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Application of Geospatial Technologies in Military Operations

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Abstract

Geospatial technologies have made great significant difference in the world today as these technologies have wider applications in solving human problems. Globally, military operations are conducted through several methods to achieve their end state. However, over the years, some of the adopted methods most especially in developing countries have become obsolete due to the dynamic nature of the operating environment of military warfare, hence the need to adopt new technologies. The main thrust of the paper therefore is to examine the role of geospatial technologies in modern military warfare. Geospatial technologies revolve around the use of remote sensing, geographic information system, global positioning system, big data, and geospatial intelligence among others, to proffer solutions to geographic problems. The study used secondary data that were sourced from both published and unpublished works through the internet, and also applies descriptive approach. The results of the study indicated that the effective application of geospatial technologies in military operations will enables the military to effectively wage war against all forms of criminality and insurrections. The military will do better if the use of geospatial technologies is adequately applied in their operational engagement. The paper concluded that the military should train its personnel in the field of geospatial technologies in order to effectively confront the enemies of the state. The paper further recommends that personnel of the military who has received training in geospatial technologies should be deployed to the rightful departments within the military and relevant civil organizations in order to fully maximize their potentials to the benefit of the military in particular and the state at large.

Keywords: Armed Forces, Geospatial, GIS, Military, Nation-Building, Warfare

Introduction

The military all over the world is one of the elite institutions that bring about national unity, cohesion, solidarity and integration. This institution is majorly established by political leaderships of nations to basically protect the territorial integrity of their nations against external aggression (Egbule, 2019). In some cases, the military are called upon to assist the civil police to quell internal insurrections, restore law and order and performs other internal security and humanitarian duties. One of the lasting apprehensions concerning the relationship between the military and the society is how the military is

legitimized, seen and sustained by the societies which they exist to defend and protect (Forster, 2006).

The military is a noble institution that is full of several values, ethics and camaraderie (Bennett, 2020). The military comprises of the Army, the Navy and the Air Force. While the Army is responsible for the protection of a nation's territorial land, the Navy and the Air Force are respectively responsible for the protection of the territorial waters and air space. The Military as species of social institutions have played a dominant role since the beginning of civilization and the creation of mankind, as both officers and men of the Armed Forces are usually deployed around the world for aggressive warfare, peace keeping and peace enforcement operations. Any country that has a strong military force ruled the major and significant part of the world. This is because military power is the legally authorized, certified, endorsed and sanctioned tool of viciousness and violence which governments use in conducting their diplomatic affairs and relations with each other. Military diplomacy involves the assembly and analysing of relevant information on the Armed Forces and the security situation in the host state as well as promoting cooperation, communication and common relations between the Armed Forces of both states, thereby enhancing and strengthening bilateral relations between the sending and receiving states (Satyanarayana & Yogendran, 2013; Pajtinka,2016).

Military warfare is dynamic and a very complex one that demands precision, accurate and reliable data. For an effective military operation to be conducted, military planners and commanders need adequate and strategic data to successfully prosecute their operations to a logical conclusion to the advantage of the state. Data that relates to land, air and maritime warfare are collected through various traditional and scientific means. One of the modern and scientific means that could aid the military acquire relevant data and meaningfully analyse the data is through geospatial technologies. Geospatial technologies revolve around Remote Sensing (RS), cartography, Geographic Information System (GIS), big data and Global Positioning System (GPS) among others. GIS plays a fundamental part in military operations as the operations essentially have spatial dimensions. The concept of Command, Control, Communication and Coordination in military operations principally relies on the availability of precise and up-to-date information that could enhance taking the fastest time for decision making (Satyanarayana & Yogendran, 2013).

The military needs technology to effectively conduct all its operations. Technology has changed the way modern battles are fought and the application of technology has equally become a master key in accomplishing the supremacy and ascendency in military power. The goal of this paper is to bring to fore, the application of RS cartography and GIS in conducting effective military operations around the world. The paper will assist military commanders, strategists and planners to explore the possibility of using these technologies in modern warfare and incorporate them in their day-to-day military planning and execution of their operational orders. The paper will look at the roles of the military in nation building and the application of geospatial technologies in military operations. The limitations of geospatial technologies in conducting military operations will also be examined.

II.   Materials and Methods

The study used only secondary data that were sourced from both published and unpublished works. Materials were also sourced from the internet to enhance the quality of the work as the study mainly applies descriptive approach.

Methodological Approach / Research of Literature. The research of literature has been carried out in the libraries of AFRIGIST and Obafemi Awolowo University Campus, Ile-Ife, Nigeria. It also includes the internet through google.com.

Description of Document. To enhance the quality of the work, the study applies descriptive method to analyse the various collected documents to retrieve relevant information on the subject matter.

III.   **Results**

IV.   **Literature Review**

Roles of the Military in Nation Building The military as an organic institution plays a dominant role in nation building. Nation building refers to the concerted efforts put in place by political leadership to bring all segments of the society, and people together so as to actualize a common goal for the overall development of a nation (Egbule, 2019). Nation building is an effort to promote the survival of a nation and to build a strong, dynamic and prosperous nation. It is an attempt to harness all the potentials of a nation and this include both human and material resources for the overall benefits of both the citizens and the nation. Hence, all individuals, groups and the government must come together to work for the common good of the unity and progress of the nation (Omolade, 1998; cited in Egbule, 2019).

Aduke (2019) posited that the task of building a nation is a duty for all citizens, institutions and this include both the military and civilian administration. The military is an extraordinary institution that is full of several values, ethics and camaraderie (Bennett, 2020). A nation that has good political and military relations will experience a high degree of stability and achieve a great political power. The military is a stabilizing factor in national unity, integration and cohesion. It strengthens democracy and is constitutionally assigned to ward off external threats and quells internal dissidents (Bennett, 2020).

Any nation that has a strong and efficient military power enjoys a higher degree of security and stability than the country that has a weak military. Developed nations like USA, China, Russia and United Kingdom among others developed their military to an effective and efficient standard. This has made these nations to become strong and powerful in various aspects of economic, political, technology and environment among others (International Strategic Analysis, 2018). A nation with a strong military can develop the capacity to project its military power beyond its borders in an aggressive, terrifying and fearful manner. Any country that can protect its territory, resources and trade routes has a major economic advantage over other countries that cannot provide protection and effectively secure its sea lane of communication. Hence, military power can be a reagent for economic growth and sustainability if appropriately and correctly applied (International Strategic Analysis, 2018).

At the global and international level, senior military personnel have been deployed by their home government to other countries as defence attaché and ambassadors and consulates as retired military officers. These sets of retired/serving military officers project the image of the country abroad and by extension maintain cordial diplomatic relations with their host countries and at home. Military forces facilitate their government foreign policies, taking part in peace keeping operations and peace enforcement, humanitarian missions and in a joint and combined military exercises as they continue to expand their roles in international affairs (Chretien et al., 2007).

During the period of Covid-19 pandemic for example, the military has been used extensively to assist in tackling the dreaded pandemic and increased engagement in

health-related activities at the domestic and local level. The outbreak of the coronavirus as a public health emergency of global concern led to the increased involvement of the military in setting up of field hospitals as seen in France, Serbia, and treatment of patients. The military were actively deployed in the delivery of thousands of equipment and doses of drugs around the world and enforcement of lockdown in countries like South Africa, Italy and Spain and other parts of the world among other responsibilities (Michaud, 2019; Fawzia, 2021).

Furthermore, the military usually conducts medical services. They provide public health care services such as carrying out medical outreach programmes even to the rural and local dwellers, all these geared towards enhancing the total well-being of the citizens. During emergencies period, the military are usually deployed to maintain law and order and assumes various leadership responsibilities such as crises communications, and stockpiling of essential supplies and other useful commodities. Also in peacetime, the military are fully involved in research development, training, capacity building and partnership (Chretien et al., 2007; Lakoff, 2017; Michaud et al., 2019; cited in (Fawzia, 2021).

Similarly, during national independence anniversary celebrations of most countries around the world, the military are made to perform ceremonial and colourful parades demonstrating and show-casing their various operational capabilities and national unity. This kind of symbolic display is part of the strategies mapped out by political leaderships to promote and foster national unity and cohesion. It also makes the citizens to develop a sense of feelings towards one another. The military also acts as stronghold against societal disorder and chaos and are well positioned and trained to manage violence   (Stover, 2008).

The military has also demonstrated its ability to conduct effective and efficient academic trainings, established vocational and skills acquisition centres among others for people to develop and improve on their skills, thereby enhancing the nation's economy. The military as a nation building institution and as a warrior provides security and can cultivate essential services and governance. They can create the enabling environment for politics to thrive for enhanced development (Perez, 2010). Figure 1, shows the synoptic view of the levels of military engagement in nation building.
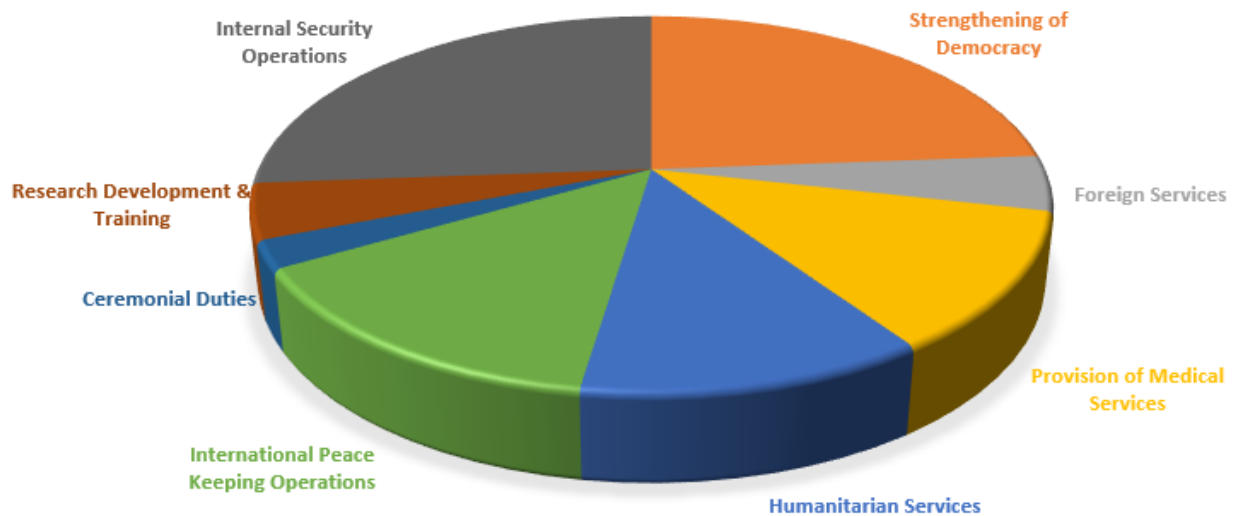
Figure 1: Levels of Military Engagement in Nation Building.
Source: Authors' Analysis (2023)

Application of Geospatial Technologies in Military Operations
The concept of geospatial technologies rotates around the field of GIS, cartography, RS, GPS, geospatial intelligence and big data among others. Spatial information has always been very useful to the military commanders, strategists and planners. The military commanders need the clear understanding of the terrain and the operating environment, without which they may find it difficult to achieve their end state. To understand the operating environment, the military personnel need the required skills to operate, acquire, manage and interpret various collected data about the battlefield. GIS can be used effectively in military operations in different areas like cartography, intelligence gathering, battle field management, terrain analysis, RS, military installation management and tracking of the activities of terrorists and bandits around the world (Satyanarayana & Yogendran, 2013).

In the field of GIS, various analysis such as kernel density estimation hotspot analysis, krigging and Getis-Ord G* methods of hotspot analysis, overlay analysis, buffering analysis and best route/origin destination cost matrix analysis among others can be conducted in order to ascertain the activities of terrorists, bandits and other undesirable and disgruntled elements threatening the corporate existence of a nation. With these methods and analysis, military commanders can effectively visualize, understand and interpret the activities of criminals and areas they are heavily concentrated (Okpuvwie et al., 2021). Military commanders and strategists can deploy GIS technology to enhance the process of taking meaningful decisions for enhanced security (Lewis & Ogra, 2010).

The use of RS, geospatial intelligence, GPS among others will provide timely information to military commanders to effectively prosecute their operations. The military that gathers, acquires and interprets its information fast and uses it fast will be at advantageous position in the frontline. This was the clear case during the 1990 Gulf war by the Allied forces against Iraq, when Major General Gurbaksh Singh VSM, stated that "The lessons gained from military history indicated that the key to military victory lies (regardless of military size of the opposing forces) in remaining ahead of the enemy in time

sensitive SCORE loop of C4I2 process. If a defending force or weapon system can with some accuracy and sufficient warning finds out where the attacker is or his future course of action would be, it would be easier to defeat him by occupying position of advantage or by massing a superior force at the point of decision" (Satyanarayana & Yogendran, 2013). Yes, remaining ahead of the adversary depends on the amount and quality of information gathered, analysed and effectively utilized. This is where geospatial technologies and geospatial intelligence come into play. The military therefore needs adequate intelligence to successfully prosecute all its battles in the five main domains of warfare as shown in Figure 2.
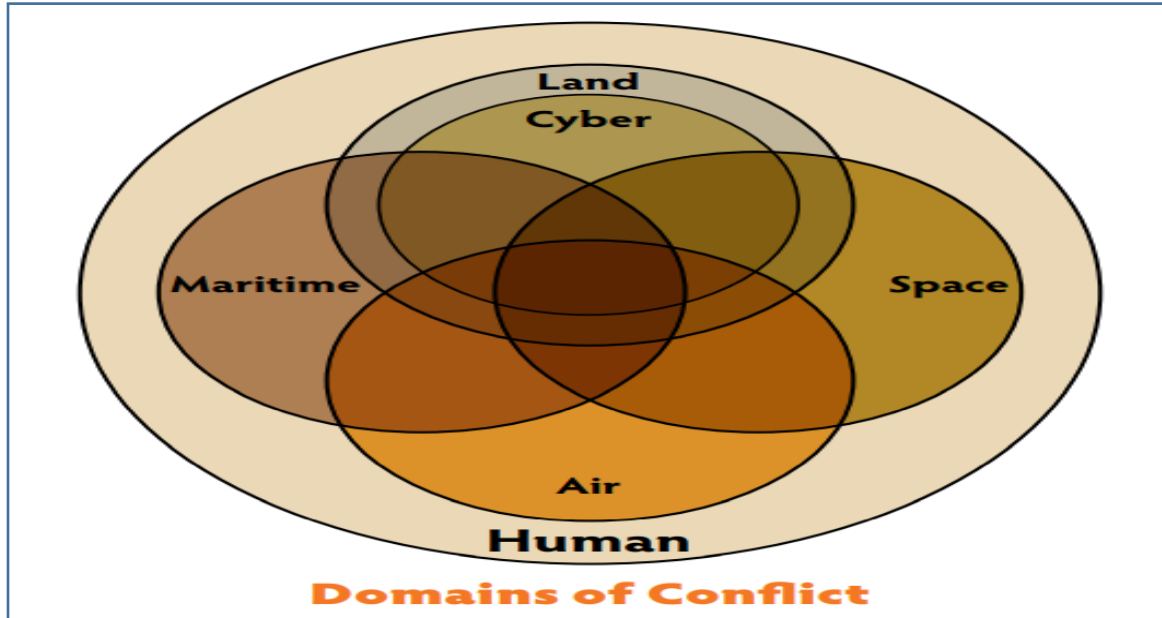

Figure 2: The Domains of Warfare/Conflicts
Source: Adapted from Herbert (2014)

Figure 2 shows the five main domains of warfare that are engaged by the military. At the center of these domains of warfare is the human being; as warfare is characteristically a human affair (Herbert, 2014). The military needs information and intelligence about the activities of the adversaries operating on land, water, air, space and the cyber-world. For this to be effective, the application of RS, GIS, GPS, geospatial intelligence, cartography, big data and web GIS among others needs to be adopted by the military high command.

In maritime warfare, the Navy's vessels depend largely on indirect methods to navigate when there is no means of establishing their position with visual aids. With GPS the means of determining the position at sea becomes easy. For example, the effective use of the GPS was noticed during the Gulf war where the GPS played an indispensable and critical role in locating the position of the ground troops for the allied forces to avoid bombing their own forces operating on land. The air force also needs precise information regarding the battle environment to be able to successfully conduct air interdiction and precise striking of the required targets. These include the detailed information about the target location, proximity of civilian areas, terrain evaluation and meteorological conditions. Every commander in the battlefield needs accurate information regarding cloud coverage, wind conditions, visibility and temperature parameters in order to avoid

taking the wrong decisions (Satyanarayana & Yogendran, 2013). Remote sensing deals with the collection of data without having any physical contact with the acquired data. This can easily be achieved through aircraft, satellites and drones. It is the gathering of data concerning an object that is been investigated with gadgets and devices used in acquiring the data having no physical and direct contact with the phenomena (European Space Agency, 2016).

Through the aid of RS, great information regarding the battlefield and the adversary can easily be acquired from the sky. Spy satellites and drones can be used by the military commander to acquire high-resolution satellite data both in peace and war time about the enemy. RS technology has been deployed by most developed countries to monitor the enemy activities in establishing nuclear installations and warheads around the world. Space-based satellite technologies can easily facilitate access to the unreachable landscapes, aid and support humanitarian workers, support intricate disasters and effectively contribute to the monitoring and validating battle regions. The RS technology has the capacity to provide unbiased near real-time insights at the ground level to the military field commanders   (Avtar et al., 2021).

In the past, military commanders always look for vintage positions with a high elevation, such as mountains and ridges, to have good visual intelligence about the location, activities and movement of their adversaries (Kääb, 2005). But in today's world, military commanders can use aircraft and drones for aerial reconnaissance (Campbell, 2008; cited in Avtar et al., 2021). The aerial photographs obtained can be classified, analysed and used for the identification of trenches used by the adversaries as well as their hidden positions. The results of the analysed images obtained can also be used to locate the movement of the enemies' troops, logistics routes and warehouses and to also validate the efficacy of artillery attacks against the foes (Thomas & Joseph, 2015; Stichelbaut, 2006, cited in Avtar et al., 2021).

The military can effectively deploy, analysed satellite data to classify, recognize and detect populated areas, landscapes, creeks, rivers, ridges, strategic installations, communication networks, oil installations and detection of genocide among others (Singhal, 2009; United Nations (Ed.), 2009; cited in Avtar et al., 2021). Witmer (2015) posited that in difficult terrains and remote environments that are known to be conflict zones where ground-truthing is difficult to achieve, satellite data can easily provide useful evidence. Satellites images can be used to verify increased cooperative missions at an international level in the decommission of facilities, disengagements, storage, and destruction that are important and strategic in the peace process (Avtar et al., 2021). The RS technique has become indispensable in different areas and scopes of international peace building and security (Marolda, 1994; Jamieson, 2001; cited in   Avtar et al., 2021). With the collected and analysed remote sensing data, the military high command can effectively use the obtained results to improve upon peace building, peace enforcement and security around the world. Figure 3 shows the increasing trend of remote sensing relevance in international peace and security.
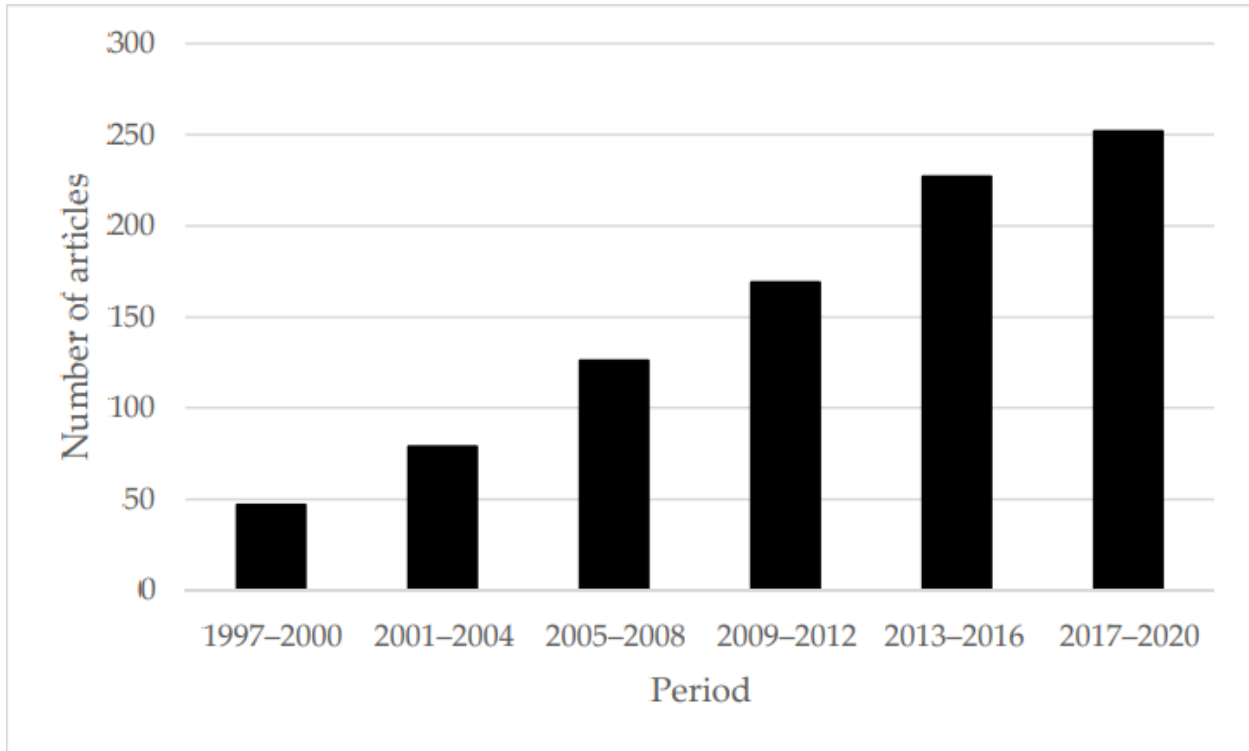
Figure 3: Increasing Trend of Remote Sensing Relevance in International Peace and Security
Source: Adapted from Avtar et al., (2021)

From figure 3, it is crystal clear that the application of remote sensing in international peace and security has grown overtime. It is expected that the use of this technology in peace keeping, peace building and enforcement will continue to increase with time. The military can also use remote sensing to fight environmental crimes. Crimes like illegal waste dumping, illegal mining, illegal oil bunkering, detection of hazardous cattle-breeding facilities, cattle rustling among others can easily be monitored through remote sensing technology (Satyanarayana, & Yogendran, 2013). Aerial photo and remote sensing imagery can be a veritable source of data to provide information on physical environment for the frontline troops. The combination of both remote sensing data and ground information will enable the military commander to effectively analyse the ground situation during the period of hostility.

The drone technology as component part of remote sensing is a vital tool in military operations. In 2011, the International Civil Aviation Organization defined drone or an unmanned aerial vehicle as an aircraft operated without a human pilot on-board. Drones can provide real-time data on the activities of terrorists and bandits. Also, the military can equally use the drone to aerially deliver medical supplies like blood, vaccines, drugs, and laboratory test samples during health emergencies to remote areas during emergencies. Military drones can also help in tracking the enemies' movements which then helps the selection of target killings (Ayamga et al., 2021). Drones have the advantage to cut costs and reduce risks to military personnel as they can be used in surveillance compared to using aircraft that are manned by personnel (Hunt, 2017). Kindervater (2016) posited that drones used in lethal surveillance are directly connected to targeted killings with assimilated mechanisms for making decisions on life and death. Artificial intelligence

plays a dominant role in military drones which has made such drones able to differentiate between civilians and the targets (De Swarte et al., 2019).

Military commanders depend on GIS and GPS to make informed and tactical decisions such as guiding troops, supplies/equipment and ships, informing them of possible threats. GIS data combined with satellite imagery, military commanders will be able to conduct terrain analysis, which is a major role in shaping the movement of troops. The roles of GIS in military logistics cannot be overemphasized because with GIS, troops can easily move supplies, equipment where they are most desirable. Maps which fall within the domain of cartography are indispensable tools for effective military operations and assaults. The digital base in GIS setting enables the production of various types of maps needed for smooth military assault to be conducted in order to meet the commanders' end state (Satyanarayana & Yogendran, 2013).

Factors of Geospatial Technologies Limitations in Effective Military Operations
The usefulness of remote sensing and geographic information system in modern day military operations cannot be overemphasized because of the increasing roles of technology. Despite the enormous and beneficial roles of remote sensing and geographic information system in military operations, there are some observed limitations on the effective use of these technologies in modern day military operations. Some of the limitations are highlighted in the succeeding paragraphs.

Though very useful in intelligence gathering and surveillance, drones as part of remote sensing technology can cause injuries and damages to people and properties if the user is not trained and if there is a component failure during flight. Drones could also be hijacked by an extremist and divert the payload for their self-interest (Avtar et al., 2021). The use of drones and helicopters for intelligence gathering and surveillance duties can adversely be affected with bad weather. Bad weather condition can inhibit the smooth flight of both the drones and helicopters and when this happens, the collected data will be affected leading to poor output.

Inadequate trained manpower is another identified limitation to the effective application of remote sensing and geographic information system in military operations. Though most advanced countries around the world have the required trained manpower that can use these technologies, but the scenario is quite different in the developing countries where there are no enough trained personnel in these emerging technologies. The costs of purchasing and using satellite, imagery data and geographic information system hardware are very high. These technologies are not reachable and accessible to all actors playing a role in peace-making and peace building processes at the international level (Avtar et al., 2021), however, most advanced countries can afford these technologies but the reverse the case with developing nations around the world.

The usage of aircraft/drones and satellites in intelligence gathering and surveillance are complex. Remote sensing technology is rigorous and thus demands a special kind of training to be ready mentally to analyse and interpret the images acquired through these platforms. The instruments used in remote sensing may sometimes be un-calibrated which may lead to un-calibrated output giving room for human error if the instruments are not properly calibrated. Furthermore, the procurement and maintenance of GIS software are expensive and this can act as a stumbling block in the effective utilization of this technology in military operations (Okpuvwie et al., 2021). The under-utilization or lack of utilizing those trained personnel in the area of remote sensing and geographic information system in the military is another major limitation. There are instances where

some military personnel who were trained in these technologies are not fully utilize to practice or put to use what they have learnt, rather they are been deployed to other areas and departments that is not related or connected to the application of these technologies. This is indeed a drawback to the utilization of the full potentials of those personnel that are trained in these emerging technologies. Figure 4 shows the factors that limit the effective utilization of geospatial technologies in military operations.
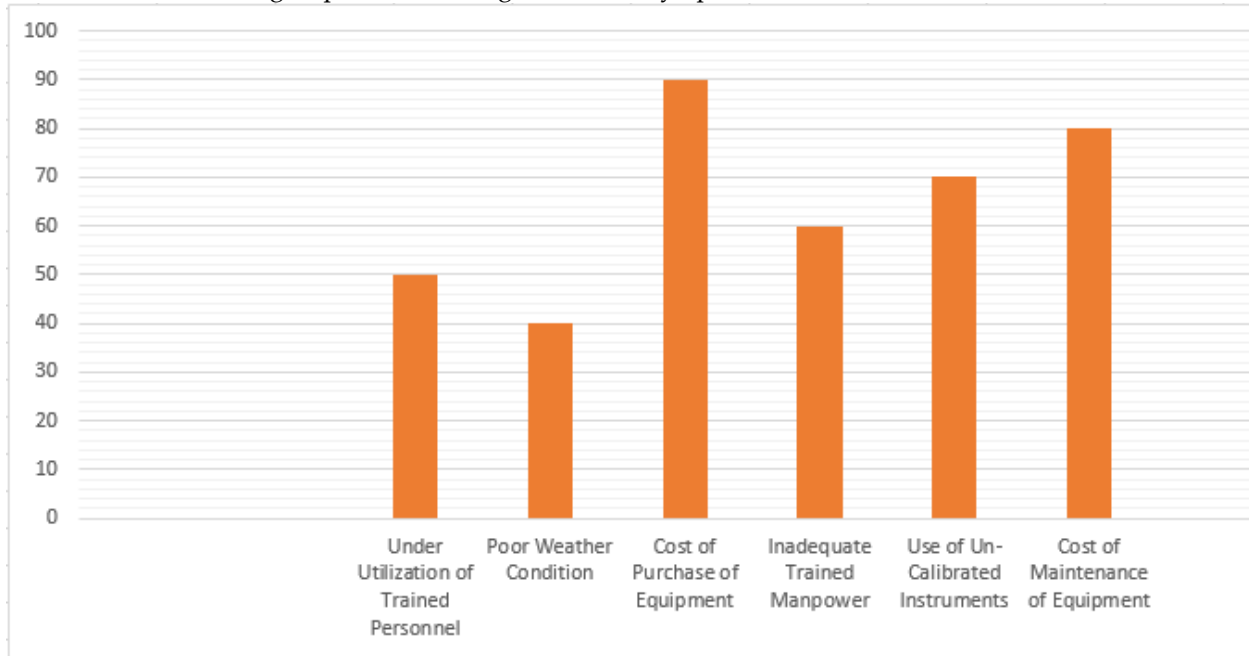

Figure 4: Factors of Geospatial Technologies Limitations in Effective Military Operations.
 Source: Authors' Analysis (2023)

V.   Discussion

Geospatial technologies have revolutionized the way data are collected, assembled, analysed and interpreted. The use of remote sensing and geographic information system in providing solutions to geographic problems cannot be overemphasized. Geospatial technologies play an important role in military operations both at local, national, regional and international level. Information obtained by the means of remote sensing can increase transparency in the case of counter-terrorism (Avtar et al., 2021). Advanced near real-time geospatial data can offer some valuable and suitable information that will aid the control and management of conflicts if combined with mobile data (Weir, 2019). Geospatial technologies can effectively aid military operations in all the five known domains of warfare. For this to be realized, the military high command needs to invest in the training of its personnel in these fields of technologies. After the training, such personnel should be made to practice what they have learnt by posting or deploying them to their respective departments and sections of areas of specializations. This review has revealed and demonstrated that there has been substantial progress in several technologies such as machine learning, sensors, data analysis and electronics among others that are incorporated together with remote sensing applications. The full potential of the application of remote sensing and geographic information system in military operations has already been discovered, however the future of remote sensing and geographic information system applications in the military will be shaped and determined by how

much the military high command most especially in the developing countries embraces, accepts and adopts these technologies in its day-to-day administrative and operational duties in order to achieve their end state.

VI.   Conclusion and Recommendations

The military is an organic institution that holds the state monopoly of violence which needs to be well catered for in order to maximally utilize it for the overall benefits of the state. The roles of the military in nation building are fantastic, as the military has on several occasions, maintained peace and security around their various countries and at the global scale. The military is usually deployed for humanitarian missions and rendering of medical services like medical outreach programmes to various communities and rural dwellers over time. The military conducts its operations both on land, air and water, hence, needs special and continuous training of its personnel to be able to confront the enemies of the state and brings them to total submission to the advantage of the state. The training required by the military in today's modern warfare is the application of modern technologies. Geospatial technologies offer the best way for the military to enhance its operational capabilities in the five domains of warfare including: the land, air, water, space and cyberspace. The application of remote sensing and geographic information system in military operations has been examined. The military will do better if the use of these technologies is adequately applied in their administrative and operational responsibilities. It is hope that personnel of the military would be given adequate training and the needed exposure in geospatial technologies. It is also the believe of the researchers that personnel of the military who has received training in these technologies would be deployed to the rightful sections and departments within the military and other relevant defence agencies to maximize their full potentials to the benefit of the ministry of defence in particular and the state at large. It is therefore recommended that the military should (a) Effectively apply geospatial technologies in all its operations in the five main domains of warfare. (b) Train and expose its personnel on regular basis in the field of geospatial technologies. (c) Ensure that personnel who have received training in geospatial technologies should be deployed to the rightful sections within the military and relevant agencies of the ministry of defence. (d) Provide the rightful equipment for the utilization of geospatial technologies and (e) not under-utilize trained personnel in geospatial technologies.

References

Aduke, E. (2019). The Military and the Challenges of Nation-Building in Nigeria. *European Journal of Social Sciences Studies,* Volume 4, issue 3. Doi:10.5281/zenodo.3228532.

Ayamga, M., Selorm, A., & Albert, A. N. (2021). Multifaceted Applicability of Drones: A Review. *Technological Forecasting & Social Change,* Volume 167.

Avtar, R., Kouser, A., Kumar, A., Singh, D., Misra, P., Gupta, A., Yunus, A.P., Kumar, P., Johnson, B.A., & Dasgupta, R. et al., (2021). Remote Sensing for International Peace and Security: Its Role and Implications. *Remote Sens*, 13, 439. https://doi.org/10.3390/rs13030439

Bennett, E. (2020). Importance of the Military Army in Society. *PKSOI.*

Chretien, J.P., Blazes, D.L., Rodney, L.C., Michael, D.L., Gaywee, J., Kana, K., Sirisopana, N., Vallejos, V., Mundaca, C.C., Montano, S., Gregory, J.M., & Gaydos, J.C. (2007). The Importance of Militaries from Developing Countries in Global Infectious Disease

Surveillance. *Bulletin of the World Health Organization, Mar:85(3). Doi:10.2471/BLT.06.037101*

De Swarte, T., Boufous, O., & Escalle, P. (2019). Artificial Intelligence, Ethics and Human Values: The Cases of Military Drones and Companion Robots. *Artif.Life Robot* 24 (3).929 6311 1164

Egbule, P.O. (2019). Appraising the Role of Military Governments Towards Nation Building in Africa: A Focus on Murtala- Obasanjo Administration in Nigeria. *Journal of Nation-Building & Policy Studies,* Volume 3, Number 1. Doi:10.31920/2516-3132/2019/3n1a7.

European Space Agency (2016). What is Remote Sensing? Available: http://www.esa.int/SPECIALS/Eduspace_EN/SEMF9R3Z2OF_0.html (Accessed 25 June 2023).

Fawzia, G. (2021). Military Responses to Covid-19, Emerging Trends in Global Civil-Military Engagements. *Review of International Studies 47(2).*

Forster, A. (2006). Armed Forces and Societies: Changing Roles and Legitimacy. In: Armed Forces and Society in Europe. Palgrave Macmillan, London, https://doi.org/10.1057/9780230502406_4

Herbert, M. (2014). The Human Domain: The Army's Necessary Push Toward Squishiness. *Military Review.*

International Strategic Analysis. (2018). The Importance of Military Power in the 21st Century.

Satyanarayana, P., & Yogendran, S. (2013). Military Applications of GIS. IIC Technologies Private Limited, Hyderabad - iicacademy.com

Kindervater, K.H. (2016). The Emergence of Lethal Surveillance: Watching and Killing in The History of Drone Technology. *Secur.Dialog* 47(3)

Kääb, A. (2005). Remote Sensing of Mountain Environment. In Proceedings of the ProjectingGlobal Change Impacts and Sustainable Land Use and Natural Resources Management in Mountain Biosphere Reserves, Pinos Genil, Spain, UNESCO.

Lewis, M., & Ogra, A. (2010). An approach of Geographic Information System for Good Urban Governance. 2010 18th International Conference on Geoinformatics. doi:10.1109/geoinformatics.2010.5567741.

Michaud, J. (2019). Military and Global health: Peace, Conflict and Disaster Response. *The Lancet*,393.

Okpuvwie, E. J., Toko, M.I., & Tohozin, C.A.B. (2021). Remote Sensing and Geographic Information System in Crime Analysis and Monitoring. *International Journal of Automatic Control System*. Volume 7, Issue 1.

Pajtinka, E. (2016). Military Diplomacy and Its Present Functions. *Security Dimensions, International & National Studies,* No. 20; DOI 10.24356/SD/20/9

Perez, C.Jr. (2010). Politics and the Soldier: On the Limits of Nation-Building as a Political and Military Objective. Being a Paper Presented at the American Political Science Association's Annual Conference, September 2-5, 2010, Washington, D.C.

Stover, W. J. (2008). The Armed Forces and Nation Building: Revolutionary Socialist Theory and Praxis in China. *Journal of Contemporary Asia*, Volume 6, Issue 3. https://doi.org/10.1080/00472337685390411.

Witmer, F.D. (2015). Remote Sensing of Violent Conflict: Eyes from Above. *Int. J. Remote Sens*. 36

Weir, D., McQuillan, D., & Francis, R.A. (2019). Civilian Science: The Potential of Participatory Environmental Monitoring in Areas Affected by Armed Conflicts. *Environ. Monit. Assess*, 191

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