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Politics, Science and Technology: A General Overview

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Abstract
Science and Technology underpin every aspect of human existence. The linkage between science and technology has a long history. The two are as old as humanity and has been an integral part of the pre-historic man and thus integral to the evolution of mankind. The great scientific discoveries and technological revolutions of the past 200 years have had powerful effects on political institutions, political competition, public policy and international relations, these effects are not well understood. This endeavor is embarked on against the background of politics, science and technology mix and in an effort to build a well-to-do society, we are confronted with both exceptional, historic opportunities and critical challenges. This is a descriptive study and depends on data majorly from secondary sources, the subsections of this discourse embarks on an overview of Science, Technology and politics. It focuses on the impact of scientific and technological development on patterns of distribution of power and authority. Science has been at the bane of humanity and human development. Conclusively, science and technology are proffered as the only viable means to safeguard humanity from global threats, they are also the greatest threats to human existence. The responsibility of politics is to explore scientific discoveries and harness technological breakthroughs in the art of governance, security, and national development.
Keywords: Politics, Governance, Science, Development, Technology

Introduction
Science and Technology underpin almost every aspect of human existence. The intimate connection between science and technology has a long history. Science and Technology are as old as humanity itself and has been an integral part of the pre-historic man and thus integral to the evolution of mankind. If we compare traditional societies with those of the present, it becomes clear that norms and processes of creating a meaningful environment for living are currently being heavily transfused with science based knowledge. The great technological revolutions of the past 200 years have had powerful effects on political institutions, political competition, and public policy, but these effects are not well understood (Lindvall, 2017: 1). The increasing needs of the society in the face of limited resources have forced renewed thinking towards effectiveness. This requires improved knowledge of science and technology. In the last few decades significant advancements have been made in the global economy resulting in a departure from traditional production processes.

Politics are at the centre of people's views about several of today's most hot-button scientific issues, especially those revolving around climate, energy policy, and the government's role in financing science initiatives (Pew Research Center, 2015). The society we live in these days is a fast developing one and it is characterized by various technological changes (Iyoboyi, 2016: 1). The changes are fast encroaching into every sector of life. The intimate connection between science and technology has a long history. In the context of development, science and technology has impacted such economic areas as poverty reduction, brought about healthier and more productive lives, rapid improvement in agriculture and economic growth. It has been critical to the growth in agriculture, energy, improved environmental and health conditions, among others (Iyoboyi, 2016: 1). Today, we are living in digital world where new media technology has changed the world. We all have been heavily influenced by new media technology. We all use internet for

information and connection purposes. The advent of internet has drastically changed our life styles. Web sites like twitter and You Tube, Facebook, whatsApp are playing a big role for global connections between individuals and communities. We are now living in the age of democracy and democracy is only possible in the societies where there is freedom of information and discussion. Free media is a pivotal part of the democratic societies. New media technologies can flourish in such societies promoting an atmosphere of participation and democracy.

Politics, science and technology can be explored from a variety of perspectives stretching from classic subjects such as nuclear weapons to recent debates about nanotechnology, drones, peak oil, cyberspace, supercomputers and biomedical technologies (Mayer, Carpes, and Knoblich, 2014). Technological developments has led to substantial improvements of economic progress and human conditions. It is revealed that a mixture of science and technology offers better solutions to precarious global challenges such as security, public health, energy, food and water supply, poverty, and climate stability. The overarching inclinations towards more efficiency, smartness, and artificial intelligence are implicit as not only reshaping and redesigning but essentially improving urban planning, reproduction, advertisement, and business models (Kurzweil, 2006 in Mayer, Carpes, and Knoblich, 2014).

On the other hand, it is proclaimed that the employment of autonomous and unmanned weapon systems makes warfare more precise, ostensibly less inhuman, and thus an ethical imperative (Arkin 2010, Kaag and Kaufman 2009 in Mayer, Carpes, and Knoblich, 2014). The idea of the "technological fix", to put it inversely, dominates decision-makers from Beijing to Kinshasa and from Washington to Brussels and to other parts of Africa. The optimistic tale of technology is driven by unmitigated ambitions and high expectations about continuous improvements. However, the assumption that technology and science primarily are instruments of progress is contested (Mayer, Carpes, and Knoblich, 2014). The inherent risks of pollution and ultimately annihilation, paradoxically resulting from technological progress, and the objective status of related scientific knowledge itself became subject of public concerns and contestation (Lear 1993; Jasanoff 1990; Nelkin 1992 in Mayer, Carpes, and Knoblich, 2014) hence the agitation to mitigate the harsh effects of climate change, green house emission and perforation of ozone layer leading to many covenants and conventions for instance, the Kyoto Protocol. Many of the most important scientific questions are political. A bulk of what scientists considered as "scientific advice" should be central and fundamental to good public policy. They hope that the results of their research are persuasive to decision makers. Yet, a democratic system constructs a multitude of sources of political influence and information. Scientific advice is just one piece of the policymaking agenda (Silver, 2006).

This study is embarked on against the background of politics, science and technology mix and drawing from the State Council of the People's Republic of China, (2006), who clearly enunciated and painted the picture that in an effort to build a well-to-do society, we are confronted with both exceptional, historic opportunities and critical challenges. Most nation's economic development and progress shows disproportionate dependence on the utilization of energy and resources, with extraordinary associated environmental costs; the economic structure is unfounded, characterized by a delicate agricultural base and lagging high-tech industry and modern service industry; and firms lack essential competitiveness and their economic earnings are yet to be improved as a result of weak indigenous innovation capability.

As Jeffrey Toobin noted in the August 28, 2005, *New York Times Magazine*,(cited in Silver, 2006) there are other debates on the horizon that may mark the next 20 years of the science–politics relationship (as it is today with all the issues that has been generated by Covid 19. It has raised a whole lot of issues that the boundary between science, technology and politics has been fused), as scientific discoveries provide advances in nanotechnology, genetics, sensors, surveillance, and other areas of life that will raise social and ethical implications and political questions. Policymakers will continue to sort out competing claims and political needs in addition to the scientific proof to make and implement public policy (Silver, 2006). "The starting point of this piece and the collection that follows is that the relationship between science, technology and politics is complex and heavily interdependent (or hybrid), and that the effort to tease out the processes of contemporary governance into scientific, technological and political strands is an object of

reflection in its own right" (Abram, 2005: 3). There are a wide range of problems concerning employment, distribution, health care, and national security that require rapid solution. Science cannot ensue without the federal government's support. Yet, as scientific advances generate more ethical dilemmas, the political intrusion may grow and disturb the science (Silver, 2006). All these issues requires extensive evaluation and analysis, hence the concern of this study.

Science Technology and politics: Broad Overview

In 1968, William T. R. Fox implied that "nothing very useful" can be said about the relations between science and politics. In the decades since, a paradigm shift has taken place in research into the politics of science and technology (Fisher, Pearce and Molfino, 2021). Arriving at the 21st century, it is obvious that science and technology have made tremendous progress. In addition, the rapid progress of information and communications technology (ICT) in recent years has brought about a new reality in which information, people, organizations, logistics, finance—in reality, everything—are persistently connected on a global level and jointly influence one another (Council for Science, Technology and Innovation, 2015). This is starting to produce hitherto non-existent synergy without being bound to the confines of existing industrial structure and technology fields, thereby creating new businesses and markets, and is also starting to induce how we work and live. Moreover, as our economy and society matures, values are diversifying, with people's interests shifting from the tangible to the intangible. Rather than just seeking conventional technological innovations, users now demand new values and services to be created that resonate with their diverse needs (Council for Science, Technology and Innovation, 2015). Technology innovation and the welfare of the country are tightly linked. One-half of all economic growth since World War II is ascribed to technical innovation. Technology innovation and the welfare (the core duty of politic) of the country are firmly connected. One-half of all economic growth since World War II is attributed to technical innovation (Pietruszkiewicz, 1999).

In their revelation, State Council of the People's Republic of China, (2006) noted that in the 21st century also, the new science and technology revolution is briskly unfolding and gestating noteworthy new breakthroughs, which will overwhelmingly change the economic and social visages. Advances in information science and technology, still in the ascendant, will continue to be the prevailing driving force for economic growth; rapid advances in life science and biotechnology will play a strategic role in improving quality of life; renewed efforts in energy science and technology will open up new avenues for tackling global energy and environmental issues; Energy is required in every stage of water production, extraction, transportation, treatment, distribution, consumption and disposal (Williams, Bouzarovski and Swyngedouw, 2014: 7), and exciting new inventions and discoveries in nanometer science and nanotechnology will usher in a profound technology revolution. Thrilling breakthroughs in basic research fields will create a whole new horizons for science and technology development and economic growth. Science and Technology achievements are being applied and transferred at an ever faster pace, thus creating new opportunities for catching up, leapfrogging**.** Dovetailing and encompassing new areas (State Council of the People's Republic of China, 2006)

Fisher, Pearce and Molfino, (2021) contend that: The ever-increasing reliance of modern states and societies on scientific expertise and technological systems has redefined relationships between science and technology, government affairs, and political power in a wide-ranging of issues underneath the development of the modern world, including technologies of aging and reproduction; interrelations among social media, citizens and global affairs; e-government, electronic voting, and the legitimation of liberal democratic governments; technologies of warfare from nuclear weapons to drones; biotechnology, stem cell research, and genetic engineering; environmental issues from climate change to geoengineering; development and social justice; human enhancement and radical life extension; and the governance of emerging technologies. The intensification and magnification of existing issues and the emergence of new ones are further complicated by dwindling trust in experts in the wake of controversies from hydrological fracking and climate change to genetically modified organisms. While this complex and intricate enmeshment of scientific and political institutions has often been neglected by scholars in political science, sociology, and

economics, an increasingly influential body of literature now addresses the politics of science and technology.

Open science is becoming the universal trend in scientific research. Inspiring scientists to share and make shared use of research findings across fields and national borders is increasing the possibilities for creating knowledge and value outside conventional frameworks. In the meantime, networks are briskly growing on a global scale and have the budding to overturn the conventional rules of society and people's values. As a result of this, it has become essential to create new rules for protecting personal information and establish codes of conduct to address the security ramifications, which is within the domain of politics. Turning to the Internet of Things (IoT), robots, artificial intelligence (AI), regenerative medicine, and neuroscience, it is obvious that developments in these new sciences and technologies will have a tremendous influence on not only human lifestyles but also human existence itself. The method of creating knowledge and value has improved radically, and it is steering in a "revolutionary era" where the structure of our economy and society go through substantial change on a regular basis. This will entail a rethinking of the relationship between politics and science and technology. These different transformation are all interrelated and progressing at an accelerating rate (Council for Science, Technology and Innovation, 2015). Moreover, the degree to which modern sciences and technologies were implicated in colonial domination, racism, and exploitative suppression, both practically and as a "white mythology", has remained essentially under-scrutinized in social sciences (Adas 1997; Endres 2009 in Mayer, Carpes, and Knoblich, 2014).

In the 21st century, the most persuasive issues are energy, resources, food limitations, a declining birthrate and aging population, and the impoverished rural economies and communities. In particular, the significance of stable and inexpensive supplies of energy and resources in supporting the foundation of our economy and society. Furthermore, the increasing social security costs that come with the progression of an aging society and our deteriorating infrastructure are increasing social costs and becoming a major limitation to upholding and improving our economy, as well as the living standards of citizens (Council for Science, Technology and Innovation, 2015). Besides, there is demand for suitable responses to the risks of large-scale cyclone, earthquakes, storm, Hurricane, volcanic eruptions, Tornado and other natural disasters, as well as the changes in the security environment, and the necessity to increase the resilience of land and social functions. The world population continues to rise, and food and water resources are becoming progressively deficient. There are also the dangers of infectious disease and terrorism, widening income disparities, and environmental issues such as climate change and reduced biodiversity. As nations become more and more interdependent, there must be an interplay between science, technology and politics to aggressively contribute to a global framework for handling such issues to make comprehensive use of knowledge in the humanities, social sciences, and natural sciences to promote and disseminate universal initiatives for building economic and social systems that will simultaneously help solve these problems and grow the economy (Council for Science, Technology and Innovation, 2015).

In their arguments State Council of the People's Republic of China, (2006: 11) states that if nations must tinker with politics, science and technology mix as China they have to meet the following objectives in some major scientific and technological areas:

i. Mastering core technologies in equipment manufacturing and information industry that are critical to the nation's competitiveness, and bringing the technological capability of manufacturing and information industries to the world advanced levels;
ii. Making the nation a world leader in overall agricultural Science Technology capability, raising the comprehensive capacity of China's agricultural production, and ensuring the nation's food safety.;
iii. Achieving technological breakthroughs in energy development, energy conservation, and clean energy, and advocating optimized energy structures, with unit energy consumption of major industrial products reaching or approaching world advanced levels;

iv. Establishing technological development models featured with cyclic economy in major sectors and municipalities, and providing Science and Technological support for building a resource saving and environment friendly society;
v. Noticeably enhancing the level of major diseases prevention and control curbing the spread of major diseases, including HIV/AIDS, hepatitis, Covid 19 and other major diseases, striving for breakthroughs in new drugs and key medical equipment, and developing a technological capability for industrialization;
vi. In defense science and technology, basically meeting the needs in developing modern arms and associated information technology, and providing Science and Technology support for safeguarding national security;
vii. Establishing a world-caliber contingent of scientists and research teams, attaining high-impact innovative achievements in the mainstream of science development, bringing the technological level in such frontier areas as information, biology, materials, and space to world advanced levels; and
viii. Establishing a number of world-class research institutes and universities, and world-competitive industrial Research and development centers so that a fairly comprehensive national innovation system of Chinese characteristics can take shape.

The reality of international affairs has speedily grown in complexity, compelling the discipline of International Relations (IR) to engage with new phenomena. IR scholarship thus has to address concerns and issue areas by translating them into innovative theorizing. Science and technology is the most prominent among these—it is difficult to imagine any international or global issue that does not demand technological or scientific aspects (Mayer, Carpes, and Knoblich, 2014). Science and technology are key drivers of development. This is because technological and scientific revolutions and innovations underpin economic advances and contribute to improvements in health systems, education, and infrastructure. Thus, developments in science and technology have profound effects on economic and social development. Apart from constituting a salient political issue, access to and application of technology are critical to a country's development. By the same token, access to high quality education, especially higher education, is essential for the creation of scientific knowledge. Science and technology are the differentiating factors among countries separating those that are able to tackle poverty effectively by growing and developing their economies, and those that are not (Stivachtis, 2019: 2).

The level of countries' economic development depends to a large extent on their ability to grasp and apply insights from science and technology and use them creatively. To promote technological advances, developing countries need to invest in quality education for youth, continuous skills training for workers and managers, as well as to ensure that knowledge is shared as widely as possible across society (Stivachtis, 2019: 2). Moreover, adopting appropriate technologies leads directly to higher productivity, which is the key to growth. Creativity and technological innovation emerge naturally in societies that have large stocks and flows of knowledge. In sharp contrast, in societies with limited stocks of knowledge, creative people feel constrained and migrate to other countries thereby causing 'brain drain' to their own countries and societies. Such societies are prone to remain in poverty and dependency (Stivachtis, 2019: 2).

Energy is of crucial strategic importance to the national economy (State Council of the People's Republic of China, 2006: 12). O'Sullivan, Overland and Sandalow (2017: v) noted "that in a world in which renewables are the dominant source of energy and technology may progressively become sources of international cooperation or rivalry. First, increased tensions between developing and developed countries could develop over the transfer of technology. Second, conflict over renewable energy infrastructure could develop, especially if new asymmetric dependencies arise between major producers and consumers of renewable energy. Finally, it is not clear whether the expansion of renewable energy will involve a shift to more decentralized and distributed energy generation (similar to farming) or to larger companies with the financial and scientific clout to keep pace in an intense global race to continuously improve technology and cost-cutting".

Science and technology enhance the capabilities of states and societies to obtain and transform resources necessary for their development and advancement. On the other hand, lack of scientific knowledge and access to technology not only affects a country's level of development but also jeopardises its national security (Stivachtis, 2019: 1). Also, International security, statehood, global governance as well as warfare and foreign policy are comprehensively infiltrated by and embedded in material artifacts, technical systems and infrastructures, and scientific practices. As theme, science and technology attracts noteworthy attention within IR; security studies are perhaps the most notable case, treating science and technology as key strategic tools in the Cold War. However, for many approaches within IR the analysis of science and technology remains fundamentally challenging (Mayer, Carpes, and Knoblich, 2014). Over the centuries, scientific and technological advances have frequently enabled foreign powers to interfere with the functioning economies of the underdeveloped countries, as well as to undermine the security of the less advanced countries (Stivachtis, 2019: 3). In the economic sector, national security issues can emerge involving linkages between economic capability on the one hand, and military capability, power, and socio-political stability on the other (Buzan 1991, 126 in Stivachtis, 2019: 9). Moreover, a state's military capability rests, at least partly on the possession of an industrial base capable of supporting the armed forces. The absence or the economic decline of basic industries can, therefore, raise questions about the ability of the state to support independent military production (Buzan and Sen1990 in Stivachtis, 2019: 9).

On the flip side and from a skeptical angle, "technological progress" is thus seen as the last remaining great myth of the postmodern age. It seems resilient to an unending series of catastrophes, accidents and imminent risks of annihilation related to modern weapon systems, fragile infrastructures or the proliferation of toxic particles and artifacts (Virilio 2010 in Mayer, Carpes, and Knoblich, 2014). The referent object of security is mainly the state. Military action usually threatens the state's physical base (territory and population) and institutions (Buzan 1991: 117 quoted in Stivachtis, 2019: 7). The relevance of science and technology to military security is highlighted by the need of states to produce weapons systems necessary for national defence. It is not by accident that due to current conflicts, the major focus of the states is access to military-related technologies. States that have the necessary technology to produce their own weapons systems find themselves in a better position than those that have to import weapons. This is not only for economic reasons (i.e. impact on trade balance) but also because they can be less politically dependent on weapon supply countries (Stivachtis, 2019: 7). Akubo and Alidu (2019: 143 citing Toon, Robock and Turco, 2008 in Slade, Tickner and Wynn – Pope 2016:734) noted that the creation of the Atomic Bomb marked a shift in the application of science and technology to military causes, by creating a weapon that has potential to make life on earth unfeasible. "Science seems ready to confer upon us, as its final gift, the power to erase human life from this planet (Richard & Jack, 1989: 34 in Akubo and Alidu, 2019: 143).

Conceptualizing Science, Technology and Politics

Science

Talking about Science "It is difficult to give a definition because science is a polysemic word with a long history, covering multiple types of activities." (Arvanitis, n.d. : 4). Science may be conceived both "as a process and as an outcome – the process of obtaining knowledge and the knowledge that is obtained. "Interconnectedness" is a basic attribute of Science. Science is a chain of models" (Attri, 2016: 1). According to Thomas Kuhn (cited in Attri, 2016: 1), a Physicist and historian of Science, hints at this duality when he says that Science is "the constellation of facts, theories and methods collected in current texts", while "scientists are the men (and women) who, successfully or not, have striven to contribute one or another element to that particular constellation", whereas in view of Carl Sagan (in Attri, 2016: 1) "Science is more than a body of knowledge, it is a way of thinking."

Department for innovation, universities and skills (2008) opined that by science we mean all-encompassing knowledge based on scholarship and research undertaken in the physical, biological, engineering, medical, natural and social disciplines including arts and humanities which is underpinned by methodologies that build up and test increased understanding about our world and beyond. Scientific activities are mainly aimed at producing organized knowledge about physical, chemical, and natural phenomena (Arvanitis, n.d.

: 4). “Science is generally believed or understood about both the search for “Truth” and new knowledge. The “Truth” must be obtained in an objective and systematic manner, by incorporating models and methods statistical analyses controlled experimentation and replication. Its goal is to better understand the world in which we live and to create rational and probable models that explain occurrences within it”. Science is essentially “value free” (Attri, 2016: 1).

Science improves the quality of daily life, underpins prosperity and increases readiness to face the challenges of the future (Department for innovation, universities and skills, 2008). The potential for science to contribute to good policy making and sound government has been greater. Science has and will continue to help us to address the main challenges we face as nations and as a planet:

i. Tackling and adapting to climate change
ii. Global security and international terrorism
iii. Rising populations and the consequent pressure on food, water and other natural resources
iv. The impact of human diseases such as pandemic influenza and animal diseases such as foot and mouth and blue tongue , Ebola, Covid 19, etc. (Department for innovation, universities and skills, 2008: 6), and the likes.

Technology

Technology is enormously an important aspect of the human condition. Technologies feed, clothe, and provide shelter for us; they transport, entertain, and heal us; they provide the bases of wealth and of leisure; they also pollute and kill. For good or ill, they are woven inextricably into the fabric of our lives, from birth to death, at home, in school, in paid work. Rich or poor, employed or non-employed, woman or man, ‘black’ or ‘white’, north or south - all of our lives are interwoven with technologies, from simple tools to large technical systems (Donald and Judy, 1999).

Arvanitis (n.d.: 5) in his conception of technology was explicit and expansive. To him,

Technology is knowledge produced around technical artifacts. The most elegant definition of technology is probably this: “practical knowledge.” Rather than looking for a precise definition, it is more useful to see what technology is composed of. It comprises three interdependent components: i) material artifacts, usually machinery and pieces of equipment, that are used as tools; ii) knowledge and information on the productive processes where this equipment is used; and, iii) people – “human resources,” that is technicians, engineers, workers, scientists – who operate the equipment and put the practical knowledge into action. Technology is neither exclusively hardware, nor exclusively software; it is a combination of software, hardware, and discourse (*logos*) that ties these elements in practical processes. Not all the knowledge produced is explicit or plain. Technology always contains tacit knowledge, that is, knowledge embedded in the hands and the minds of people who use the technical artifacts. This “tacit” component is usually rather important as without it one does not have a clue to the correct use of a piece of equipment or a software.

Dyson (in Allotey n.d.,.: 4) of Institute of Advanced Studies, Princeton assert that “Technology is a gift of God after the gift of Life, it is perhaps the greatest of God’s gifts. It is the mother of civilization, of Arts and of Sciences. Technology continues to grow to liberate mankind from the constraints of the past. The most revolutionary aspect of technology is its mobility. Anybody can learn it. It jumps easily over barriers of race and language. And its mobility is still increasing.” For Murphy (2017, 1 quoted in Stivachtis, 2019: 2) he views Technology as the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, sciences, and applied sciences. In this sense, technology is embedded deeply in social, cultural, economic, and political systems. Due to its spatial diffusion, technology has uneven geographies of use, significance, and impact. Orlikowski (1992: 399) notes that technology is a “generic tasks, techniques, and knowledge utilized when humans engage in any productive activities". Stivachtis, (2019: 2 citing Hanska 2016, 32) contend that With respect to development, technology is seen as an essential driver and determinant of socioeconomic, cultural, environmental, and political change. Economically, technology can increase national productivity through improvements to the efficiency of production and logistics, while encouraging and enhancing innovation and knowledge creation. Alternatively, technology can exacerbate socioeconomic differences and create uneven development within and between countries and regions.

Culturally, technology has a profound effect on the norms and identities that help to constitute particular social groups. Environmentally, technology can contribute in significant ways to greener and more sustainable societies or exacerbate ecological degradation through intensified or expanded impacts locally and globally. Politically, technology can have democratising effects (e.g. the Facebook revolutions in the Middle East) or it can facilitate enhanced forms of repression or surveillance by state authorities.

Types of Technology

i. Robotics: technology expected to be used in various fields such as communication, social service/work assistance, and manufacturing;
ii. Sensor technology: technology that collects information from humans and all kinds of "things"
iii. Actuator technology: technology related to activating mechanism, drive, and control devices in the real world, as well as the results of information processing and analysis obtained in cyberspace;
iv. Biotechnology: technology transforming sensor and actuator technologies
v. Human interface technology: technology using augmented reality, affective engineering, neuroscience, etc;
vi. Material/nanotechnology: technology that leads to differentiated systems through enhanced functionality of various components, such as innovative structural materials and new functional materials;
vii. Light/quantum technology: technology that leads to differentiated systems through enhanced functionality of various components, such as innovative measuring techniques, information/energy transfer technology, and processing technology (Council for Science, Technology and Innovation, 2015:17)..

The development of technological innovation is progressively dependent on scientific discoveries. New "generic technologies" in the jurisdictions of information and communication, biotechnology, energy, and new materials have appeared. These technologies depend heavily on automation, basic scientific research (also named "basic technological research"), and innovative skills (Arvanitis, n. d.). Specific leading industrial sectors are concerned with these technologies and are usually identified by catchwords such as "high-tech industries" or "strategic sectors": aeronautics, electronics, pharmacy, electrical equipment are among the more important ones, and, to a lesser extent, the automobile and chemical industries. The sectors that consume the greatest amounts of "high-tech" goods are education, communications, and information (Arvanitis, n. d.).

Science and Technology

Science and technology have by no means always been closely connected activities (Donald and Judy, 1999: 8).Arvanitis (n.d.; 3) asserts that Science and Technology here refers to all technical and knowledge production activities, whether novel or not. "Before the latter part of the nineteenth century the contribution of activities we would now think of as science to what we would call technology was often marginal. The watermill, the plough, the spinning wheel, the spinning jenny, even the steam engine—these crucial inventions were in no real sense the application of pre-existing science" (Donald and Judy, 1999: 8). Most people engage with issues related to the personal impact of new science or technology such as:

a. Synthetic biology
b. Food security/sustainability
c. Artificial intelligence
d. Reproductive technologies
e. Data issues
f. Genetic modification technologies
g. Nanotechnology
h. Energy (personal responsibility)
i. Certain medical advances, for instance those related to ageing
v. Animal research (Department for innovation, universities and skills, 2008: 25).

In his opinion Brooks (1994: 477) revealed that Science contributes to technology in at least six ways: They are:

i. New knowledge which serves as a direct source of ideas for new technological possibilities;
ii. Source of tools and techniques for more efficient engineering design and a knowledge base for evaluation of feasibility of designs;
iii. research instrumentation, laboratory techniques and analytical methods used in research that eventually find their way into design or industrial practices, often through intermediate disciplines;
iv. Practice of research as a source for development and assimilation of new human skills and capabilities eventually useful for technology;
v. Creation of a knowledge base that becomes increasingly important in the assessment of technology in terms of its wider social and environmental impacts;
vi. Knowledge base that enables more efficient strategies of applied research, development, and refinement of new technologies.

Science and technology has gone through epochs and trajectory which began with the Stone Age period, the Iron Age, the ancient time, the medieval period, Renaissance and the age of enlightment which dovetail into the age of industrial revolution. Perez (2002, 14 in Lindvall, 2017: 5) identifies five technological revolutions" during the past 250 years, defining a technological revolution" as a powerful and highly visible cluster of new and dynamic technologies, products and industries, capable of bringing about an upheaval in the whole fabric of the economy": (1) the Industrial Revolution (Britain, beginning.1770); (2) the Age of Steam and Railways (Britain, spreading to European Continent and USA, beginning 1830); (3) the Age of Steel, Electricity, and Heavy Engineering (USA and Germany overtaking Britain, beginning 1875); (4) the Age of Oil, the Automobile, and Mass Production (USA, spreading to Europe, beginning 1910); and (5) the Age of Information and Telecommunications (USA, spreading to Europe and Asia, 1970).

Lindvall, (2017: 5) argued that (1) and (2) are often collapsed under the heading “The First Industrial Revolution" and (3) and (4) are often collapsed under the heading “The Second Industrial Revolution." We can see immediately that these three revolutions were followed by three politically transformative periods: the aftermath of the First Industrial Revolution (the second half of the nineteenth century), the end of the Second Industrial Revolution (the turn of the twentieth century, especially the First World War and the years that followed it), and the Age of Information and Telecommunications (the late twentieth century).

For Lindvall, (2017: 7) In this first period, it is also important to pay attention to the investments that states made in information-gathering and information storing political institutions such as censuses and national statistical agencies. In the second period |that is, in the first decades of the twentieth Century |these developments accelerated: electrification, the increase in telephone density, and the availability of automobiles provided governments with ever more effective means of communication and information exchange. The Second Industrial Revolution was also the period in which industrialization took off outside the early industrializers, and the period when large, modern corporations developed. There is every reason to believe that all these factors mattered for the political transformations of the time. It is noteworthy that Hicks (1969, 162) Identifies the years 1914-1918 as a crucial period in the history of government; he argues that the experience of effective management and political control during the First World War resulted in what he calls the Administrative Revolution. In the third period, the main event of interest was the introduction of the modern computer. The theory of the computer was first developed in the 1930s and 1940s, and computers were first used by governments in the 1950s and 1960s mainly for military purposes, but also, and increasingly, for non-military ones. Vastly increasing the capacity of political authorities to collect and manage detailed and easily accessible information about individuals (and society), computers are essential for contemporary public administration.

Science and Technology is indispensable if an economy or nation is to provide for the health, prosperity and security of its citizens (Attri, 2016). “On science and technology depends the standard of living of a nation whether in agriculture, food production, good health, good housing, communication and better

roads" (Allotey, n.d., : 5). For Economic Cooperation and Development (OECD in Attri, 2016: 2), "if current trends continue, as the World Population grows from 7 billion in 2010 to more than 9 billion in 2050, per capita consumption will more than triple, from roughly US$ 6600 to US$ 19,700 per year, and global GDP will nearly quadruple, requiring 80% more energy". To sustain the growth at this massive level, we need to adopt radically new business models, products and means of production implying thereby a greater role for innovation and shifting towards a strong Low Carbon Economy through materials science and digitisation which are already making an impact across the Global Economy, increasing productivity, reshaping entire industries, and creating opportunities for leap frogging by skipping less efficient and more polluting stages of development.

The impact of scientific and technological development on patterns of distribution of power and authority

The development of information and communications technology (ICT) is now changing economic and social rules in the blink of an eye, while also influencing our lifestyles and the very existence of society and humanity. Scientific and technological innovation is at the moment manifesting itself in places beyond the traditional boundaries and is spreading across the world almost rapidly. With the development of globalization, nations have become ever more interdependent, and the various issues of each country now escalate to the global scale in a flash (Council for Science, Technology and Innovation, 2015).

Political Control

Technological change has transformed politics (Lindvall,- 2017: 1). Science is part of the political process. Politics is often defined as the competition for the allocation of scarce resources. In recent years budget constraints and priorities suggest funding increases for science could become scarce. The research and development budget has grown and is still growing because of the compelling need for scientific innovation. The size of the annual increase and how they allocate that funding has become part of the political concerns of scientists and their representative societies (Silver, 2006).

For instance in USA it was observed that science and scientists have entered into the mainstream politics to advance their cause. Silver (2006) revealed that The American Association for the Advancement of Science (AAAS) monitors and speaks out on research and development funding as well as sponsors an annual symposium each spring spends a significant portion of its agenda evaluating how the science budget is doing. Scientific societies have organized into groups like the Coalition for National Science Funding, which lobbies for increased dollars for the National Science Foundation (NSF), and the Ad-Hoc Group for Medical Research Funding, which does the same for National Institutes of Health (NIH) budget. Many universities have their own Washington government relations activities and hire big lobbying firms to seek funding. The social science community when threatened with the loss of federal funding for its research in President Ronald Reagan's first budget, created the Consortium of Social Science Associations (COSSA), as a lobbying response to that threat. In many areas of national activity (e.g., agriculture, justice, education, homeland security) scientists and their advocates also joined the game. Scientists have become deeply involved in interest-group politics in the American policymaking process. To him, the recent doubling of the NIH budget was part of a political effort by many disease groups, pharmaceutical companies, and biomedical researchers. The campaign was launched with a public relations activity that included Hollywood and TV personalities, included the proffering of public opinion polls to support the position, and cultivated key congressional actors through the presentation of awards. All of these activities are part of the political process to persuade policymakers to do something you want done. Kuhn (cited in Abram, 2005: 3) long ago established that "scientific paradigms are established through political social relations". Taking the argument further, it is obvious that some actions, inactions and decisions of government overtly or covertly has a lot of implications for science and technology at one point or the other. Silver (2006) revealed also that in USA:

The Union of Concerned Scientists (UCS) also issued a report, *Scientific Integrity in Policy Making*, condemning the Administration's practices that it viewed as politicizing science. This report and others, including a statement signed by 62 scientists, including Nobel Prize winners, accused the Administration

of a number of anti-science actions: Politicizing scientific advisory panels through the appointment process; distorting scientific results that disagree with President Ronald Reagan's Administration policy (particularly in the area of climate change); needlessly limiting stem cell research; overruling scientific advisory panels to limit the "morning after" contraception pill to satisfy religious right supporters; distorting results of government research by editing out results that disagree with the Administration, as happened with a report on health disparities; removing information from government websites.

Science and engineering research and innovations are intricately linked to societal needs and the nation's economy in areas such as energy, transportation, communication, agriculture, education, environment, health, defense, and jobs. As a result, policymakers are concerned in almost every facet of science and technology policy (Stine, 2009). Science and technology policy issues tend to reach the highest level if they involve multiple agencies; have budgetary, economic, national security, or foreign policy dimensions; or are highly visible to the public (Stine, 2009: 18). The areas of science and technology where politics need to exercise control over are varied and limitless.

According to Hurd (1997: 412) they are:

i. Health (biological, behavioral, social, environmental).
ii. Wellness (fitness and safety, optimizing biological systems).
i. Knowledge of oneself (human nature, human identity).
ii. Environment (ecological and environmental protection).
iii. Communication systems (sources, processing, and utilization of information).
iv. Science (technology, social, and cultural interactions).
v. Growth and development (from birth through old age).
vi. Factors in learning how to learn (self-directed learning, building human capital, knowing processes).
vii. Human social interactions and collaboration in resolving civic problems.
viii. Human diversity (individual, cultural, and value systems).
ix. Quality of life (criteria, social, biological, aesthetic, physical elements).
x. Real-life problem solving (decision making, practical thinking, making judgments, taking action).
xi. Changed images of science (historical, current, and future perspectives).
xii. Unsolved problems in science/technology ("the endless frontier").
xiii. Contemporary science and public policy.
xiv. Food and agriculture (biotechnology, genetic engineering).
xv. Life skills (personal and social adjustment).
xvi. Public health (illegal drugs, control of pandemics, war on cancer, sexually transmitted diseases).
xvii. Dynamics of human population growth (population explosion).
xviii. Diversity in ecosystems (species extinction).
xix. Energy (resources and controls).\
xx. Ethical, value, moral, and judicial issues in science/technology.
xxi. Participation in community-science-related activities (recycling, urban transportation, sanitation).
xxii. Genetic continuity in humans, plants, and animals (biotechnology).
xxiii. Exploration of the biological and physical worlds (awareness, experiencing nature, earth system and global changes).
xxiv. Strategic research in science/technology in relation to human and social affairs and the quality of life.
xxv. Initiation of action programs related to human and social welfare.

Political Socialization

Digital technology has essentially changed how we access information, communicate and collaborate with our peers, and engage in political processes (Panel for the Future of Science and Technology, 2019). Democracy faces a frightening new challenge. The age where electoral activity was conducted through traditional print media, canvassing and door knocking, is rapidly fading. Instead it is dominated by digital and social media. They are now the basis from which voters get most of their information and political messaging (House of Lords, 2019). Among the many transformations taking place in this era none is more prominent than the growth of huge Internet platforms. Amazon, Apple, Facebook, Google, Twitter whatsApp and the likes are already powerful, as convenient as their technology is, the advent of such dominant corporations should ring alarm bells—not just because they hold so much economic muscle but also because they exert so much control over political communication (Fukuyama, Richman and Goel 2021).

These behemoths now dominate the dissemination of information and the coordination of political mobilization (Fukuyama, Richman and Goel 2021). Not only that but social media is now also fully entrenched in political communication. Most political parties and candidates have an online presence and digital targeting has become an indispensable tool in any politician's electoral kit, with campaigners developing increasingly sophisticated strategies every election cycle. The massive endorsement of information and communication technologies has also empowered new forms of political discourse and engagement. Platforms like Facebook, Twitter or WhatsApp are allowing more people than ever before to connect over shared interests and mobilise (Panel for the Future of Science and Technology, 2019).

Political participation

Media is a product of science and technology. Media play a dominant role in term of political mobilization and participation. Media and politics are in a tense relationship in a functioning democracy. Regardless of their divergent missions, it is a symbiotic correlation. Political forces turn to the public to motivate their actions, to campaign for their ideas and to win people’s trust. Media, in turn, have to inform people about politics and to exercise control over politicians when the latter perform their duties. They need each other and, at the same time, they benefit from each other. Without access to current affairs, media would be deprived of topics to cover, and without media, politicians would hardly find a way to the people (Barner, 2010).

The Internet and other information and communication technologies (ICTs) evident in the smartphone and other electronic gadgets are transformational communication technology that has features that include talk, text messaging, Internet access, electronic mail, faxing, pictures, video, and a wide range of applications (Shaul-Cohen and Lev-On, 2020). Before the Internet, most communication has been essentially unidirectional as well as traditional in nature. Print media consists of Newspapers, Magazines, and Books while, broadcast consist of Radio, Television. The new media which is in form of Digital media comprises of hard disk drives or computer networking which is a form of electronic media where data is stored in digital form (Ayotunde, 2012). The Internet has the ability to provide feedback rapidly and easily from receivers to senders. The Internet has introduced mass interaction to mass media through the use of chats, blogs and so many other applications which are being put to use in the mass communication field (Ayotunde, 2012).

Mobile devices are the essential reasons for the rise of political participation (Shaul-Cohen and Lev-On, 2020) and are now portrayed as a voting agent in the least developed countries (Aker, Collier and Vicente, 2016). Technology does not operate in isolation; rather it serves as a fundamental part of information strategy, knowledge management, communications goals, and institution-strengthening initiatives (Guberek and Silva, 2014). Increased availability of mobile phones, and subsequent access to the public sphere, has enhanced individuals' and groups' ability to bring attention to and organize around specialized issues (Creeber, 2009). Social media has emerged as one of the main platforms for politics. Millions of users can learn about politicians' policies and statements, interact with political leaders, organize, and voice their

own opinions on political matters (Parmelee and Bichard, 2012) Political campaigns are also using social media sites to reach voters using political advertising.

Norms, Value and integration

The expansion of technology and of access to the internet is transforming many sectors, it is also changing the landscape of the international human rights movement (Guberek and Silva, 2014). The diverse set of challenges facing human rights activists and organizations include data collection, management, preservation, analysis, effective communication and strategic use of evidence, and data security (Guberek and Silva, 2014). Technology touches multiple social, political, and organizational contexts both as information and communications infrastructure and as instruments that serve human rights organizations and work practices. (Guberek and Silva, 2014). For MacKinnon. (Guberek and Silva, 2014: 11)"The major challenge for the human rights movement is drawing connections to the structural and institutional developments with new technologies and how they shape new norms, laws, and practices that may facilitate future human rights abuses," Technology itself is being adapted to synthesize, curate and amplify varied data and diverse voices (Guberek and Silva, 2014).

In an age of widely available cell phones, digital cameras, internet connections and distribution platforms, such as Facebook, YouTube, and Flickr, which has positioned more individual citizens to play a significant role in free flow of information, documentation and advocacy. It has enlisted, engendered and galvanized new types of actors, such as bloggers, citizen journalists, and online social movements, are becoming increasingly integrated into the international human rights system thereby generating a new set of norms and values, there is need or it will require a new thinking and response. The diversity of actors and skills creates challenges for cross-sector collaboration, and there is no consensus (Guberek and Silva, 2014).

The fast-pace of technology development presents challenges to the creation of standards, practices, and monitoring systems to keep up with the technologies and dangers posed by governments, private companies and individual attackers. The risks are multi-faceted: threats may include mass surveillance and censorship across large populations or entire networks, targeted surveillance focused on individuals, various forms of content filtering, and "leaks" of user information (Guberek and Silva, 2014).. There is need for citizens to better understand exactly how governments use technology as a means of repression, and all the ways in which companies, whether deliberately or inadvertently, enable and participate in abuse and altering the norms and values and how individuals use their freedom of uncensored and uninhibited liberty of expression to scandalize to damage someone's reputation and friendship, inflame passion, hate and incite crisis and conflict (Guberek and Silva, 2014).

Science and technology occupy a central place in national integration. In the presence of many social, economic and defence needs and demands, access to quality education as well as the adoption and application of appropriate technologies do not only constitute a policy question but also a question of policy priorities. Moreover, both of these questions are tied to a country's political development (Stivachtis, 2019; 2). Technology is not a self-organizing platform. It does not cause change by itself. However, it is intimately connected with effective use of information, amplifying people's voices, and connecting communities (Guberek and Silva, 2014).

Conclusion

Science, technology and politics is an interplay between the three very important and complex phenomena or concepts. Science has been at the bane of humanity and human development. In the history of the evolution of man, science is central. Since the evolution of man science and technology has been in harmony, at some point science, at another point technology, they also have a meeting point science and technology before now if we have to go back to history, we remember the age we call the age of human development, at the beginning of development,, we were told that man was moving from one place to another as a gatherer of food, man was eating raw food, that was unprocessed man began to eat fruits that he can find on the surface of the earth, we gradually moved to the stone age period, where he had a club that he can use for hunting games, which became like a weapon that he was using to get others things

outside fruits, from there development became visible gradually, moving to the age of enlightment, the age of industrial development, then the digital age of information and communication technology. The age of information technology. The questions that should be on our mind should be what would have life been without science and technology? What becomes of science and technology outside politics? Science and technology has been very fundamental to our existence, it has been very essential to human development and progress, space, industrialization and manufacturing, agriculture, heath and living, and every aspect of life. It has made life easy through a lot of discoveries, and innovation. Science and technology has induced a lot of changes and transformation in people's life across the world. While its effects are unmatched in scale and importance, its political implication remain very intriguing, and its long term consequences are either ignored or neglected. Technology is always celebrated as the engine of economic prosperity, an accelerant of culture and creativity, a means to health and longevity, an essential tool of governance and the cornerstone of security.

Science and technology is proffered as is the only viable means to safeguard humanity from global threats, and it is also the greatest threats to human existence. What a paradox? Where is the place of politics in all of these? When we talk about governance, security, safeguarding humanity from the global threats we are already within the domain of politics. Politics is about people, politics is about governance, politics is about security, it is also about safeguarding the human rights, of citizens, politics is about protecting lives. If science is viewed as playing dominant role in these areas, science and technology are already romancing politics. It becomes crucial for politics to be concerned with science and technology because advancement in science and technology has a lot of implications for politics whether at domestic level or international level. At the domestic level science and technology is central to discussion and efforts on how to make life worth living for the citizenry of the country, or improving the betterment of our environment for existence, or providing the basic necessities, or making life comfortable as science and technology becomes a veritable tool in the hand of politics. At the international level for instance, each time we talk about politics or international relations, we talk about diplomacy, one of the cardinal reasons why we engage nations is because we want to benefit from them scientifically or technologically, in fact, the world is polarize on the basis of science and technology the classification of the world into developed and undeveloped nations, which induces and regulates the political conduct- behavior of nations, political relations between and among nations in the era of globalizations where the boundaries of the world has been fused together with the removal of artificial boundaries which is one of the benefits of the advancement in science and technology. Making the world a global village with life becoming easier and rosier but it has a lot of implications that only politics through public policy can manage or regulate.

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