



## THE IMPACT OF TECHNOLOGY ON THE PROCESS OF PLANNING AND DECISION MAKING

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Planning or forecasting, as a function of management, has a special role in the military field, in conjunction with the development of new technologies, because it offers the possibility of exposing possible courses of action and helps the military leader in decision making. Judicious planning, a correct presentation of resources and how to use them, setting goals and opportunities to achieve them are aspects that contribute to the completion of the decision-making process and involve the need for modern technologies applied. In the current context, the possibility offered by the modeling and simulation of military actions has also developed ways to obtain an effective decision, by using calculation systems and identifying different courses of action, knowing all the risk factors. All the changes suffered by the military equipment and technological systems have forced the emergence of new doctrines, restructurings and acquisitions absolutely essential to ensure the purpose of the military organization, national security and international alliances based on peacekeeping. Regarding the military system, the development of new technologies and the attribution of the decision-making process contribute to the emergence and use of "smart ammunition", which is mainly based on the efficient flow of information, systematized operation and resource management in a timely manner.

**Keywords:** technology; decizion; planning; artificial intelligence; smart ammunition.

### The technological context and its importance in the development of processes in the military system

Complex, unpredictable and dynamic are terms that define the current security environment. The changes suffered by the armed conflict throughout history have involuntarily led to the modernization of military strategies and the implementation of new concepts with the role of emphasizing the military power of a state. Through the efficient management of all types of resources, the application of the principles of lessons learned, the implementation of new types of techniques and technologies and the design of the purpose of the goal, the leaders of military structures develop skills necessary to achieve objectives and missions.

The war has taken various forms throughout history, from classical battles, trenches fighting wars gunpowder, war tanks, aviation and machine guns on the water, to information, psychological and even nuclear warfare. Military actions developed to ensure a stable security environment, whether for international missions or for the national defence require continuous development of rapid

response capacity, of using converging forces, adapted to modern technologies.<sup>1</sup> In order to ensure their military power, most developed states or multinational alliances have allocated considerable resources for the involvement of technologies in the processes of training and development of forces, but also for streamlining the specific processes of leadership and operation.

The accelerated process of technology development and the emergence of the concept of artificial intelligence, have involuntarily led to the urgent need to adapt and improve the military organization, in order to increase performance. The global operational environment is characterized by the impossibility of delimiting between new, asymmetric or hybrid threats and classic threats. Global security is threatened by the continuous development of technology and information, correlated with increasing tensions at the ideological, ethnic or political level.

The risks, threats and vulnerabilities to which the components of the military system are exposed, whether we refer to the structure of forces, to doctrines, or to the resources necessary to achieve the goals, are unpredictable and continue to produce dysfunctions. As a result, the need to identify risk limitation procedures, or to identify and evaluate them, is a problem often analyzed by military specialists.

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Knowing that any military action is based on a decision-making process, designed to establish different courses of action and opt for the optimal option, based on principles such as cost-effectiveness, cause-effect or design of the final goal, the need to exercise decision-making, adaptation to changes in the environment, mainly in current and future technologies, are an essential step in maintaining military performance standards. The trend of endowment has been and is constantly growing, which is also evident in the emergence of new military equipment, in order to support the conduct of military operations and the successful completion of military training. Confronting the military with high-risk, dynamic missions, when their physical and moral integrity is affected, required the identification of automated systems, with the role of reducing the risks to which they are exposed.

Battlefield robotization has gradually become a necessity both for the military technology revolution and strategic thinking. The capabilities of smart system architectures are usually based on the ability to react quickly and efficiently to different types of critical infrastructure attacks. Also, the use of advanced technologies to facilitate human efforts and to ensure the protection of forces is constantly increasing, which impresses the urgent need to allocate the necessary resources for their development.

Technological implications are found in many areas specific to the military system, whether we are talking about performance in the field of logistics, operations or information. An extremely debated topic by specialists, it draws attention to the use of technology in streamlining the planning and decision-making process. Starting from the classic theories of war games, meant to offer optimal solutions in choosing a course of action, currently, intelligent integrated decision-making systems are being developed, with the role of offering multiple perspectives on the possibilities, risks and resource management for making the right decision. All these systems are based on classical theories, adapted and transposed into intelligent software or autonomous equipment.

### **The planning and decision-making process in the military system**

Generally, the notions of management and leadership risk being used with the same

meaning. These terms and their meanings are not mutually exclusive, but it must be borne in mind that management is represented by speed, while leadership is characterized by targeting. That said, leadership becomes the highest component of management.<sup>2</sup>

The applicability of management and leadership in the military field led to the emergence of two basic components, namely the theory of military leadership and the applicative component.<sup>3</sup> The theory of leadership provides ways to lead in peacetime and in crisis situations, while the application component includes the actual management process, responsible for the effective coordination of the military system and for the successful fulfillment of assigned tasks.

Among the management functions we mention forecasting or planning. This function involves a set of processes through which the objectives and components of the military organization are determined, the modalities of action are established and the necessary resources are allocated. The special role of this function is to ensure a link between what is (present) and what is wanted (future), and by exercising it one can anticipate the evolution of the conditions of management of the military system and its functioning. Important for this characteristic of the management process exercised in the military system is the fact that it estimates the influences of uncertainties and the risks specific to the environment in which the military action will take place.<sup>4</sup> Often, planning or forecasting involves establishing a strategy to achieve the objectives.

Decision making is a dynamic, rational process, through which a course of action is chosen, from a greater number of possibilities, in order to reach the desired result.<sup>5</sup> In the process of military management or military leadership, the decision follows the diagnosis and prognosis and precedes the realization or implementation. That said, the decision becomes the most representative product of the leadership and the most effective, becoming an essential process for any military action.

The planning and decision-making process must first and foremost adapt to the environment in which it is embodied, otherwise it offers the possibility of solving problems late, without providing efficiency. The decision-making process starts from the receipt of the mission, which can

come in a hierarchical way or can be anticipated by the commanders of the structures, knowing the possibilities of hiring the enemy, or solving problems. The complex circumstances in which decision-makers find themselves do not fully offer the possibility to wait for orders, which is why they have to establish possible courses of action, efficiently managing resources and identifying risks. Therefore, the planning and decision-making process is continuously manifested. Stressful situations can lead to hasty decisions or without first establishing risks, threats and vulnerabilities, which is why the use of integrated procedures in intelligent systems provides support for decision-making by commanders.

Decision-makers or commanders are responsible for analyzing and synthesizing information in order to focus on the current conditions of the operational environment, and in their support is always the staff, responsible for various categories and areas.

Soldiers, like all other people, are constantly making decisions. This can involve both routine and unexpected, challenging situations. Judgment and human decision making is the result of a complex interaction of many simultaneous factors, such as sensations, feelings, memory, emotions and thoughts. In reality, these interconnected processes develop in a mixed way, producing mainly two types of thinking, the intuitive and the one based on complex analysis. A biased judgment or decision systematically deviates from logic or utility.

In some cases, prejudice can have serious consequences, especially when the stakes are high, as is often the case in military action. Another factor that makes human decisions difficult is uncertainty, and uncertainty characterizes military situations. Modern military missions take place in a dynamic and highly interactive way. Assessing a tactical situation requires taking into account a large number of variables (e.g., strength of own forces, estimated force and enemy intentions, weather and terrain conditions, population behavior, communications, etc.), which are often uncertain. However, it is the responsibility of the military commander to understand the conflict, to use the available resources to control it, taking into account the orders received and the constraints. In order to act effectively in decision making, the commander must make various assumptions, which

can often be difficult to manage by human analysis and reasoning.

The military sees decision-making as a continuous and cyclical process, as it is constantly fed by up-to-date information. In order to create structure and unity, the military has developed dedicated methods for conducting decision-making processes (for example, the doctrine of operational planning, according to NATO standards).

Every commander at every level goes through such a decision-making process. However, depending on the level of the structure and the complexity of the environment, or the final purpose, the process is more extensive and complicated. What methods at all levels have in common is that they use formalized and standardized procedures and analyses. The decision-making methods reflect the analytical approach of commanders in solving problems. They help commanders and staff to examine a situation and make logical decisions, to apply soundness, clarity, sound judgment, logic and professional knowledge to make a decision. Completing the decision-making process is detailed, deliberate, sequential and time-consuming, especially when there is adequate planning time and sufficient staff support needed to set courses of action.

A quality management decision must meet certain requirements of rationality according to scheme no. 1.

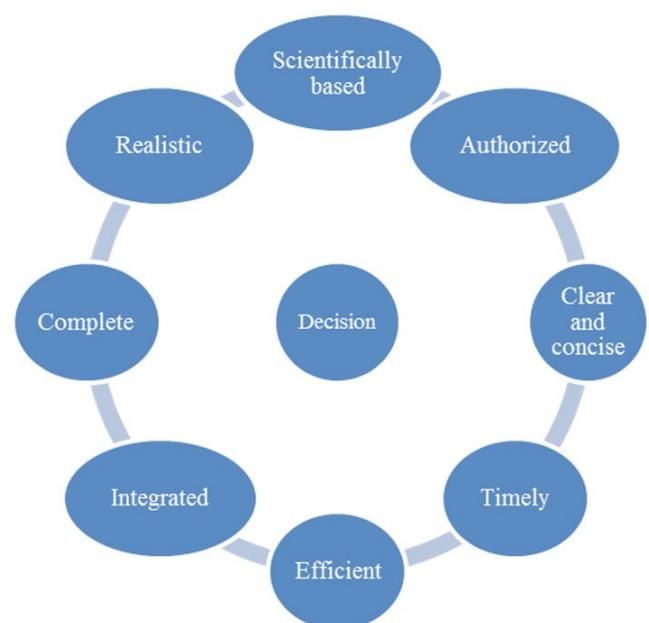


Figure 1 Rationality requirements (Author's view)



In the literature in the field, the decision-making process includes the following stages:<sup>6</sup>

- identifying and defining the problem;
- establishing decision criteria and objectives;
- establishing possible variants / courses of action;
- choosing the optimal option;
- application and implementation of the chosen optimal variant;
- evaluation of results based on total / partial control.

Regarding the decision-making process, there is a preliminary algorithm for decision-making, which includes the following steps:<sup>7</sup>

- preparatory stage (identifying the problem, formulating the final goal, gathering information);
- establishing the decision variant (establishing the decision criteria and objectives, establishing the possible decision variants, comparative analysis of the variants, choosing the variant that offers the best results);
- application of the decision;
- evaluation of the obtained results.

Adherence to the established algorithm for decision making is extremely important, as it provides the efficient and necessary decision to achieve objectives, but the use of theories and the use of technologies to streamline the decision-making process can often reduce the time required, an extremely important factor in the military system. Reducing the time needed to make a decision helps both strategically and morally, by relieving the stress of commanders and the possibility of solving several requirements. As a result, the emergence of technological or automated systems, essential for the decision-making process offers the possibility to streamline military actions, speed and minimize human stress.

Military decision-making takes place in various areas (defence, security, cybernetics, change of doctrines or strategies, legislative changes), not only in terms of conducting a military action. Artificial intelligence not only allows the reduction and synthesis of data, the development of predictions about the information taken into account. Most of the time, the collaboration between artificial intelligence and human resources is the best solution to solve a problem. These studies in the field were easily adapted in the military field, later

being implemented to provide support in decision-making processes. A software can present several data and possibilities, and the decision maker can compare these variables, giving him the possibility to choose an optimal solution.

### **Aspects regarding the impact of technology in the military field**

Starting from the words of the great military strategist, Napoleon Bonaparte, according to whom "the more sweat on the training field, the less blood on the battlefield", the role of training and training of troops, regardless of the form on which the battlefield acquired it in the contemporary era, is to train skills and increase the performance of the military. Training is a premeditated process for progression to the level of knowledge or skills, which adjusts the attitudes of the individual, with the ultimate goal of gaining performance in the defined sphere. In order to gain performance in the force training process, the simulation of military actions has become an essential vector.

Currently, the training of military combat skills is closely related to training and exercises that simulate the reality of the battlefield, which is why the concept of modeling and simulation has become common in the process of planning and organizing a military action.<sup>8</sup>

With the rapid evolution of technology, new systems and equipment have emerged designed to support the training of military structures. The use of modeling and simulation in troop training is an advantage in training skills and developing their capabilities.<sup>9</sup>

By simulating military actions and framing them in the process of training the forces, the perception of the real battlefield and the employment possibilities of the enemy are exposed in a realistic way, but which protects the human resource. At the same time, through the use of simulation training exercises or war games, military structures achieve the performance needed to solve real problems and provide a vision of how to solve them.

The war game is actually a simulation game, in which participants try to achieve a specified military objective, using predetermined resources and restrictions.<sup>10</sup> The general objectives of the war games are to support the activities of the General Staff in terms of training the military<sup>11</sup> in command by designing possible scenarios, contributing



to the process of planning and making strategic decisions.

The simulation of military actions has different valences, being used for the design of war games and the testing of war theory, for assistance in decision making, defence planning or procurement.<sup>12</sup> The central point in creating a scenario for war games or training exercises is the relationship between the physical world and the use of a virtual world based on the conduct of human operational training. Implementing a versatile program that allows for the rapid simulation of a wide range of scenarios to predict the extent to which a structure's resources are available to meet requirements has been an advantage in the concept of modeling and simulating force readiness.<sup>13</sup>

The MARS simulator (The Managed Readiness Simulator) is an example in this regard and has a role in the dynamics of staff promotion and certification and in the acquisition, maintenance or disposal of equipment. Its software provides a graphical user interface for creating and executing simulation scenarios, based on inputs and final analysis, concluded in outputs. The concept of the MARS simulator is to design a given, established scenario, in which the capacity of a structure is found, including the staffing with the military, technique and equipment, to perform a number of tasks specific to military actions.

The physiognomy of military actions is determined by the most important factors, namely military equipment and weapons systems. The technological systems that initially appeared were later adapted to their applicability in the military field, but the needs imposed specific requirements for these intelligent systems over time. That said, at present, military strategies require new technologies to achieve objectives, which requires the adaptability of the technological field to the requirements of the military system. All these intelligent systems, necessary for the military environment, have contributed both to the modification of combat strategies and to the restructuring and organization under other principles or skills.

Among the great weapon systems of the future we find mainly systems such as remote controlled, unmanned (UAV), or the involvement of robots in armed conflicts, but also the prospects of conducting conflicts at the cosmic level. An

extremely important feature of artificial intelligence or modern technology systems is accuracy, both in time and space. Accuracy is an absolutely necessary component for the efficient conduct of a military action, which is why the use of technologies that provide precision, accuracy and low time, contribute to the successful achievement of military goals. Theorists in the analysis of current conflicts highlight a comparison between the way of practicing the art of war in the past and in the present, without omitting the aspects of the future. Thus, the destabilization and misleading of the enemy currently competes with the precise jamming of certain actions taken by the enemy. As for the war of the future, it will generally involve the imposition of new types of confrontations such as cyber warfare, information warfare, network-based warfare, economic warfare or any other type that will affect sensitive areas, capable of destabilizing and destroying the most important opponent's abilities. Mainly, the modification of all the constructive and basic elements of a military conflict will be transposed in another vision or form, difficult to identify and assimilate, but the rules and principles are still preserved and adapted to the existing context.

It is imperative to clarify some aspects related to network-based warfare, as it has become highly discussed in the specialty literature and comes in close conjunction with the rapid development of information technologies and systems. Network-based warfare occurs through the implementation of modern military systems and technologies, consisting of a network of sensors, a network of central command and a network of combat platforms.<sup>14</sup> In principle, the rules of a classical war are followed, but they are adapted to their design in contrast to artificial intelligence.

The three components of network-based warfare are interdependent and contribute to the efficient transmission of information in real time, in order to maintain the advantage. These issues facilitate both effective governance and decision-making, as well as the action itself and the protection of stakeholders. Thus, the possibility of using an information shield, offers staff protection and real-time logistical support, thus ensuring a confrontation carried out only in the technological space, where equipment and intelligent systems take over the most difficult attributes. In other



words, information systems and technological achievements, combined with intelligent software, which involve human resources only at the decision-making level, will be capable of conducting military conflicts.

Conflicts based on the lack of physical contact of the military have quickly gained particular importance through the use of all types of computer and technological systems designed to continue tense relations and destabilize state powers. However, in order to perpetuate this type of conflict, an essential basis or logistical support is also needed, starting mainly from the economy of each state or based on alliances. In order to continue the development of technologies and bring them to the battlefield, it is essential to keep in focus both the allocation of considerable financial resources and the training of staff as well as their training in the efficient operation of all equipment. Small dysfunctions may occur here, because a military power is based on considerable financial capital, while some states become vulnerable precisely because of these shortcomings. In order to ensure effective financial and logistic support, alliances and non-governmental organizations have emerged, designed to use resources from all states involved, to achieve the common goal, mutual defence and military support.

The technological impact on the military field is also reflected in the urgent need to develop the adaptation and processing capabilities of the new systems, as well as the obligation to provide considerable resources in order to maintain an operational level of combat.<sup>15</sup> Thus, whether we are talking about the use of simulations designed to provide safety or effective training for conducting military operations, or we are talking about the use of equipment that provides more protection to personnel, all these are found at an absolutely imperative level of being implemented, both in the context of preparation for war and in the context of maintaining a combat capability for a particular military power.

#### **Peculiarities regarding the planning and decision-making process based on the use of technology**

Relating to the past helps to have a good understanding of the present and to design a predictable future. This is a great advantage of

planning, which provides an overview of the three benchmarks and contributes to the efficient conduct of the decision-making process. In the military field, planning allows dealing with uncertainty, the security environment and constraints related to defence resources, helping to identify specific procedures and tools to ensure the ultimate goal, the successful fulfillment of the mission.<sup>16</sup> Being embodied in a complex process, involving interdependent activities, planning is considered the key element of resource management that ensures the necessary conditions for the efficient fulfillment of specific missions.

Management provides techniques, tactics and procedures that facilitate decision-making and resource management in order to develop military capabilities. The essential functions of management are integrated to achieve the finished product, the effective achievement of objectives. These functions are found in all areas where management has a special role and are assimilated under various names. For the military system, forecasting or planning are basic elements in the conduct of military actions; organization, coordination and training are also often found, as well as evaluation and verification. All these functions play an important role in increasing performance and implicitly in streamlining the decision-making process.

Ensuring a solid system for defending and maintaining the security of society, involves the development of the four areas that define a military capability (force structure, promptness, sustainability and modernization). In the process of developing the military organization and adapting to new technologies, planning and decision-making must include a plan based on military capabilities, which supports the provision of necessary equipment, training of human resources according to requirements and the use of processes to capitalize capabilities.

Planning, as a vital function of management is a precursor to decision, which in turn has a special role in the management process of an organization or system. The decision is practically an instrument through which the military leader manifests the leadership process, through which a solution chosen from a number of possibilities is obtained, based on different variants of action.<sup>17</sup> In order to be considered optimal in solving the problem, the decision must be qualitative and efficient, avoid the



appearance of unfavorable reactions and combine the factors involved, without creating dysfunctions. Mandatory, a decision must offer as little uncertainty as possible and provide security for the achievement of goals.

The decision-making process is based on one or more previous models, on the resources available, whether human, informational, material or financial, on the time required, as well as the level of substantiation. The use of artificial intelligence in the decision-making process brings a great advantage by reducing factors that affect the responsiveness of human resources, such as: stress, fatigue, inattention, poor concentration, subjectivism, routine, intrapersonal feelings and interpersonal relationships.

Commanders and decision-makers in general often face various complex problems, in unusual situations, for which no automated or rule-based solutions can be identified. The military decision-maker and the team involved in the planning and decision-making process are the ones who collect, analyze and synthesize the information necessary to understand the context of the military action, and then develop the possible options and courses of action. In order to provide certainty or at least to limit the risks, the information underlying the decisions must be updated in a timely manner and be relevant.

The emergence of sensors and analysis software, specific to technological development, has contributed to the support of decision makers by implementing systems with a high flow of information needed for rapid decision making. The flow of information can increase the workload of the decision maker, through the need to process them, the result sometimes becoming a danger to the correct understanding of the situation and the quality of human decision. Given this, the need for decision support systems to merge, process and interpret information quickly is evident in the military field.

Recent technological advances in information technology and artificial intelligence contribute to the coordinated and integrated functioning of human resources and technology, for a common understanding of the task and to enable an objective and rapid decision to be made, based on the possibilities of achieving the goal.

Given the dynamics of the current security

environment, time is an essential variable in gaining the advantage in critical situations. Thus, the need to obtain information in real time, timely communication, as well as effective action, are correlated with the decision-making process, with the planning of a military action and with the excessive use of technologies and artificial intelligence in the military field. Noting these aspects, the influence of technology and artificial intelligence in any activity specific to the military environment is obvious and capitalized by the development of performance and timely fulfillment of goals.

The characteristics of the technology and artificial intelligence used in the field of planning and decision-making are materialized in maximum efficiency or maximum performance, relatively short time solution, rigidity, logical coherence, verifiability (using scenarios or simulations) and extensive possibilities for repetition. The use of military technologies inevitably contributes to reducing the risks for engaged human resources, shortening lead times and increasing the intensity or complexity of action. At the same time, the involvement of technology and artificial intelligence in the decision-making process leads to the efficiency of the entire algorithm and obtaining the optimal solution in relation with time and other predetermined factors.

The automation of the systems necessary for the military field determines a continuous and unpredictable change of the character of the war, contributing implicitly also to the necessity of modifying the classic concept of decisional process, based most of the times on a single variant of action.<sup>18</sup>

It can be appreciated that the capitalization of technology in the military field is an essential activity for increasing performance and involves the implementation of concepts and adaptation to the requirements of the global security environment. Considering artificial intelligence as an essential factor in developing and obtaining military capabilities necessary to maintain the role of the military organization, it can be concluded that the entire management process specific to the military field is influenced by its existence.

### **Conclusions**

Current technology offers possibilities for modeling and simulation of military actions,



in accordance with the purpose of the mission, starting from the level of the independent fighter and reaching the level of large units and structures of assembled forces. Regarding the modeling of equipment, weapons systems or military equipment, this process is simplified by the possibility of making replicas, with low costs. Also, given the technologies developed by modern equipment currently used, their acquisition following a test of the characteristics in the construction or virtual environment is an advantage, given their high cost.

In the past, military strategies have equated success with achieving strategic goals, such as losses to enemy troops and forcing the adversary to cease its actions. The war of the future presupposes another type of success, the success of asymmetric and network-type conflicts, which collaborate intensely with artificial intelligence and modern technologies. All these technologies have the role of supporting and providing a different perspective for the military decision. All three levels of the military field, namely strategic, operational and tactical, are based on the existence of clear and concise decisions, which help to establish the necessary elements for strengthening the military system.

The impact on the decision-making process is seen in the possibility of establishing several possible courses of action in a timely manner and verifying all implicit causes and effects. As a result, it is imperative that the military environment be constantly in tandem with technology and the implementation of a decision-making process based on artificial intelligence is stringent.

Given that the decision-making process involuntarily requires the establishment of necessary resources, mode of action, destabilizing factors or other variables, the use of systems capable of exposing the possibilities and effects of military action, is a support for commanders of any level, be it tactical, operative or strategic.

In conclusion, both its technology and its linear evolution, as well as the emergence of the concept of artificial intelligence and their use in the military, contribute to effective planning and optimal decision-making for military missions. The influences of technology and artificial intelligence on decision-making and planning are implicit in the advantages of these factors, which inevitably

contribute to the constant improvement of military capabilities. Benefits such as reduced execution time, security of human resources, elimination of subjectivism and cognitive errors, analysis and verification of all possibilities are among the best arguments to support the particularly important role of technology in decision-making and military action planning.

The military strategy aims to achieve a victory, and this victory often depends on the decisions of the commanders and the level of training of the forces, combined with the equipment and technology used by them. As a result, in order to successfully fulfill the ultimate goals of a military organization, it is necessary to correlate military doctrines, decision-making and training of forces with the capitalization of technological and informational advantage.

The decision often has the role of ensuring the continuity of military actions, and in order to choose from the multiple possibilities of courses of action, the commanders are the ones responsible and depend mainly on the employment possibilities and the allocated resources. Thus, in order to obtain a decision that is as efficient as possible and related to the final goal, the use of possibilities to verify causes and effects through information technologies becomes the key to success. In most cases, the modeling and simulation of military actions has helped to establish opportunities to engage in combat effectively. Considering the modern war as another dimension than the classical one, the implementation of technological methods for decision-making comes in support of the commanders, providing precision and timing.

In conclusion, technology (especially stroke speed and accuracy, driving automation, modeling and simulation concepts, etc.), together with the correct and judicious application of viable doctrines and structures become a sensitive and essential point, which will allow for smarter, faster and more efficient conflict management.

I believe that both the ability of the military system to adapt to new technologies and automated systems, and the possibility of using them in real time and in a timely manner are essential issues that underlie the decision-making process for military action. The correspondence between the military decision and the existing technology emerges from the possibilities of determining the possible effects, eliminating uncertainties and allocating concrete



resources, without considerable losses. I also believe that over the years, technology, whether we relate to rudimentary systems or automated ones, has played an extremely important role, both in leading a military action and in achieving victories. As a result, I conclude by arguing that the technological impact influences both the decision-maker and the military decision, giving him timely support on the "battlefield" and the entire military system or military organization through its contribution to personnel protection and efficient use of necessary resources. It is also important to specify that, following in the perspective of the evolution of military conflicts, they will be constantly related to technological development, as a result of which the interdependence between the military field and technology is obvious and constantly developing.

The development of technologies is a broad and continuous process, which influences not only the planning and decision-making process, but the entire modern society. The processes and tools used in the planning and decision-making system are regularly modified and adapted due to frequent changes in technology and the environment. But modern technological equipment has the role of reducing the identified risks and improving the planning and decision-making process by implementing modern systems based on modern scientific tools and adapted to the contemporary security environment.

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