

Improved Model for Use of Geographical Information System (GIS) in Sri Lanka Army

Lt Col S Pakshaweera Head of the Department of Information and Communication Technology and Nandana Pathirage

1. Introduction

Since the beginning of civilization on planet Earth, Military forces have played a dominant role. Mankind has since time immemorial has a fetish for warfare and this continues till today. Only methods have changed with technology used in warfare, which are changing rapidly with technological revolution. They have not only changed the way wars are fought but have become a key factor in attaining dominance in military power. The battle victory is complete only after ground forces occupy the enemy land and take control of the area. To hold and maintain the control of the occupied land armed forces need to know the spatial extent upon which they have the control (Devid, 2001). According to Singh (2007), the need to understand terrain has always been an essential skill for the military commander. Understanding has been supported by paper mapping for at least 1,000 years at the strategic level and at least 300 years at the tactical level. The concepts of Command, Control, Communication and Coordination (C4I2) in military operations are largely dependent on the availability of accurate information in order to arrive at quick decisions for operational matters.

In the present digital era, GIS is an excellent tool for Military commanders during operations. The use of GIS applications in defence forces has revolutionized the way in which these forces operate and function. Military forces use GIS in a variety of applications including cartography, intelligence, battle field management, terrain analysis, remote sensing, military installation management and monitoring of possible terrorist activity. Now GIS play a pivotal role in Military Operations as they are essentially spatial in nature.

Furthermore, according to Baijal (1997), digitization of the battlefield - "The Electronic Battlefield" - is now demanding the next technological leap, which is the embracing of digital geographic information (DGI) and the means of exploiting DGI, which is the geographic information system or GIS. That will not happen until GIS runs an infrastructure that can be folded up into a side pocket, get soaking wet, require no external power, and be disposable that is some distance in the future. For the foreseeable future, the paper map and GIS will be complementary.

This paper is intended as a research to formulate the set of guidelines and recommendations to Sri Lanka Army for effective use of GIS technology. These recommendations were formulated based on the examination of how GIS was used in SL Army and how it impacted on the war and the identified benefits and constraints of fully integrated GIS for Sri Lanka Army.

2. GIS and Military

The military command, which acquires the information fast and uses it fast will be at an advantages position in a future war. This was amply demonstrated during the Gulf War in the early nineties by Allied Forces against Iraq. In an article in Electronic Today of November 1996, Major General Gurbaksh Sing, states:

“The lessons gained from military history indicate 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 C 412 process. If a defending force or weapon system can with some accuracy and sufficient warning find out where the attacker is or what his future course of action would be, it would be easier to defeat him by occupying a position of advantage or by massing a superior force at the point of decision.”

This statement would amply demonstrate how important the spatial information to a field commander or his superior at command headquarters, is for taking an appropriate decision for military operations. C 412 referred in his statement indicates Command, Control, Communication, Coordination, Information and Interoperability. He has rightly indicated the importance of interoperability, which is a very important aspect in the current scenario of proliferation of several computer systems and software systems used in the military operations.

In addition as stated in Military Analyzing Report of Indian Army (2008), spatial data is of crucial importance to the military commander in the battle as it is for a decision maker in planning and development in a state's growth. Ministry of Defence in any country gathers data on routing, filtering, analyzing and presenting information for decision-making. The regional conflicts, rapid deployment and flexible response imposes heavy burdens on military commanders, their staff and supporting systems to keep up-to-date situation on the ground about enemy activities. Visualizing raw tabular data within a spatial framework has many benefits. Therefore digital mapping and GIS occupy centre stage in activities as diverse as battlefield simulation, mission briefing and communications planning, logistics management and command control.

Moreover, use of GIS in the management of military bases facilitates maintenance and the tackling of all stores, which may be found on the base. GIS allows military land and facilities managers to reduce base operation and maintenance costs, improve mission effectiveness, provide rapid modelling capabilities for analyzing alternative strategies, and improve communication and to store institutional knowledge.

The digital revolution and in turn, GIS has changed the way militaries operate while fighting wars, defending countries, and gathering intelligence. Furthermore nearly, all military activities are terrain sensitive and need careful planning and reconnaissance to ensure success. Spatial data is crucially importance to the military commanders in the battle as it plays a major role in decision making. With GIS and accompanying equipment, information is readily available to be uploaded, processed and stored. Military history is full of incidents wherein a smaller army having a good knowledge of the terrain has defeated a much larger well-equipped and organized army.

3. Impact of GIS

When an operation is planned either an offensive or a defensive, the commanders will have to consider the terrain, enemy, its own forces and resources. If the Sri Lankan Army has a GIS which cover that information, commanders will be able to operate efficiently and effectively. Having such a system will be advantageous and they will be able to gain in those respective fields. Having accurate information about, terrain, enemy, own forces and resources, the commanders can work out a number of possible deployment plans for his troops as per the GIS as follows:

- **Deployment of Infantry**

The GIS provides information on terrain, enemy and own resources in one map and according to the information the ground commanders had deployed the troops considering the terrain, enemy, own forces and resources in recent war.

- **Deployment of Armour**

The role of armour is to provide aggressive mobile action to destroy enemy armour and close combat in conjunction with infantry. According to the information about terrain and enemy commanders decide how best to employed armoured troops efficiently and effectively, with the help of GIS during the war.

- **Deployment of Artillery**

To provide fire support required for the operation plan and to locate enemy weapons and movements and acquire targets in conjunction with other arms for attack by nuclear and non-nuclear fire power. To provide the air defence facility. According to the information about terrain and enemy commanders enable to deployed artillery efficiently and effectively, with the help of GIS during the war.

- **Deployment of Engineers**

The primary role of combat engineers is to improve our own mobility while doing everything possible to hinder the movement of the enemy. With use of GIS engineers manage to lay obstacles and clear the obstacles effectively in defensive operation and offensive operation during the war.

4. Methodology

Considering the nature of the research, as the chosen research methodology for the research, a mix of quantitative and qualitative methodologies was used. The characteristics of the quantitative and qualitative methodologies and the variables of the research necessitate a coherent synthesis between these two methodologies.

The main stimuli behind using such a combination is that the research demands the formulation of an improved model for the use of GIS within the Sri Lankan Military establishment which takes into accounts the socio-economic and strategic dimensions of using GIS in an operational basis. Therefore, this combination made the research more in-depth and productive.

Within the larger frame work of selected methodology, several research techniques were employed to gather the necessary data. Interviews, observation, and case studies were employed in the process research as these techniques facilitated the elicitation of descriptive data found in the problem domain. When looking at disadvantages of interviews, it can be identified that some of the participant were inhibited by the presence of an interviewer discouraging them to be totally truthful.

Further, questionnaires and document reviews provided the researcher with the necessary numerical data in order to identify ground realities and generate conclusions in the course of the research but being an impersonal medium it was unlikely to yield attitudinal data or any other sort that has emotional implications. Hence, questionnaire was used to gather current practices and issues related to GIS usage in the Sri Lanka Army and its usage during the war situation in North and East. Questionnaire targeted a randomly selected sample of 120 officers with the minimum military service of 12 years in the army and it consisted of 25 questions.

Finally, to theorize and reach conclusions, an inductive approach which uses data to formulate theories was applied to the qualitative data and a deductive approach which applies a tentative hypothesis to the concerned data to ascertain its validity was applied to the quantitative data.

5. Benefits of Fully Integrated GIS for each Unit in Sri Lanka Army

The following figure illustrates the benefits of using GIS for each unit in SL Army as measured according to the level of GIS utilization during operational tasks.

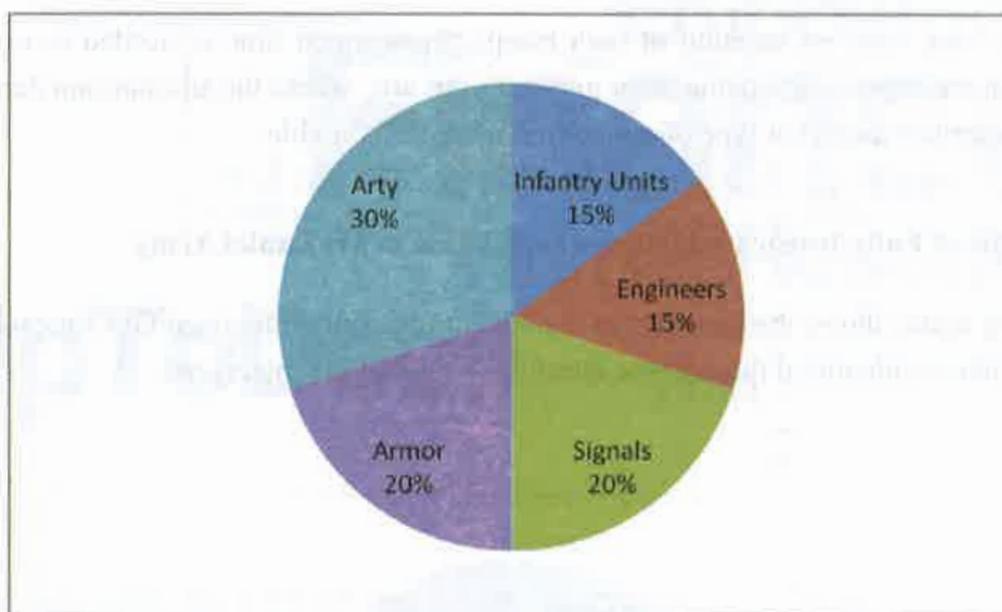


Figure 5.1: Benefits of Implementing a GIS for each Unit in SL Army

Source: Author

As shown in the Figure 5.1 diagram, benefits for fully integrated GIS for SL Army were discussed in question 7A and 8A. In addition to the feedback of questionnaires, feedback of interviews which were conducted with the Unit Commanders, Intelligent Officers, Officer Commanding and Platoon Commanders were also considered. It was very much appreciated by the answering party for these questions and participation for the interviews. Further, according to the above diagram, from all operational units such as Engineers, Signal, Armour and Infantry, the Artillery unit in the army which gave covering fire for ground troops to advance forward without any resistance from the enemy, and engaging the forward targets get benefits of implementing a fully integrated GIS at greatest extent. Furthermore, after analyzing the feedback received from the interviews, Artillery

unit getting following benefits by implementing fully integrated GIS. The information about terrain and enemy would enable the commanders to decide how best to employ his artillery efficiently and effectively, with the help of GIS.

Following factors were identified as being advantages that were common to all units and were of greatest importance to all units.

- To Identify the Terrain

GIS typically provides data on the best soil available to deploy artillery, the areas with crest clearance to deploy guns, the areas ideal for ammo dumps, suitable locations to establish the command post, and setting up defenses for gun positions.

- To Identify the Enemy

The information on the firing range, enemy defenses and their condition, required ammunition, blocking enemy reinforcements, and identification and confirmation of targets is obtained with aid of GIS.

- Own Forces and Resources

GIS helps to keep track of location of own troops, how much time is needed to reinforce gun position in an emergency, where the other gun positions are, where the ammunition dumps will be, and what Quantities and what type of ammunition will be available.

6. Benefits of Fully Integrated GIS for each Phase in Sri Lanka Army

The following figure shows the benefits for implementing a fully integrated GIS for each phase in SL Army which are identified through the questionnaires and the interviews.

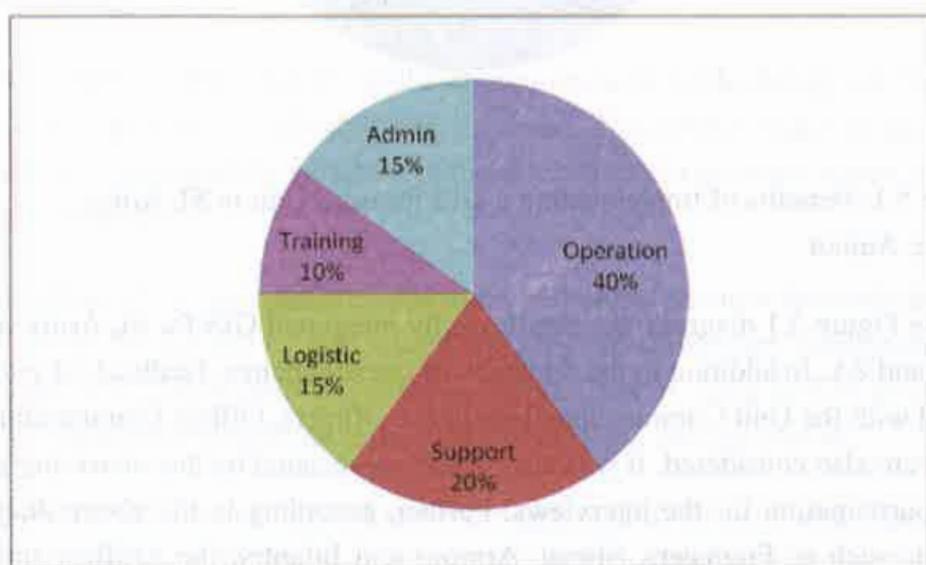


Figure 6.1: Benefits for Implementing a Fully Integrated GIS for each Phase in SL Army

Source: Author

Empowering of Authorities is the next constraint with the same percentage. There are some high ranking army officers who don't like to move with the latest technology due to lack of their knowledge about it. They think their command and control will be lost with these new technological improvements. Time has the lowest percentage which is 10%.

Due to all the above mentioned reasons, implementing a fully integrated GIS for the Sri Lanka Army might take a considerable time.

8. Conclusion and Recommendations

Based on the research findings, the recommendations for implementing a fully integrated GIS for the army and specialized regiments according to their necessity are presented below

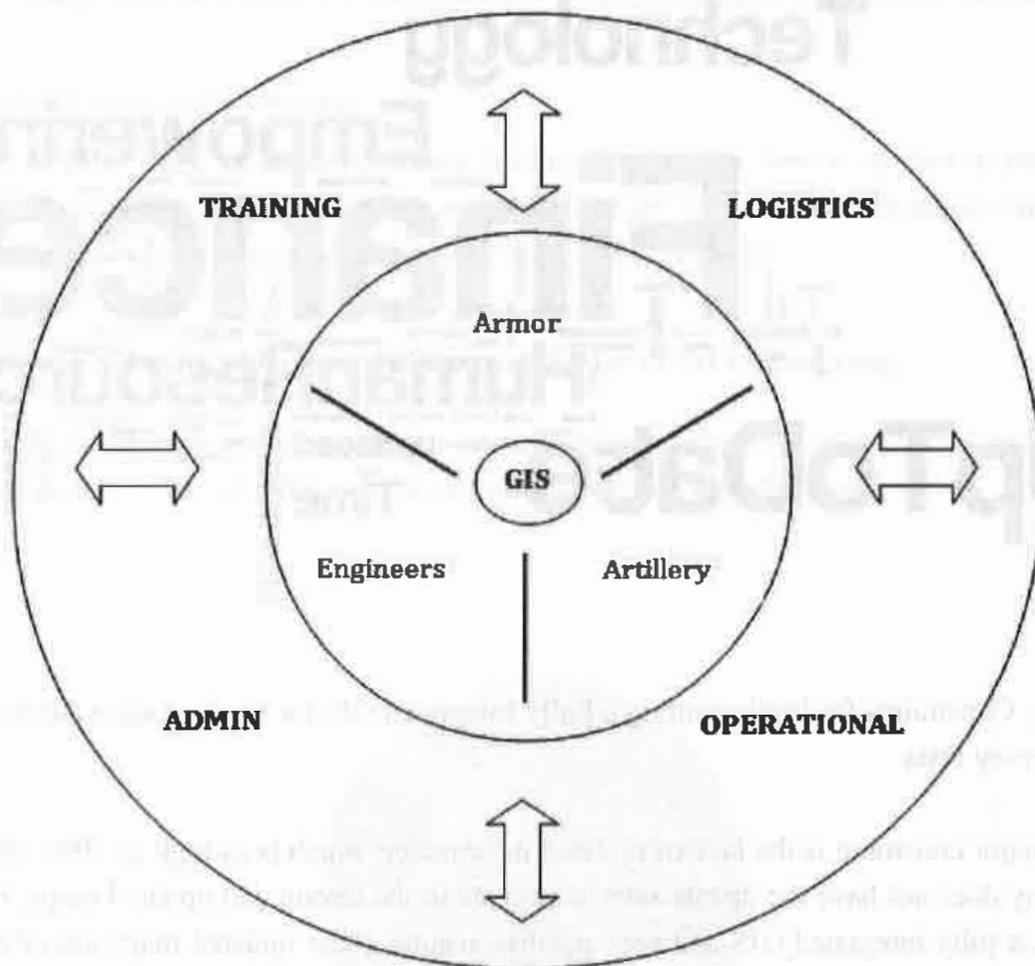


Figure 8.1: Units/Phases for Implementing a Fully Integrated GIS for the Sri Lanka Army

Source: Author

8.1 General

Training, Logistic, Administrations and Operational All Regiments are common to entire Army

8.1.1 Training

It is highly recommended to establish a GIS directorate under the Signal Regiment and there should be a GIS training institute to train all Army Officers and Other Ranks.

8.1.2 Logistic

- Ammo storing and distribution System
 - Fuel Distribution System
 - Military vehicle maintenance System
 - Medical System
 - Rehabilitation System
 - Maintenance of Assets, Inventory, Procurement System

8.1.3 Administration

- Personal information system for Sri Lanka Army

8.1.4 Operational All Regiments

- To identify the space available for troop deployment.
- To identify the direction of assault.
- To block and cut off enemy likely reinforcement.
- To calculate the available forces.
- To measure the quantity of combat supplies available .
 - To identify the location of own troops and enemy.

8.2 Specialized Regiments

Armor, Artillery and Engineers have specific guidelines apart from the common.

8.2.1 Armor

- To identify the type of soil and where the “go” and “no go” areas are.
- To decide the kind of formation to be adopted.
- To identify where the repair and recovery elements would be and how they could be used.

8.2.2 Artillery

- To establish the command post.
- To set up defence for gun positions.
- To decide the range to be applied
- To register targets.
- To locate other gun positions.

8.2.3 Engineers

- To decide how much mines are required to cover the area and what types are required.
- To identify where to lay mines to prevent enemy movement.
- To identify the density of mines needed for each area.

Finally, it can be concluded that the recommended guidelines for fully integrated GIS for Sri Lanka Army to effective use of this technology in a future war situation has formulated successfully. This formulated guidelines can be apply to the both administrative and military operations purposes.

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