# DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY: THE ARMED FORCES OF NIGERIA IN PERSPECTIVE

## INTRODUCTION

1.      Since the turn of the Twenty First Century, the world has been in a state of rapid evolution and proliferation of technologies, driven largely by the Commercial Sector. Indeed, one could actually say that the world is witnessing a renewed arms race, with the principal focus being on the development and application of modern technology, as global military powers strive to outpace their competitors. This acceleration of the rate of change is shaping the direction of society, industries and the military. Novel technologies such as AI, quantum computing, internet of military things, hypersonic air vehicles, loitering munitions, synthetic media, robotics, nano-technology and autonomous munitions are disrupting the way things are done. The wars in Ukraine and the middle East have witnessed the innovative development and application of modern technology. Keeping abreast with the development and application of modern technology is imperative for society and for any serious military organization.

2.      The development and application of modern technology refer to frameworks that engender the incubation of innovations and their production for use. It implies the advancement of concepts and their induction into usage by beneficiaries. It is dependent on the quality of the population and the intellectual progression of a nation. Undoubtedly, the development and application of modern technology improves the technological base of a nation and affect all segments of society including the armed forces. Hence the need for armed forces to the educated on technological developments; this is even more so with the high rate of innovation in the world.

3.      There are indications that the ongoing rapid changes in technology pose a veritable threat to the traditional sources of military advantage erstwhile the preserve of global powers. Due to proliferation and miniaturization, the development and

application of modern technologies engender entirely new capabilities that were once the exclusive domain of a few developed states or corporations. Thus, developing nations have the opportunity to progress and apply modern technology for the benefit of their armed forces. It is worthy to note that technology may not necessarily win a war but it would lessen casualties on the side that is able to develop and apply the more modern technology. Accordingly, many militaries increasingly aspire for technological superiority, within the limits of economic realities, to ensure dominance in conflict

4.    In the Brazilian armed forces, the development and application of modern technology has brought about improvements in the quality of training of its personnel as well as the lethality of its services. In this regard, the Brazilian armed forces embarked on strategic projects that entailed the development and application of modern technology to improve their operational efficiency. The objectives included the strengthening of their Defence Industrial Base, developing highly trained professionals and reducing foreign dependency. This initiative was responsible for the creation of more than 60,000 direct jobs, accounting for 4% of the Brazilian Gross Domestic Product and moving about R$ 200 billion into the economy. The projects include a Geostationary Satellite for Defence and Strategic Communications to provide secure communications for the Brazilian armed forces, a submarine for the navy, armoured vehicles for the army as well as helicopters and a transport aircraft for the air force. The projects are being implemented by 125 local industries such that it enhances the indigenous capacity for the development and application of modern technology for the Brazilian armed forces.

5.    The Republic of South Africa has a history of the development and application of modern technology for her armed forces. Their 2023 White Paper of Defence seeks to maintain an efficient defence industry that can address the needs their armed forces. This is by ensuring that their armed forces are abreast of developments in defence

technology and other relevant technologies required in developing, manufacturing and supporting complex defence systems. Numerous cutting-edge technologies and many competitive products, in the fields of artillery, self-protection systems, mine-detection vehicles, secure communications, electronic warfare and radar systems, unmanned aerial vehicles and guided weapons are being applied in the South African military forces. Industries related to the development and application of modern technology have created about 2.1 million jobs, improved the well-being of citizens by about 5 per cent, with attendant positive impact on their armed forces. Moreover, the strategic focus on developing and applying modern technology contributed to increasing South Africa's Human Development Index (HDI) from 0.621 in 1990 to 0.665 in 2017. Accordingly, the South Africa's military has been bolstered by the development and application of technology in a diverse array of advanced weaponry; from the Valour class frigates to the G6 Rhino self-propelled howitzers, Umkhonto GBADS air defence system, and the recently established Defence Artificial Intelligence Research Unit.

6.      In Nigeria, the Federal Government of Nigeria (FGN), through the Federal Ministry of Science and Technology (FMST), took steps to engender the development and application of modern technology by its revised National Policy on Science, Technology and Innovation, 2022. The policy aims to encourage research and developmental efforts in new fields of science and technology with a view to fast tracking Nigeria's socio-economic development which has implications for the AFN. In the AFN, the DRDB is the institutional framework for the development and application of modern technology in the armed forces.  In addition, all the services have their research and development organizations which have made modest achievements such as the design and development of the Ezugwu MRAP, NNS ANDONI, NNS KARADUWA and the Tsaigumi UAV. Considering the Nigerian environment, a lot has been accomplished. However, and as always, there is a lot of room for improvement by way of the development and application of technology for the AFN.

7.      The appropriate policy, institutions, human capacity and infrastructure to develop and apply modern technology for the AFN are inadequate. The purpose of this lecture, therefore, is to proffer strategies for the enhanced development and application of modern technology for the AFN. Evidently, we cannot exhaustively cover this all-important subject matter in the time available for this lecture. Accordingly, my intervention merely seeks to sufficiently agitate our minds towards further constructive engagement in the subsequent interactive session.

## AIM

8.      The aim of this lecture is to discuss the development and application of modern technology as it affects the AFN.

## SCOPE

9.      In order to achieve the aim, the lecture will cover the following:

a.      Conceptual Clarifications on development, application and modern technology.

b.      Efforts of the AFN in developing and applying modern technology.

c.      Challenges limiting the development and application of modern technology by the AFN.

d.      Prospects for development and application of modern technology for the AFN.

e.      Strategies to enhance the development and application of modern technology for the AFN.

## CONCEPTUAL CLARIFICATIONS

10.     The key variables for our consideration in this lecture are; development and application and modern technology, with the AFN as a rider. For obvious reasons and to save the valued time of this esteemed audience, we shall assume a common understanding of what the AFN is, and rather focus on conceptualising the key variables.

By this token it should be accepted that the development and application of modern technology inherently translate into enhanced capabilities for the AFN. Accordingly, the variables will now be conceptualised and the relationship between them clearly established.

## DEVELOPMENT AND APPLICATION

11.     There does not exist a single, universally accepted, definition of the phrase 'development and application'. The word development is an abstract concept, the meaning of which is far more difficult to grasp than something tangible. One thing is clear though, the word 'development' refers to some kind of process of change that occurs over time. For the word application, it conveys the idea of usage of an item, either tangible or intangible. For today's purposes, we shall use my definition of the phrase development and application. We shall view it as "the progression of the conceptualization of an idea, establishing it and moving from being an abstraction to a functional product that can be used to bring about improvements in the performance of tasks".

## MODERN TECHNOLOGY

12.     There are a variety of perspectives to the phrase modern technology. It is contemporary and to this papers purpose let us consider the views of Aasif, A.N et al (2018) as well as Demirbaga K.K. (2024). Aasif, A.N et al (2018) posit that modern technology is the way of methods and tools that a society has created in order to make possible solutions of present problems and to provide essential demands for the community. This view captures elements of modern technology such as its being created to address difficulties in the society and thereby improve quality of life. However, their view is not elucidative enough and approaches the phrase from an undesirable communal perspective. The view of Aasif et al (2018) is therefore not suitable for this study and is thus not adopted.

13.     Atiananakofi (2023) considers modern technology to encompass the knowledge, tools, techniques, products and systems that improve the quality of human life including a broad spectrum of innovations, ranging from information technology and communication devices to biotechnology, renewable energy, and more. Atiananakofi's view on modern technology in broad and captures essential attributes such as knowledge, systems, products and innovation. It also embraces modern technology's positive impact on human life and by extension all facets of society including the military. This is sufficiently inclusive and in concordance with the focus of our discussion today, and it is therefore adopted.

## RELATIONSHIP BETWEEN DEVELOPEMNT AND APPPLICATION AND MODERN TECHNOLOGY

14.     The conceptualization of ideas is based on knowledge and can bring about new techniques, products and improvements in the quality of life. The ideas would necessarily have to be processed from an intangible state to tangible. Improvements in the quality of human life cannot happen without being conceptualized first and improvements require a process to become realities.  From the foregoing, increased development and application activities engenders modern technology, while a decline development and application activities would lead to a decline in the emergence modern technology. It therefore stands to reason that a direct relationship exists between development and application and modern technology.

15.     Having conceptualised the variables and established the relationship between them, we should next turn our attention to efforts of the AFN in the developing and applying modern technology.

## EFFORTS OF THE AFN IN DEVELOPING AND APPLYING MODREN TECHNOLOGY

16.     The AFN has for long recognised the importance of modern technology in its continuing quest to effectively secure the nation as well as her interests and critical assets. This is in recognition that the development and application of modern technology have always being a major factor in conflict. In the words of Alvin and Toffler (1995)

> *"Armies that could reach farther, hit harder, and get there faster usually won, while the range-restricted, less well-armed, and slower armies lost. For this reason, a vast amount of human creative effort has been poured into extending the range, increasing the fire power, and accelerating the speed of weapons and of armies."*

However, the development and application of modern technology in the military can be somewhat paradoxical; while the military mind may recognise the need for modern technology, it is often, by design and indoctrination, resistant to modern technology. Theo Farrell captures this sentiment in his book, "The Sources of Military Change" where he notes that;

> *Large bureaucracies (military included) are designed to produce routine, repetitive and orderly action: they prefer continuity not change...Military rigidity in dress and parade ground practice is suggestive of rigidity in military thought.*

This paradox was also captured by the military historian Norman Dixon in his book "On the Psychology of Military Incompetence", when he described the attitude of British Army generals to the emergence of tanks at the turn of the Twentieth Century thus:

> *Rather than recognise the potential of the tank, the army chiefs drew the conclusion that innovation and progress are inherently dangerous and therefore should be eschewed.*

The foregoing thoughts capture an inconvenient but inescapable truth with which we must come to terms in this discourse, for a meaningful consideration of the realities, opportunities and risks inherent in the development and application of modern technology for the AFN.

17.     We must accept that, despite our best efforts, some of which we shall examine subsequently, the development and application of modern technology in the AFN has been less than optimal. Meanwhile, in other militaries the development and application of modern technology continues without pause. At present, any rogue element can, for instance, acquire and weaponize commercial over-the-shelf drones to very devastating effect. The same can be done with IoT, AI, robotics, software, etc. Against this background, therefore, we must ask; what are the Services doing about being in sync with the development and application of modern technologies? In response, we shall see that there are indeed snippets of engagement all over, though a critical mass is yet to be attained in terms of optimally harnessing the development and application of modern technology for the AFN. Let us now discuss some of the efforts of the various Services, vis-à-vis the development and application of modern technology as it affects the AFN.

**NIGERIAN ARMY**

18.     The NA has developed a Land Forces Simulation Centre as well as the Cyber-Warfare Command, which hosts NA websites and protects the Service's IT resources from hostile elements. Also, several Corps, formations, Units and even individuals have been in the forefront of the development and application of modern technology in the NA. Notably among them are NAEME, NASEME, CED, NAE and NAS. Others are NASME, NACA, NAOC and Promto Microsystems Technologist Limited. The efforts of the various establishments in the development and application of modern technology are detailed as follows:

a.    **Medium Repair and Recovery Vehicle**.    The Medium Repair and Recovery Vehicle (MRRV) is one of the efforts from CED. The vehicle was conceptualized in a bid to have a recovery vehicle and also a mobile workshop. The vehicle is deployed in the NE theatre of operation and other theatres in the country.

b.    **Ezugwu MRAP**.    The Ezugwu MRAP is among the first set of Nigerian made MRAPs. The vehicle is capable of stopping 7.62mm rounds and other light weapons at close range.

c.    **Conversion of Scorpion APC Engine from Steyr to Cummins**. The Scorpion APC originally with Steyr engine was observed to have several mechanical issues due to ageing after long time usage and non-availability of the spares. After several R&D efforts, it was discovered that the Cummins engine could work on it properly without any issue. The modification had since been completed and the APC returned back to owner units.

d.    **Conversion of American MRAP Engines to Cummins**. The MRAPs donated to Nigeria by the American government in 2019 had several operational deficiencies due to the complexity of the engine and gearbox. The MRAPs could not be used for more than 6months in the theatre before they all packed up. After some research it was discovered that the Cummins engine could also work on it effectively.

e.    **Automatic Ammunition Counter**.    The Automatic Ammunition Counter (AAC) is a device used for counting small arms ammunitions with speed and accuracy. This has greatly conserved manpower that are used when there is need to issue out large quantities of ammunition.

f.      **Mobile Power Box**.      The Mobile Power Box (MPB) is a locally manufactured inverter for external or backup power supply. The appliance is deployed in the field for troops during operations and exercises.

g.      **Inverter Arc Welding Machine**.      The inverter arc welding machine is an effort by NASEME that seeks to have a welding machine that is capable of operation without power supply. This machine has been tested at several exhibitions and found to be reliable.

h.      **Unmanned Tactical Ground Vehicle (T)**.      The Unmanned Tactical Ground Vehicle (UTGV) tract is a robotic design that acts as a scout for troops in operations. It can go up to 20km ahead of troops and equally monitored from a screen on a workstation.

i.      **Unmanned Tactical Ground Vehicle (W)**.      The Unmanned Tactical Ground Vehicle (UTGW) wheel is a robotic design that acts as a scout for troops in operations. It can go up to 20km ahead of troops and equally monitored from a screen on a workstation.

j.      **Mobile Missile Launcher**.      The Mobile Missile Launcher (MML) is a tactical vehicle that is capable of launching a missile electronically.

k.      **Unmanned Gun Vehicle**.      The Unmanned Gun Vehicle (UGV) is a tactical vehicle where a gun mounted mechanically on a B vehicle is fired electrically unaided.

l.      **Multi Barrel Rocket Launcher**. The Multi Barrel Rocket Launcher (MBRL) is similar to the normal artillery MBRL but in this case the rockets are launched electrically from the top of a Hilux vehicle.

m.      **Claymore Mine**.      The claymore mine is an improvised explosive device that explodes in one direction.

n.     **Design and Manufacture of Prosthetics**.     The design and manufacture of prosthetics was borne out of the need to produce prosthetics for troops with amputated limbs or arms. This effort has gained a lot of recognition and could save the country some foreign exchange if mass produced.

o.     **Automatic Dishwasher**. The automatic dishwasher is a collaboration between HQ NACST and CED. It seeks to reduce the use of manpower in the process of dishwashing during big events and in the field where there is no time and men are committed.

p.     **PMTL 6901 and 7630**. The PMTL 6901 and 7630 are locally manufactured handheld radios. These radios are deployed for operations and have a range of 10 – 15km depending on the terrain.

## NIGERIAN NAVY

19.     As part of efforts towards the development and application of modern technology, the NN has incorporated elements of AI in some ship engine controls, alongside other embedded systems. In addition, the NN also applies AI and robotics in her underwater vehicles and the IoT is central in the NN's Maritime Domain Awareness (MDA) Infrastructure otherwise known as "Falcon Eye". It is also noteworthy that the "Falcon Eye" MDA also employs cloud computing, in its data storage and analysis systems. Other developments are:

a.     **Construction of a Thermal Desalination System.** The Navy has produced a Thermal Desalination System for purifying saltwater that mimics the natural water cycle through evaporation and condensation. The System has the capacity to produce 50 Litres of fresh water in 3hrs. Additionally, it utilizes heat from various sources like fossil fuels, solar thermal collectors, or industrial waste heat to boil seawater. The application of the Thermal desalination system on board ships would produce fresh water that could be used for drinking and

domestic purposes. Furthermore, the fresh water could also be used as a cooling medium for ship's propulsion system.

b.      **Production of Electrically Driven Outboard Engine.**      In a bid to develop a network of fast-charging stations for electric boats in major Naval Bases, seaport terminals and other key locations, the Navy produced an Electrical Driven Outboard Engine (EDOE). The EDOE has an electric motor in contrast with conventional outboard engines that use fossil diesel. It also offers a quieter, cleaner and more efficient alternative to traditional gasoline-powered engines and has an output power of 25 Horse Power that can power up to a 6 meters boat. Integrating the EDOE on NN boats could extend their range by providing alternative propulsion power while on patrol. Accordingly, the EDOE require network of fast-charging stations for electric boats in major NN Bases and Nigerian maritime environment.

c.      **Design of Ballistic Material.**      The Navy is currently designing ballistic materials for armour jackets. The materials used include sourced palm kernel, groundnut shells, fiber, and epoxy resin composite.  The design of the ballistic material would enhance the Navy's efforts towards indigenous capability and self-sufficiency.

d.      **Fabrication of Water Blasting machine.**      The Navy produced a water blasting machine which utilizes high water pressure jet to clean, cut, or scrape surfaces on board ships. In addition, the Machine offers an eco-friendly alternative to traditional sandblasting methods. It also has a closed loop system which recycles used water thereby minimizing water consumption and environmental impact. The water blasting machine would enhance cleaning of the ship hull and on-board equipment. It would also be used for removing deteriorated protective coating on board NN ships.

e.  **Construction of Acoustic Sound Detector.**  The Navy developed an Acoustic Sound Detector (ASD) capable of detecting, capturing and analysing sound waves from various sources in the environment using a highly sensitive microphones and acoustic sensors. The acquired sound data undergoes advanced signal processing algorithms like filtering, amplification, and spectral analysis. The construction of the ASD would enhance NN efforts geared towards technological acquisition and underwater detection operations. It would also boost sustainable development of own innovations in support of NN ships.

f.  **Naval Dockyard Activities.**  Some of the activities of the Unit are:

   (i)   Construction of SDB I, II and III.

   (ii)  Construction of SDB IV and V.

   (iii) Construction of 25-man Houseboat.

   (iv)  Construction of 500-ton Water and Fuel Self-Propelled Barges

   (v)   Fabrication of Ship and Engineering Structure and Equipment

   (vi)  Construction of 4000-Ton LPG Coastal Transportation Barge.

   (vii) Design and Construction of 6 x GRP Boats for the FMARD.

## NIGERIAN AIR FORCE

20.  The NAF has been in the business of the development and application of modern technology aimed at promoting self-reliance in aerospace, armament and artificial intelligence technologies to enhance NAF operations primarily using AFIT and the AFRDI. Utilising collaborations with credible agencies, organizations and institutions, there has a been a vibrant development and application of modern technology to the benefit of the NAF. Majority of the efforts not only provide solutions to immediate

problems but also develop the technical capacity of personnel. Accordingly, the NAF has saved huge sums of money by not having to contract some projects to foreign vendors as a result of the development and application of modern technology.

a. **Development of 7 tube x 70mm Rocket Launchers.** The Agusta 109P Hel fires 70mm rockets and a 12.7mm gun. There have been several instances when the 70mm rocket hung adversely affecting the mission. The frequent malfunction also damages the Rocket Launcher due to its fragile nature (as designed by the OEM). In order to overcome this challenge, the NAF carried out reverse engineering of the OEM FZ220 Rocket Launcher and produced a more rugged prototype. The launchers were released on 3 Feb 23 for the on-going operations. So far, the Rocket Launcher is performing optimally without any constraints.

b. **Batch Production of 30.1mm Rockets.** Batch production of qty 20 x 30.1mm rockets were recently completed and have since been issued to 271 NAF Det Birnin-Gwari. Qty 12 of the rockets have been used so far operationally. The rockets have proved decisive in the fight against insurgency. They helped in warding off an attempt to infiltrate 271 NAF Det's AOR.

c. **Development of 57 mm C-5 Rocket Prototype.** The NAF embarked on a reverse engineering of C-5 aircraft rockets with the objective of producing qty 10 x 57mm (Ni) rocket prototypes. So far, the first, second, third and fourth phases of the project which include the concept design, material analysis, production of all metallic/non-explosive components and filling of explosives and assembly have been completed. Live test firing was conducted and adjudged successful. This research is still ongoing to ascertain the suitably cost effective metallic/explosive materials for batch production.

d.      **Production and adaptation of 6 Tube 68mm SNEB Rocket Launcher on Agusta 109 Power Helicopter.**   The 6-tube 68mm SNEB rockets launcher produced locally by the NAF were recently adapted for use on the Agusta 109 Power Helicopters. This was due to the myriads of problems facing the OEM Fz-220 launchers. The adaptation has been completed and this enabled the helicopter fleet to fire 68mm SNEB rockets for operations.

e.      **18-Tube SNEB Rocket Launchers.**   The NAF has completed all testing process of qty 2 x 18-tube rocket launchers. The launchers were produced in close replica of the F4 rocket launchers for Alpha Jet aircraft. The rocket launchers passed all ground and airborne functionality tests and also passed 2 years storage stability tests. The NAF intends to consequently move on to batch production of the rocket launchers after 3 years stability test.

f.      **Production of Heat Shields for Alpha Jet.**   The consumable heat shields protective cones for use on the Alpha Jet aircraft were often imported from the Original Equipment Manufacturers. However, due to the closure of production line for Alpha Jet components, replenishment of consumable items such as heat shield was difficult. Following successful research, the NAF continues to produce the heat shield. Qty 5,500 have so far been produced within 3 batches of production.

g.      **Production of Tactical Gun Vehicles.**   The Tactical Gun Truck project was conceived in view of the need to improve the fire power of NAF Regiment for Base defence. Using a COTS Hilux, a lot of considerations were taken during the design phase to accommodate the excessive 23mm gun's recoil action. The gun mount allows manual and automated aiming. The NAF successfully produced 7 units of the tactical gun trucks and are currently deployed in operations.

h.      **Production of Blank Firing Adaptor for CAK 103 Gun.** The        NAF researched and has produced qty 250 x blank Firing Adaptors for CAK 103 assault rifle. This adaptor allows the automatic firing of the rifles using the non-lethal blank ammo for training purposes. Qty 250 x BFA have been have been released for regiment training.

i.      **Retrofitting of 68mm SNEB Rockets.**      The 68mm SNEB rockets being utilized by the Alpha Jet aircraft were failing and affected the combat operation of the aircraft. Accordingly, the NAF conducted the research and retrofitted qty 2,000 x SNEB rockets locally. The rockets have been released for operations.

j.      **Hexacopter Unmanned Aerial Vehicle.**      The Hexacopter UAV is a variant of the unmanned aerial vehicle with vertical take-off-and-landing capabilies and lots of other advantages over the fixed wing variant. The hexacopter was developed using locally available material saving foreign exchange. The Hexacopter was retrofitted with an electro-optical/Infra-red camera making it capable for day and night ISR operations. Presently, the NAF is making further modifications of the Hexacopter to a hybrid system with a view to improving the overall endurance and performance as well as the avionics system.

k.      **Tsaigumi Unmanned Aerial Vehicle**.      The Tsaigumi is a fixed wing UAV with a conventional body layout, H-tail with rear mounted engine designed and manufactured by the NAF. It is a reconnaissance system fitted with an electro-optical/Infra-red sensor payload capable for both day and night operations. The Tsaigumi is powered by a 3W 157CS /DA170 engine which uses PMS. It was developed in partnership with Messrs UAVision of Portugal with a design specification of 150km range.

l.      **Mugin Unmanned Aerial Vehicle**.      The Mugin is a trainer UAV with a wingspan of 3600mm and a length of 2488mm with a flight time of of 3hrs. It is a H-taill configuration with a rear mounted engine powered by PMS. The engine is a two stroke piston valve petrol aircraft engine with about 6.5ltrs of fuel capacity and engine rpm between 1600 to 7800rpm with a 20 x 12 to 23x8 two-blade propeller. It was reconfigured by the NAF to perform autonomous day and night missions. It has a max take-off-weight of 28kg with a landing distance of 70m. The NAF has since successfully test flown the Mugin aircraft with the autonomous capabilities to about 7km within the limitation of the test telemetry communications system at the Institute. With this the NAF has successfully developed the capacity to design and integrate a fully autonomous UAV indigenously.

m.      **Refurbishment of C-130 Aircraft Radome.**      The C-130 nose radome is a laminated plastic cone protruding forward of the normal contour of the fuselage nose. The radome is made of laminated fiberglass bonded with epoxy resin. The C-130H Aircraft Radomes usually gets damaged from external factors such as lightening, bird strikes, or strikes from FOD during taxing. In accordance with structural manual of the aircraft, the NAF successfully carried out repairs on qty 4 radomes damaged due to birds strikes.

n.      **Design of Precision Guided Munition**.      NAF developed a 40kg Precision Guided Munition prototype. The frame was produced and the guidance mechanism of the munition is pre-programmed autopilot system with control actions to the control surfaces for pitch, roll and yaw commands. The PGM design is presently undergoing a series of subsystems integration, tunings and subsequently, ground and airborne tests.

o.      **Some other projects**.      Some other projects worthy of mention are

i. Design and integration of tested autopilot system.

ii. Conceptualization of a VTOL UAV.

iii. Conceptualization of a UAV auto takeoff and landing algorithm.

iv Conceptualization of a hybrid Hexacopter UAV.

v Conceptualization of an AI-enabled remote weapon system

## CHALLENGES LIMITING THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY FOR THE ARMED FORCES OF NIGERIA

21. Some of the challenges limiting the development and application of modern technology for the AFN include; inadequacy of policy, non-compliance with funding scheme, insufficient training of personnel and infrastructure deficit. These challenges are expounded upon subsequently.

## INADEQUACY OF THE ENABLING POLICY FOR THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY

22. A policy framework is essential to facilitate the development and application of modern technology across the services. A sound policy would, among others, outline the measures for the building of capacity as well as collaboration with civilian organizations in the development and application of modern technology for the benefit of the AFN. The extant policy that addresses matters related to the development and application of modern technology in the AFN is the Research and Development Policy for the AFN issued by the Defence Headquarters in January 2019. The objective of the policy is to achieve modernisation and self-reliance through the utilisation of R&D products within and outside the AFN and it provides guidelines for general R&D activities in the AFN.

23. The Research and Development Policy acknowledges Executive Order 5 which seeks to improve local technology content in the equipment used by the AFN but it uses

the vague phrase "there shall be collaboration between civil and military R&D .....". While it is true that Nigeria's industrial capacity is weak, the aforementioned choice of words does not convey the importance of collaboration with private organizations and it is not explicit enough to encourage private sector collaboration as regards the development and application of modern technology. Private sector participation in defence brings in new technologies, capital, and management practices that can help to modernize the sector and improve its efficiency. The private sector must therefore be a significant player in the development and application of modern technology for the AFN. This inadequacy of the policy in relation to collaboration with civilian organizations has brought about gaps which pose a challenge affecting the development and application of modern technology for the AFN.

## NON-COMPLIANCE WITH SCHEME FOR FUNDING THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY

24.     Globally, adequate funding is a critical requirement in the development and application of modern technology. It is no coincidence that the nations with the most advanced Military Industrial capabilities also commit the highest level of financial resourcing to the critical R&D which drives innovation in indigenous defence production. The Research and Development Policy for the AFN specifies that there shall be a DRDB fund in which 0.1 percent of annual profits before tax of companies and enterprises shall be credited. It also says that funding for R&D shall be derived through FG appropriation. Furthermore, it states that the Defence sector shall set aside 15 percent of its annual budget for R&D in line with the NNDP 2017.  Sadly, this is not being complied with. All the efforts by the services towards the development and application of modern technology are being done from "savings". Thus, there are no designated funds to finance the few innovations that arise for even the production of hardware prototypes for field trials.  Accordingly, the non-compliance with the stipulated

funding scheme for R&D is a challenge for the development and application of modern technology in the AFN.

## INSUFFICIENT TRAINING OF PERSONNEL FOR THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY

25.     Human capacity is essential for the development and application of modern technology in the AFN. It is also worthy of note that the AFN must be knowledgeable buyers with regards to any technology acquired hence the significance of capacity development of personnel. Similarly, a certain level of intellectual capacity is necessary to drive the development and application of modern technology in the AFN. With regards to building of capacity of personnel, the Defence R&D policy states that the DRBD is to "encourage" the services to develop a pool of well-trained adequately motivated service personnel and specialist civilian staff to conduct R&D for the AFN. Considering how important the development and application of modern technology to an armed force, the use of the word "encourage" is inappropriate as all of the services have hardly heeded the encouragement. In the NAF, for example, her Policy on R&D does not expressly outline the guidelines for her personnel to develop capacity in the fields of technology. Worthy of note is that there is no deliberate programme, across the services, to improve the intellectual capacity of personnel along the lines that will facilitate the development and application of modern technology.

26.     Personnel with a minimum of a Master's degree in fields such Artificial Intelligence, Aerospace Engineering, Mechanical Engineering, Electronics Engineering, Automobile Engineering, Robotics, Hydrodynamics, Naval Architecture are needed in large numbers across the AFN to enable significant development and application of modern technology. The NAF, for example, has over the years developed substantial capacity in Aerospace Engineering which translated into the design and production of various series of UAVs. This development of capacity still continues but on a much lower scale. To attain significant development and application of modern technology, a critical

mass of well-trained personnel must be achieved by training a large number of personnel consistently across multiple disciplines. This is not being done in the NAF and same is true in the Army and Navy. Clearly then, there is the need for the NAF and indeed the AFN as a whole to engage in comprehensive capacity building in a variety of disciplines. The insufficient training of personnel in relevant fields is a challenge to the development and application of modern technology in the AFN.

## INFRASTRUCTURE DEFICIT FOR THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY

27.     Infrastructure plays an important role in the development and application of modern technology for the AFN and the range of infrastructure required varies. For instance, the infrastructure required for sustained UAV operations include hangars, runways, ground control resources and relay stations. For cyber-security, the required infrastructure includes a mix of switches, routers, firewall devices as well as software for intrusion detection and anti-malware. Additionally, the reliance of most emerging technologies such as IoT, AI, social media on internet, makes it essential to have easy access to broadband internet across the nation. Another major infrastructure requirement without which the development and application of technology would not thrive is electric power supply. Evidently, availability of infrastructure is a determinant to sustainable development and application of modern technology in the AFN. However, the problem with the development and application of modern technology in relation to AFN is due to Nigeria's infrastructure deficit.

28.     The deficit of enabling infrastructure is a challenge to the effective development and application of modern technology in the AFN. Nigeria's per capital power consumption is 141 kWh. This is low when compared with South Africa, Brazil and India with per capita power consumption of 3320 kWh, 2695 kWh and 1024 kWh respectively as at 2024 (World Energy Consumption, 2024). Hence, Nigeria's low

electricity utility is insufficient to adequately support the development and application of modern technology for the AFN. A similar trend can be observed across Nigeria's other stocks of technologically relevant infrastructure compared with other nations. Therefore, the deficit in infrastructure relevant to the development and application of modern technology is an impediment to their as relates to the AFN. Notwithstanding the identified challenges, there are some prospects for the development and application of modern technology for the AFN.

## PROSPECTS FOR ENHANCING THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY FOR THE ARMED FORCES OF NIGERIA

29.     There are prospects for improving the development and application of modern technology for the AFN. These are prospects as relates to areas such as AI, quantum computing, internet of military things, synthetic media, robotics, nano-technology and autonomous munitions. Some of the prospects are the establishment of the National Centre for AI and Robotics, as well as the National Digital Innovation and Entrepreneurship Policy.

## ESTABLISHMENT OF NATIONAL CENTRE FOR ARTIFICIAL INTELLIGENCE AND ROBOTICS

30.     The National Centre for AI and Robotics was commissioned on in Abuja on 13 November 2020. The Centre is to be a leading hub for the fostering of the development and application of modern technology towards preparing Nigeria for the Fourth Industrial Revolution. The Centre is equipped with a Digital Innovation Laboratory, Marketspace and Fabrication Laboratory, workspace for start-ups and training facilities. The intent is to provide opportunities for the incubation of talent and growth of innovative capacity in the critical areas for the development and application of modern technology needed for the Fourth Industrial Revolution.

31.     The facilities provided would offer a platform for young Nigerians to hone their talents in the emerging technologies, thereby deepening the knowledge pool and human capacity needed to drive the transformational application of such technologies. This would serve not only the interest of the AFN but also provide needed technical manpower for other relevant areas. Thus, the National Centre for AI and Robotics, if properly supported and judiciously utilised, offers good prospects for the development and application of modern technology by the AFN.

## NATIONAL DIGITAL INNOVATION AND ENTREPRENEURSHIP POLICY

32.     The National Digital Innovation and Entrepreneurship Policy is aimed at eradicating barriers hindering local innovations in digital technological fields. The goal of the Policy is to create an enabling environment for Innovation-Driven Enterprises (IDEs) to thrive in the country. This would in turn open up the vast potentials for job creation and revenue generation inherent in such enterprises, with commensurate positive impact on national development.

33.     The effective implementation of the Policy would create an IDE mind-set and corresponding skillset amongst the teeming Nigerian Youth, giving priority attention to local innovators. The consequent growth of IDEs in the country would spur competitiveness and further growth and diversity of the technically skilled manpower needed to drive the development and application of modern technology, with the AFN uniquely positioned to benefit from the human resource potentials. Thus, the National Digital Innovation and Entrepreneurship Policy, if properly implemented, holds good prospects for the development and application of modern technology by the AFN.

## STRATEGIES TO IMPROVE THE DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY BY THE ARMED FORCES OF NIGERIA

34.     Some of the strategies to improve the development and application of modern technology for the AFN include a review of the 2019 R&D policy, compliance with the

funding scheme, concerted human capacity development and increased investment in technology infrastructure. These strategies are expounded upon subsequently.

## REVIEW OF THE 2019 RESEARCH AND DEVELOPMENT POLICY

35.     The challenge of an inadequacy of the enabling policy for the development and application of technology could be mitigated by simply reviewing the policy. The objective of the review would be, among others, to have formal guidelines that would encourage the participation the private sector in the development and application of modern technology for the benefit of the AFN.   The review would facilitate the harnessing of private sector efficiency and talent for the development and application of modern technology for the AFN. The review would also seek to deepen the capacity of of the AFN to absorb new and emerging technologies.   In this regard, the Defence Headquarters (DHQ) could set up a committee to review the 2019 Research and Development Policy for the AFN by Third Quarter of 2025. The policy review process could be funded from DHQ resources. The Committee could submit its report by Fourth Quarter of 2025. The emerging technologies policy could be promulgated by First Quarter of 2026.

## COMPLIANCE WITH FUNDING SCHEME FOR DEVELOPMENT AND APPLICATION OF MODERN TECHNOLOGY

36.     The DHQ could show leadership by ensuring 15 percent of its annual budget is set aside for R&D purposes as outlined in the policy document. It could thereafter compel the services to do same then follow up by seeking the Presidency's backing for the setting aside for R&D of 0.1 percent of the annual profits before tax of companies and enterprises. To this end, the DHQ could organize a dedicated programme to pursue the realization of the aforementioned to enable funding for the development and application of modern technology for the AFN. The programme could commence by Third Quarter of 2025 and be funded from statutory appropriations for the Services.

## CONCERTED HUMAN CAPACITY BUILDING

37.     A concerted human capacity building programme across several disciplines in emerging technologies will mitigate the challenge of insufficient training of personnel. The objective would be to galvanise specialist institutions such as NDA, AFIT and the NAU Biu to systematically and progressively generate additional capacity for the AFN in relevant technology fields. Accordingly, more AFN personnel will have to be initially trained in foreign institutions to rapidly build instructional capacity. A two-pronged approach could be adopted as follows; training of personnel that have qualifications in technologies related fields. Secondly, the AFN would increase enlistment and recruitment of qualified professionals in the different fields of technology.

38.     The DHQ could direct the Service HQs to articulate a sustainable programme for building personnel capacity in fields of technology as well as give priority to qualified candidates who are certified in any field of emerging technologies during the Services enlistment and recruitment exercises for officers and airmen. The resources for enlistment and recruitment exercises are included in the Services statutory budget appropriations. Enlistment of personnel with sufficient knowledge in various fields of emerging technologies could begin by Third Quarter of 2025.

## INCREASED INVESTMENT IN TECHNOLOGY INFRASTRUCTURE

39.     Increased investment in technology infrastructure would mitigate the challenge of infrastructure deficit. The objective of this strategy is to ensure the availability and continuous upgrade of emerging technologies infrastructure towards improving the AFN. The DHQ could engage in advocacy through the Ministry of Defence (MOD) for increased budgetary provisions to the Services, dedicated to the development of the necessary infrastructure for promoting technology utilisation by the AFN.

40.     Funding for the advocacy could be drawn from DHQ budgetary provisions, while the resources for investment in technology infrastructure could be subsequently included in the Services' statutory appropriations as 5 percent of the total annual budget for a period of 4 years commencing with the 2027 budget. In the short term, DHQ could also approach the MOD for special intervention in the acquisition of the technology infrastructure by Second Quarter of 2025. Subsequently, the AFN could begin the increased investment in technology infrastructure from First Quarter 2027.

## **CONCLUSION**

41.     The AFN has for long recognised the importance of modern technology in its continuing quest to effectively secure the nation as well as her interests and critical assets. There is a shared understanding that the development and application of modern technology is in essence tantamount to improvements in the quality of the AFN. The NA has developed a Land Forces Simulation Centre as well as the Cyber-Warfare Command, which hosts NA websites and protects the Service's IT resources from hostile elements. Also, several Corps, formations, Units and even individuals have been in the forefront of the development and application of modern technology in the NA. Notably among them are NAEME, NASEME, CED, NAE and NAS. Others are NASME, NACA, NAOC and Promto Microsystems Technologist Limited.

42.     As part of efforts towards the development and application of modern technology, the NN has incorporated elements of AI in some ship engine controls, alongside other embedded systems. In addition, the NN also applies AI and robotics in her underwater vehicles and the IoT is central in the NN's Maritime Domain Awareness (MDA) Infrastructure otherwise known as "Falcon Eye". It is also noteworthy that the "Falcon Eye" MDA also employs cloud computing, in its data storage and analysis systems. The NAF has been in the business of the development and application of modern technology aimed at promoting self-reliance in aerospace, armament and artificial intelligence technologies to enhance NAF operations primarily using AFIT and the AFRDI. Utilising

collaborations with credible agencies, organizations and institutions, there has a been a vibrant development and application of modern technology to the benefit of the NAF. Majority of the efforts not only provide solutions to immediate problems but also a develop the technical capacity of personnel. Accordingly, the NAF has saved huge sums of money by not having to contract some projects to foreign vendors as a result of the development and application of modern technology.

43.     Some of the challenges limiting the development and application of modern technology for the AFN include; inadequacy of policy, non-compliance with funding scheme, insufficient training of personnel and infrastructure deficit. There are prospects for improving the development and application of modern technology for the AFN. These are prospects as relates to areas such as AI, quantum computing, internet of military things, synthetic media, robotics, nano-technology and autonomous munitions. Some of the prospects are the establishment of the National Centre for AI and Robotics, as well as the National Digital Innovation and Entrepreneurship Policy. Some of the strategies to improve the development and application of modern technology for the AFN include a review of the 2019 R&D policy, compliance with the funding scheme, concerted human capacity development and increased investment in technology infrastructure.

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