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THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN THE MILITARY: A CASE STUDY OF THE GHANA ARMED FORCES

BY

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DECLARATION

I hereby declare that this Dissertation is the result of an original research conducted by me under the supervision of Dr. Ken Ahorsu and that no part of it has been submitted anywhere else for any other purpose.

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Alexander Godwin Azera Dr. Ken Ahorsu
DEDICATION

This work is dedicated to my wife, daughter and son. They are the reasons for life.
ACKNOWLEDGEMENT

I appreciate the Most High God for His grace and mercies once again. Special thanks go to my supervisor, Dr Ken Ahorsu, for his immeasurable input into this work. I cannot forget the immense contribution of all the workers at the Ghana Army Corps of Signals. Finally, I salute all the officers and men of the Ghana Armed Forces who were part of this research. ‘RANGERS LEAD THE WAY.’
ABSTRACT

Technological advances in Information and Communication Technology are accruing at exponential rates unprecedented in history and impacting on every sphere of life. Most militaries the world over have therefore employed ICT in their operations to achieve greater success. This research set out to study the application of ICT in military operation in the Ghana Armed Forces. Primary and secondary data were assessed via questionnaires, personal interviews and through books and publications. The results revealed a low level of awareness of the immense possibilities of ICT for the military and its application for military operations in the GAF. It is recommended that policies be promulgated and training levels improved to enhance the employment of ICT in GAF operations. This will enhance effectiveness and efficiency.
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CHAPTER ONE

RESEARCH DESIGN

1.1 Background of the Study

Technological advances are accruing at exponential rates unprecedented in history and impacting on every sphere of life. Modern technologies are providing vast amounts of sequence, expression and functional data which are rapidly captured, processed, stored and retrieved when needed. This data is often communicated through electronic pulses that are sent through cables, satellite and radio waves to their destinations. These processes are made possible by ICT which is redefining and enhancing the functions and interaction of organizations within the global environment. The advances and applications of ICT span the whole spectrum of activities in corporations and governmental organisations including the armed forces.

These advances in ICT have created a global and relatively unrestricted information flow environment. This has resulted in a gradual shift from the traditional methods of force and means of combat towards non-traditional methods, including information warfare. The ability to access the right information at the right time has made tremendous impact on command and control. Nowadays, information and ICT tools are becoming real weapons, not just in a metaphoric sense but in its direct sense as well. The drivers of the current Revolutionary Military Affairs (RMA) are the precision-guided munitions, sensors, fibre optics, miniaturisation of microchips, GPS, satellite technologies and simulators. These are all products of ICT and components of network-centric warfare.\(^1\) Therefore, the appropriateness of information could make a difference in the preparation and outcome of a war.
The potentials of ICT are enormous and are developing rapidly hence, tactics and doctrines must be adapted to these changes as well. The world’s armed forces are increasingly involved in conflicts and sometimes in deterrence. This creates a whole spectrum of military operations which include war fighting and Military Operations Other Than War (MOOTW). These military operations could be single or joint service operations within national, regional and international boundaries. Given that war fighting has become more deadly and MOOTW more complex, the efficient management of operations has become an important element in defining military power.

A significant portion of military research in developed countries is nowadays devoted to improving the application of technological advances to military operations. For instance, military research in the USA was responsible for the development of the internet. In India, the thrust has been towards adapting available technology to the Indian environment, utilising the Privately Accessed Specification (PAS). PAS relies on the purchase of equipment or weapons platforms which are then stripped, studied and reconfigured by the Indian Armed Forces in conjunction with Indian universities and research centres.

ICT advances in the last decade of the twentieth century became reality by the invention of microchips and microprocessors. On account of their high processing power and low production cost, microchips and microprocessors have been widely utilised by the armed forces of developed countries. They are used in computer sized battle management systems, guided missiles, sensors, communications, surveillance and reconnaissance which are the driving force in RMA.

The RMA also includes the increasingly complex information, communication, intelligence and control systems required in today’s dynamic battle space environment. The facilities to perform
these functions are based on C4I systems. These systems ensure interoperability, swifter response and comprehensive coverage, thereby enhancing success in operations. The C4I systems represent the synthesized capability to exercise control over military units, and to continually monitor their operations, movements and status.5

A superficial look reveals that there has been a low level of application of the ICT advances in Ghana and by extension the Ghana Armed Forces (GAF). The application of ICT is observed less in military operations, where most tasks are usually performed with equipment which does not employ ICT. These perceived lapses aroused the interest of this researcher in the study.

1.2 Statement of the Research Problem

The proper capture and maintenance of documentation of personnel is of prime importance in the administration of the GAF. The method currently used is mainly manual and comes with all the associated problems of storage, bulkiness, sharing, access, security and many more. The employment of ICT will enable digitization and networking which will enhance good documentation in a paperless environment.

The GAF is currently working relentlessly towards improving its civil-military relationship. Efforts so far have been channeled through organizing GAF Open Days, provision of services including medical and engineering services and many more. The use of appropriate ICT to stream and transmit collaborative and goodwill messages will help speed up the security sector reforms and restore professionalism and honour to the GAF.
The role of the Ghana Navy in providing security for Ghana’s oil exploration is crucial to the success of the oil sector. The deployment of vessels with modern ICT infrastructure will greatly enhance their efficiency in terms of reaction in time and space.

Current disaster management operations in Ghana could be described as a disaster themselves due to the lack of coordination between the various stakeholders. The GAF which usually plays a lead role in disaster management could employ the appropriate ICT to network the various stakeholders. This would increase efficiency and effectiveness.

Ghana as a developing country is not an originator of technology. Technology, therefore, is not readily available and is acquired from the developed world usually through trade-offs, which could be costly. These acquisitions sometimes take a political dimension and never see the light of the day. This study therefore seeks to uncover the benefits and/or challenges of a heightened employment of ICT in GAF’s operations.

The problems appeared to be worsened by the inability of the Services to communicate during operations or to share a Common Operational picture (COP) for a flawless integration of operation. In a review of operations conducted by the Ghana Armed Forces during the peace support operations in Liberia and Sierra Leone, Col Aboagye observed that the lack of standardization of communications equipment led to the inability of the Services to effectively communicate with each other. The rebel forces used this to their advantage and inflicted heavy casualties on the ECOMOG forces.

Ghana’s current operational commitments are basically in external Peace Support Operations and Internal Security Operations. In all these operational areas, the GAF has demonstrated a poor
application of ICT. Reports from almost all Ghana’s Peacekeeping missions indicate a consistent inability of the contingents to meet the ICT equipment requirements.

1.4 Objectives of the Study

The objective of this study is to examine the application of ICT in military operations, with particular regard to the implications for the Ghana Armed Forces. In doing so, the paper will:

a. Examine the relationship between ICT and the conduct of military operations.

b. Assess the level of ICT acquisition and application in the Ghana Armed Forces.

c. Determine the problems and challenges of ICT in the conduct of military operations by the Ghana Armed Forces.

d. Identify strategies for the enhancement of ICT utilisation by the Ghana Armed Forces in military operations.

1.3 Research Questions

a. What is the relationship between ICT and the conduct of military operations?

b. Determine the level of ICT acquisition and application in the Ghana Armed Forces?

c. What are the problems and challenges of ICT in the conduct of military operations by the Ghana Armed Forces?
d. Are there strategies to be adopted to enhance ICT use by the Ghana Armed Forces in military operations?

1.5 Rationale of the Study

The study is significant in that it is being carried out at a period of unprecedented global technological explosion, and the GAF appears to be lacking. This research is geared towards establishing the effect of ICT on military operations, with particular reference to the GAF. It will further, attempt to provide solutions for the inability of systems, units or forces to provide or access services from other systems, units or forces.

The outcome of the study would contribute to the existing body of knowledge on the significance of ICT in military operations. It could thus be a useful guide to policy makers and planners at the Defence and Services headquarters in establishing an integrated ICT system for the Ghana Armed Forces. It will also assist in making realistic projections for future applications of ICT and serve as reference material for a wide range of users especially defence information managers.

1.6 Literature Review.

1.6.1 Concept of Information

Four centuries ago, Francis Bacon wrote that ‘information is power.’ The current global revolution is based on information handling, aided by rapid technological advances in computers,
communication and the concurrent dramatic decreases in the cost of processing and transmitting information. According to Machlup, information is ‘signal transmission…telling of something or something that is being told to a person.’ This concept envisions information as being addressed to and received by human minds. In the same light, Von Weizsacker conceives information as a twofold category, namely ‘that which is understood and that which generates information….a prima facie something that flows between a sender and a receiver.’ However, the approaches of both Machlup and Von Weizsacker are inadequate in that they limit information to humans.

Kornwachs and Jacoby proposed a theory of ‘Naturalization of Information,’ in which information is a mind-dependent semiotic unit whose interpreter could be any kind of living organism. Although Zoglauer agrees with this naturalization theory, he disagrees with regard to semantic and pragmatic information as the interpreter could only be human. These views have sparked some controversy in the naturalisation of information between naturalists and engineers. In particular, Hartley, an engineer, argues that electrical transmission systems have to do with machines and not with human beings. He posits that ‘it is desirable to eliminate the psychological factors involved and to establish a measure of information in terms of purely physical quantities.’ The physicists and engineers arguments however lacked the originating mediums which are usually humans.

Shannon’s theory of information refers to the common use of information with its semantic and pragmatic dimensions, while at the same time redefining the concept within a specific engineering framework. He proposes a model of information that includes 6 elements namely a source, an encoder, a message, a channel, a decoder and a receiver. This definition conceptualised information as a quantitative entity, concerning the possible selection out of a
range of physical symbols. Capurro agrees by describing information as ‘a measure of physical organisation’. His argument thus conceives information as inherently human, but transmitted over purely physical routes. This approach has been the basis of the development in IT.

1.6.2 Concept of Information Technology

A related concept that is central to this study is IT. IT is based on microelectronics and entails the use of semi-conductor devices, computers, and other forms of telecommunications to facilitate speedy, accurate and cheap information processing for decision-making. As institutions the world over debated the various aspects of information, giant strides were also occurring in the application of tools and methods to the improvement of task completion. This included devices such as machines and techniques for manufacturing and productive processes.

There are several definitions of IT, ranging from computer communications networks and information systems that enable exchanges of digital objects to the actual technology involved. Roger for instance, defines IT as ‘the use of modern technology to aid the capture, processing, storage and retrieval and communication of information whether in the form of numerical data, text, sound or image’. This definition is fundamental and catches the essence of IT as a physical entity.

Roger’s definition, however, states that ‘IT includes all matters concerned with the furtherance of computer science and technology and with the design, development, installation and implementation of information systems and applications.’ IT as conceptualized by the Northern Examination Association of UK is the study of information handling and its use in
society by means of modern technology. This includes the acquisition, processing, storage and communication of information in any form by appropriate means. Within information technology there is an identifiable body of subject content, skills and activities. This common core is transferable, relevant to other curriculum areas and has wide application in society.\textsuperscript{20}

Olunloyo identifies some of the characteristics of IT as globalization, linkage to major infrastructure such as communication and informatics, speed and scale of penetration.\textsuperscript{21} These 3 approaches represent a practical approach which is significant to this study and conceives of IT in a global 3 dimensional environment. IT in the context of this study is conceived as the utilization of information science and technology to enhance military capabilities during operations.

\subsection*{1.6.3 The Concept of Military Operations}

The United Kingdom Doctrine for Joint and Multinational Operations Joint Warfare Publication defines military operations as military action or the carrying out of a strategic, tactical, service, training, or administrative military mission; the process of carrying on combat, including movement, supply, attack, defence and manoeuvres needed to gain the objectives of any battle or campaign.\textsuperscript{22} The USA AFM defines military operations as ‘a military action or the carrying out of a strategic, tactical, service, training or administrative military mission.’\textsuperscript{23} It further defines it as ‘the process of carrying on combat, including movement, supply, attack, defence and manoeuvres needed to gain the objectives of any battle or campaign.’\textsuperscript{24}
It is worthy to note that generally, definitions of military operations are similar; the common factor being the need to achieve the desired end-state. Consequently, the same definitions have been adopted by the GAF and as such, would apply in the context of this paper. However, present day operations are possible only if they exist in an information-enhanced environment encompassing the individuals, organisation and systems that collect, process, store, display and disseminate information.\textsuperscript{25}

Eisenhower stated that ‘military operations could be single or joint.’\textsuperscript{26} Joint operations could be among services of the same nation or multinational. In recent times operational missions include not only war but also MOOTW. Military operations in war are usually dominated by offensive and defensive operation, while stability and support operations dominate MOOTW.\textsuperscript{27} Others are enabling operations such as CSS. All of these are increasingly dependent on the application of ICT in this century.

\textbf{1.6.4 ICT and Military Operations}

ICT deals with new concepts of military operations such as the processing of battle space with computer technology. Murray and Millet, however, note that ‘sheer technical innovation does not win wars.’\textsuperscript{28} They noted that the interaction of technical changes and organisational adaptations is what determines real military capabilities. This argument supports the latest trend in developed militaries especially in USA, India and South Africa.

The First Gulf War emphasised the integration of information systems, technology and operations in ways that heralded a new form of warfare. According to Lt Gen Bogdanov, ‘Iraq
lost the war before it even began.\textsuperscript{29} This was a war of intelligence, electronic warfare, command and control and counter intelligence. Iraq troops were blinded and deafened. That meant a complete denial of visual and auditory intelligence. After the war, the US built on the lessons learnt during operation Desert Hammer VI. This operation conducted in 1994 was used to test the DDSS and IIS. The DDSS featured computerized sensors for enhanced vision through obscurants, while IIS used the sensors to enhance information and situational understanding on the move. The results of the operation proved invaluable during the second Gulf War as it enabled individual soldiers to see further and vehicles to communicate better than during the first Gulf War.\textsuperscript{30}

It could, therefore, be deduced that technological innovations are successful in military operations when they produce corresponding innovations in their application. ICT was also utilized during the Gulf and Afghanistan Operations to provide commanders and subordinates with a COP tailored to each echelon with the aid of digital surveillance and reconnaissance assets which refined pictures of the enemy.\textsuperscript{31} Furthermore, precision fires from smart weapons were used to destroy enemy cohesion while contact between commanders was limited as unmanned reconnaissance aircraft were used collected vital information on the enemy. Commanders were able to lead operations from the front and remained connected to computers and the information they provided.

Combat Service Support was also enhanced by improvements in the management of information and distribution systems. During the first Gulf War for example, logistic data was moved on floppy diskettes. By the time of the second Gulf War in 2003, robust communications architecture had been created that relied on satellite links and networked computers. This enabled CSS supporting units in Iraq to be digitally connected to the theatre logistics base in
Germany. The CSS personnel were then able to use IT innovations such as in-transit visibility to track equipment, personnel and supplies. Real time information was also exchanged using the STAMIS thus allowing commanders and logisticians to share a common COP adapted to each echelon.  

In India, the emphasis of the defence industry is on ordnance. Even though the country has a robust commercial IT industry, there hasn’t been much interface between it and the military applications. India has 40 defence industries which specialize in the manufacture of ordnance and platform mainframes. They also adapt imported equipment and platforms to the Indian environment. However, some evidence of the application of IT in her recent military operations was demonstrated during Operation SANGRAM against Pakistan from 2001 to 2002. During that operation, the PRF decoder for laser target designators and software for logistics management systems were utilised extensively.

South Africa also has a robust military. Her defence industry evolved during the apartheid era as a consequence of the UN embargoes on arms sales. It has a total of 29 defence and defence-related industries which specialize in weapons upgrade and integration, command and control system, secure communications systems and Unmanned Aerial Vehicles (UAV). These are built to meet the requirement of the modern battlefield through integration into data and speech networks.

The South Africa system further takes advantage of Commercial Off the Shelf Technology (COT) by using processors licensed to South Africa by Intel. Other applications are FSMS which include logistic engineering support, management, facilities, spares and human resource management. There is also the CURIS which is used for electronic intelligence gathering. It
provides users with intelligence of current operational interest and handles the rapid distribution of finalised intelligence to operational users.  

1.6.5 ICT and Military Operations in GAF

The main objective of the MOD ICT policy statement is to transform the ministry and the GAF into an institution that conducts its activities, nationally and internationally, through the deployment and exploitation of state-of-the-art ICT facilities. The GAF Equipment Policy stipulates that, “The Ghana Armed Forces depends on the equipment development of advanced countries to meet all its major equipment requirements. The equipment in use and accepted as standard military equipment in these countries will normally be the only equipment types considered for introduction into the GAF. The GAF will maintain and improve its technical competence in all major equipment fields, in order to be able to assess and evaluate equipment under consideration”. Despite major breakthrough in ICT equipment by the advanced countries inferred in the Equipment Policy above, the GAF continues to face setbacks in its attempts to provide and maintain a standard ICT infrastructure due to financial challenges. Despite the low budgetary allocation to the GAF, its role in national security is still crucial. There is therefore the need for collaboration with state agencies including the National Information Technology Agency (NITA), Ministry of Communication, Ministry of Finance and Ghana Investment Fund for Electronic Communication (GIFEC). The establishment of a suitable ICT infrastructure through the nation ICT4AD policy and E-governance programme could be arranged. This should include a Fibre Optic backbone, computer peripherals and related accessories. It would form the foundation on which Centralised Databases and appropriate application programs for Personnel
Management, Financial Management and inventory control and Hospital Administration could be developed. The efficiency of units including Military Secretary, Records Office, Civilian Establishment, Defence Mechanical Transport Battalion, Base Workshop, Directorate of Ordinance Services, Base Ordinance Depot, Base Ammunition Depot and military Hospital could be enhanced.

Military operations conducted or participated in by the Ghana Armed Forces have not witnessed the application of ICT as recorded by some developed countries such as USA, India and South Africa. A review of available Ghanaian literature showed a low level of ICT application and awareness. Col Aboagye in commenting on military operations in Liberia noted the near lack of ICT in the operation as a major logistical challenge. Ghana’s current operational commitments are basically in external Peace Support Operations and Internal Security Operations. In all these operational areas, the GAF has demonstrated a poor application of ICT. Reports from almost all Ghana’s Peacekeeping missions indicate a consistent inability of the contingents to meet the ICT equipment requirements. Back home the situation is worse. During the last general election, the GAF had to borrow some ICT equipment from the Customs Excise and Preventive Service (CEPS) to enable it accomplish its task of providing security for the elections. The application of ICT has dominated every sphere of life and military operations in the GAF cannot be left out. The use of ICT enhances real time information of the operational situation upon which decisions could be accurately taken. For the GAF to be up to date, it must invest in ICT. Unavailability or inefficient use of modern ICT will lead to failure in operations.
1.6.6 Concept of Revolution in Military Affairs

There is no agreement among scholars that the present technological developments constitute a RMA. According to most scholars, there have been other defining moments in military history. These are said to include the invention of the internal combustion engine in the mid 1800s and Hitler’s use of the blitzkrieg or lightning warfare during the Second World War. However, the US DoD identified the ‘trend as technology that gives forces greater military capabilities through advanced concepts, doctrine and organisations so as to dominate future battlefields.’

Berkowitz further noted that ‘no one has felt the effects of IT more than the world’s military forces. This is no surprise, considering how much of the technology was developed in military laboratories or under defence contracts.’ On account of these developments, the front line is disappearing from war because weapons have longer range, precision and more power. Furthermore, worldwide communications enable armies to disperse and even deploy covertly within the AO before a battle even begins. Consequently, victory goes to the side that understands how to use information technology more effectively.

According to Owens, RMA consists of 3 schools of thought, namely; battle space awareness, C4I and precision force schools. His approach centres on the precision force school which requires a radical change in the organization of armed forces. The reorganization would discard the corps system in favour of small, compact mobile units of soldiers. The flaw in this approach is that it will involve the controversial and difficult effort of organising new ways of conducting warfare without corresponding changes in technology. Interestingly, in spite of his humanistic approach to RMA, he agrees with the applications of IT.
Owens maintained that ‘the commercial IT revolution that is transforming the world today has powerful military applications, including advanced computer system, global communications networks and land, air and space-based surveillance.’ Berkowitz buttressed this point when he stated that ‘the next wars will be fought not just on battlefields but also in the world’s computers and communications system.’ O’Hanlon on his own identifies 4 main schools of RMA thought namely: systems school, dominant battle space knowledge school, global reach and power school and the vulnerability school. The first 3 schools focus on the potentials of rapidly improving computers, communications and networking to make existing weapons systems function in a more integrated manner.

The vulnerability school posits that less advanced adversaries may benefit at least as much as the advanced ones from the developed technologies. O’Hanlon’s approach is however flawed in that he does not explain much on the vulnerability school, possibly because it holds much promise for the developing nations. Developing militaries could utilise vulnerability to their advantage by appropriating the widely available new technologies to tilt the military imbalance in their favour.

O’Hanlon also attempted to show that the real strength of RMA was in IT-based components, computers and communications. Consequently, he carried out a survey of developmental levels for military hardware to determine the likely trends from 2000 to 2020. At the end of the survey, he discovered that most of the rapid advances centre on computing speed, robotics and the performance of precision munitions. Advances in the other trends tended to be less dramatic. He therefore concluded that the real RMA is in computer and software.

O’Hanlon’s definition holds much promise for Ghana as upgrading computer and software would be within the nation’s fiscal reach. Furthermore, the opportunity to build on the advances
made notably the US has never been greater, given the global information highway. As the US AFM 3-0 pointed out that: ‘the US does not have monopoly on IT. As USA Forces exploit technology to achieve operational advantage, so might an enemy force. Never in history has access to advance technology been so widespread. Even adversaries lacking research and development capabilities can purchase remarkably sophisticated system in the global market.’

GAF needs to take advantage of such IT equipment in the global market to enhance her operations. This would further ensure that the armed forces make use of RMA thus enhancing her operations.

1.7 Theoretical Framework

The study uses Marshall McLuhan’s Medium Theory as the theoretical framework. The term was originated by Joshua Meyrowitz in his 1985 book “No sense of Place”; however McLuhan pioneered the study of this theory in his book “Understanding Media: the Extensions of Man” first published in 1964. Medium theory examines the potential influences of communication technologies on the human society in addition to and apart from the content they convey. According to McLuhan, a medium is any extension of people or any new technology. He states that “technologies are any extensions of our physical and nervous system to increase power and speed.” That is technologies are any extensions of some physical, social, psychological, or intellectual function of humans. Thus a wheel extends our feet, the phone extends our voice, television extends our eyes and ears, the computer extends our brains and electronic media in general extend our central nervous system.
McLuhan originated the concept that the “medium is the message.” This means the power of the message lays on the medium itself rather than on the content of the message. This is because the form and structure of the medium amplifies and accelerates existing processes and introduces new patterns into our daily affairs, which in turn shape the society. In this way, each medium changes human relations and relations with time and space. On this basic notion, he divides human history into oral, print, mechanical and electronic cultures. According to McLuhan, language can also be considered as technology because it is an extension of man’s inner consciousness; that is his inner thoughts, ideas and feelings, and it is from language that subsequent technologies have evolved. In McLuhan’s view whereas pre-electronic technology except speech extended parts of our bodies, electronic technology extended the central nervous system itself “in a global embrace, abolishing both space and time as far as our planet is concerned.” What he meant is that electronic technology extended our senses particularly those of sight and sound. So for instance, the telephone and the radio have become a long distance ear as the television and computer extend the eye by projecting further than our biological range of vision. The basic precepts of his view are that the rapidity of communication through electronic media echoes the speed of the senses. Through media such as the telephone, television and more recently the personal computer and the 'Internet', we are increasingly linked together across the globe and this has enabled us to connect with people at the other side of the world as quickly as it takes us to contact and converse with those who inhabit the same physical space. McLuhan argues that it is the speed of these electronic media that allow us to act and react to global issues at the same speed as normal face to face verbal communication. The effect of this, McLuhan suggests, is a new ability to experience almost instantly the effects of our actions on a global scale, just as we can supposedly do in our physical situations. He writes: ‘As electrically
contracted, the globe is no more than a village. Electric speed at bringing all social and political functions together in a sudden implosion has heightened human awareness of responsibility to an intense degree.’ He creates the image of ‘one being’ connected by an electric nervous system within which the actions of one part will affect the whole. In one sense the image of a global village represents simply the notion of a small space in which people can communicate quickly and know of every event that takes place. In a broader and more ideal sense the village represents community and the idea that we can all have a role in shaping our global society.

McLuhan identifies hot and cold media. Hot media are media that intensely engage a particular sense of the observer over the others and provide him with a lot of data yet does not require high participation by the observer for instance radio, film, photography and lectures. Cool media however are those that only mildly engage the observer’s attention yet require active participation on his part in order to fully comprehend all its parts for example television, cartoons and seminars. In classifying media thus, he does not seek to provide strict classifications of media but rather he attempts to capture the experience or effect of the medium. Consequently, a medium may be hot or cold depending on the society into which it is introduced and the stage of technological or social development of that society. Also, whether a medium is hot or cold also depends on how it is used in a particular society. He points out that media interact with each other so the introduction of a new medium changes the way existing media are used. It is this interaction between media that produce an impact on the society.

Meyrowitz elaborated on this theory by describing it as a theory that is concerned with the features of each means of communicating and how these features make the medium physically, psychologically and socially different from other media and face to face interaction. According to him, the theory examines variables such as the senses required to attend to the medium,
whether the communication is bi-directional or unidirectional, how quickly messages can be disseminated, whether learning to encode or decode in the medium is difficult or simple and how many people can attend to the same message at the same moment. He posits that it is such variables that influence the medium’s use and its social, political and psychological impact. He applies the theory in his article “Shifting Worlds of Strangers: Medium Theory and Changes in “them” versus “us” where he uses a medium theory perspective to analyse how oral, print and electronic modes of communication each create a different balance between people who know each other and between people who do not know each other.

Williams, a critic of McLuhan’s theory criticised McLuhan’s theory for being too technologically deterministic. According to him, technological determinism reduces everything outside of media to an effect. He also stated that McLuhan’s idea of a global village was ridiculous because he elevated instant communication from a technical level to a social level and ignored the fact that electronic media are shaped by social institutions. He argued that if the effect of the medium is the same regardless of whoever controls or uses it, and whatever apparent content he may try to insert, then the technology should be made to run itself and then no arguments should be made concerning its political and cultural effects.

Eco is perhaps the harshest critic of McLuhan’s theory. He opposed the idea that the medium is the message based on his view that the observer is free to interpret the message carried by the medium in a different way. He challenged this further by suggesting that the message becomes what the receiver makes of it by applying it to his own codes of reception which are neither those of the sender nor the scholar of communications. He also attacked McLuhan’s terms and definitions by arguing that McLuhan was wrong in arguing that media are metaphors that translate experience into new forms.
This theory is relevant to my work because the study lays emphasis on ICT which in McLuhan’s analysis are forms of media and how they can provide potential benefits and challenges to developing countries in the area of defence. The theory is also relevant because the study also examines how the use of ICT in the military has brought some changes into military organisations and how it has also changed the perception of governments and regional bodies regarding the conduct of operations.

1.8 Hypotheses

There are 2 variables under investigation in this research. These are ICT and military operations. In order to achieve the objectives of this research, deductions drawn would be tested vis-à-vis the following null and alternative hypotheses:

a. Ho – There is no relationship between ICT and military operations.

b. Ha – There is a relationship between ICT and military operations.

1.9 Research Methodology and Sources of Data

The research methodology employed is the qualitative method. Primary and secondary data were assessed via questionnaires, personal interviews and through books and publications. The sampling technique employed was a cross-sectional survey design to assess the level of ICT awareness among GAF personnel who have taken part in operations.
The purpose of the design was to ascertain the impact of ICT on military operations and aid in logical deductions to be considered within the theoretical framework of the study. Test samples were drawn from various units, bases, students of GAFCSC Course 35 and the entire military community in Burma Camp. This is because they formed an invaluable sampling design as most had experiences in joint and combined operations. A questionnaire was then generated for completion by various personnel who have taken part in military operations. With this approach, it was expected that data so gathered would establish the level of application of ICT to military operations by the GAF.

2.0 Arrangement of Chapters

The study is organized into four chapters. Chapter One outlines the Research Design. Chapter Two is the role of ICT in the world’s military. Chapter Three provides an overview of ICT in GAF. Chapter Four consist’s of summary of findings, conclusions and recommendations.
Endnotes


6 F.B Aboagye ECOMOG. 159.


8 Ibid, P. 32.


18 Ibid.


22 United Kingdom Doctrine for Joint and Multinational Operations JWP 0-01.1, P. 185.

23 United States AFM, FM 3-0, pp. 7-2.

24 Ibid, pp. 7-4.


26 Dwight Eisenhower, FM 3-1, op. cit., P. 2-1.


29 United State AFM 3-0, op. cit., p. 274.


31 Ibid, p. 7-76.

32 Ibid, p.7-16

33 Rajiv Kumar (Maj), ‘Defence Production in the Private Sector’, (United Service’s Institute of India Journal, 1990), p.27.


38 GAFCSC Operational Equipment Manual.

39 F.B Aboagye ECOMOG. 159.


44 Ibid, p. 23.

45 Bill Owens, Lifting the Fog of War, (Baltimore: Johns Hopkins University Press, 2001), P. 10.
Ibid, p. 25.

Berkowiz B, op. cit., P. 3.


Ibid, p. 66.

United States AFM 3-0, FM 7-0, pp. 8-9.
CHAPTER TWO

THE ROLE OF ICT IN THE WORLD’S MILITARY

2.1 Introduction

The purpose of this chapter is to discuss how ICT is used by the world’s military in conflicts, war, counter-terrorism, peace support and other operations. It will further explore the role ICT has played in influencing public opinion and foreign policy via the conduct of military, counter-terrorist, and aid operations. This is aimed at addressing my research questions as well as providing insight for future researchers. The past decade has shown an increase in ICT infrastructure in all parts of the globe, including both peaceful areas and those areas rife with regional conflict. Advancement in technology has inversely affected the cost of satellite receivers. The decrease in cost has resulted in a boost in the availability of radio telephony, and television. In conflict areas, ICT infrastructure has been brought in by aid organizations, military organizations, terrorists, and private investors. The net result is an increase in ICT infrastructure in areas where much of the country is without any other infrastructure (electricity, transportation, communication). Cell phones and text messaging have revolutionized how people live.\(^1\)

Conflicts, and for that matter, military operations occur independently of the existence of ICT. These conflicts have occurred in highly developed countries such as Northern Ireland and the former Yugoslavia as well as in places with very little infrastructure such as the Sudan and Rwanda.\(^2\) We can classify the way that ICTs are utilized in conflicts, war, and counter-terrorism in three main categories:
(1) Spreading information, viewpoints and propaganda;

(2) Gathering information to support operations; and

(3) Directly supporting operational activities.

2.2 The Role of ICT

In several ways, the internet has changed how information is transmitted during military operations. Instead of the one way flow of information that is seen via TV and newspapers it now becomes multi-directional, allowing multiple senders/receivers in various locations, from various backgrounds to participate. During the 1991 Persian Gulf War, the majority of the information received was via television and was highly dependent on military sources, with Colin Powell becoming well recognized by a large number of Americans.³

Most advanced armies the world over, are embracing and employing Network Centric Warfare (NCW). NCW has a constantly evolving definition, but the concept is rooted in the horizontal and vertical information-sharing using advanced ICTs. With NCW, power is shifted away from the industrial-age focus on mass, towards access and flow of information as an essential element of combat power.⁴

These armies are gaining leaps in effectiveness through information-sharing in established networks with real-time collaboration. By using digital ICT to acquire exchange and employ timely information throughout the battle space, units are able to conduct rapid and timely operations at the tactical and operational levels.⁵ A near-universal situational awareness gained
through Common Relevant Operating Picture and near-to-real-time intelligence gathered using drones and other Unmanned Aerial Vehicles is reason for success. This process allows both access to censors and shooters which allows rapid and precise identification and engagement of targets. For example the US Army employs the Force XXI Battle Command Brigade and Below (FBCB2) to enhance situational awareness for decisive decision making.

In military operations involving psychological operations, propaganda or information operations, information originating from the Internet gives users the chance to see situations from different points of view and to evaluate and compare the information from different prejudices and biases. There is also no time bias on the delivery of information; it is posted as it occurs without regard to deadlines and schedules which are characteristic of traditional media. Information is available whenever the users choose to access it. However this freedom also comes with its downside as there are no censors on the information for accuracy and/or reliability.\(^6\)

The recent escalation between Israel and Lebanon showed the evolving role of the media when communicating about a conflict. Blogs by media personnel embedded directly at the center of the crisis gave minute by minute descriptions of the events as they occurred. The media actually became part of the story instead of simply reporting it. The Internet's audience is greater and more geographically dispersed than that reached by popular news sources such as BBC or CNN. Terrorists have also learned the power that ICT affords when it comes to disseminating information to the public. They can manipulate the structure and method used to communicate, without having to rely on traditional media. This allows them to reveal themselves, their cause, and their actions, in the exact manner they want without the censorship of military or
government agencies or traditional media. The use of the Internet also allows them to gather a geographically dispersed following and influence perception across the globe.  

In both Kosovo and Burma the utilization of the Internet played a key role in how the conflict was portrayed to the public and in some respect, resulting in changes in the foreign policy of other governments. In Kosovo, both sides of the conflict used the Internet to spread information as well as their viewpoint in an attempt to gain support. Individuals used the Internet to tell their personal stories of horror and fear. This is a case where awakening, awareness, activism and radicalism can be stimulated at a local level and then mobilized into a wider process of dissent and protest, in the hope of changing foreign policy in other areas of the world.

Among many reasons, warfare is constantly changing due to changes in the art of war brought about by advancement in technology. ICT dominate today’s battle space. ICTs have resulted in an explosion of information that is available to commanders for decision making and the conduct of operations.

Spatial Audio Displays are ICT advancements that make it easy to design and synthesis auditory cues. In time past, most system displays were visual. Therefore, when a user’s visual system was overburdened, s/he could not detect a critical event in the environment. For example a pilot must simultaneously monitor the aircraft’s visual displays and look out of the cockpit windows when flying. Audio cues are useful by themselves or serve as a supplement to visual feedbacks, because they are able to increase awareness of surroundings, cue for visual attention and provide a variety of complex information to the user. It is particularly important when there is a high visual load. This technology allows a listener to perceive specialized sounds that appear to originate in different locations and distances from the ear, giving a 3-D effect of audio sound,
which is meaningful to the listener. This enables a listener to selectively attend to more than one sound at a time in different locations. Spatial Auditory display is also used to provide location-based warning of system failures, especially in aircrafts. For example failure in left engine or trouble in right shaft of an airplane can be cued.

Enabling or disabling ICT infrastructure is often the goal of a military operation. In the Israeli-Lebanese Conflict, a number of the July 2006 Israeli air strikes were targeted at transmission stations used by television, radio and mobile phones. An Israeli army spokeswoman said Israel hit a transmitter broadcasting Hizbullah radio and television programs and a second transmitting telephone frequencies used by Hizbullah. The official said that the stations were used for broadcasting anti-Israel propaganda and incitement against the country.\(^{10}\) The choice of these targets was not arbitrary, but a well thought out plan to reduce communications.

In the Yugoslavia conflict, NATO intentionally did not target satellite or Internet service providers. Policy instead was to keep the Internet open. In contrast NATO forces operation targeted Serb communication sources that were disseminating Milosevic’s propaganda. This demonstrates how ICT affects military decision making. Yugoslav and NATO opponents used the Internet to disrupt service on government computers and change contents on web sites. These types of actions certainly can have an indirect effect on public support.\(^{11}\) ICTs are used in conflicts for intelligence gathering, planning, communications, coordinating troops, disseminating propaganda and also for high-tech, smart weapon systems. ICTs provide a logistics capability to not only military and warfare operations but also to peacekeeping and aid efforts. Advanced armies also employ ICTs to permit a focused and streamlined logistical system which is centred on anticipation rather than responsiveness, thus dispatching requirements to arrive-just-in time.
Peacekeeping organizations view ICTs as a method to help deal with the underlying causes of a conflict by promoting access to knowledge, they can promote mutual understanding, an essential factor in conflict prevention and post-conflict reconciliation. ICTs also offer ways to reveal human rights abuses, promote transparent governance, and give people living under repressive regimes access to uncensored information.12

In World Disasters Report 2005, the International Federation of Red Cross and Red Crescent Societies emphasizes that in relief efforts ICT must be recognized as a form of aid in itself. Terrorists and rebel groups use the Internet extensively. In a report presented to the House Permanent Select Committee on Intelligence, May 4, 2006, Bruce Hoffman explained that in 1998, while fewer than half of the 30 groups that the US State Department designated as Foreign Terrorist Organizations (FTOs) had websites, within one year almost all of them did. Despite the multiplicity and diversity of terrorist websites, they share a number of key characteristics in common. These sites are often notable for their colorful, well-designed and visually arresting graph content. In this respect, they seem designed particularly to appeal to a computer experts, technologically inclined, video game addicted generation. Terrorists use satellite systems to communicate in remote areas. ICTs are used for the training of members and communicating operational instructions. They use the Internet to gather open source information and to hack into secure information sources. Terrorists use the Internet to gather information, communicate, plan and coordinate attacks. Past events provide evidence as to how terrorists use the internet to actually carry out an operation through denial of service attacks, planting viruses, stealing sensitive information, and interrupting or disturbing public services. A well-known example is the “Pakistani Hackerz Club” where a pro-Israel lobby organization’s database was electronically breached and 700 credit cards numbers were stolen and published openly on the University of Ghana http://ugspace.ug.edu.gh
ICTs play a role in both public perceptions of conflicts, military operations and terrorist organizations as well as the operations conducted by terrorists. These technologies can be easily and cost effectively exploited for multiple purposes and for what may be viewed as both “good and evil” purposes. ICTs have the ability to empower all organizations no matter what their fundamental objectives may be. In his report presented to the House Permanent Select Committee on Intelligence, Hoffman states the necessity to develop ways in which to limit the ability of terrorists to exploit the Internet. While a great deal of information is available on the current uses of the Internet by these groups there is a need to investigate and plan for what the future may bring by the military.

One other class of ICTs employed by advanced militaries is Skin-based displays. These are the ones that interface with the user’s skin. Examples are haptic and tactile displays that interface with the hand and skin respectively. These can be used to provide information when visual and audio signals or cues may not be available. One example of a tactile displays is the vibrate function in pages and cellphones. The United States’ Stryker Brigade Combat Team (SBCT) is a new organization which employs such ICT to optimize for complex and urban terrain. It is capable of leveraging complex Command, Control Communication, Computers, intelligence, Surveillance and Reconnaissance (C4ISR).
Endnotes


CHAPTER THREE

OVERVIEW OF ICT IN GAF

3.1 State of ICT Infrastructure and Application in the GAF

This chapter seeks to examine the existing ICT infrastructure within the GAF. The evolution of ICT in the GAF dates back to the early 1980s. This began with the acquisition of the first set of ICT based equipment and weapons platforms in the navy and air force. These equipment were acquired at that time because they were the most technologically advanced equipment available. The purchase was not based on a deliberate policy that sought to attain a higher level of ICT awareness. Consequently, personnel were trained in the handling of the equipment with each posting. This situation continued until the early 1990s when the global application of ICT became profound. This is because Nano technology was discovered and semi-conductors could be made as small with higher speeds as possible. This means computer chip sizes could be reduced further and more complex operation carried out. Apart from the weapons platforms and equipment, communications also play a vital role in military operations. However, the available communications equipment in the 3 Services of the GAF was found to have been acquired a long time ago and was analogue. These analogue sets which cannot be networked and therefore not interoperable with the current digital systems would not meet the requirements of modern battle space – less bulky but faster rate.

The computing aspect of ICT in the GAF at the initial stage was restricted to the use of computers for word processing basically. This means that all the other various usages of computers, such as information gathering, information dissemination, command and control and
smart weapons were neglected. This situation has however improved slightly, with the introduction of the internet facilities to some units and thus the employment of computers for reconnaissance, smart weaponry and command and control purposes. Let us look at the following critical areas.

a. **Mailing System.** The GAF still circulates correspondence through the signal Dispatch System (SDS). This system where correspondence are still printed out in hard copies and circulated around by courier is cumbersome, inefficient and a major drain on the already scarce resources of the GAF. For efficient administration, advanced militaries employ an electronic mailing system based on the Lotus Notes or other similar means. This facilitates easy daily transactions amongst Departments, Directorates, Service HQ and all offices and command posts both in peace and war time.

b. **Burma Camp Exchange.** The Burma Camp Exchange which provides line communication to the entire GAF is obsolete. Despite the rapid expansion of the GAF, the exchange has not received any major rehabilitation. Most offices are without telephone lines, thus compelling some appointments to use personal cell phones to conduct official business. This poses security challenges as classified information is made available in unsecured public networks.

c. **Combat Communication.** The state of combat net radios in various units is inadequate.¹ Most of the existing ones are old analog radios that fall short of modern communication standards. Most important is the need for secure communication by way of encryption frequency hopping and tunneling as is available in more modern military pattern radios.
d. **Internet Facilities.** Until recently, the provision of internet services to GAF units was mainly based on individual unit private arrangements. This implies that units had to contract private service providers to give them internet services. This state of affairs left several units without internet facilities, leading to low productivity. Thus the use of the internet for psychological warfare, cyber-attacks, espionage, winning hearts and minds of interest groups, information gathering etc. was neglected.

### 3.2 State of Equipment and Weapons Platforms

A survey of the various Services of the GAF showed that none of the Services has a fully functional ICT based system or a completely digitized system. It also showed that most equipment and weapon platforms were obsolete. These equipment and weapons were built as stand-alone units while the current ICT environment is one of systems integration or interoperability. It is also important to note that none of the Services has been able to effectively implement its ICT policy. Consequently, a pragmatic approach was adopted for the purpose of identifying the platforms’ IT fits or component. The various Services of the GAF are at different level of application of these platforms in their operations.

a. **Ghana Army.** The Ghana Army Weapons platforms range from the old Swiss MOWAGS to the current Chinese O5P and 122 MLRS. Information gathered in the course of this research revealed that few of the equipment carry digital apparatus which are capable of processing large amounts of data. Furthermore, most of the equipment is not capable of being networked due to variations in technology and countries of manufacture. Most of the Army’s threats are in the area of Internal Operations and International Peace Support Operations (IPSO).
In IPSOs, GA is expected to operate with other countries. This calls for interoperability in terms of ICT systems. Internally, conflict areas are becoming more dangerous as the belligerents are becoming increasingly sophisticated in their weaponry.

b. **Ghana Navy.** The Ghana Navy’s weapon platforms are her ships. Of the 14 ships and fast patrol boats in her inventory, only 2 ships namely the GNS YAA ASANTEWA and GNS NAA GBEWA are equipped with Automatic Identification Ship (AIS) system. This technology serves as eyes to the ship. A Digital Action Information System (DAISY) which is responsible for controlling all the sensors and weapons on board modern ships is lacking in the GN fleet. Piracy, pair trolling, illegal oil bunkering etc., continue to remain the Navy’s major threats. The lack of the above mentioned ICT systems make addressing these threats a daunting one.

c. **Ghana Air Force.** As is the case in the other services, there has been little acquisition or upgrading of equipment and weapons platforms by the Air force in the past 10 years. It is worth noting however that a few digital Air planes (k-8, CASA 295 and Embraer) were recently acquired and these carry the latest ICT fittings. Our noble ambition ought to be to acquire the technology instead of relying solely on mere acquisition of products of technology from the developed nation.2

### 3.3 Problems and Challenges of ICT in the Conduct of Military Operations by the GAF

The foregoing paragraphs focussed on the weapons platforms and equipment in the GAF. However, in order to facilitate a comprehensive study, it was necessary to assess the level of ICT
awareness and actualisation among the personnel who conduct the operations. The delimitation of the study is that it was based on units that had taken part in operations including military exercises both within and outside the country.

**TABLE 1. TARGET GROUP AND RESPONSE DISTRIBUTION**

<table>
<thead>
<tr>
<th>Serial</th>
<th>Target Group</th>
<th>Distributed Questionnaires</th>
<th>Returned Questionnaires</th>
<th>Response Rate (%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
</tr>
<tr>
<td>1.</td>
<td>Ghana Army</td>
<td>40</td>
<td>33</td>
<td>82.5</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Ghana Navy</td>
<td>30</td>
<td>22</td>
<td>73.3</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Ghana Air Force</td>
<td>30</td>
<td>24</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Total</td>
<td>100</td>
<td>79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Fieldwork, 2014.*
A total of 79 duly completed questionnaires were returned by respondents. This constitutes 79 per cent response rate which in the opinion of this researcher is a good response level. The data collected was therefore high enough for credible analysis and rational deduction as the number was also fairly distributed among the sample population. Random interviews were also conducted.

Table 1 presents the percentage response level for each of the Service. The basic assumption is that the target respondents represent the views of members of the GAF. The data analysis and interpretation led to some logical findings which form the basis of the assessment of the effect of ICT in operations conducted by the GAF. Figure one shows that questionnaires sent to the 3
Services were returned with high percentage. The army had 82.5 per cent return of questionnaires while the navy and Air Force had 73.3 and 80 per cent respectively. Consequently, deductions are made in the statements and tables below:

<table>
<thead>
<tr>
<th>Serial</th>
<th>Description</th>
<th>Percentage Participation in Operations</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
</tr>
<tr>
<td>1.</td>
<td>Operations outside Ghana</td>
<td>50.53</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Operations within Ghana</td>
<td>25.25</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>No operations</td>
<td>24.22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows that a large number of the respondents had participated in at least one operation outside Ghana, while a significant number had participated in operations within Ghana. The numbers are 50.55 per cent and 25.23 per cent respectively. The operations outside Ghana were the UN Peace Keeping and ECOMOG Operation while those within the country were mostly Internal Security Operations. The balance 24.22 per cent had not participated in any operation. Thus the survey population is adjudged capable of assessing ICT application in operations.
### TABLE 3. LEVEL OF APPLICATION OF ICT IN DIFFERENT OPERATIONS

<table>
<thead>
<tr>
<th>Serial</th>
<th>Operation</th>
<th>High ICT Application</th>
<th>Low ICT Application</th>
<th>Total</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
</tr>
<tr>
<td>1.</td>
<td>UN</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>ECOMOG</td>
<td>33.73</td>
<td>66.23</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Within Ghana</td>
<td>11.88</td>
<td>88.12</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>


### FIGURE 3. BAR CHART SHOWING LEVEL OF APPLICATION OF ICT IN DIFFERENT OPERATIONS

Table 3 shows the breakdown of level of application of ICT in the different operations. The United Nations (UN) Operations had the highest level of ICT application as a total of 75 per cent rated the level of ICT application high, while 25 per cent rated it low. The application in ECOMOG operations is passable with 33.73 per cent of respondents rating the level of application high and 66.27 per cent rating it low. In operations within Ghana the level of ICT application was far lower with an 88 per cent poor rating. This shows that majority of the troops had experience with ICT related equipment while on UN operations. Further interviews indicated that the application of IT in the ECOMOG Operations were of high immense benefit to the troops and success of the operation.

**TABLE 4. COMPUTER USES**

<table>
<thead>
<tr>
<th>Serial</th>
<th>Description</th>
<th>Usage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
</tr>
<tr>
<td>1.</td>
<td>Word Processing</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Internet/E-mail</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Sensors</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 indicates the level of computer use for different applications. Computers were mainly employed for word processing and other secretarial duties. The response of the respondents showed that 50 per cent utilise ICT purely for word processing, 37 per cent for Internet, e-mail and other forms of communication. Only 13 per cent is utilized for sensor and precision guided equipment such as artillery weapons. This showed that most of the respondents’ experiences of ICT were with the use of computer. However, the table and figure shows that the respondents mostly used computer for word processing and communication whereas the important part for military operations such as intelligence gathering and Command and Control was neglected. Thus it is important for this aspect of areas affecting military operations to be given consideration.
TABLE 5. FACTORS CONTRIBUTING TO LOW LEVEL APPLICATION OF ICT

<table>
<thead>
<tr>
<th>Serial</th>
<th>Description</th>
<th>Percentage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
</tr>
<tr>
<td>1.</td>
<td>Lack of Awareness</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Lack of Training</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Lack of ICT Equipment</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>


FIGURE 5. BAR CHART SHOWING FACTORS CONTRIBUTING TO LOW LEVEL APPLICATION OF ICT

Table 5 gives details of respondents view on factors responsible for low level of ICT application in the Ghanaian military. The major reasons for the low application of ICT in military operation in the Ghanaian Military are the Lack of awareness and training. These accounted for 50 per cent and 30 percentage of the problem, respectively, while the lack of ICT equipment accounted for 20 per cent. Thus with appropriate awareness campaign and training the Ghanaian military would be adequately prepared to use ICT in her operations. The number of ICT based equipment in the Ghanaian military could have also attributed to the lack of awareness and training on ICT applications.

**TABLE 6. LEVEL OF AWARENESS AND APPLICATION OF ICT**

<table>
<thead>
<tr>
<th>Serial</th>
<th>Description</th>
<th>Good (%)</th>
<th>Poor (%)</th>
<th>Decline Comment (%)</th>
<th>Total (%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
<td>(g)</td>
</tr>
<tr>
<td>1.</td>
<td>Knowledge of ICT</td>
<td>75</td>
<td>14</td>
<td>11</td>
<td>100</td>
<td>90% of Respondents took part in UN Operations</td>
</tr>
<tr>
<td>2.</td>
<td>Conduct of Operation with ICT</td>
<td>62</td>
<td>30</td>
<td>8</td>
<td>100</td>
<td>82.7% took part in UN Operations</td>
</tr>
</tbody>
</table>

*Source: Fieldwork, 2014.*
Table 6 indicates the level of awareness and application of ICT among respondents. Almost all respondents had good awareness of ICT as 75 per cent responded positively. Fourteen percent had poor knowledge and the remaining 11 per cent declined comments. However, 90 per cent of those who were aware of ICT were also those who had taken part in international operations. Concerning operations conducted with ICT, the response rate was 62 per cent rated the level of ICT in operations high. Thirty per cent rated it low, while 8 per cent declined to comment. It was observed that those who rated it high were those who had participated in international operations.

3.4 Findings

The analysis showed that the lack of awareness and deficiency in ICT training in the GAF. The analysis further revealed that the level of application of ICT in military operations was generally low for national and regional operations. The level was, however, high for UN operations and among personnel who had taken part in international operations.

The study also found that ICT awareness and literacy was largely restricted to word processing, internet/e-mail while communications and sensors use were not significant. These findings are at variance with the definitions of Olunloyo\textsuperscript{3} and different from Berkowitz’s assertion that the next wars will also be fought on the world’s computer systems.\textsuperscript{4} It could be noted that the inconsistencies also point to a lack of coordination among the Services.

In view of the findings in this study, an attempt will be made to assess the implications for the Ghanaian military using the research findings as logical premises. Consequently, strategies for enhancing the application of ICT for military operations in the GAF will be suggested.

3.5 Strategies for Enhancing ICT Use by the GAF for Operations

The study results show that there would have to be changes in the Ghanaian military in order to improve the application of ICT in military operations. Furthermore, the changes should take into consideration the expected direction of the GAF up till 2025 as articulated in the scope of the study. In order to ensure continuity, a 10 year forecast extending to the end of the scope period was considered. The plans are based on the following assumptions regarding the threat scenario in the sub-region:
a. There will be no real aggressive projection of military power into sub-Saharan Africa by foreign powers for the purpose of conquest or occupation.

b. African conflicts will remain primarily intra-state, although inter-state conflict of limited scale and intensity could occur.

c. International and regional interventions such as peace support operations sanctioned or endorsed by the UN and AU will also continue to take place.

d. There is also a need for preparation for full scale war. Though this remains an unlikely event, nevertheless, the type of readiness required cannot be built up overnight.

The strategies would focus on the integration of ICT innovations with training and logistics planning to enhance the overall military value of ICT in operations undertaken by the GAF. The proposed blueprint would comprise 4 phased strategies, some of which would run concurrently. The phases are policy formulation and implementation, technology transfer and military industrial espionage, training and funding.

3.5.1 Phase 1: Formulation and Implementation of Information Technology Policy.

The formulation and implementation of ICT Policy phase involves the proposal and formulation of strategies and an integrated ICT policy. The proposed policy could be known as the GAF Integrated Information Communication and Technology Policy. Integrated because the current battle space is joint, therefore the MOD could be tasked to coordinate its formulation in conjunction with the services. The joint formulation of the policy would also improve
coordination which is the foundation for efficient joint operation. The policy could adopt relevant sections of the NITA’s Policy. It is suggested that the proposed policy inputs could at inception contain certain elements. These elements are objectives of the policy, funding, joint training, procurement guidelines and setting of appropriate standards. These could be reviewed and refined as the formulation process progresses.

3.5.2 Phase 2: Technology Transfer and Military Industrial Espionage.

The technology transfer and military industrial espionage phase involves a determined effort by Ghana not to only purchase ICT equipment but to also acquire a technology transfer. Ghana could get a head start on new technologies through technology transfer and military industrial espionage. This would enhance the adaptation of available technology to the Ghanaian environment as shown in the Indian and South African models. The foregoing therefore presupposes that even though Ghana would be starting from behind, it has the advantage of learning from developed countries and avoiding their mistakes. Furthermore, the MOD could task GHQ (R&D) to go into research and development of relevant areas.

3.5.3 Phase 3: Training.

The ICT environment of the Twenty First Century presents greater training challenges which are due to the rapid advances in technology. This makes the strategic environment to be less predictable and more diverse, indicating a need for joint, inter-governmental and multinational training. In the light of the study findings therefore, the proposed training schedule could begin
with the articulation of an appropriate ICT Training Doctrine which would emphasise performance-oriented training. It could include proficiency in the adaptation of emerging ICT trends to the domestic environment, training on the maintenance and sustenance of ICT systems. This training phase is expected to commence after the articulation of the ICT Training Doctrine as expressed in the proposed ICT Policy.

3.5.4 Phase 4: Funding.

The funding phase should be the result of a sequence of events and the funding policy would be described in the ICT policy. It would spell out the tasks the Ghanaian military are required to carry out and the level of funding required in executing those tasks. Furthermore, the tasks would be programmed to ensure that personnel and equipment are maintained in an orderly and prudent fashion. It is to be noted that the initial phases of this strategies would require large amount of funds to take off. Consequently, it is suggested that representations be made to the Legislature for extra funding in defence budgetary allocation. It is expected that the implementation of the above strategies for the application of ICT would enhance the conduct of operations by the GAF. For such radical changes to be viable however, a multi-dimensional approach which would involve other relevant organs of government is suggested. This suggestion takes cognisance of the fact that the military does not operate in isolation, but is part of a democratic process.
3.6 Summary

The variables identified in this research are ICT and military operations undertaken by the GAF. ICT is the independent variable while military operations undertaken by the GAF is the dependent variable. For this study, a combined qualitative and quantitative research methodology was used. This was done to enable the study answer the research questions.

A sample size of 100 personnel drawn from various units was used. Each respondent was given a questionnaire containing 12 questions. Seventy nine of the questionnaires were returned thereby making the instrument valid.

The analysis yielded a set of results which showed the lack of awareness and deficiency in ICT training in the GAF. The analysis further revealed that the level of application of ICT in military operations was generally low for national and regional operations. The level was however high for UN operations and among personnel who had taken part in international operations. The study also found that computer awareness and literacy was largely restricted to word processing and Internet/e-mail/communications while sensors use were not significant.

To position the GAF to effectively benefit from ICT, some strategies were proposed. A 4 phased strategy was proposed which are formulation and implementation of an ICT Policy, technology transfer and military industrial espionage, training and funding.
Endnotes

1 ISR Report on the Inspection and Assessment of ICT Facilities for the Expansion of GAF Network


CHAPTER FOUR

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary of Findings

The analysis yielded a set of results which showed the lack of awareness and deficiency in ICT training in the GAF. The analysis further revealed that the level of application of ICT in military operations was generally low for national and regional operations. The level was however high for UN operations and among personnel who had taken part in international operations. The study also found that computer awareness and literacy was largely restricted to word processing and Internet/e-mail/ communications while sensors use were not significant.

To position the GAF to effectively benefit from ICT, some strategies were proposed. A 4 phased strategy was proposed which are formulation and implementation of an ICT Policy, technology transfer and military industrial espionage, training and funding.

4.2 Conclusions

This study set out to examine the level of application of ICT in military operations in the GAF. The study specifically assessed the relationship between ICT and the conduct of military operations and the level of ICT acquisition and application in the GAF. Others were determining the problems, challenges and strategies for improving ICT in military operations. In order to accurately measure the level of awareness and the implications therefore, an empirical survey
was carried out. The findings were then considered in the light of existing literature on ICT, military operations and the application of ICT advances to maximise military capabilities.

The study revealed that there was low awareness of the immense possibilities of ICT and its application for military operations in the GAF. Furthermore, it showed that the domestic and regional operations were low in the application of ICT and the opposite was seen for international operations such as UN Operations. It also found that basic ICT training was deficient, thus causing the personnel to be disadvantaged during international operations. Additionally, the use of computers and computer appreciation was seen to be inadequate. Others are the lack of adequate training and the obsolescence of equipment.

For the Ghanaian military to take advantage of the immense possibilities of the latest ICT advances, the problems would have to be tackled aggressively. Consequently, a 4 phase strategy for positioning the GAF to effectively benefit from ICT was proposed.

4.3 Recommendations

It is recommended that the Ministry of Defence should promulgate a GAF Integrated Technology Policy in conjunction with NITA’s policy for Information and Communication Technology. This should prioritize the acquisition and employment of ICT in all GAF operations.

The Ministry of Defence should extend training on ICT to both military personnel and civilian staff of the Ministry. This can be enhanced by embedding Civilian Contractors to train and operate with the military personnel.
The Ministry of Defence should establish combat information operation directorates in each of the services. These directorates should further establish field experimental units to constantly apply ICT to military operations. Their ultimate aim should be to achieve inter-operability between the services.

The Ministry of Defence should increase defence budgetary allocation to ensure appropriate budget flexibility to exploit unanticipated advances in ICT.

The Ministry of Defence should encourage further research into adapting available ICT advances to the GAF. This can be enhanced through partnership with the relevant higher institutions of learning.
BIBLIOGRAPHY

BOOKS


Bill, O., Lifting the Fog of War, (Baltimore: Johns Hopkins University Press, 2001).


Kornwachs K., Jacoby K (ed), Information: New Question to a Multidisciplinary Concept (Berlin, Akademie Verlag, 1996).


Murray, W., Information Technology Trends and Applications in Science and Business (Concept Publication 2001).


JOURNALS


OFFICIAL PUBLICATIONS


Joint Chiefs of Staff, Department of Defence Dictionary of Military and Associated Terms: Joint Publication 1-02, (Washington DC, Office of the Joint Chiefs of Staff, 1998).

Joint Chiefs of Staff, Joint Doctrine for Information Operation JP 3-13 (Washington DC, 1998).
Joint Chiefs of Staff, British Defence Doctrine: Joint Warfare Publication (JWP) 0-01, (Swindon, Joint Doctrine and Concepts Centre, 2001).

United States Army Field Manual FM 3-0 (Washington DC, Department of the Army, 2001).


UNPUBLISHED MATERIALS


