society in science" (ibid.). The scientific citizens era has brought about the collapse of the "ivory tower in which scientists once worked" and has therefore redefined "the relationship between science, innovation and society" and demands imaginative "efforts in the area of public communication of science and scientific education." Scientific citizenship is about the democratic governance of science and technological innovation, and according to science and society scholars "today there is a huge demand for more open and inclusive research and innovation in which citizens and all players in society have a role and a space to make their contribution" (ibid.). In Europe, the European Commission supports "the voice of citizens in defining research programmes" through "projects that involve the various social players in the definition of research priorities." The CIMULACT (Citizens and Multi Actor Consultation on Horizon 2020) which involved 5000 citizens and 600 experts and VOICES (Views, Opinions and Ideas of Citizens in Europe on Science) which involved 1000 EU citizens are EU-level project examples of public consultation projects on science (ibid.).

d) Science Literacy or Scientific Literacy

This is yet another ancillary notion of the science consciousness regime. This notion states that everyone in a civilized society "should have working knowledge of science and its role in society" (Wikipedia [3]). The rendering by the National Science Education Standards as reproduced by Sheril Kirshenbaum (2009) is such a perfect and rounded explanation of this notion that I beg to indulge in quoting a large chunk of it:

> Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity. It also includes specific types of abilities…
>
> Scientific literacy means that a person can ask, find or determine answers to questions derived from curiosity about everyday experiences… Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify

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> scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed. A literate citizens should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.

Implicit in the foregoing rendering is the conceptualization of scientific literacy as part of basic literacy. Some states, having understood the acute importance of science literacy in a modern political state, have obviously built this quest into their standard literacy programmes, while attaching socio-economic leverages to same.

The National Science Education Standards (ibid.) further elaborates that individual scientific literacy quotient will differ in their preference for or savvy in different domains such as a higher understanding of life-science concepts and their terminologies as compared with a lower understanding of physical-science topics and jargon. Scientific literacy then manifests in varying degrees and forms in individuals, while expanding and deepening in the individual over a lifetime. However, the attitudes and values developed towards science during school years shapes the individual's growth in science literacy as an adult (ibid.).

The OECD PISA Framework (2015) gives a standard definition of science literacy as "the ability to engage with science-related issues, and with the ideas of science, as a reflective citizens" (Wikipedia [3]). A person who is science-literate then, according to the Framework can be engaged in "reasoned discourse" concerning the state of science and technology in his country. For the Framework, this engagement of the so literate citizens would require the prior development of certain capabilities and competencies, which include the ability to "explain phenomena scientifically," especially natural and technological phenomena, the ability to "evaluate and design scientific inquiry" which includes the capability to address issues scientifically and the ability to "interpret data and evidence scientifically," which includes the capability to draw accurate scientific conclusions. One of these three capability would suffice to define a science-literate person in most countries.

The launch of the sputnik satellite in 1957 and the Japanese economic boom of the 1980s drove education reforms in the United States toward the science literacy regime. These external challenges from the defunct USSR during the Cold War and Japan's economic expansionism and dominance led educationists and reformers in the United States to take a hard look at the country's science education system. Contemporary science literacy in the United States is conceptualized as the right of every American citizen and "a requirement for responsible members of society" (ibid.) which builds into average citizens the ability to make better decisions and to enrich their lives. The publication of *Science for All Americans* and *Benchmarks for Science Literacy* in the early 1990s necessitated this contemporary notion of science literacy (ibid.).

e) Citizen Science and Public Engagement with Science and Technology

These anecdotes of science consciousness have already been discussed in one form or another in the foregoing review. However, I shall attempt to outline them as they appear in current literature.

Public engagement with science and technology (PEST) has already been treated under *Science Awareness*. Be that as it may, I would like to add more comments here and relate it to Citizen Science. The American Association for the Advancement of Science (AAAS) actually runs a department or programme known as Public Engagement with Science and Technology (PEST). Though the AAAS mission statement is "advancing science, engineering and innovation throughout the world for the benefit of all people," its primary area is the US society where it works as a pressure group on governmental institutions to achieve "sustainability for our nation's research" (AAAS). Since its establishment in 2004, "the AAAS Centre for Public Engagement with Science and Technology has worked to further awareness of science and the scientific process and increase public input into scientific research and policy agendas, encouraging and facilitating dialogue between policy makers, the general public, and the scientific community"(ibid.).

The Center equips scientists and scientific institutions with "opportunities and resources" to engage the public in "meaningful conversations" (ibid.) through:

- Increasing awareness and understanding of public engagement and its benefits.
- Demonstrating excellence in public engagement.
- Training scientists to communicate with non-scientific audiences.
- Building capacity for conducting public engagement with science activities.

Apparently, "demonstrating excellence in public engagement" goes beyond public conversations and public rhetorics on science and technology and includes actual practical engagement of the public or non-scientists in scientific research activities. Thus, the AAAS goal of "building [and demonstrating] capacity for conducting public engagement with science activities" and similar organizational and institutional visions in technologically advanced countries led to the emergence of the notion of citizen science. So, one of the goals of PEST programmes in science-active

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countries will be efforts to create a vast army of citizen scientists (that is, to turn as many of its nationals into citizen scientists). To the development of this hallmark in the evolution of the science consciousness regime I now turn.

Citizen science is the most advanced form of the science consciousness regime which seeks to convert a vast proportion of the population of a state into an army of amateur scientists who assist the work of professional scientists. For SciStarter, "citizen science is the public involvement in inquiry and discovery of new scientific knowledge." Its aliases include " 'amateur science,' 'crowdsourced science,' 'volunteer monitoring,' and 'public participation in scientific research'" (SciStarter). Other aliases include "community science, crowd-science, … civic science, or networked science" (Wikipedia [4]). Such public involvement typically involves data collection, data analysis, or reporting. A typical citizen science project can involve thousands or even millions of citizen scientists. Citizen science is predicated on two axioms: "1) that science should be responsive to citizens' concerns and needs; and 2) that citizens themselves could produce reliable scientific knowledge" (ibid.).

According to Wikipedia, 'citizen science' and 'citizen scientists' entered the Oxford English Dictionary in 2014. Citizen science therein is defined as "scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions" (ibid.), while a citizen scientist is the term used to refer to a member of the public who participates in a citizen science project. A citizen scientist then is a member of the society with or without a formal science background "who voluntarily contributes his or her time, effort, and resources toward scientific research in collaboration with professional scientists or alone" (SciStarter).

In the United States today there are boundless opportunities to participate in citizen science projects, and organizations like SciStarter provide databases of thousands of "vetted projects," such that for any hobby or interest or curiosity a citizen may have, there is a corresponding and available citizen science project he can participate in. The social impact of citizen science resonates more when socialites and crowd pullers participate in citizen science projects such as "current and former NFL and NBA cheerleaders …who tune thousands of non-traditional audiences into citizen science…" (ibid.).

Suzuki (2014) views citizen science as "using the same technologies that separate us from nature to help us understand and enjoy it." Thus he states that "Smartphones, the Internet and accessible research technologies deinstitutionalize science and get the inner scientist in all of us outside to contribute to a broader understanding of a variety of topics…" The citizen science regime in this view is a veritable tool for decentralizing science in society abd a way to effectively get science "out of the laboratory and into the culture." Suzuki's view of the scientist in every man capable of activation by citizen science defines an underlying axiom in arguments by the scientistic movements implicit in science consciousness regimes. In Suzuki's view, "citizen science is a way to encourage us all to get outside, hone our senses [of observation], and undertake meaningful activity to monitor and maintain our environment, improve scientific literacy and …be happier and healthier." Thus, citizen science bequeaths scientific literacy gains to the participants.

Garbarino's and Mason's (2016) summary on the subject is worthy of note:

> Citizen science has become a powerful force for scientific inquiry, providing researchers with access to a vast array of data points while connecting nonscientists to the authentic process of science. This citizen-researcher relationship creates an incredible synergy, allowing for the creation, execution, and analysis of research projects that would otherwise prove impossible in traditional research settings, namely due to the scope of needed human or financial resources (or both). …emerging citizen-science projects show how improved protocols for reliable, large-scale science can realize both an improvement of scientific understanding for the general public and novel views of the world around us.

Citizen science therefore adds value to the public understanding of science. It is "a valid mechanism to help rectify shortcomings in the public's understanding of science." Garbarino's and Mason's rationale herein derives from a 2015study by the Pew Research Centre wherein "it was reported that the public's limited knowledge in science, technology, engineering, and math (STEM) is a problem for scientific progress." Similarly, the report "revealed that scientists and the general public see scientific issues through different lenses, creating a gap – sometimes a chasm – between the scientific consensus and the public belief." Citizen science as the acme of the science consciousness regime comes as a demonstrable antidote to this "problem for scientific progress." As Garbarino and Mason (ibid.) further stress: "Evaluations on a variety of citizen-science projects have suggested a positive impact on participants' awareness of specific scientific issues and their content-knowledge gains, as well as improved skills related to scientific inquiry and critical thinking." This is enhanced by the potential of citizen-science projects "for making positive impacts on the public's attitude to science." The rationale here is that "by encouraging inclusivity and openness, citizen science can break down the fear about or perceived distance from science, making science more accessible" to the general society. The second rationale lies in the message embedded in or inherent in citizen science itself, which is "that science is for everyone,

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regardless of personal, geographic, or socioeconomic background" (ibid).

The future of scientistic movements has arrived in citizen science. Through citizen science, science and technology practitioners, especially in technologically underdeveloped countries, can expand their sociopolitical capital as a vital component of their reward system in epistemes of dearth of scientific patronage (Nwosu, forthcoming). Citizen science too shrinks research costs, thus expanding the horizons and possibilities of scientific research in any economy.

f) Science for Citizenship

This school of thought in the science consciousness domain argues that modern democratic states require as their citizens populations with an enhanced understanding of science to enable their engagement in contemporary dialogues about science and technology issues to enable them arrive at reasoned decisions especially about the political, moral, and social challenges these have brought about in the modern state. Authors in this school include American Association for the Advancement of Science (1989), Jenkins (1997, 1998), Millar (1996), Millar & Osborne (1998). Osborne (2002) approaches this notion more as an educational problem in science education and advocates that mass science education requires a mass science curriculum, unlike the present curriculum with its "foundationalist emphasis" on traditional standard content suitable for the training of the career scientist only (ibid., pp.126-127). The non-inclusion of "the grand ideas of science" disconnects the learner from understanding science as " a cultural achievement" and thus cannot sustains the interest of the vast majority of citizens of the modern state who nevertheless are inadvertently required to learn science as concomitant to better citizenship. Science education for citizenship then must first "demonstrate the tremendous libratory power that science offers – a combination of the excitement and thrill that comes from the ability to discover new knowledge, and the tremendous insights and understanding of the material world that it provides" (ibid. p. 126). The second point for science education for citizenship according to Osborne is the tinkering with traditional school science curriculum to include "the science that interests adolescents," that is "contemporary science" defined as "the science and technology of informatics… mobile phones… modern cosmology… medical genetics," artificial intelligence, robotics, in a word, high technology. This is "what makes young people want to learn science…" and school science curriculum should be tinkered with to include at least an introduction of this all-important content.

Osborne further explains Science for Citizenship campaigns as a necessity to deal with an economic problem, namely the ever dwindling rate of recruitment of scientists into the science and technology sector. While the supply of scientists in the UK and the US remains "a small minority of the school cohort of around 10-15%" (ibid. p.133), one can imagine how insignificant this figure will be in less developed countries. This economic problem, for Osborne, can be alleviated by a working science for citizenship regime which itself is a "science for all" regime that demands "a curriculum for all" which has a catalytic effect in turning out scientists for the state through expanding and sustaining students' interest in the science and technology domain.

Millar and Osborne (1998) argue that "science education should be for the majority and should be for scientific literacy," that "Scientific knowledge can best be presented as a set of explanatory stories that would provide a holistic overview of the great ideas of science," and that "The science curriculum must give more emphasis to key ideas about science" as reform recommendations among others for science education for citizenship.

V. Theoretical Framework: Snow's Scientism for Africa and the Third World

Frameworks that best support this paper are generally theories of technological take-off and technological development. C. P. Snow (1961) explains the Scientific Revolution not in its traditional historic construction but as an on-going and replicable event which occurs in a political state that prepares for it. The Scientific Revolution is a system which can be produced or reproduced anywhere in the world when its algorithm is applied with mathematical precision. In expounding the algorithm of the scientific revolution, Snow details its composition, which includes a high quotient of science consciousness among the population of a sovereign political state – that is, a certain critical mass of science consciousness in the population of a political state. Snow's algorithm precludes the existence of biological or racial advantage in technological capability-manifestation or "scientific teachability" of a given country. This work stands upon Snow's axioms to discuss the socio-political complex of science consciousness in Africa and the Third World.

Snow's arguments in his scientism include the doctrine of internalization of science. This means that science should expand beyond its primordial homeland and become a citizen of the entire world. Africa and the rest of the poor world in Snow's scientism are called upon to champion this internationalization of science *by making science their major business*. Of course, the premise for this bold recommendation is that Arica and the rest of the poor world are not inferior to the already scientifically advanced countries of the world in terms of national IQ or general intelligence. Building a science

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consciousness regime cannot succeed on an abysmally weak IQ infrastructure, but the population of any African state does not need a high scientific literacy to develop confidence in its own scientists and to understand that science is the solution to the plagues of governmental corruption and low agricultural production and that these can be remedied by putting science at the centre of the state's business.

Whereas political consciousness among Nigerians for instance has become probably higher than in the average American citizen because the Nigerian scenario is oiled by ethno-religious consciousness and passion and low republicanism (the very reverse of the US political atmosphere where ethnic homelands for instance do not exist), a science consciousness regime can be introduced in Nigeria and can thrive therein in spite of perceived inadequate IQ infrastructure because it can be mixed with and driven by the existing ethno-religious competition. Arguments about the IQ status of African countries as reasons for their technological backwardness (for example) are therefore not valid. Much as rocket-science IQ is required among the science and engineering professionals, you do not need an equivalent IQ in the rest of the population to initiate and sustain a science-consciousness regime. Competition for scientific achievement among the major ethno-religious blocs – which yields a science-conscious culture – can take off in the Nigerian scenario. When science consciousness mixes with ethno- religious interpretations, ethno-religious group A which dominates geopolitical zone A only needs to become aware of the calculations of ethno-religious group B which dominates geopolitical zone B and competition in science mobilization begins. Science consciousness regimes then can serve as science mobilization instruments, which succeed no matter how low the given society may be on the IQ ladder. Similarly, as a ladder has rungs so does a country, a population have different levels of IQ at each time in its history. IQ of political states then is not a permanent irreversible structure. Once some science has taken off in a political state in the first instance, the natural condition of man in terms of IQ strength must move upward and continue in that direction. This is because science itself will continue to reveal to those who have taken it as their business how IQ can be grown, whether from the environment or from blood. More and better smart drugs will be discovered, more and better smart nutrition will be discovered.

When periphery countries join in the internationalization of science by making science their business, they subject science to the requisite domestication process which begins as an expanding science-consciousness regime. Snow is telling Africa and the Third World that it is not only the Caucasoid West that can do science. The Mongoloid East (starting with Japan in 1939) has become a great army in the science race. And so Negroid Africa too and the rest of the poor world, great and small countries alike, will join in the race and will one after another succeed. Science is not voodoo whose secret incantations are only known to the white world, for the Mongoloid East (Japan with China marching on) have also become great masters at it. The internationalization of science doctrine as proposed by Snow is a direct antithesis to the diffusionist political theories of development and underdevelopment championed by Western scholars during his time. I therefore revere Snow for his uncanny thinking in the circumstance of his time and christen him as the *father of technological take-off*.

African countries and the rest of the poor world then must develop their own requisite army of scientists and believe in them and rely on them. Whether the army of scientists are trained at home by imported expert scientists from the technological world or are taken to the academic institutions of the technological world, trained therein and returned to their home countries, the salient point in Snow's scientism is that the requisite number and quality of scientists must be found or developed for the poor world to take off. This brings up the notion of the critical mass. Snow's scientism is a pragmatic technological take-off manual for underdeveloped countries livened up with mathematical calculations. The critical mass of scientists and engineers and technologists trained to the levels prescribed by Snow and finally *engaged in the business of doing science and technology in their countries and* relied upon by their people and governments to provide the good life is simply a game of numbers. The numbers are also determined by the local terrain. Hot tropical terrains would require more of these experts than temperate cool terrains. Factoring in differences in geographical terrains, a certain number of these professionals must be determined per million of the population and per thousand square kilometers of landmass. This number per million of the population and per thousand square kilometers should be the minimum recommended quantity that will trigger and sustain a technological take-off. This is the critical mass of scientific experts required for the technological take-off of the specified country. Nigeria's requirement then will be different from Ghana's requirement. Then the ability of countries like Ghana and Nigeria to work on a national agenda like technological competition will be reviewed. This calls up the ethnicity question. Again, Ghana's circumstance is different from Nigeria's circumstance, using these two countries as examples in this analysis. Whereas Ghana has very few ethnic groups that are nearly equal in landmass occupation and population uptake, Nigeria has hundreds of unequal ethnic groups whose powers are difficult to balance, and so ethno-religious distraction of national goals is

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very high here. Mono-ethnic countries have a great advantage here (I have in several writings treated the thesis of ethnic homogeneity as a precondition for technological take-off wherein I referred to several technological states of Europe as ethnic-group countries), but multiethnic countries can devolve such 'national' agendas to their respective ethnic enclaves in the structure of provinces or federating states, the essence being to achieve ethnic ownership of those agendas to ensure their survival through their *ethnicization*. Whatever the obstacles are, Snow's algorithm in his scientism states that "the poor world" must one way or another *make science their business* (and I must add that he particularly had Africa in mind when he said this).

Adjunct to the creation of an army of research scientists, engineers, and technicians trained to world-class standards is the provision in Snow's algorithm for a public that knows enough science to understand what the scientists are talking about. This is the prerequisite background that switches on the Scientific Revolution. In Snow's algorithm for technological take-off in the poor world, the Scientific Revolution in each country must precede their take-off. Each country must experience the Scientific Revolution in its own time because, for Snow, the rest of the poor world must take off technologically whether Western countries believe it or not, whether Western countries are prepared to accept the consequences or not.

Snow as father of technological take-off theory has this knack for debunking traditional theories and thinkers of his time. Snow as a utilitarian thinker, in opposition to classical thinkers, saw the Scientific Revolution as an ongoing phenomenon, a human experience that establishes the rule by science in human societies. It is the human experience in its engagement with science that takes science "out of the laboratory and into the culture," thus rendering it as a cultural practice of each people who experience it. The Scientific Revolution puts science into human culture and must therefore be experienced in every culture on Earth if the world must rid itself of the evils of poverty, disease, and nuclear genocide. If the Scientific Revolution is a compulsory cultural explosion required for technological take-off, then the science-consciousness regime is the massive accumulation of gunpowder, which requires just a flame from anywhere.

a) Brief History of Scientism

Scientism is a hotly contested doctrine of modernity such that it is in various circles taken as taboo. Attacks on scientism can be explained in terms of its contextual development. Historically, the scientistic regime was at least a century or more ahead of the democratic regime. Countries that championed this scientistic development (mostly European countries) had not yet realized well-fermented democratic regimes as several of them were either perpetrators of political enslavement of other people in the form of colonialism or slavery or beneficiaries of such enslavement. Libertarian democracy was the missing political context in the historical development of scientism. Described as "a dogmatic faith in the power of science" (Whitney, 2007, p.2) or equated with the Holocaust, the two World Wars, and the possibility of a nuclear world war, critics of scientism question whether modernity has achieved any 'progress.' A great critic of scientism, Voegelin (1998), captures scientism as a dire condition of man thus: "The damage of scientism is done. The insane have succeeded in locking the sane in the asylum… As a consequence of the interlocking science and social power, the political tentacles of scientistic civilization reach into every [part] of an industrialized society…"

Whitney (2007) defines scientism as "a pseudo-religion, or a form of idolatry." Voegelin (1998, p.205) is most apprehensive because scientism has fused with political power.

The origin of the scientistic movement is traceable to Francis Bacon's publication of *Novum Organum* in 1620. Whitney (2007, p.3) describes Bacon as "perhaps the first philosopher to explicitly suggest that society could be advanced through science." Francis Bacon openly advocated for the union of science and political power. Bacon's "optimism in the unlimited power of science" (ibid.) produced his later work, *New Atlantis* which is a utopia wherein "inventors are given god-like status" (ibid.). Francis Bacon can aptly be described as the father of the Scientific Revolution. The origins of the Scientific Revolution can be traced to Bacon's *Novum Organum* of 1620 and his *New Atlantis*, which is his piece of scientific utopia driven by his *optimism in the unlimited power of science.*

For Bacon, history does not repeat itself but "represents progress so that [his] own age is greater than that of antiquity" (ibid., p.4). The perfect society would be produced by Baconian scientism as found in his utopia, *New Atlantis*. Bacon's utopia is a "technological paradise" built on the principles of his new science (ibid.). White (1973, p.350) describes this technological paradise as "transhistorical and not subject to decay" and "universal in character and not subject to the evils of previous human societies."

Francis Bacon's "dogmatic faith in the power of science" exemplified in his utopianism formed the background for the scientistic movement which later became the forerunner of the Scientific Revolution (Whitney, p.4). Baconian political philosophy is built on an advocacy for scientific advance as the general good. This is because science itself is the instrument with which man can realize his greatest good (White, p.344).

Newtonian science emerged subsequently as the next big push to the scientistic movement with his

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"idea of absolute space [which] had important philosophical and political consequences" (Whitney, p.5). Newton's philosophy defines "a rational, utilitarian core that promotes technology and wealth, but seeks to delegitimize… forms of knowledge that do not promote practical utility" (ibid.).

The rational-utilitarian influence of Newton's scientistic philosophy had a great impact on the French thinker Henri de Saint-Simon during the French Revolution. Saint-Simon sought to reunite his French society under the philosophy of scientism as framed by him. Saint-Simon rejected both Libertarianism and Christianity and proposed a society led by the "Council of Newton, consisting of twenty-one scholars and presided by the mathematician who had received the most votes" (Hayek, 1979, p.219). This Newtonian Council, serving as "the representatives of God on Earth," would overthrow the pope, cardinals, the bishops, as well as the priests who "do not understand the divine science which God had entrusted to them and which some day will again turn Earth into paradise" (ibid.). In Saint-Simon's scientism, "the law of human progress guides and dominates all; men are only its instruments," and those who are unable to keep up or unwilling to follow this plan for 'progress' should be treated by the rest of society as malformed (ibid., p.222).

Saint-Simon's totalitarian philosophy is expressed thus: "the vague and metaphysical idea of liberty impedes the action of the masses on the individual and is contrary to the development of civilization and to the organization of a well-ordered system" (ibid., p.249). This dictatorship of the masses presents Saint-Simon as the primogenitor of Marxism. In his philosophy, there must not be ideological pluralism and for this purpose "individual liberty must give way to collective necessity" (Whitney, p.6). Saint-Simon advocates for scientific totalitarianism or totalitarian scientism. In Simon's doctrine, science should be seen as a social enterprise driven by "collective necessity" as opposed to individual liberty. Saint-Simon's scientism therefore can best be understood as *authoritarian scientism* which can easily lead to *scientific tyranny*. Every religion in Simon's doctrine must comply with the requirements of his "positive science" if it must be permitted to exist. To this end, he rejects the Christian code but admires only the hierarchical structure of the Church (ibid.). The twenty-one scientists of the "Council of Newton" according to Simon's utopianism should structure their hierarchy after the pattern of the Catholic clergy and lead the education of the masses (ibid.). This Council would therefore "elect a scientific pope, employ excommunication for crimes against the ideology, and institute a Newtonian form of baptism" for all (Lyon, 1961, p.62).

Saint-Simon had a disciple, Auguste Comte, who further developed his master's utopia. The emergence of positivism as a very powerful aspect of scientism is widely credited to Comte. Auguste Comte desired to introduce into the society a "new spiritual organization" founded on "a new dogma of science" (Whitney, p.7). To this end "the organic and rational society of the future must be based on science: the principles of its organization will be scientifically elaborated, and all its members must adopt scientific modes of thinking" (Kolakowski, 1969, p.50). Like Bacon and Saint-Simon, Comte rejects the "cyclical view of history" and maintains that history is progressive and does not repeat itself (Whitney, pp.4,8). He rather proposes the three progressive stages of history, namely the theological stage (in which the mind explains natural phenomena through supernatural causes), the metaphysical stage (in which the mind finds singular, universal causes of phenomena), and the positivist stage (in which the mind rejects all metaphysical questions and accepts only knowledge that has practical utility which is defined as matters that deal only with observable phenomena) (ibid., p.8). In his 'positivist utopia' Comte treats human beings as "organisms" with defined "structures and functions" and rejects human "emotions, rights, and thoughts" and concludes that science can achieve unity of all members of the society within a massive "integration of religion and knowledge" (ibid., p.9).

But it is Karl Marx who took scientism to the political sphere where it made its greatest mark. As Whitney (p.10) notes, "The main difference between Marx's brand of scientism and that of Comte, Bacon, and Saint-Simon is that Marxism became socially [and politically] relevant" by getting the full attention of the powerful politicians of the world. Marxism, like its predecessors, elevates science to the position of the acceptable religion for all and repudiates conventional religions as "opium of the masses." The pursuit of science by the state to the point of truncating virtually all human freedoms, including the prohibition of "socialist man from asking questions about his origin," all bespeak classical scientistic principles (ibid.). Man's "classless realm of freedom" requires no government and is the "perfection of man" (ibid.).

In spite of the collapse of the Soviet Empire, the principles of Marxist scientism have however remained in China. The end of Maoism "did not result in the abandonment of scientistic principles" in China (ibid., p.11). Factors that explain the continued prevalence of attitudes of scientism in post-Maoist China will make an interesting study. But for one, Maoist Marxism seems to have been replaced with "a technological/materialistic scientism" in contemporary China (ibid., p.12). There is total acceptance of science in China as the answer to the material existence problems of the Chinese people.

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This implies a cultural inclusion of scientism in contemporary Chinese society. In China, scientism has been absorbed into the contemporary culture. This easy uptake of scientism becomes natural for the Chinese people because of scientism's natural similarity with Confucianism, with its noted intellectual tradition and other pragmatic elements of Chinese culture. Thus, Hua (1995, p.33) states:

> 1) Scientism inherits the Confucian cultural and intellectual tradition which has a holistic approach. All aspects of social consciousness are regarded as an inseparable whole. This intellectual holistic notion is also linked to the monistic political orientation in the Chinese culture where only one legitimate source of truth is recognized. Scientism is also in line with the utopianism embodied in the Chinese tradition. 2) It is a psychological response to what is termed voluntarism and ethic-purism as demonstrated during the Cultural Revolution. 3) It is a practical response to the socioeconomic problems encountered by the Chinese people after the Cultural Revolution.

The Chinese are obviously enamoured by scientism's claims to give unlimited material power. The Chinese must be naturally power-hungry people or they have over many decades been indoctrinated to be so. The "rational, utilitarian core of scientism… promotes technology and wealth" but at the same time denigrates everything it considers to be non-utilitarian knowledge which includes religion (Whitney, p.13). Freedom of conscience and other civil liberties are unknown in China and the one-child policy has not been repudiated since 1980. With most churches operating underground, only the officially approved Christian churches can operate. The implication here is that in the 21st Century the Chinese government still prioritizes "pragmatic politics over individual rights" (ibid., p.14). The Chinese authorities are aware of the delicate situation that religious pluralism would destroy the established political order. Everything is done by the authorities to encourage the apparent worship of science. Hua (p.145) notes a popular comment nearly a hundred years old:

> During the last thirty years or so there is a name which has acquired an incomparable position of respect in China; no one, whether informed, ignorant, conservative or progressive, dares openly slight or jeer at it. The name is Science. The worth of this almost nationwide worship is another question. But we can at least say that ever since the beginning of the reformist tendencies (1890) in China, there is not a single person who calls himself a modern man and yet dares openly to belittle Science.

Totalitarian impulses across the ages have been branded scientism. This is because science has become the new consciousness of man that enables him to become the master of his physical world, endowing him with the power to eliminate disease and hunger and to achieve a longer life span. The enamouring power of science became its own trappings which has convinced political men over the ages that anything could be sold across to the people when it is branded science. Subsequently, the equalitarian ideology in Marxism (which is not evil in itself) could be sold to the masses along with a repudiation of religion; and the destruction of man's freedom of conscience (a great evil) could gain public acceptability because these ideologies at polar variance with equalitarianism were branded 'science.' Contemporary scholarship on scientism should begin to separate totalitarian scientism from libertarian scientism.

VI. Domesticating Science Fiction for Building Science Consciousness in African States: An Examination of the African Science Fiction Project

I have explored in this paper to some extent how science consciousness or science awareness shapes and propels political participation, political expectations, and generally political orientations and ultimately political culture of members of political systems and how this motive force can best be exploited to propel African states, whether underdeveloped or developing, onto the path of the technoscientific state.

Politics of African states cannot transcend their cultural milieu. The import of this statement is that a nation's culture components determines to a large extent the colour and character of her politics. Ethnicity and ethnocentrism, religion and tribalism, sectionalism and *clanism* for instance are basic components of Africa's cultures which became prominent upon decolonization and subsequently became the elements of her political culture. Africans were completely untutored on the values of universal consciousness which at least could manifest as Africaness, much less on the value of national consciousness, which is a country by country consciousness. Country-consciousness manifested at most the first ten years after independence of each African state and thereafter the primordial cleavages quickly took the reigns. In several African countries it manifested in military takeover of governments and in others as outright civil wars.

Granted that cultural backgrounds determine the character and pattern of politics in Africa and have in fact produced the peculiar reality called African politics which has produced little progress in Africa over a period of half a century of political independence, what possible ways can we begin to reshape Africa's culture, what ingredients and components and elements can we inject into the culture such that its influence in the political sphere will be desirable? Culture is extremely

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dynamic and is one aspect of human society that is readily amenable to change.

In this section of the paper, I shall explore science fiction as a method of reshaping Africa's culture towards expanding the science consciousness quotient of her diverse peoples. I shall understudy The African Science Fiction Project and the efforts of this institution at domesticating science fiction in Africa.

Every human society at any stage of development has a science fiction possibility. Science fiction novels and short stories and movies are works about the future of man in a specific society. Therefore, arguments that science fiction is not useful in Africa because it would not be understood and appreciated by the African masses is baseless because human imagination and curiosity are universal drives in man irrespective of the environment and upbringing, and can be used to propel the African along the path of imaginations about his future with science as the theme of that future.

Science fiction over the years has failed to connect Africans to science-thinking and imagining because the stories told in them have been about Western civilizations represented by the developed countries, and this way it has failed to critically ignite the imagination of Africans. This is the basis for arguments against the relevance of science fiction because it is for societies whose level of development puts their people on a plane of reasoning to flow with science fiction thoughts and imaginations. The real problem is that science fiction has not been prepared to include the African and African countries and governments in its visualizations. This is the missing link, and this absent link has added to the mystification of science to the African masses rather than achieve its goal of demystification of science. Professor Mark Brake and Martin Griffiths (insert reference) capture the role of science fiction in the culture formulation of society thus:

> On the eve of the millennium *The Times* asked a number of prominent scientists to identify major issues in science leading into the C21st. Professor Susan Greenfield of Oxford University and the first female head of the Royal Institution suggested the scientific breakthrough of the C21st would be: "*The engagement of the public in science and the expression of scientific ideas in a way they can understand and contribute to*"
>
> We believe science fiction can be used to help demystify science, highlight its social and cultural context, and act as a bridge to public consciousness, providing an opportunity to tackle pseudoscience head-on.
>
> …Why is science rarely appreciated as a cultural activity at all? If science is to be restored to its rightful place in our cultural heritage then science fiction can help to play an important part in bringing science "...out of the laboratory and into the culture.

Communicating science to the masses or publics is viewed in the above extract as a prime problem of societies in the 21st Century. Of course the essence of communicating science to the public is to build science literacy and science consciousness in the vast majority.

Mass orientation programmes whose focus is the expansion of science literacy, science awareness, and science consciousness (of the public) are essentially bottom-to-top approaches to scientific development of the state and are therefore best conceptualized as democratic approaches. Bottom-to-top approaches too are social approaches since they are apt to get into the cultural milieus of the societies being addressed and thus become autogenic in temper and propulsion. While governmental mass orientation programmes traditionally adopt a top-to-bottom approach and are therefore autocratic in outlook, non-governmental mass orientation programmes are usually democratic in approach and outlook because they adopt a bottom-to-top approach. The African Science Fiction Project in my assessment is a non-governmental mass orientation movement for the cultivation of science consciousness in Africa through the establishment of African Science Fiction in diverse media. Some slogans of the Project as indicated in the Advocacy Campaign Document (TASFP – Document, 2014) include:

- *Producing Africa's Best Leaders.*
- *The African Scientific Revolution.*
- *Stirring up the African science Spirit.*
- *Celebrating science-thinking in Africa.*
- *Bringing science-thinking to the African grassroots.*
- *The African Visualization Project*
- *Bringing Africa's tomorrow now…*
- *Putting Science into Africa's Culture…*
- *The African Science Consciousness Programme.*

VII. Science Consciousness and the Political Relevance of the African Science Fiction Project in the Era of Africa's Leadership Crisis: Specific Political Leadership Imageries in Science Fiction

This focus or conceptualization derives from the fact that The African Science Fiction Project is a bank of ideas on political imaginations on science in Africa which are not just idealistic but also very seriously realistic and pragmatic in outlook. These imageries of political imaginations on science throw up a challenge for present and future African leaders and as indicated in the Advocacy Campaign Document,

> Books and movies such as produced by Scifi Africa project images of African leadership and scientific and technological attainments of Africa of the future in a manner that has the capacity to *infect* the imagination and consciousness of Africans of today.

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The African Science Fiction Project therefore is not just "a new movement in African Literature… committed to public communication of science and technology and the inculcation of scientific and technological temper among the African masses through the creation of African Science Fiction" (ibid.), it is also laden with political undertones through its challenge and enrichment of the political sphere with a million political imaginations on science in Africa that bother on political leadership. Images of African leadership laden with political imaginations on science continually bombarded upon the political class cannot but stamp themselves into the consciousness of Africa's political leaders, and having invaded their consciousnesses the outward expression in the political sphere becomes unstoppable. This engagement is scientifically and mathematically true because "once a mind has been stretched by an idea, it never returns to its original shape" (ibid.). African Science Fiction visualizations through film and novel are especially targeted to affect the political class. The African Science Fiction Project creates imaginary political leaders who are different from and superior to the real-life leaders which creates a conflict in the minds and consciousnesses of present day African political leaders. Basically driven by the fear of becoming obsolete, the present-day African political leaders will begin to *idealize* and consciously begin to appropriate into their modus operandi the patterns of thinking of those imaginary African heroes. The vehicle – The African Science Fiction Project – connects with the imagination of Africans to impart science-thinking and science consciousness to the masses and political leaders in diverse visualizations of Africa's future societies and politics.

The African Science Fiction Project owns a manual called *African Science Fiction Imagery* (TASFP – Imagery, 2014) which is a collection of ideas (imageries) from which its novels and short stories are created. At idea number two (ibid., p.6) we read:

> Defining the Nigerian State anew. Fusing Science and Government. Government is about Science. Science is about Government. Scientists are agents of Government. In the 2030s the Nigerian State redefined its purpose as follows: the Nigerian State is a scientific state and to this end a preponderant part of the job of the Nigerian Government (that is each regime) is the production and reproduction of science and its consumption. Governance in the Scientific State (such as Nigeria) is therefore inseparable from Science and is all about the expansion and deepening of scientific knowledge and its application. In the Scientific State, Science is an object: therefore the pursuit of Science is a grand objective of the state.

African Science Fiction Imagery is a working document of The African Science Fiction Project which is periodically updated. As at the time of writing this paper, it is five volumes with a total number of 300 ideas for African Science Fiction stories. A good number of these imageries or visualizations focus on Africa's political leadership of future years or an imaginary past which transposes Africa's real past (alternate history) which all-in-all stretch the imagination of Africa's political leadership. The picturesqueness of *African Science Fiction Imagery*, especially those about African political leaders, is the soul and magic of it. It is like showing Africans in clear pictures the leaders they have waited for generations to have and the political systems they have worked hard to achieve without success because of the existence of contrary political forces. In these political systems, equalitarian justice and the supremacy of law are achieved through the power of science and not through the goodwill of the man with political power.

In these imageries, political leaders of African societies are creators and facilitators of Technoscience. The leaders depicted herein are like individuals carrying the political burden of closing four hundred years of the technology gap between Europe and Africa. Thus, we read again from the Imagery (ibid., p.14):

> In 2025 the President of Nigeria initiated a project that he called *Extreme Engineering*. Then he garnered his efforts and got requisite legislation that recognized Extreme Engineering as a Nigerian programme that will run for 100 years, that is from 2025 to 2125. With its base in Nigeria the territory of the project was the ECOWAS sub-region with a total population of 300 million. The President enthused about Extreme Engineering and stated that while some Nigerians are living in the past and others in the present, provision must be made for some Nigerians to live in the future. So Extreme Engineering was all about creating tomorrow's techno-scientific society today…

The following reading concerns Africa's future legislators (ibid., p.12):

> The Biotechnology and Life Science industry in Imo State in the 2040s was comparable to the magnitude of that industry in the entire South Africa. The state had become the Mecca of experts in this field throughout sub-Saharan Africa. The National Assembly had rejected the passage of *The Sixth Day Laws* as proposed by some assembly men. So the Assembly had failed to pass legislation regulating the practice of biotechnology and the life sciences as applied to humans, the onus of which it said fell upon the Assemblies of the respective states, being as it is a moral question more than anything else. Soon the state became home, a haven, to hundreds of European and American scientists frustrated and silenced by *The Sixth Day Laws*. The effect was an exponential growth in r-DNA research and capacity accumulation. Human r-DNA or r-DNA as applied to humans (Human recombinant DNA) is where the state built its strength. It was revealing that for those who visited Human r-DNA clinics the quest for a higher IQ ranked most, followed by beauty desires, etc. One billion Euros in naira equivalent was accumulated by way of gross earnings by r-DNA clinics operating in Imo State in 2040 alone. The Government of Imo State had aggressively transformed the state into "a eugenics workshop." Indeed

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> Imo State by 2040 was variously described as "the eugenics workshop of Africa" and "Africa's Centre for Life Sciences." The government re-christened the state as "Africa's Centre of Genetic Excellence." Imo State had become Africa's Genetic Engineering technopole.

Each of these imagery-ideas is billed to generate at least ten novels and short stories for public consumption. It is expected that as the imagery-ideas are packaged into novels and movies, they shall arrest the attention of Africa's publics. Once the people are shown possible political leadership patterns in the form of stories revolving around certain individuals, government institutions, leadership patterns defined by technology incubation skills, a marked temperament for science domestication, and an unprecedented science business savvy, we can expect and predict that imageries of this category of African political leaders shall diffuse into the political consciousness of both the leaders and the led, to pave the way for the emergence of these species of leaders in real life.

Politicians seeking elective offices will directly or indirectly, overtly or covertly begin to associate their personalities with the imageries of technoscientific political leaders in African Science Fiction. In other words, *Africa's political leaders can be led, influenced, directed, and inspired by Africa's fictional techno-scientific leaders.*

The following are other specific African political leadership imageries in science fiction (ibid., p.25):

> IQ Political Parties. The rise of IQ Party of Africa (IPA). The philosophy behind the formation of this party is the assertion that political leadership is for persons of extremely high intelligence. A gathering of 100 professors of Science at Benin in 2021 gave birth to this unusual political party. These founding fathers were all of them active members of *Future Generations* (an international eugenics society that originated in the United States) and *Foundation for the Future*. Subsequently members were drawn from the Nigerian Chapter of *Mensa International* (an international association of persons of IQ above 130 which originated in the United States). Membership continued to grow in leaps and bounds, until total number of registered members reached one million in the first two years. Over two-thirds of the members were students in higher institutions studying mathematics, engineering, and the sciences. Around 150,000 came from MTN Brain Development Programme. The master plan was to transform the party into a continental political movement and political party, such that in 2023 IQ Party of Ghana and IQ Party of Sierra Leone were formed in Ghana and Sierra Leone respectively. By 2030 the Party had been formed in all English-speaking African countries, including South Africa. IQ Party of Nigeria by 2026 had 30 seats in both chambers of the national legislature and had produced three State Governors – those of Edo, Enugu, and Lagos. The Party was responsible for the realization of 'Nobel-Laureate Presidency' – a law requiring persons who wished to run for the Presidency to be men and women who had won a Nobel Prize for Science. The re-definition of the Nigerian State by the national legislature as a Science State (or Scientific State) in the 2030s is also credited to the vision and tireless efforts of IQ Party of Nigeria.

At number 28 of the same source we read (ibid., p.26):

> Nobel-Laureate Presidency. In 2028 a law was made requiring persons that may be elected to the position of President of the Science State of Nigeria to be men and women who had won a Nobel Prize for Science. In the absence of a Nobel Prize winner, the winner of any of several listed national and international Science laureates would suffice to run for the Presidency. Politicians rally around Nigeria's Nobel Laureates. The proponents of this law and the politics. The proponents in the National Assembly and the various State Assemblies argued as a university as an academic institution is headed by a person with the highest level of academic achievement – a professor, so also must a Science State be headed by a person with the highest scientific achievement – and the benchmark was the Nobel Prize for Science. In Nigeria the lawmakers were driven by the vision that Science must be crowned with political power. The impact of this law on Science and Politics in Nigeria. Nigeria is the first and only country in the world to have such a law.

The African Science Fiction Project is building models of science-based African political leadership through the instrumentality of African Science Fiction. The African Science Fiction Project is building African models of political science fiction. In the words of Donald M. Hassler and Clyde Wilcox, (2009) political science fiction.

> …examines the close relationship between politics and science fiction and shows how much of the former is grounded in the latter.
>
> [It]…analyze [s] science fiction texts as literature and …discuss [es] them as models of political science theory and practice …[It arises from] the propensity of [science] fiction writers to center their works on particular governmental structures.

Political science fiction entails "how current cutting edge technology might have social and political ramifications" (Bowers). "How can imagining the future help us understand the present? How does considering the future help us think critically about politics today?" (ibid.). These questions are at the centre of campaigns to develop science consciousness in a political system, and campaigns of this nature are key to achieving the requisite political transformations for the technoscientific development of African nations.

VIII. Anticipation as a Political Dimension of Science Consciousness

What are the troupes for anticipating the future in sovereign political states of Africa and the Third World? It is important to first define the political character of the political state before discussing the

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anticipatory regime. This is because non-sovereign political states are not in the proper frame of mind to navigate the anticipatory regime since they are basically puppet-states in the hands of the master-states, and so their anticipatory scope is constricted, and to the extent that their sovereign status exists in truth and indeed so can the anticipatory regime be articulated within their borders.

Anticipation is "a virtue emerging from actuarial saturation as sciences of *the actual* are displaced by *speculative forecast*" (Adams, *et al.* p.246). Key elements of the anticipatory regime then are optimization, preparedness, and possibility: "*optimization* as the moral responsibility of citizens to secure their 'best possible futures'; *preparedness* as living in 'preparation for' potential trauma; and *possibility* as 'ratcheting up' hopefulness, especially through Technoscience" (ibid.).

Our "politics of temporality" defines the way "[the] present is governed, at almost every scale, as if the future is what matters most." In this 'politics,' "eternalism" and "ephemeralism" are united, thus producing an "instantiation of 'modernity' "[which] offers both a promise of certainty (that the truth can be known for certain in a way that applies across time, into the future) coexistent with the acknowledgement of an ongoing deferral of truth as ever changing (as more sophisticated ways of knowing it continually emerge)." The future then is understood as "a conceptual possibility" that "is always knowable in new ways, even as the grasping for certainty about it remains persistent" (ibid., p.).

The science-consciousness regime then is an anticipation intensifier which engages the public mind to work with the governmental mind to scan the future in order to leverage, on 'optimization,' 'preparedness,' and 'possibility' which are troupes that involve "abduction as [the] requisite tacking back and forth between futures, pasts, and presents, framing templates for producing the future…"(ibid., p.246). Abduction itself is the mental state of "governing" the present as though the future is the most important component thereof (ibid., p.248).

While the politics of anticipation is both "temporal and affective," anticipation is seen to possess both "multiple valences" and "epistemic value" and is therefore a virtue. Science consciousness defines the "modes of prediction" in "the speculative forecast" which is a mode by which knowledge of the future can be known, which replaces the saturated sciences of the actual (ibid., p.247). In the anticipatory regime, "Preparedness is infinitesimally possible and infinitely malleable when one has a good working model of an anticipated future" (ibid.). Science consciousness shapes both the "infinitesimally possible" and the "infinitely malleable" nature of our preparedness agendas.

Driven by uncertainties about the future, anticipation becomes "an affective state, an excited forward-looking subjective condition characterized… by nervous anxiety as a continual refreshing of yearning, of 'needing to know'" (ibid.). Anticipation describes the 'palpable effect' on the present of imaginings of the future. Anticipation is also "a way of actively orienting oneself temporally," to deal with the mundane today that will affect the unknown (spiritual) tomorrow (ibid.). Whether as "terror-inducing apocalyptic visions" or as "an excited forward-looking subjective condition," anticipatory regimes define "a …self-evident 'futurism' in which our 'presents' are necessarily understood as contingent upon an ever-changing astral future that may or may not be known for certain, but must be acted on nonetheless" (ibid.).

Science consciousness is an instrument of cogitation which catalyzes futurism. It opens the citizens up to awareness of certain possibilities that can be maximized or minimized today to achieve the desired public future or avoid an unpleasant anticipated public future. Since modern anticipatory regimes do not occur or exist in a vacuum but are defined by scientistic calculations, the science-consciousness regime then becomes the foundational structure – the substructure that is – upon which anticipatory regimes are built and upon which they thrive. The relationship between anticipation and science consciousness can also be interpreted in terms of embeddedness, such that science consciousness assumes the interface with which to navigate anticipation. Anticipation is implicitly embedded in science consciousness regimes.

The notion of "injunction" defines the "moral imperative" of anticipation (ibid., p.246); thus anticipation is "a moral economy in which the future sets conditions of possibility for action in the present, in which the future is inhabited in the present" (ibid., p.249).

While science fiction enhances science consciousness, science consciousness itself becomes the language of expressing anticipation in political practice. However, anticipation and science consciousness can be observed to have a two-way relationship of their own wherein one fires/ignites the other and the other in turn is fired/ignited by one. As the principal regime in science consciousness, anticipation is the trajectory wherein "the future increasingly… defines the present [and] creates material trajectories of life that unfold…" while it 'reconfigures' "technoscientific and biomedical practices as a totalizing orientation" (ibid., p.248) as transformational agents of great utilitarian value.

Anticipation as politics of science consciousness is defined as anticipatory modes that "enable the production of possible futures that are *lived* and *felt* as inevitable in the present, rendering hope and

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fear as important political vectors," otherwise known as "the politics of affect" (ibid.). Science consciousness as it imbricates with anticipatory rhetoric utilizes a "breathless futurology" in its logic (Harrington *et al.*, 2006, p.3). While biotechnology and nanotechnology "stun us, generating a sense that we not only can but must *hold* anticipation," the diverse science awareness campaigns in Earth Science literacy, global warming campaigns, green energy campaigns, endangered species campaigns, etc, actually "infuse a sense of looming time limits that generate [a sense of] urgency and anxiety about acting now to protect the future" (Adams, *et al.*, p.248). Invocations of anticipation then provoke "preparation (tied to hope) but also surprise, uncertainty, anxiety, and unpreparedness (tied to fear)," such that "[the] unknown …plays an integral role in producing action" (ibid., p.249). 'Psychopolitics' is a politics of anticipation which defines the way "states, corporations, and military complexes tactically project and distribute fear and anxiety as a means to interpellate and govern subjects" (ibid.). The military-industrial complex can be interpreted as a highly sensitized science consciousness regime driven by psychopolitics which itself is an anticipatory regime.

Science consciousness can also be considered as the self-awareness of the science system. Technoscience or the science system can be seen as an *organic* system which develops in much the same pattern as any evolutionary system. Science consciousness in its diverse languages and troupes then is the self-aware status of the science system in its evolutionary history. The self-awareness of the science system can be likened to the maturity manifestation of the science system with which it can self-correct, inspire, and motivate and practically teleguide itself with its in-built intelligence and internal logic. It is the total engagement of the human collectivity of the state in the task of constructing and shaping its technological future. Whether it is framed as technological nationalism or as technological competition paradigm driven by primordial sentiments such as ethnicity or racism, science consciousness is an anticipatory regime in the scientific state agenda. Science consciousness regimes drive technoscience into the public consciousness and transforms same into the playing field of societal publics. Anticipation by the wide societal publics then becomes *the self-aware element* of science consciousness paradigms.

Anticipation then is the spirit of the scientific state. This notion of anticipation captures all the aforementioned tomorrow-today manifestations of anticipation. The language of expressing these aspects, again as stated, is the science consciousness regime in its diverse elements and troupes. In this perspective, "Anticipation is… a strategy for avoidance of surprise, uncertainty and unpreparedness, [and] also a strategy that must continually keep uncertainty on the table" (ibid., p.250). Similarly, "sciences and technologies of anticipation demand that the phenomenon be assessed and calculated – producing probabilities for anticipatory projects as interventions in the present" (ibid.). Implicit in this regime of anticipation, "the unanticipated… offer new territories for expanding anticipation" which opens up conversations on "new forms of curiosity." Science consciousness formulates anticipation in the creation of the scientific state. It catalyzes anticipation in the direction that forms the spirit of the scientific state. To this end, anticipation in its aspects of injunction, abduction, optimization, preparedness, and possibility imbricates with the spirit of the scientific state. These aspects of anticipation are themselves epistemes of the scientific state.

Injunction is the ethical imperative to anticipate, to articulate an "orientation toward the future" (ibid., p.254). From the complexities of modernization, "there is a moral injunction to anticipate as an act in which life, death, identity, and prosperity are at stake personally and collectively" (ibid.). Similarly, our "obligation to 'stay informed' about possible futures has become mandatory for good citizenship and morality, engendering alertness and vigilance as normative affective states" (ibid.). Injunction then as a dimension of anticipation defines science consciousness as a civic obligation. Several troupes of the science consciousness paradigm buttress this observation such as scientific literacy, science for citizenship, and citizen science. These science consciousness regimes inform citizens' imperative to "stay informed about possible futures" through a working knowledge of the scientistic possibilities, with a view to creating in them a natural orientation toward preparing for the future. Science consciousness then is the most powerful tool in politics of anticipation.

IX. Addendum

In aspiring for technological independence, it may be required as a citizenship obligation in backward political states for citizens to know the technological histories of products imported into their countries and sold to them. Products such as the television, music systems, mobile phones, etc, should have embedded in their packaging systems concise or possibly elaborate histories of their technological invention and subsequent development. This practice has the potential to trigger a home-thinking attitude to science and technology development which inspires a do-it-yourself sense, which itself is a fertile soil for the Scientific Revolution to replicate in that political state. And of course a sine qua non for technological take-off in a political state is the occurrence or replication of the Scientific Revolution. Expanding or increasing technological self-confidence develops into the Scientific Revolution. Technological

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histories of technological artefacts tell who did which technology and under which circumstances the technology was done and in this sense is a stimulating learning experience. Mass communication of technological histories then becomes the tillage and fertilization process of the soil before planting. The Scientific Revolution thereon needs no deliberate planting as its germinal seeds have already infected the soul of the population through the selfsame technological histories running in the collective memory and imagination. The Scientific Revolution then sprouts and builds itself into the cultural practices of the population and becomes endemic, redefining and restructuring the political system. It is difficult for a state to achieve technological independence without a cultural experience of the phenomenon known as the Scientific Revolution.

Intellectualization of scientism entails looking at scientism as 'what it is outside ethics.' Scientism, anticipation, and science consciousness are imbricated with each other (where scientism is defined as the highest point in the expression of anticipation and science consciousness). Scientism is contextual – its practice is influenced and defined by the prevailing sociopolitical determinants such as religion, the prevailing values of the social system, the type of political system (whether libertarian, authoritarian, or totalitarian), and the economic system (whether neoimperial capitalism, post-Marxist capitalism, liberal capitalism).

What has scientism achieved? The government of China sponsored the massive production of its own scientists at home and abroad (especially in the United States) because it was propelled by scientism. Demystification of science and technology by Japan (which paved the way for the Chinese intrusion) is another grand achievement of scientism. The Japanese applied scientism to become the first non-Western, non-Caucasoid scientific power in the world. The blackening of scientism by mostly Western scholars underscores the fact that those who have a thing mostly do not understand what they have (or in its reverse form being that you do not know the value of what you have until you lose it). The present super-sophistication of Western science systems is the very product of scientistic movements of the past, albeit radical they may have been. Yet these traditional science-countries of Europe (with Germany included) have been threatened and overtaken by Japan and lately China in terms of technological refinement and quantity of high-tech production. Scientistic movements will one day achieve *freedom from disease* as a fundamental human right championed by the UN.

Scientism is the mentality and force that pushes scientists; it is the mentality that pushes science, and as it is, human civilization cannot get by without it. Scientism is the very air that science breathes without which it cannot live.

Scientism is an important political dimension of the science consciousness regime. Every citizen of the world in the 21st Century has the responsibility to become science-conscious compliant as a citizenship requirement. Every citizen of the world must know and speak some science to enable its complete domestication and democratization and to guide and direct it to build a world free from overpopulation, terrorism, hunger, and tyranny. This is scientism. It is a reality embedded in the Scientific Revolution.

X. Conclusion

Building science consciousness in Africa is an antidote to the century-long neocolonialism and lingering economic imperialism. Science consciousness generates an African political consciousness that can best be described as revolutionary – the absolute awakening of her technological inventiveness and latent power, the complete mastery and control of her political will herself without external influence. Increasing science consciousness strengthens a country's assertion of her political will.

Technological artefacts allowed into Africa because of the proddings of commerce must needs have their histories embedded in them in whatever medium so that African consumers can learn and be inspired by the fact that the path of science and scientists has historically been rather tortuous than a bed of roses.

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