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APPLICATION OF A CONCEPT OF A COGNITIVE FACTOR IN MANAGERIAL DECISION-MAKING AND PLANNING

Abstract. The article examines application of a concept of a cognitive factor in the operational planning process under conditions of a complex and dynamic environment. The main focus is on analyzing the mission and identifying the problem under resource constraints. NATO's core operational planning doctrines and national doctrines of NATO member states such as AJP-5, COPD and JP 5-0 define operational factors such as time, force, space, and information, but do not take the cognitive factor into account. The necessity of applying the concept of the cognitive factor as an operational factor to ensure effective operational planning for the joint employment of military forces and assets with non-military capabilities has been theoretically substantiated. The concept of the cognitive factor is an integral part of the managerial decision-making process; failure to take it into account may lead to an incorrect identification of the problem, to misidentifying the opposing party as the one causing the problem, and to the failure to develop the optimal solution to the problem. The cognitive factor is archetypal in nature, relatively stable, and can be shaped by values, beliefs, national and organizational cultures, decision-making cultures, mental models, doctrines, and rules. It has been determined that the concept of the cognitive factor integrates the factors of time, force, space, and information into a unified whole in the operational planning process; in particular, it facilitates forming a systematic understanding of the current state of the environment and the social system, visualizing their dynamic development and a desired future state, analyzing the problem, and developing solutions to it. It is proposed to apply the concept of the cognitive factor in the operational planning process at the doctrinal level in conjunction with the operational factors of time, force, space, and information. It can help to improve effectiveness of operational planning and establish decision dominance under the martial law.

Keywords: *management decision-making process, cognitive factor concept, operational planning, factor analysis, problem.*

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Introduction

A complex and dynamic operational environment (OE) and disruptive innovations in military affairs confuse managerial decision-making (DM) and planning. It requires reviewing a planning methodology including operational factors.

Despite of a significant coalition advantage in forces, resources and dominance in political, military and economic domains for the last decades desired end states of military operations and activities, for instance, in Vietnam, Iraq, Afghanistan, Syria and Iran have not been fully achieved. In many cases, occurred second and third-order effects were negative. Not considering a human terrain and cognitive aspects of actors of the conflict in the operational planning process has led to operational failures.

Ignoring cognitive aspects of actors can lead to failure in DM and planning as counteraction to an opposing side. Physical factors do not consider will, ambitions, thinking (creativity), mentality, cultural and religious features. Cognitive aspects can be critical in problem framing and its solving in the complex and dynamic OE.

To ensure effective operational planning requires taking into account cognitive aspects of opposing parties. An introduction and theoretical justification of the importance of application of a concept of a cognitive factor in operational planning beside of operational factors of time, force, space and information can facilitate increasing effectiveness of operational planning and establishing decision dominance through achieving desired ends by minimum means and optimal ways.

Literature review

Ackoff (1971) explains the importance to see a social system (system) as an entire whole to manage its development. Llachinski (1996) considers warfare as a complex adaptive system. Rittel and Webber (1973) emphasize on dilemmas in planning because social problems are naturally wicked and nonlinear when theories deal with tame linear problems.

Development of the system is realized through operational planning in which Vego (2000, p. 29, 95) considers operational factors of space, time, force and information (TFSI). According to NATO and national planning doctrines, for instance, AJP-5 (NATO, 2019), COPD (NATO, 2023) and JP 5-0 (Joint Chiefs of Staff, 2020) these factors are applied for the whole operational planning cycle. By applying operational factors Eikmeier and Iova (2021) define a deductive factor analysis as an important technique to support mission analysis. However, to make operational planning effective in condition of complex and dynamic environment requires taking into account a cognitive factor beside of operational factors of TFSI.

Decision dominance is defined as a primary focus to win a conventional warfare (HQs Department of the Army, 2021, p. 8). Application of a concept of a cognitive factor in operational planning may become decisive to shape human behavior through cognitive effects that are enabled by technology and other means (Blatny, p. 6). From the perspective that "a domain is a space in which forces can maneuver to create effects" (Garretson, 2017) a cognitive domain appeases as a sixth domain of operations (Guyader, 2022, p. 3-1). Also, in the context of growing AI technologies to leverage

the cognitive domain (Deppe & Schaal, 2024; Constantinescu, 2026) consideration of a concept of a cognitive factor becomes essential in operational planning. Therefore, the issue of application of the concept of the cognitive factor, as an operational factor, in operational planning in the complex and dynamic OE requires researching.

The purpose of the article

The purpose of the article is to introduce the concept of the cognitive factor as an operational factor and provide theoretical justification of the need to apply it in the operational planning process under the martial law in Ukraine.

Research methodology

The study is based on a systematic approach to operational planning that allows comprehensively visualizing an operational space and helps balance ends, ways, means and risks. Methods of analysis and synthesis provide a theoretical basis for the use of the concept of the cognitive factor. The deductive method allows considering operational factors when identifying a problem by using factor analysis. The method of argumentation logically explains that failing to take one of the operational factors into account makes it impossible to form a complete picture of the situation and respond effectively.

The study is systematic and logical in nature and examines operational planning as management of development of the system. The combination of these methods and approaches made it possible to theoretically justify the need to apply the concept of the cognitive factor in managerial DM and planning in the complex and dynamic OE.

Presentation of the main research material

The system develops in the OE through a managerial decision-making process that aims to balance the system by establishing equilibrium with the OE and achieve a desired goal. Social systems are open systems that "(1) have a purpose of their own, (2) are made up of parts that have purposes of their own, and (3) are parts of larger systems that have purposes of their own and contain other systems that have purposes of their own" (Ackoff, 1994, p. 179).

Interior and exterior factors disturb functionality and balance of the system. They influence development of the system by revising its functions to resist negative influences. Making managerial decisions aims to balance the system and achieve a desired goal by minimizing influence of exterior and interior factors. A balanced system is the most effective because works with minimum consumption of energy. In a military sphere the system of the operational level is managed through the operational planning process (OPP) that is conducted in the framework of TFSI to put everything in a certain synchronized and synergetic order to achieve a desired goal.

"A system is a whole whose essential properties are not shared by any of its parts… Therefore, when a system is disassembled, as it is when analyzed, it loses its essential properties" (Ackoff, 1994, p. 182). Development of the system in the given environ-

ment presents a cycle process that includes combined by thinking the past, the present and the future. Thinking in DM encompasses memory of the past, the present as reflection of reality and visualization of the future that are placed in the framework of operational factors of time, force, space and information (TFSI). However, without consideration of cognitive aspects the system can become closed and not functional because it loses the past and does not see the future. Thus, it is possible to claim that to conduct DM a cognitive factor is critical beside of other operational factors.

Social problems are complicated and relative. Their framing may depend on a selection of factors, perception, judgment, mental models and risk taking. "The problems of governmental planning – and especially those of social or policy planning – are ill-defined; and they rely upon elusive political judgment for resolution" (Rittel & Webber, 1973, p. 160).

In the complex and dynamic OE the logic of cause and effect may not be always applicable. It is more about nonlinear and spontaneous behavior with low predictability when cause can emerge different types of effects. Under these conditions the system should be a complex adaptive system as "a complex system whose parts can evolve and adapt to a changing environment" (Llachinski, 1996, p. 2). The system (consciously or unconsciously) can change its shape in conditions of a conflict.

A military conflict is "a nonlinear dynamical system composed of many interacting semi-autonomous and hierarchically organized agents continuously adapting to a changing environment" (Llachinski, 1996, p. 8). A conflict is possible to consider as a big system that includes at least two opposing interacted sides or subsystems (notionally, blue and red) that function in the OE (Naplyokov, 2025) and managed by feedback loops. Elements that do not belong to the subsystem cam generate exterior influence. Because of different reasons elements of the subsystem can become a source of internal unrest. The system can develop through its adaptation to the OE and/or shaping of the OE by it.

In the OPP factors are considered in political, military, economic, social, informational, and infrastructural (PMESII) spaces and maritime, land, air, space, and cyberspace operational domains in which "military and non-military organizations integrate their capabilities" (NATO, 2022, p. 97). The OE includes national and international government and non-government actors that can be divided into opposing (blue, red) and green as neutral ones (see Figure). "One way to visualize, understand, and depict this environment is as a complex and adaptive system of systems" (Joint Chiefs of Staff, 2011, p. IV-1).

Feedbacks manage a set of different interdependent systems (see Figure). Feedback 1 controls internal influences (system disturbances) on the blue subsystem and feedback 2 – external influences. The blue subsystem includes interacted a subject (S) and an object (O) that cooperate through feedback 1. Feedback 2 aims to maintain equilibrium between the blue subsystem and the OE and achieve a desired goal. A big system integrates opposing subsystems into a unified whole. The big system must be also balanced and in equilibrium with the OE through feedback 3. Feedback can be negative and positive as well. A negative feedback directs the system to keep its shape on the way to achieve a desired goal when a positive one forces changing its shape and reviewing goals because they may lose their relevance in the changeable OE.

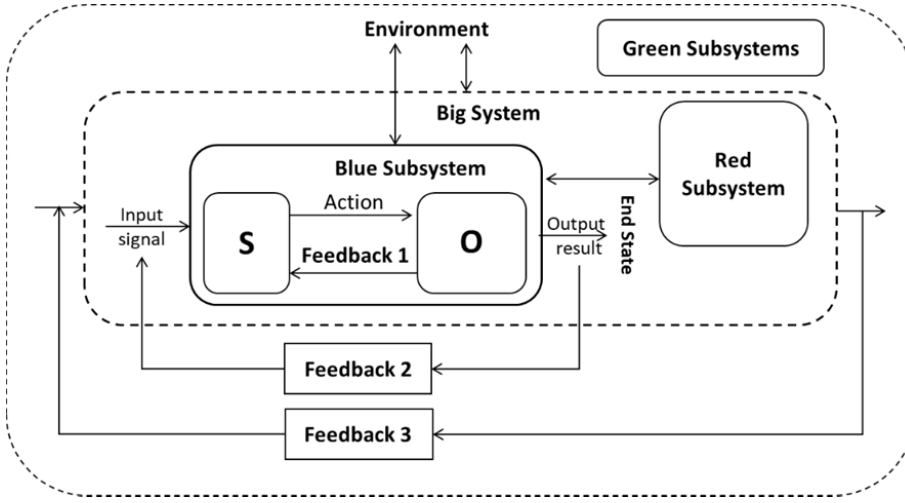

Figure. System functionally

Source: created by the author.

Problem solving can be considered as management of development of the big system through simultaneous planning for the blue and the red subsystems (Naplyokov, 2025) based on knowledge of their cognitive aspects, in particular a way of thinking, mental models, human biases, prejudices and traps. Cognitive aspects define blue and red interactions that should lead to balancing the big system as a state of peace.

Operational factors and factor analysis

In the OPP exterior and interior factors are divided in operational factors of TFSI (NATO, 2019, p. A-1-A-3). They are mutually dependable and present an entire whole (Vego, 2000). Internal (local, regional, and national) and external (international) factors are interrelated and can negatively or positively influence system development. If actors share common interests factors may positively reinforce each other.

It is important to distinguish difference in facts, factors and assumptions. Facts are statements of known data concerning the situation. Facts are general data that may not define the problem. "A factor is one of the things that affects an event, decision, or situation" (Collins dictionary). An assumption is a supposition about the current or future situation that is assumed to be true in the absence of facts. Assumptions should be confirmed or refuted as soon as possible. "To be valid, an assumption must be logical, realistic and necessary for the planning to continue" (NATO, 2019, p. 4-10). An assumption helps to fulfill informational gaps based on experience, feeling and intuition to create a complete picture of reality. It can balance the process of judgment with a probabilistic confidence.

A level of unknown is a function of a wish to fulfill informational gaps of chaos by visualized idea, hopes, believes feelings, simulation modeling, expectation as a wish to see a set of desired conditions and others. Often predictions are becoming popular as a way to test assumptions and turn dreams into reality.

A problem is directly related to "the factors that must be addressed to move the current system to the desired system" (Joint Chiefs of Staff, 2011, p. IV-1). A problem is generated by competition of opposing sides. Problems of opposing blue and red sides are different, but do not exist without each other. Two problems may form a single whole and resolving them requires clear understanding of cognitive aspects of each side.

Factor analysis (FA) is conducted based on a deductive method (NATO, 2019, p. 4-8) through the prism of operational factors in the PMESII domains to frame the problem and define its root causes. Critical factors "define the problem and which must ultimately be addressed when resolving it" (NATO, 2023, p. 3-28). FA conclusions contribute to conducting center of gravity analysis and operational design development that requires balancing operational factors (Joint Chiefs of Staff, 2020, p. IV-20).

FA is conducted through thinking and judgments that are based on values, believes, moral and cultural aspects, risk evaluation, pragmatic and non-pragmatic considerations. An angle of problem observing and framing can be different because of similar factors can be seen differently, for instance, because of certain mental models, experience, values, believes, risk taking and judgment.

Judgment involves a certain degree of uncertainty regarding the answer, on which we assume there may be disagreement among knowledgeable and competent people (Kahneman et al., 2021, p. 46). Judgments differ for various reasons, such as different factors chosen to address a problem, diverse ways of thinking during their analysis, perspectives on a situation, risk evaluation, beliefs and values. It shapes the system's structure to make it functional to achieve a desired goal.

Selection of factors is relative, individual and ambiguous because it is a product of human imagination, experience and prejudice. Planners from available data and facts select relevant factors that directly or indirectly may define a problem. Strategic documents, limitations, products of preliminary analysis can be sources to collect facts and select factors that should be relevant to a crisis situation.

The concept of the cognitive factor and influence on problem framing

Notionally factors of influence may be divided into physical and cognitive (spiritual) ones. TFSI, as possible physical factors, are relatively independent from human influence. Human mindset and thinking can define the concept of the cognitive (C) factor that, in its turn, may form perception of TFSI factors. Physical factors can describe qualitative and quantitative aspects of the system and the OE when cognitive ones can define thinking, judgment and social relationships based on values, moral and cultural aspects. All factors describe the state and behavior of the system and the OE.

Cognitive factors directly influence DM, in particular, perceiving, interpreting, analyzing and evaluating information. The C factor can be defined by values, believes, national and organizational culture, a DM culture (Naplyokov, 2017, p. 5), mental models, analytical reasoning, cognitive biases and heuristics, intuition, doctrines and rules. The C factor is relatively stable because of its archetypal nature and may focuses on unconscious in thinking to comprehend a situation. The TFSI factors are changeable and may emphasis on conscious in DM.

The concept of the C factor can be presented by a set of communication lines and language, intellectual capabilities, education, technology development, knowledge

of the subject and others. It can make the system able to respond to changes of the OE or itself through arrangement of actions in the framework of TFSI factors. The concept of the C factor reflects an inner world of a decision maker and defines what and how to deal with TFSI operational factors of influence.

Reflection of today reality and imagination of the future are different in their nature, but present an entire whole in operational planning. In this process CTFSI factors complement each other and work together. To prove the need of the C factor in operational planning may help consideration of the concept of "imaginer" that includes (1) the one, who imagines; (2) of what is imagined and (3) the process of imagination (thinking) itself (Durand, 1992).

According to Durand (1992) logos is linear; it operates on facts and the laws of logic and strives for division, analysis, and objectivity. Logos is rational, evidence-based approach emphasizing logic and systematic reasoning. Mythos is narrative-based, symbolic understanding rooted in traditional stories and cultural values. Mythos forms imagination, which constitutes the collective unconscious. Mythos is holistic, irrational, and draws on emotions and archetypes. Mythos is the foundation of the psyche, constantly generating meaning.

Forming a reality thought the prism of the CTFSI factors may allow correcting potential errors and human biases stemming from the influence of the past (C factor) as mythos, through reflection on reality as logos (TFS factors) and Information, which is constantly changing. Collection and analysis of information serves as a link between the C and TFS factors. Thus, the factor of Information can be described as a regulator of proportion of mythos and logos in DM. The C factor can be introduced as an ability of a DM team to properly select and combine TFSI factors in a way that will balance the system. The C factor becomes glue for TFSI operational factors to properly reflect (imagine) the reality.

The C factor is critical in mission analysis because knowledge of a red C factor means understanding thinking of a red actor. It can help to understand features and the difference of mutual reflection of opposing blue and red subsystems. The C factor shapes a certain picture of reality as connection of the system with the OE through selected factors based on an archetypal point of view of a decision-maker.

Selection of factors, problem framing and its solving present an entire whole joined by a mental model that is applied by a decision maker in this particular situation. It is also supported by the notion of "imaginer" as forming imagination, selection of the object that may create a problem and thinking on how to balance the situation.

CTFSI factors are mutually dependent and should be balanced in order to develop "imaginer" to shape DM that may minimize a problem and optimize its solving. Deleting one of the factors makes "imaginer" not completed. The C factor may regulate TFSI factors to make decisions that provide system functionality in the PMESII domains of the OE. Application of the C factor can help to deal with ill-structured and wicked problems because of its archetypal nature that can organize DM. It may verify that an object, a subject and the process of thinking are reconciled by CTFSI factors that explain relevant links to make the system able to act properly to achieve a desired goal.

Thinking in the framework of TFSI builds an object that can be evaluated based on a set of existing values and believes created in the past. To avoid influence of obsolete metal models and biases in DM may require combining convergent and divergent thinking through applying the C factor and TFS factors accordingly. The archetypal nature of the C factor can support convergent thinking that stabilizes DM in the chaotic OE from a view of a decision-maker. The TFSI factors may generate divergent thinking as reflection of reality.

Visualizing a space is shaped by our perception that immediately brings to mind a specific mental model stored in the repertoire of a decision-maker. This model may frame a false problem and a way to solve it. To avoid this effect the C factor can serve as a tool that comprehensively and systematically integrates TFSI factors to conduct DM properly (Table). The C factor answers the question why and how a certain actor thinks to act. The TFS factors answer questions of when, who (what) and where to behave. Actually the CTFSI framework is a prism through which operational planning goes and eventually transform to a developed course of action that should answer on similar questions. Without C factor operational planning can look incomplete and mistakable.

The C factor can be considered as an archetypal tool to regulate behavior of the system in the chaotic OE. At the same time, combination of TFSI factors, as conscious reflection of the reality, with the C factor, as unconscious interpretation of the reality, should supplement each other to eliminate biased decisions. Contradictive combination of the C factor with TFSI factors can provide a required proportion of convergent and divergent thinking in DM in the given OE. Literally, it can make the system a complex adaptive system or a learning organization (Senge, 2006, p. 3-4).

An archetypal pattern, constructed from relatively stable archetypes, develops a certain picture of reality. The C factor can influence arrangement of TFSI factors according to this pattern to reflect and visualize the reality of the OE and the system as

Table

Interaction of CTFSI factors in the operational planning process

Planning activity	Interaction of CTFSI factors
Monitoring the situation	• Reflection of reality as combination of factors of TFS, collecting data and selection of information.
Visualization of system development and a desired end state	• Developing a picture of reality: to construct reality – apply a framework of TFSI factors supported by C factor (there is a gap between a real situation and a visualized picture of reality).
Analysis and judgment	• Framing the problem through competing conscious (TFS) with unconscious (C) and supported by changing I factor (assumptions). • A puzzle of reality is trapped by a certain mental model that is, in many cases, not appropriate one because of new conditions (C vs. TFS). • Operational approach and design development – C dominates.
Problem solving	• Course of action development – arrangements of means to conduct activities (TFS) to generate effects and establish decisive conditions (supported by C and I factors).

Source: created by the author.

an entire whole. This arrangement should present a suitable from a decision-maker perception, thinking and judgment that balance the system by creating a picture of reality, visualizing a desired future, framing and solving the problem. It can facilitate explaining and forecasting possible thinking in a game of blue, red and green actors, their interactions as subsystems of the big system (see Figure).

The C factor integrates other TFSI operational factors in a certain combination to frame the problem and solve it by making a system functional. The C factor may define a format to visualize, analyze, judge and make decisions in the given OE. Harmonization of operational factors by the C factor can facilitate natural reaction of the system to factors of influence through proper application of ways and means.

The CTFSI factors contribute to defining a social phenomenon that, in a view of a decision-maker, destabilizes the system. Considering a social phenomenon without the C factor looks incomplete because it fails to capture how other factors fit into a certain puzzle, based on the philosophical framework of the problem with its underlying values and principles.

The C factor takes into account cultural aspects, mental models and doctrines that influence thinking, methods and forms of deploying forces and means in time and space. It is reflected in a certain way to apply means (hard and soft power, adaptation and shaping) to frame and solve the problem. The C factor forms relationships between the subject and object (see Figure) in the context of generation of certain actions described by factors of TFS.

The C factor can define thinking and judgment in selection of factors, problem framing and its solving. The C factor can direct a way of thinking to conduct FA properly and support the whole set of factors CTFSI. In this case FA conclusions will help to focus on an operational approach development based not only on physical dimensions, but also correct a way of thinking towards possible red reaction that can make operational design "smarter." Thus, the C factor is a balancer and controller of other factors to create the whole systemic picture about a nature of the problem.

Under influence of the C factor forces and means are distributed in time and space. Time is unidirectional and, physically, can be accelerated (compressed). The Time factor is critical in DM because it is connected with energy and influences combination of FSI factors. Acceleration of time may be a result of fast change of the OE and the system. Saving traditions may mean slow time running. In the context of CTFSI factors it means saving the picture of reality longer than it is. We do not change the picture in front of us and our attention still focuses on one object (a set of objects) that is supported by accepted rules and traditions. Change is about competition, speed, acceleration, new reality and rules.

Conclusions from C factor analysis can focus on influence a cognitive domain of actors. A properly applied C factor in operational planning means that the red actor changes its attitude to the blue and does not count the blue as a competitor physically and/or mentally. Based on this it is possible to say that the war is an intellectual game that can be won as cognitive dominance by applying the C factor.

To manage development of the system properly through operational planning in the complex and changeable OE also may require reviewing the C factor in the

context of an organizational culture, mental models and planning doctrines to adapt them to a new social and technological reality. To control relevance of the archetypal C factor and its validity requires applying critical thinking (Paul & Elder, 2008, p. 2). It can minimize influence of obsolete mental models, human biases and traps that are often automatically applied in DM in the complex and dynamic OE.

Conclusions and prospects for future research

The article introduces and theoretically justified the concept of the cognitive factor as an operational factor in the operational planning process. The concept of the cognitive factor, as an archetypal notion, is relatively stable and can be shaped by values, beliefs, national and organizational cultures, a decision-making culture, mental models, doctrines and rules.

Application of the concept of the cognitive factor in operational planning together with operational factors of time, force, space and information can improve managerial decision-making and planning including visualization, problem framing and its solving associated with a simple and effective way for both parties of the conflict. Also, it can facilitate establishing decision dominance and making the system adaptable in the complex and dynamic OE.

At the same time, determination of the cognitive factor can be complex and subject to bias, which requires a specific approach and a methodology to it. The issue of mutual influence of exterior and interior factors and an approach to use it as a benefit in operational planning can be a topic for a further research.

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ЗАСТОСУВАННЯ КОНЦЕПТУ КОГНІТИВНИЙ ФАКТОР У ПРОЦЕСІ ПРИЙНЯТТЯ УПРАВЛІНСЬКИХ РІШЕНЬ ТА ПЛАНУВАННІ

Анотація. У статті досліджено застосування концепту когнітивний фактор у процесі оперативного планування в умовах складного та динамічного середовища. Основну увагу зосереджено на аналізі місії та визначенні проблеми в умовах обмеження ресурсів. В основних доктринах НАТО з планування операцій та національних доктринах країн-чле-

нів НАТО таких як AJP-5, COPD та JP 5-0 визначені такі категорії оперативних факторів як фактори часу, сили, простору та інформації, але не враховується когнітивний фактор.

Теоретично обґрунтовано необхідність застосування концепту когнітивний фактор як оперативного фактору для забезпечення ефективного оперативного планування об'єднаного застосування військових сил та засобів з невійськовими спроможностями. Концепт когнітивний фактор є невід'ємною складовою процесу прийняття управлінських рішень, неврахування якого може призвести до невірного визначення проблеми, протилежної сторони, як тої, яка її створює, та розробці оптимального шляху вирішення проблеми. Когнітивний фактор має архетипну природу, є відносно стійким та може визначатись цінностями, переконаннями, національною, організаційною культурами та культурою прийняття рішень, ментальними моделями, доктринами та правилами.

Визначено, що концепт когнітивний фактор поєднує фактори часу, сили, простору та інформації в єдине ціле в процесі оперативного планування, зокрема сприяє формуванню системного уявлення про існуючий стан середовища, соціальної системи, візуалізації їх динамічного розвитку та бажаного майбутнього стану, аналізу проблеми та розроблюванню шляхів її вирішення.

Запропоновано застосовувати в процесі оперативного планування на доктринальному рівні концепт когнітивний фактор сумісно з оперативними факторами часу, сили, простору та інформації. Це може сприяти підвищенню ефективності оперативного планування та встановленню домінування в прийнятті рішень в умовах воєнного стану.

Ключові слова: *процес прийняття управлінських рішень, концепт когнітивний фактор, оперативне планування, факторний аналіз, проблема.*

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