## Technology and nigeria's national security: challenges and prospects

Law, Security



TECHNOLOGY AND NIGERIA'S NATIONAL SECURITY: CHALLENGES AND PROSPECTS INTRODUCTION 1. Human existence has been characterized with attempts by man to apply technology to control his environment with a view to improving his material existence. This has resulted in epoch making developments such as the discovery of gun powder and the invention of industrial machines both of which have had significant impact on the development of the society.[i] These technological innovations also had significant effect on the evolution of nation states and the need to maintain national security of states within the international political system. This has thus made the application of technology a critical factor in the maintenance of national security. 2. In the past, national security was synonymous with physical security of the state, but later expanded to include efforts geared towards improving the material condition of the people.[ii] In line with this development, the maintenance of the socio-economic and psychological quality of life of the people has now begun to occupy central position in the security agenda of nations.[iii] The shift in emphasis has, however, not completely eroded the importance of safeguarding the sovereignty of the country.[iv] 3. The United States of America (USA) relies on the effective application of technology to enhance her national security. One of such technological innovations is a new Predictive Screening Project currently being used to derive observable behaviour that precedes a suicide bombing attack.[v] Developed by the Directorate of Science and Technology, the new devise has inbuilt monitors capable of identifying and alerting personnel to indicators of suicide bombing behaviour.[vi] The potential operational benefit of this new technological innovation is the enhanced ability to interdict

Improvised Explosives Device (IED). This has assisted the Department of Homeland Security in its mission of preventing terrorism, thus enhancing the country's national security.[vii] 4. The Republic of South Africa (RSA) has also been leveraging on technological innovations in her agricultural sector as part of the country's agenda to enhance her national security. Towards this end, the country established the National Agricultural Research Council to coordinate and link agricultural research and technology with industry.[viii] Through the application of biotechnology and experiments in genetically modified seedlings, the RSA has been able to increase agriculture's contributions to the country's Gross National Product (GNP) from about 1.4 per cent in 2006 to about 1. 9 per cent in 2009.[ix] This is comparable to an average of 2. 1 per cent by the European Union in the same year.[x] The application of technology in agriculture has improved food security in RSA, thus enhancing the country's national security. 5. Nigeria has a number of agencies devoted to promoting the country's technological development. Two of such agencies are the National Office for Technology Acquisition and Promotion (NOTAP) and the National Agency for Science and Engineering Infrastructure (NASENI).[xi] Both agencies have the goals of moving Nigeria to technological development.[xii] However, the efforts of the country to leverage on technology in enhancing her national security have not been encouraging. For instance, the Technology Achievement Index ranked Nigeria 66 in its list of marginalized countries in areas of technology creation and diffusion in 2009.[xiii] 6. Thus, Nigeria has to contend with a number of challenges arising from her inability to attain the desired level of technological development. Consequently, the country still expends a bulk of

her resources to import goods and services which could have been produced locally through effective adaptation of technology. The gaps in technological advancement could further constitute a major hindrance to the country's guest for development.[xiv] These have brought to the fore a number of socio-economic and other challenges which have impinged negatively on the country's national security. 7. It is in realisation of this development that the National Defence College (NDC), in its Block 4 package on Strategy, Statecraft and National Security, tasked Syndicate 6 to research on the topic, ' Technology and Nigerian National Security: Challenges and Prospects'. The outcome of this research forms the basis of this paper. The purpose of this paper, therefore, is to examine the state of technology in Nigeria and its effects on the country's national security. The paper will consider conceptual clarifications and give an overview of technology and Nigeria's national security. In addition, issues, effects, challenges and prospects of technology on Nigeria's national security will be discussed. Finally, strategies will be proffered to mitigate the identified challenges. This paper will consider the impact of technology on Nigeria's national security from 2003 to 2011 being the period that coincides with the last comprehensive review of the Science and Technology Policy. AIM 8. The aim of this paper is to discuss the effects of technology on Nigeria's national security with a view to making recommendations. CONCEPTUAL CLARIFICATION 9. The key variables in this paper are Technology as the independent variable and National Security as dependent variable. The variables will be conceptualized to get a clear understanding of the context in which they are used. Thereafter, the relationship between them will be established. TECHNOLOGY 10. Olunloyo

defines technology as information, techniques and tools with which people utilize the material resources of their environment to satisfy their needs.[xv] This definition considers the input and output of the subject but not explicit on the means of utilisation and is therefore not suitable for this paper. 11. Daniya described technology as the application of science and scientific methods to harness the forces and resources of nature in order to improve the quality of life of mankind.[xvi] Daniya's perception of technology is dynamic and central to security practices. It also provides the link between technology and security which could form the basis of establishing relationship between them.[xvii] It is therefore suitable in the context of this paper and is thus adopted. NATIONAL SECURITY 12. Loun defined national security as " the condition of freedom from external physical threat that a nation state enjoys.[xviii] This definition focuses more on physical protection of the state. It captures only the physical essence of national security without taking into consideration other socio-economic variables that equally impact on the well-being of the people. It is thus inadequate for this presentation. 13. In Adamu's words, "whether national or regional, security transcends the definitive rubric of military alert or valour. It extends to the interlocking realms of economic self-reliance, social cohesion and political stability. "[xix] To him, national security depends on people's needs, goals, and aspiration which have to be determined by production of goods and services, a process that requires technology. These services, If not provided, could put the security of a nation in danger. Adamu's definition provides for the basic elements that forms the content of national security and also links

adopted. RELATIONSHIP BETWEEN TECHNOLOGY AND NATIONAL SECURITY 14. The concept of technology implies the utilisation of knowledge and skill of man to convert material resources within his environment to develop, produce and deliver tangible and intangible products for the betterment of his life. National security on the other hand considers the stability of a nation from the standpoint of meeting citizens' needs, goals and aspirations through a production process that requires technology. 15. The attainment of national security requires technological support. Technology aids the development of knowledge, skills, capability and expertise that mobilises a nation's resources for optimum use to achieve national security. It therefore provides the opportunity for people to convert what they have to meet their desires and aspirations. National security on the other hand, provides the enabling atmosphere for technology and its instruments to develop and flourish. Furthermore, low level of technology would adversely affect production processes and inhibit the people's desire to meet their aspirations. This could also have negative repercussions on Nigeria's national security. There is therefore a strong direct relationship between technology and national security. OVERVIEW OF TECHNOLOGY AND NATIONAL SECURITY IN NIGERIA 16. Rudimentary technology in Nigeria predates the colonial era. It was exemplified by the use of bows and arrows for hunting as well as hoes, machetes and cutlasses for farming. The advent of colonialism brought in forms of technology akin to those in Europe. This was followed by the establishment of scientific institutions around the mid-60s during which National Research Council's were established.[xx] During this period, there were growing concerns to build up the country's S&T as part of a broader

project of national growth and self-sufficiency.[xxi] 17. The main focus of the policy was the achievement of self-reliance through the acquisition of technological knowhow, skills and material to defend the integrity and security of the nation.[xxii] The first attempt to formulate a S&T Policy for Nigeria dates back to 1983 when the Federal Government of Nigeria (FGN) constituted a committee to produce a draft S&T Policy for Nigeria. However, this was not actualized until 1986. 18. Also in the 1980s, the FGN established 3 research councils and institutes to foray into areas considered critical to Nigeria's technological development. These councils are the Medical Research Council of Nigeria (MRCN), Natural Sciences Research Council of Nigeria (NSRCN) and the Agricultural Research Institute of Nigeria (ARIN). [xxiii] This was followed in 1977 by the establishment of the National Science and Technology Development Agency and the National Science and Technology Fund (NSTF) which was founded in 1987 to fund research and development (R&D) in the country.[xxiv] 19. The FGN gave further impetus to Nigeria's industrial and technological development through the establishment of industries such as the Ajaokuta Iron and Steel Industry, the Machine Tools Industry at Osogbo and the establishment of refineries in Warri, Port Harcourt and Kaduna.[xxv] The policy focus, at this time, was transfer of technology by which Nigeria's foreign technical partners were to transfer their technological know-how to their Nigerian partners over time. 20. In 2003, the S&T Policy was reviewed in line with the technological needs of the country. This was followed in 2007 by the FGN's decision to establish the Federal Ministry of Science and Technology (FMST) as an autonomous body with the mission of anchoring the scientific and technological

development of the country.[xxvi] Later in May 2007, Nigeria joined the club of countries that forays into space technology when the country launched NigcomSat1 which was deorbited after 18 months.[xxvii] In March 2010, the Federal Executive Council approved a new National Information Technology (ICT) Policy for Nigeria.[xxviii] The implementation of the policy was enhanced in April 2010 with the establishment of the National Information Technology Development Agency (NITDA).[xxix] A new communication satellite, NigcomSat1-R, was also launched in 2011 as a replacement for the earlier one.[xxx] Furthermore, a new STI Policy was formulated in 2011 by the government to address 11 areas considered to be critical to Nigeria's technological development. These areas included ICT, biotechnology and space research, among others. 21. Despite the numerous government initiatives to reposition Nigeria for technological development, Nigeria has remained essentially backward in terms of socio-economic development with negative impact on national security. For instance, the United Nations Human Development Index ranked Nigeria as 159 in a survey of 178 countries as at 2009.[xxxi] The Deputy Director Technological Acquisition at the FMST, Dr AA Talabi, has blamed this development on a number of factors which include national science, technological and innovation policy, science and technology education and infrastructural support.[xxxii] These observations form part of the issues in technology and national security in Nigeria, which would need to be discussed. ISSUES IN TECHNOLOGY AND NATIONAL SECURITY IN NIGERIA 22. The issues involved in technology and national security in Nigeria include national science, technology and innovation policy, research and development and science and technology

education. Others are level of ICT penetration and infrastructural support. These issues are discussed hereunder. NATIONAL SCIENCE TECHNOLOGY AND INNOVATION POLICY 23. National Policy on Science and Technology was first formulated in 1986 and reviewed in 2003 in the light of new developments in science and technology in the country.[xxxiii] In 2011, a new Science, Technology and Innovation Policy (STI Policy) was formulated with the specific objective of facilitating the acquisition of knowledge to adapt, utilize, replicate and diffuse technologies and encourage the creation of indigenous knowledge and technology, among others.[xxxiv] This is in line with the mandate of the FMST as contained in Appendix 1. The FSMT has been striving to carry out its mandate albeit with minimal impact on national development and security. This calls for a thorough review of the STI Policy. 24. The key highlights of the Policy include R&D, Intellectual Property Rights (IPR), technology transfer and diffusion and Human Resource Development, among others.[xxxv] Unfortunately, Nigeria's STI Policy has suffered from the inability of the government to link innovation with industry such that technological innovations could impact on industry to enhance national security. Furthermore, Nigeria's STI Policy was never mainstreamed into other national policies like defence, energy and economy, among others. [xxxvi] 25. According to the Director Technology Promotion and Commercialization at NOTAP, Dr DM Ibrahim, the application of innovation to industry was about 10 per cent in 2009 and 15 per cent in 2010.[xxxvii] However, following the introduction of the new Policy in 2011, he projected an increase in innovation diffusion to at least 25 per cent by 2013.[xxxviii] According to him, this figure, though on the increase, was still inadequate to

support industrial development. RESEARCH AND DEVELOPMENT 26. The technological transformations of the past decades and the emergence of the global market place have raised the stakes for all countries to become technologically connected, to be able to create, adapt and use global technological innovations. A key way of doing this is through R&D which is the bedrock for STI. Global R&D is concentrated in the high-income industrialized countries as shown in Appendix 2.[xxxix] These countries, with 14 per cent of world population, accounted for 86 per cent of the nearly 2 million patent applications filed globally in 2008 and 85 per cent out of about a million scientific articles published worldwide in the same year, as confirmed by the World Intellectual Property Organisation.[xl] 27. As at 2011, Nigeria had 78 R&D institutions as contained in Appendix 3. Some of these institutions include National Space Research and Development Agency (NASRDA), National Biotechnology Development Agency (NABDA), Raw Materials Research and Development Council (RMRDC), Sheda Science and Technology Complex (SHETSTCO) and National Information Technology Development Agency (NITDA), among several others.[xli] 28. The character of contemporary STI demands massive investments in R&D in order to generate technological innovation which has become central to global competitiveness. As illustrated in Appendix 4, Nigeria's Gross Expenditure on R&D (GERD) in 2009 as a percentage of the GDP was a mere 0. 2 per cent. [xlii] This figure falls short of the proposal during the Lagos Plan of Action in 1980 and the Khartoum Declaration of the African Union (AU) in 2006 that recommended the R&D intensity target of 1.0 per cent for African countries. [xliii] Nigeria's GERD of 0. 2 per cent could, therefore, be said to be low when

compared to that of some other African countries like Malawi, South Africa and Uganda with 1. 70, 1. 05 and 1. 10 GERD respectively.[xliv] 29. Another dimension to the issue of R&D funding in Nigeria is the low level of private sector participation in R&D funding in the country. As shown in Appendix 5, R&D funding by the government alone constitute about 96 per cent of total R&D funding in the country as at 2009, while the private sector contributed about 0. 2 per cent.[xlv] This is unlike what obtains in South Africa, for instance, where private sector investment in R&D was above 2 per cent.[xlvi] The low level of private sector investment in R&D is, therefore, another drawback to R&D funding in the country. This suggests that funding of R&D is an issue in technology and national security in the country. SCIENCE AND TECHNOLOGY EDUCATION 30. A critical mass of skills is indispensable to technological development. Both creators and users of new technology need skills. Today's technology requires adaptability and skills to master the constant flow of new innovations. The foundation of such ability is science and technology education to develop cognitive skills in science and mathematics. Countries that have recorded giant strides in technological development are those that have placed high premium on technology education in particular and education at all levels in general. This is predicated on the premise that human resources are crucial to technological development. 31. As illustrated in Appendix 6, no African country made the list of the first 30 countries surveyed as part of the Year 2009 Trends in International Mathematics and Science Study (TIMSS) in terms of junior secondary education.[xlvii] The survey placed China at the top of the ladder with 598 points, while Republic of Korea came second with 597 points.

England came seventh with 513 while the USA came ninth with 508 points. [xlviii] The fact that no African country made the list is indicative of the low level of science and technology education in the continent, Nigeria inclusive. [xlix] 32. Consequently, there is a dearth of human capital in some critical areas of Nigeria's STI. This is not being helped by the fact that the FGN's education policy of ratio 60: 40 for Science and Non-science admission of students into the nation' tertiary institutions is largely being ignored.[I] According to Talabi, the trend of the percentage of science and engineering graduates coming out of Nigerian universities in the past 5 years reduced from about 35 per cent in 2006 to 32 percent in 2007, about 30. 5 per cent in 2008 and less than 30 per cent in 2009.[li] This trend would need to be reversed if the country is to develop the human capacity for technological development. LEVEL OF INFORMATION AND COMMUNICATIONS TECHNOLGY PENETRATION 33. Another key issue in technology and national security in Nigeria is the level of ICT penetration in the country. For more than a decade, ICT has been attributed a key role in technological development. It increases efficiency, provides access to new markets and services and create new opportunities for income generation. There are also the growth of ICT products and services which impacted on governance, accountability, creativity and acquisition of problem-solving skills. The acquisition and diffusion of ICT knowledge is thus a key pre-requisite of technology and national security in the continent. 34. As illustrated in Appendix 7, North America led the world in terms of ICT penetration as at March 2011 with the continent having over 272 million subscribers and a mobile penetration rate of over 78 per cent.[lii] This figure is relatively higher when compared with

58 per cent in Europe, 23 per cent in Asia, while Africa had the lowest level of ICT penetration of barely 11 per cent.[liii] 35. In the case of Nigeria, the contribution of ICT to Nigeria's Gross Domestic Product (GDP) has been on the increase in recent years moving up from 0. 2 per cent in 1999, to 0. 8 per cent in 2003 and about 1. 9 per cent in 2007, while the country's internet penetration rate for 2010 stands at 28. 3 per cent as illustrated in Appendix 8.[liv] This increase has been attributed to the growth in mobile telecommunication in the country. However, the country's ICT penetration rate of 28. 3 per cent, though on the right track, is still inadequate to support her technological growth. This underscores the importance of ICT penetration as an issue in technology and national security in Nigeria. INFRASTRUCTURAL SUPPORT 36. Infrastructural support is a necessary requirement for technological development. In Nigeria, the critical infrastructure essential for technological development include foundries, versatile iron and steel companies, rolling and extracting mills among others. These essential infrastructure are either totally missing or are in such bad state that they cannot serve as the engine room for Nigeria's technological development.[lv] The Director Engineering Infrastructure at NASENI, Dr Haruna, put the engineering infrastructural support available for Nigeria's technological development as being less than 14 per cent as at 2008, 18 per cent as at 2009 and about 20 per cent as at 2010.[lvi] He attributed the marginal increase recorded to the activities of NASENI, though he observed that this is still too low to support any worthwhile technological development. 37. In addition, the state of social infrastructure like electricity and roads is poor. As noted by Sambo, Nigeria's per capita electricity

consumption which is 38 watts per person is 4 times less than the African average and about 19 times less than the world average.[lvii] These infrastructures are the pre-requisite for any meaningful application of technology for the enhancement of technology. This has been responsible for the low employment rate and the dearth of social facilities for the welfare of the people. Thus Nigeria's infrastructural support is a major issue in technology for national security. Despite the issues raised, the application of technology has had some effects on national security. These are subsequently discussed. EFFECTS OF TECHNOLOGY ON NIGERIA'S NATIONAL SECURITY 38. Technology has some effects on Nigeria's national security. The effects can be viewed within the context of food, political, societal and environmental security. These are discussed below. FOOD SECURITY 39. One of the objectives of the Millennium Development Goals (MDG) is to reduce hunger and poverty by half, by the year 2015. Agriculture has been identified as a strategic sector where the application of technology could assist the country in achieving a broad based objective of economic growth. Areas in which application of technology has led to improvement in agriculture include crops, livestock and fisheries production. For instance, scientists in research institutes have developed improved varieties of different local arable crops like cow peas, soya beans, cassava and others using improved agricultural mechanization technologies. 40. As illustrated in Appendix 9, the application of technology through mechanization has improved areas under cultivation by a single farmer from 1-5 hectares to between 10 - 100 hectares.[lviii] In terms of output, government's sustained campaign on mechanization has led to increase in cassava production from

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72, 000 mt in 2006 to 120, 000 mt in 2010, making Nigeria the leading producer of cassava in the world.[lix] Similarly, the use of satellite technology through NigcomSat 1 has led to increased production of rice and maize with rice production increasing from 24, 000 mt to 120, 000 mt as at 2012, as shown in Appendix 10. The application of technology in agriculture has thus led to increase in quantity and quality of agricultural yields, thereby impacting on the country's food security. POLITICAL SECURITY 41. Since the return to democratic governance in 1999, the conduct of elections in the country has remained largely problematic. Nigeria's electoral process has been associated with fraudulent practices as exemplified by the electoral violence that characterized the conduct of the 2003 and 2007 elections described as worst in order of declining quality since 1999.[lx] The contributions of technology to Nigeria's political security could, therefore, be assessed from the aspect of the use of Direct Data Capture (DDC) machine by the Independent National Electoral Commission (INEC) during the 2011 general elections in the country. 42. A DDC machine is made up of a laptop computer, a fingerprint scanner, a high resolution camera, a back-up power pack and an integrated printer that produce high quality voters cards.[lxi] The DDC machines were deployed to eliminate double and fictitious registration with a view to promoting free and fair elections. A total of 120, 000 sets of machines were deployed by INEC for the 2011 elections.[lxii] 43. The deployment of the DDC machines improved the credibility of the 2011 elections when compared with the 2003 and 2007 elections as cases of multiple registrations were greatly reduced. Among the long list of external observers that adjudged the 2011 elections as credible was the

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Commonwealth Secretariat. In its report released in London after the elections, the Commonwealth said, " In the event, notwithstanding the postponement of the April 2 National Assembly elections and persistent logistical and organisational deficiencies, and some serious security incidents during the campaign and on the eve of the elections, the 2011 elections in Nigeria, by and large, met the national, regional and international standards for democratic elections". [Ixiii] The application of technology by way of the DDC machines, therefore, promotes political security and by extension national security in Nigeria. SOCIAL SECURITY 44. The application of technology in social security could be viewed from the perspective of the introduction of GSM services in the country. This has led to an exponential increase in the number of telephone lines in Nigeria. As illustrated in Appendix 10, the number of telephone lines in Nigeria increased from less than 900, 000 in 2001 to about 40 million in 2007 and above 74 million as at end of 2009.[lxiv] The introduction of GSM has made to Nigerians to be more knowledgeable and armed with the necessary awareness and orientation which could enhance national security. The effect also extends to increase in the use of the social media such as face book, Twitter, YouTube and other Internet applications.[Ixv] GSM usage has thus brought about an increase in the level of social awareness and improvement in level of social interaction among the people. This impacted positively on Nigeria's national security. 45. There is, however, a negative dimension to the societal effect of the GSM technology. The rise in GSM usage, for instance, has led to increases in cases of cybercrime and other Internet based transnational crimes. This has given the country a negative image. Technology is also aiding act of terrorism in

Nigeria as terrorists are known to detonate bombs through the use of GSM phones. Uncontrolled use of the social media could also lead to situations whereby mischievous elements use it to mobilize people against the government as was witnessed during the riot against deregulation crisis in the country. However, despite its possible negative use, the application of technology offers more advantages such as increasing the level of social interaction among the people thereby enhancing social security. ENVIROMENTAL SECURITY 46. Environmental security has become integral to national security since the end of the Cold War. It denotes the prevention of threats triggered by environmental factors and trends. The effect of technology on environmental security could be viewed from the deployment of NigeriaSat-1 on flood vulnerability assessment tasks. The project covers the mapping of Shiroro Dam, Katsina Ala River Basin, Lake Chad Basin and Kainji Lake. Data from the satellite enables stakeholders in the water resources sector to prevent flooding and collapse of dams.[lxvi] 47. Furthermore, the satellites are used to monitors gully erosion in the South East and provide early warning on desertification in the northern arid zone. [lxvii] The use of NigcomSat-1 has, therefore, helped in predicting environmental problems, protecting the environment against flooding and other cases of environmental degradation as well as disaster alert and proactive actions. This has impacted positively on Nigeria's national security. Inspite of the above, there are still a number of challenges militating against the application of technology in national security. These are discussed hereunder. CHALLENGES TO TECHNOLOGY AND NATIONAL SECURITY IN NIGERIA 48. Nigeria's efforts at benefitting maximally from the application of

technology in national security have been hindered by some challenges. These challenges include lack of linkage between innovation and industry, inadequate funding of R&D, dearth of human capital, low level of ICT penetration and inadequate technology supporting infrastructure. These are discussed hereunder. LACK OF LINKAGE BETWEEN INNOVATION AND INDUSTRY 49. Nigerian research institutes and universities appear to be providing inadequate scientific and research products and innovations to industry. They have been conducting researches and publishing findings, which are being stored away. These findings have not been translated into the development of new products and processes that could impact on economic development. One important factor in this regard is the absence of institutional arrangements to nurture the links between universities, research institutes and industry. Existing approaches for linking research with private enterprise are characterized by methods and practices that are not systematic and holistic.[lxviii] 50. Consequently, strategic ties with university research are too often overridden by technology transfer options based simply on transferring technologies, innovations and knowledge from other countries to the local industries.[lxix] However, the foreign innovations are sometimes difficult to apply in the country due to lack of local domestication of the ideas. The ultimate loser is the domestic economy and society in terms of lost opportunities to harness local scientific resources and technological innovations for sustainable technological development. Therefore, lack of linkage between innovation and industry is a drawback to Nigeria's technological development, with negative consequences for national security. INADEQUATE FUNDING OF RESEARCH & DEVELOPMENT 51.

Another challenge for development of science and technology in Nigeria is the scant attention paid to R&D. A good number of research institutions in Nigeria are not adequately funded. This trend is caused by scarce resources which has to be shared between R&D and other competing socio-economic needs of the society such as provision of water and basic health care, amongst others. The result has been inadequate resources by universities and research institutes in Nigeria to effectively harness advances in global scientific research to innovate and advance the frontiers of technology for the country's development and national security.[Ixx] 52. Nigeria's R&D expenditure in 2010, for instance, is less than One hundred million United States Dollars (\$100, 000, 000. 00).[lxxi] This is less than 1 per cent of the country's GDP. As a result, Nigeria was not ranked among the top 72 countries in research and development for 2010.[Ixxii] This figure is reflective of total R&D expenditure of all African countries in that year. Ebun Davies argues that " this is unlike the level of funding for science and technology in the developed countries where allocations to scientific research range from 2 to 3 per cent of the GDP".[lxxiii] This has resulted in low level of technological development in the country. Inadequate funding of R&D, therefore, hinders the effective application of technology in enhancing Nigeria's national security. DEARTH OF HUMAN CAPITAL 53. Advances in science and technology have been key sources of productivity, innovation and economic growth. Closely related to advances in science and technology is the quality of human capital available to drive technological advances. Presently, most Nigerian tertiary institutions are more biased to producing arts and social science graduates at the expense of core science and

engineering fields.[lxxiv] This could be attributed to the capital intensive nature of research endeavours and courses. Consequently, there exists a dearth of manpower in some critical areas of STI in Nigeria. Furthermore, Nigerian institutions that train engineers, technologists, and technicians lack adequate equipment for the teaching of science and technology.[lxxv] This affects the quality of human resources for technology that are produced from these institutions. 54. Oryem-Origa indicated that only 40% of Institutions of Higher Education in Nigeria have laboratory or workshop space for technical education programmes.[lxxvi] As a result, the institutions produce insufficient and ill-prepared technical education graduates necessary for driving the technological development of the nation. The inadequate teaching, laboratory and workshop facilities have contributed to the low quantity and quality of technical education graduates in Nigeria.[lxxvii] Therefore, it has been difficult for the large numbers of universities, polytechnics and colleges of technology in Nigeria to develop the required human capacity needed to drive the nation's quest for technological development. Dearth of human capital is thus another hindrance to the effective application of technology in enhancing Nigeria's national security. LOW LEVEL OF INFORMATION AND COMMUNICATIONS TECHNOLOGY PENETRATION 55. The level of ICT penetration in Africa is still relatively low when compared to Europe and the Americas. The 2011 Internet penetration rate shows that Africa has the least with 11. 4 per cent, compared to the global average of 28. 4 per cent.[lxxviii] The inability of African countries to make maximum use of the potentials in ICT is denying most of the countries the advantages of the network age which is fast replacing the industrial age.

Africa is thus facing the grim reality of being left behind as the rest of the world forges ahead into an era, which is knowledge and ICT driven. Nigeria, like most other African countries has taken some steps to correct this situation through policies such as the introduction of GSM technology and the formulation of a National ICT Policy 2010. These steps, however, have remained largely inadequate to bridge the digital divide and jumpstart the country's technological development. The low level of ICT penetration is, therefore, a major constraint militating against Nigeria's technological development with negative impact on national security. INADEQUATE **TECHNOLOGY SUPPORTING INFRASTRUCTURE 56.** Another challenge militating against technological development is inadequate technology supporting infrastructure like foundries, versatile iron and steel industries, rolling mills, extracting mills etc. Although there are a number of these industries available in the country, most of them have either packed up or are in poor shape to serve as engine room for Nigeria's technological development. Other areas of critical infrastructural deficiency include poor conditions of roads, rail, and air transport systems and inadequate water supply.[lxxix] 57. Another key infrastructural deficiency is erratic energy and power supply. Nigeria has been flaring gas from oil wells for over 40 years without the country being able to effectively harness it to support the country's energy needs.[lxxx] It has abundant deposits of coal, yet the PHCN cannot supply electricity to Nigeria.[Ixxxi] Hence, the lack of energy to power industries and other production processes make it difficult to harness the dividends of technology. The lack of the required infrastructure has hindered the rapid development of Nigeria's technological capabilities to the

detriment of national security. The above challenges notwithstanding, there are still a number of prospects for the application of technology in enhancing national security. These are discussed hereunder. PROSPECTS OF TECHNOLOGY FOR NATIONAL SECURITY IN NIGERIA 58. Inspite of the challenges of technology to Nigeria's national security, there are still some prospects. Some of the prospects include the recently launched Nigerian Communications Satellite, government's efforts to establish a national data bank and the determination of government to apply technology in the implementation of the vision 20: 2020 programme. THE NIGERIAN COMMUNICATION SATELITTE 59. The launching of the Nigerian Communication Satellite, NigcomSat 1-R, in Xichang, China in 2011 presents a major prospect in the application of technology in enhancing Nigeria's national security. The 2011 launch was the second in the series following the first experiment carried out in 2008 but which had to be deorbited after 18 months. It is estimated that the project would save the country about One Billion United States Dollars (\$1, 000, 000. 00) annually from the use of bandwidth for GSM communications, cable television, among others. 60. Already, NigcomSat 1-R is assisting in the cadastral mapping of areas of mineral deposits in Nigeria and the monitoring of mining activities at different mining sites. The information has enabled FGN to support smallscale mining in the country and revenue projection made from estimates of mineral deposits in different locations. The NigcomSat 1-R has also provided spatial information to relevant stakeholders in the health sector on the areas that are potentially vulnerable to malaria, sleeping sickness, river blindness and guinea worm. With the launching of NigcomSat 1-R, Nigeria stands to

benefit in several ways. The application of NigcomSat 1-R is thus another prospect in the allocation of technology in enhancing Nigeria's national security. GOVERNMENT'S COMMITMENT TO APPLY TECHNOLOGY IN ESTABLISHMENT OF A NATIONAL DATA BANK 61. The FGN has been leveraging on technology in its efforts to establish a national data bank with a view to enhancing Nigeria's national security. The data base is required to assist security forces in the investigation of criminal activities with a view to ascertaining the identity of the perpetrators. One important step in this regard was the sim card registration exercise conducted in 2011during which subscribers to GSM networks were made to provide bio-data about themselves 62. Government also took another step in this direction when it began installing CCTV cameras at strategic locations in the Abuja metropolis. The project, which is ongoing, is expected to be extended to other major towns and cities across the country. The Federal Road Safety Corps also recently initiated a vehicle registration data base which is also geared towards the same purpose. These numerous steps illustrate the determination of government to use technology in executing its bio-data initiative. Government's determination to apply technology in its efforts to establish a national data bank constitutes another prospect for the application of technology in enhancing Nigeria's national security. GOVERNMENT'S DETERMINATION TO APPLY TECHNOLOGY IN THE IMPLEMENTATION OF ITS VISION 20: 2020 PROGRAMME 63. Part of the FGN's implementation programme for the Vision 20: 2020 includes the

NTWG-STI has the mandate to produce an STI Plan as part of the input to the

establishment of National Technical Working Group (NTWG) on STI. The

blue print that would lead Nigeria to be among the top 20 economies of the world by Year 2020. The Group drew up 9 targets which include the establishment of 3 technology centres and R&D laboratories and developing technology for converting at least 25 per cent of crude oil and gas produced in Nigeria to other by-products like paraffin wax and asphalt. 64. The NTWG-STI also proposed that the FGN could seek strong international cooperation for the acquisition of technological know-how in high-tech fields, among others. This determination of the FGN to apply technology in the implementation of its Vision 20: 20: 20 programme is, therefore, another prospect in the application of technology in enhancing Nigeria's national security. Furthermore, there is hope that the underlisted strategies would help to mitigate the challenges of technology and national security in Nigeria. STRATEGIES TO MITIGATE THE CHALLENGES OF TECHNOLOGY ON NATIONAL SECURITY IN NIGERIA 65. Some strategies that could mitigate the challenges of technology to Nigeria's national security are formulation of a National Technological Advancement Master Plan (NTAMP), increased private sector participation in funding of technology and innovation, human capacity development, improvements in the application of ICT and improvement of infrastructure. These are subsequently discussed. FORMULATION OF A NATIONAL TECHNOLOGICAL ADVANCEMENT MASTER PLAN 66. The FGN could formulate a National Technological Advancement Master Plan (NTAMP) to jump start Nigeria's technological development. This is with a view to addressing the issue of linkage between innovation and industry and other issues arising from the country's technological backwardness. The NTAMP could include a comprehensive road map which could incorporate inputs

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from the NTWG-STI and harnessing these with existing indigenous technology and innovations from the country's numerous research institutes and centres. 67. The NTAMP could also include the establishment of science and technology parks in various parts of the country based on the existing local technological capacity and industries targeted to benefit from the arrangement. The FGN could also encourage private sector participation by granting them 100 per cent tax holidays for at least 3 years while experimenting with innovations from NTAMP. Definite milestones for measuring progress could also be incorporated into the Master Plan. These efforts would help to develop the indigenous technology required to facilitate rapid industrial development, which is required for promoting national security. Policy framework for NTAMP could be worked out such that the Master Plan could commence by 2013. INCREASED PRIVATE SECTOR PARTICIPATION IN FUNDING OF TECHNOLOGY AND INNOVATION 68. The FGN could encourage the Organised Private Sector (OPS), comprising of the Manufacturers Association of Nigeria (MAN), the Nigerian Association of Chambers of Commerce, Industry, Mines and Agriculture (NACIMMA) and other stake holders in the private sector to increase the level of collaboration with the government in the funding of technology and innovation in the country. Government could do this by encouraging the OPS to set up a technology foundation which could be funded through the setting aside of a minimum of one per cent of their profit on yearly basis for funding R&D and other critical aspects of technology and innovation in the country. 69. The fund could serve to compliment government funding of technology and innovation in line with practices in other advanced countries like USA, Japan

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and India, where the private sector is playing a key role in funding of technological development. Government could encourage this private initiative by granting waivers in custom duties and other forms of patronage to multinational corporations to participate in the programme. Additional funding could come through contributions from Non-Governmental Organisations (NGOs) and donor agencies devoted to promoting technological development. Consultations between the FGN and the private sector on this initiative could commence by First Quarter 2013 so that this new funding arrangement could become operational by 2014. HUMAN CAPACITY DEVELOPMENT 70. Government could address the problem of dearth of human capital by utilising some graduates of the Petroleum Technology Development Fund (PTDF) Overseas Scholarship Scheme in critical STI areas. The scheme was designed to promote indigenous technology development through the granting of scholarship for recipients up to doctorate level. Since its inception in 2010, the scheme has trained 1, 800 students at master's degree level and 250 at the doctorate degree level. Most of them are engaged by oil companies as self employed. 71. Graduates of the scheme could be attached to the various research centres as part of an internship programme for a period of at least 2 years after graduation. This would serve as source of specialized human capacity to fill the gap currently being experienced at the research centres. The implementation of this strategy could start from the 2012/2013 Academic Session. IMPROVEMENTS IN THE APPLICATION OF INFORMATION COMMUNICATION TECHNOLOGY 72. The FGN could take measures to improve the level of ICT penetration in the country. These measures could include the resuscitation

of the Computer for All Nigerians Initiative (CANI) launched by the former Obasanjo administration in July 2006. Under the CANI, all Nigerians in public employment could purchase Nigerian assembled personal computers at lower rates under a microfinance scheme supported by the government. 73. Other measures include implementation of compatible standards through Galaxy Backbone (GBB) for the networking of government departments so that they could share data, information and reporting online. Government could also make provision for adequate ICT infrastructure like computers with Internet access at the different tiers of education to aid learning. Thus, the resuscitation of the CANI initiative and deployment of appropriate ICT systems and solutions would enhance national security. Preparations for this initiative could commence immediately so that implementation of the new ICT scheme could commence by 2013. IMPROVEMENT OF INFRASTRUCTURE 74. The FGN could accelerate the pace of infrastructural development of the country in such areas as power, transportation and water supply. In this regard, implementation of the ongoing power sector reform would need to be accelerated so as to ensure constant power supply in the country at the shortest possible time. Furthermore, efforts to rehabilitate the major road networks in the country and the rehabilitation of rail transport would need to be fervently pursued. These actions would mitigate the effects of inadequate technology supporting infrastructure thus enhancing national security. Government's efforts to fast track infrastructural development especially in the power sector and other key areas would need to the implemented from 2014 with a view to meeting the timeline of the Vision 20: 2020. CONCLUSION 75. This paper examined the effects of technology on Nigeria's

national security. The key issues which impact on technology and national security are STI Policy, R&D, science and technology education, level of ICT penetration and infrastructural support. Technology has, however some effects on Nigeria's national security especially in enhancing the quantity and quality of agricultural yields and promoting political development through reduction in levels of electoral malpractices. Others include enhancing the level of social interaction among Nigerians and the protection of the environment against flooding and other environmental degradation. The negative effect has to do with its application for cyber crimes and negative use of the social media. 76. However, the effective application of technology to Nigeria's national security is being hindered by a number of challenges. These includes weak link between innovation and industry which has resulted in slow diffusion of innovation to industry and inadequate funding of R&D which has impacted on the ability of universities and research centres to conduct research. Other hindrances include dearth of human capital in critical areas of STI which has created deficiencies in the human capacity to drive technology and innovation and the low level of ICT penetration which has created a digital divide between Nigeria and the rest of the advanced world. 77. Policy framework for this could be worked out such that the Master Plan could commence by 2013. The FGN could encourage increased private sector participation in the funding of technology and innovation. Consultation with the OPS on this initiative could commence by 2013 so that the increased private funding could commence by 2014. The FGN could attach some of the Graduates of the PTDF Overseas Graduate Scheme to critical research centres on internship. This could start from the

2012/2013 Academic Session. The FGN could improve the level of ICT penetration in the country by taking measures to resuscitate CANI, among other steps. This new ICT scheme could commence by 2013. The FGN could also take steps to fast track the infrastructural development of the country from 2014. RECOMMENDATIONS 78. It is recommended that the FGN should: a. Formulate the NTAMP by 2013. b. Encourage increased private sector funding of technology and innovation by 2014. c. Attach graduates of PTDF Overseas Scholarship Scheme to critical STI areas from the 2012/2013 academic session. d. Resuscitate the CANI and improve ICT penetration in Nigeria by 2013. e. Fast track power sector infrastructural development in the country by 2014. NOTES ------ [i]. G Clark, " The Secret History of the Industrial Revolution", 16 Sep 01, (21 Jan 12). [ii]. JA Amos, National Security: The International Setting, (America: The John Hopkins University Press, 1999), p. 7. [iii]. Ibid. [iv]. O Nnoli, National Security in Africa: A Radical Perspective (Enugu: Snaap Press, 2006), p. 17. [v]. A Smith, Actionable Indicators and Countermeasures Project, 27 May 11, (20 Jan 12). [vi]. Ibid. [vii]. Ibid. [viii]. T Didiza, The Strategic Plan for South African Agriculture, 30 Apr 10 (14 Jan 12). [ix]. Ibid. [x]. Ibid. [xi]. AA Talabi, Deputy Director Technology Acquisition Federal Ministry of Science and Technology interviewed " On State of Science and Technology in Nigeria" on 13 Jan 12 at the Federal Secretariat Abuja. [xii]. Ibid. [xiii]. M Desai, et al, " Measuring the Technology Achievement of Nations and the Capacity to Participate in the Network Age", Journal of Human Development, Vol. 3, No 1, (2002), p. 12. [xiv]. Ibid. [xv]. | Wirtz, " A New Agenda for Security and Strategy" in J Baylis, Z Wirts, E Cohen and CS Gray, Strategy in the Contemporary World: An

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