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**INFORMATION TECHNOLOGY
AND ORGANIZATIONAL PERFORMANCE**

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Abstract:

It is a known fact that information technology (IT) enables the military organization to decrease the amount of time spent in planning, coordinating and conducting all spectrum of operations and to increase its capabilities. This paper analyzes the overall relationship between information technology and the organizational performance inside the military organization. The aim is to establish a framework for future research in order to improve the effectiveness, efficiency and proficiency of using IT resources, both in peace time and wartime operations. The facts presented were observed and compared at first hand, as an operator, leader and manager in different military structures and task forces. The most relevant factors were seen in theatres of operations.

Key words: Organizational Performance, Decision Making, Efficiency, Input, Output, Value.

1. Introduction

The investments in information technology are financially expensive and complex for all organizations, regardless of what nation they belong or their domain of activity. Once introduced, people tend to rely more and more on the capability of information technology, this becoming an integral part of their daily activity at home, workplace and recreational time.

Understanding the full potential of IT in the military is still a challenge, due to the multitude of fields this technology is involved in. Starting with typewriting, computers were gradually understood, first by users and then by organizations, once the value of IT capability was observed, and managers started to use the extraordinary features of the computer networks in analysis, management, decision making, communicating within the organization and outside it. Furthermore, IT became a force multiplier factor. The rapid share or dissemination of information through different networks determined the operations to be shorter, more focused on the objectives and the Command and Control (C2) became more effective.

Through the ages, military organization used some different means for satisfying its needs and to achieve its primary goal: to provide the proper environment for development of the society it came from.

The first step in creating an effective army is to build a proper structure, depending on the strategy adopted by the leaders of the nation the army is supposed to serve. Then this forces have to be equipped and trained. And there is the need for communication

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through the entire military organization, both vertically and horizontally. These activities had to be done in peace times and in war.

Technology evolved and armies used assets they discovered in order to do their activities, to send orders and receive reports faster than the opponents. Carriers on horses, followed by cars, pigeons, signals made with blow horns, trumpets, drums, flags, telegraph, telephone and radios, all of them were used for communication as mankind discovered new means that offered some advantages over the opponents. As IT became available, all sectors have been affected by it, being significantly enhanced in proficiency, efficiency, effectiveness and time economical.

2. Organizational performance in the military

Organizational performance is defined as indicators of success that are indicative of meeting the mission and goals of the organization and specific to the organization (Miller, 2007, p. 130). For instance, in the military dimensions could include (a) time, (b) effectiveness, (c) efficiency, (d) innovation.

In the same time it can be considered as a comparison between the expected outputs and the achieved outputs. If the expected and achieved are the same, the difference between organizations is the time needed to achieve those outputs. A good example is the comparison of two opponent groups (A and B), both of them having the same ORBAT (Order of Battle), the same decision making process, but one of them is using IT in all processes (B).

The overall operational cycle is well known as it is shown in Fig. 1:

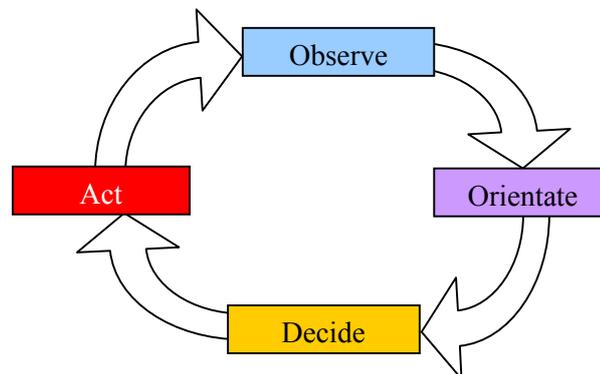


Fig. 1 (Operational Cycle)

For a better view of the comparison between the two operational cycles in this study, we will use a block view of each group, where the height of the block represents the time used for that sequence (Fig. 2).

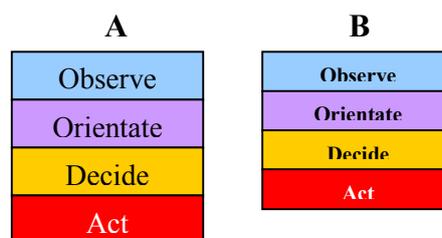


Fig. 2 (Operational cycles of the two groups)

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As we can see, each sequence performed by the group B takes less time than of the group A. That means the overall time group B spent on preparation of the battle is shorter than group A's time. Should these sequences repeat two times, the graphic would be like in Fig. 3.

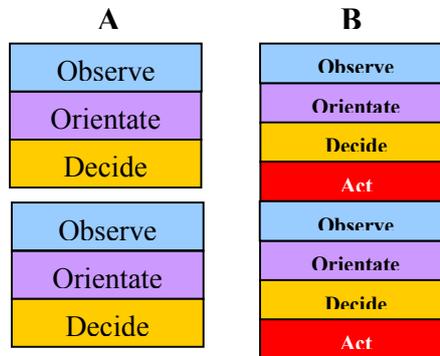


Fig. 3 (The result of the two operational cycles)

The output of each group involved is to defeat the other one. But we see that using information technology, Group B was able to shorten the time spent for each sequence. If the sequences are applied again, Group A will not act ever, and will be soon out of resources with the output as zero.

In the following sections we will analyze the reason IT affected the performance of the group B.

2.1 IT and Personnel branch performance

As Group A has not IT equipment, it has to do everything in the old fashioned way: the task organization has to be done on paper by some clerks. The right person in the right place has to be done after all the personal files of the existing personnel were consulted and choices were made. All the documents have to be carried by curriers to the offices and units. Each activity presented is time consuming.

On the other hand, Group B had its database in the computers, the comparison between people eligible for the offices and units was made automatically by special designed software and the result was sent to the decision makers through electronic mail. Decision is done in short time. Updates are made quickly and all personnel matters are sent instantly to all units and sections involved in the group through the IT network.

2.2 IT and Intelligence branch performance

Group A has to send reconnaissance on the field as well as Group B. But Group A's reconnaissance has to deliver the information gained through couriers, radios and land line telephones. They cannot send live information all the time, due to various conditions (related to weather, magnetic influences, lack of encrypted communications and electronic warfare of Group B). The imagery over the area of operations has to be made by reconnaissance planes, on tape or film, then to be processed back into the HQs, if delivered. All navigation activities, on land or in air have to be made on map and compass. The electronic warfare is based on radio triangulation, jamming and listening of the frequencies. Signal intelligence is not performed due to the inexistence of automated tools for electronic analysis. Intelligence preparation of the battlefield is a slow process: information flow is discontinuous, the intelligence priority information are not sent timely, analysis is done in an very extended time due to the amount of information on hard copies,

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source directed requirements disseminated slowly. More than that, all the information flow manned by couriers needs a lot of transportation resources: lots of vehicles, fuel, POL, maintenance. The target acquisition is done by observers in the field and it represents a reactive process – the potential target is reported, decision is made on the spot and then target is engaged.

The counterpart, Group B, accomplishes this task using IT: as reconnaissance is sending drones (Unmanned Aerial Vehicles – UAV) or people. The difference is the scouts are equipped with GPS devices (Global Positioning System) and they can report accurately the positions of the targets. In the same time, using specially designed laptops connected to the radios or through satellite radio channels, they can send into the analysis cell the images in real-time. UAVs receive images over the battlefield in visible, infrared and thermal spectrum, therefore can make a more comprehensive view of the battlespace. All imagery is processed by several automated tools provided by specific software, intelligence products being more accurate. Electronic warfare is involved with timely and full spectrum analysis of the electromagnetic environment, determining even the non-communication related signals' features and characteristics (beacons, radars). Reports are quickly made and set through e-mail to the analysts or decision makers for target acquisition and prioritization. Signal intelligence detects, analyzes and prioritizes the radio communications, determining the hierarchy tree of the opponent's emissions. Again, reports are sent through IT network for further exploitation (target acquisition for the deceptive plan, jamming or destruction).

Intelligence preparation of the battlespace becomes often an automated process, drastically shortened by the rapid response of the sensors and the analysis cells, providing timely predictive analysis products for the operational planning. High Value Targets are timely estimated and placed in a stand-by list of engagement, strike assets to be triggered by estimated decision points being under constant surveillance.

2.3 IT and Operations branch performance

Group A is forced to work all the times using colored pencils on maps. This is a heavy burden, situation rapidly evolving and the demand for paper maps increasing as battle grows in intensity. The planning process has to wait until reasonably intelligence arrives, to make the courses of action analysis. The staff is all the time involved in planning sessions and meetings, in order to all the staff to know what is the commander's vision and plan. Orders are issued on paper and they have to be carried again by couriers or spelled on radio or land line telephones.

The troops must rely on radio or stick to the original plans to work coordinated, often encountering shortfalls due to various reasons (weather, incoherence, misunderstandings, etc.). Communications are not encrypted, so they are an easy subject of jamming, deception or interferences. Troops will pass the phase lines or will wait until further notice. Either way time is wasted, operations are affected and the main expected output is not met.

Group B is enhanced with IT capability on operations. Target acquisition process is an automatic asset, triggering the fire support on electronic stimuli (endorsed previously by the commander's decision), sent through IT network. Troops deployed on the battlefield are coordinated through specially designed computers, like Battlefield Force Tracking (BFT) which works like the Yahoo! Messenger platform, informing them about the threats, sending them encrypted messages to coordinate, along with digital encrypted audio messages using radios. Every unit is visualized in HQ Tactical Even satellite and UAV

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imagery supports them in their maneuvers, providing them the targets' locations, a real picture of the battlefield and their place into it.

IT provides them an enhanced capability in using weapons, man carried or mounted on vehicles. Electronic stabilization of the main armaments, night vision systems and aiming devices, laser range detectors, TV, infrared, thermal and radar guiding systems, automated ammunition loading systems – all of them replace skills needed from man highly trained for it. This determines early detection of the enemy, rapid identification and early engagement in battle, even before they discover they are spotted.

Aerial unmanned airplanes armed with missiles are used as fire support assets where the conventional airplanes are at high risk.

Conventional airplanes are equipped with on-board computers responsible with flight issues, leaving the pilot to think and act task oriented only. Airplanes can be replaced and it involves only money and materials. Besides those mentioned, pilot making involves people highly trained, who cannot be replaced so easily if lost.

Platoon level ground radars provide targets on screens for troops deployed on the ground and assure their superiority over the enemy.

2.4 IT and Logistics performance

Logistics is closely tied with communication. In order to supply an organization with what it needs to function properly, the logisticians need information. And they have to send information to the supported organization, until they mutually understand. Then the supply chain is moved forward.

In the same time, logistics have to know all the time what supplies are at hand and what has to be refurbished. Stocks have to be kept under control. Supplies sent to the consumers need to be replaced, to reach the full capacity as soon as possible. So communication with the outer sources of materials, equipment and services is paramount for the time estimation of supply delivery.

Group A's logistics is forced to be in direct contact each entity it has relationships with. Again, time is the critical factor in this organization. Time is more extended if there are shortfalls in the lines of communication (due to weather affecting communications and transport assets, battle losses and misunderstandings). Stocks of materials and equipment have to be managed by a lot of people, sometimes causing objective/subjective blockages within the service. And this cause delays in the supply chain, delaying or denying operations of the own forces.

Group B keeps everything under control through IT. They use software and databases to control the flow of the materials and equipment, being able all the time to issue a full-scale report regarding everything it manages. E-mails with units and outer sources provide an almost instant contact with the right person, enabling the means of understanding and coordination. Periodic situational reports (SITREPs) forwarded by the consumers are analyzed and supplies/services are scheduled in order to maintain the units on full capacity of combat. As situation quickly evolves, the ability to communicate using IT provides the opportunity to adapt quickly the procedures and the assets for achieving the objectives of the organization as a whole.

The input is people, supplies, assets, IT and the output is mission accomplishment. The decisive factor for comparing the two groups' performance is time. Group B will definitely outscore Group A.

2.5 IT and Communications performance

The most visible impact of IT over the performance of an organization is inside the communication system. Even the classical radios are still used, they became digital driven by operators through IT. The network enabled capability provides the opportunity to share information within the organization, to deliver/disseminate information in specific directions and to eliminate the burden of papers. In this respect, the information flows from the generator of information, goes to the information manager and reach the consumer. In a graphic mode, it looks like in Fig. 4.

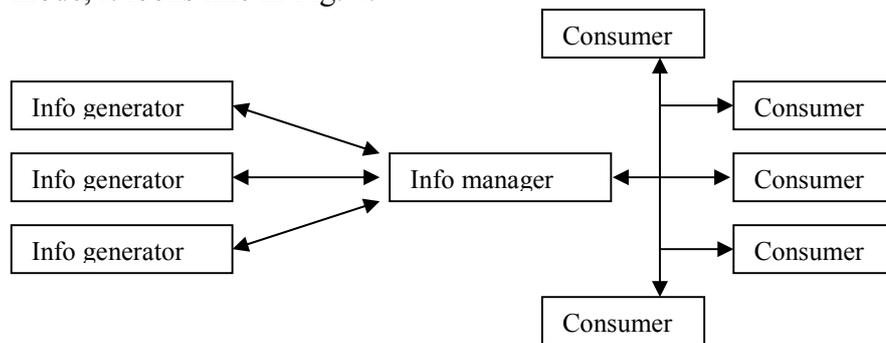


Fig. 4 (The flow of information)

The double arrowed lines show information flow, which means that an information generator both sends and receives information from the information manager, as well as the consumer. In the same time, an information generator is often a consumer of other kind of information. In this logic line, there are not pure information generators and pure consumers. Every piece from this system generates and consumes information all the time.

In the case studied, Group A has not an IT system of communication. The result is all information written on paper or voice transmitted will be duplicated in the number that will cover the amount of consumers. And Fig. 4 will suffer a major transformation, becoming something like shown in Fig. 5.

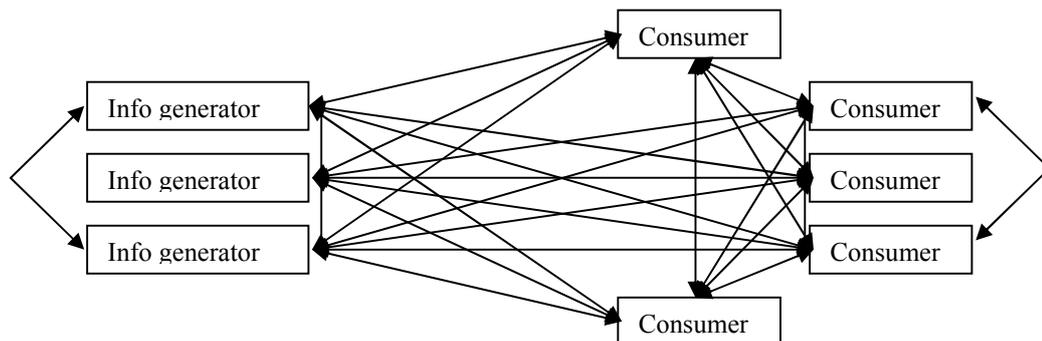


Fig. 5 (The flow of information in a non-IT organization)

The major problem is everybody has to coordinate with everybody in order to work as a coherent body. It works (as it worked through the history) but is time consuming. And there will be always shortfalls due to misunderstandings, even if there are standard operating procedures enforced (five pieces of a form will be filled in at least five ways by five different people).

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The result of communication within the Group A will be, in the end, the same like in Group B, but the time necessary to reach the culmination point is multiplied by the number of the lines of communication.

The information manager, even an automated one (as domain or e-mail servers) the key factor for a proper distribution of all information, in hundreds times more quickly and more accurate than the classic way.

In this case again, all is about the amount of time spent to close the cycle of information (generating, delivering, understanding/consuming and feedback).

2.6 IT and Command and control performance

In every conflict, if the leader is overwhelmed by information, he will not have time enough to consider all of them in order to make a decision. Every new information will distract him from what he has to do (as the information is more critical, the more damage will inflict). It is what the C2 warfare is all about.

Group A has to issue orders on hard copies, in order to deliver them to the units subordinated. The papers have to be counted, checked and delivered in a secure way (guards and vehicles, or cryptographic processed). This way a lot of resources are needed in terms of time, manpower, equipment and material.

Group B uses IT to issue and deliver the orders. Producing orders is easy, as options are developed through the planning process, endorsed by alternatives in case situation changes. Once commander made his decision, orders are issued in minutes (they are already made, endorsing each option). All the staff and units involved in operation receive the orders instantly, or with a delay imposed by the length of the network lines of communication (in many cases this delay is not affecting the rhythm of operations).

Within Group A coordination is a major problem, as reports cannot come all in the same time through the limited communication resources. Some situational reports will have to wait to be taken in account. This inflicts delays, sometimes losses.

In Group B coordination is not a problem, all reports and orders being managed through IT, in an almost instant manner. More than that, they cannot be lost, as they are stored in repositories. Feedback is quickly sent and the communicating entities within the organization understand each other in almost no time.

The same factor emerges as decisive for performance: time.

3. Conclusions

The explanations provided above are not comprehensive, though there cannot be covered all the implications of using IT in the military organization. The certain thing is information technology save a lot of resources, from human to equipment and materials.

We have seen that the measurement of organizational performance is expressed as the way the real output meets the expected or the standard one. In this case, both groups had to have the same output: defeating the other group in combat. The both of them having the same resources except IT capability, this one drastically influenced the time needed by Group B to be ready for combat. We have seen that time was the capital factor in the study: Group B managed to plan, communicate and coordinate faster than Group A, which in combat means Group B will start the combat operations while Group A still in planning/preparation progress.

As an overall picture, IT provides a capital value to the operational process of the force: the capability to allocate more efficiently it's own forces in order to accomplish the

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mission. This enables to enforce two of the principles of battle: concentration of the effort and economy of forces (to task the smallest force able to accomplish the objective).

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