A COMPREHENSIVE APPROACH TO DECISION-MAKING AND INTERACTION MECHANISMS THAT VALORIZE RELEVANT INFORMATION

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Abstract: Effects-based organizational planning aims to synthesize the operational structure and strategies that enable organizations to achieve the desired effects in the context of a rapidly changing environment. The informational domain, as a link between the cognitive and physical domains of an organization sets forth to achieve "informational superiority" and valorize the valuable information of all organizational processes. Informational superiority does no longer refer to obtaining knowledge, but to how the valuable information produced within an organization is shared and applied by its members, as we are now witnessing a shift from a need-to-know, to a need-to-share approach to information. In this context, the competences of those actors participating in the "observe $\rightarrow$ monitor $\rightarrow$ decide $\rightarrow$ act" cycle as well as the interaction mechanisms established within or outside the organization become the key enablers. Our paper considers all the above mentioned aspects and introduces a basic model for the dynamic assignment of decision rights based on competences and interaction mechanisms.

Keywords: Collaborative environments, decision rights, comprehensive approach, knowledge management.

1 INTRODUCTION

Operational environments are getting more and more dynamic, being characterized by an infinite number of variables. The force that drives operational environments is change. It is adaptation to change and especially information superiority that makes the difference between success and failure. If modern technology is the key factor that gives us an advantage over the adversaries, information and interoperability are the key driving forces that help us operate efficiently in complex environments. If not before long "information superiority" used to be achieved by extracting the relevant information, i.e. by turning data into knowledge, nowadays we are witnessing a shift from the "need-to-know" to the "need-to-spread-and-share" approach to information. (Kristina Rintakoski & Mikko Autti, 2008). Obtaining information, though still important, is no longer the main focus, emphasis being now placed on how information is shared between organizations, at a macro level, or between the members of an organization, at a micro level, the purpose being to achieve a comprehensive approach.

This article considers all the above mentioned aspects and sets forth to analyze the way decision rights could be assigned to the members of an organization, so as to have the decision-making process observe the principles of Comprehensive Approach.

2 COMPREHENSIVE APPROACH

At present, NATO is focusing on developing a comprehensive approach as an operational, strategic and tactical concept, based on the Effects Based Approach to Operations. Whilst there is no commonly accepted definition for Comprehensive Approach, there is broad agreement that it implies an integrated effort of cooperation between the actors participating in a mission. We will introduce the principles underlying the concept of Comprehensive Approach and subsequently apply them within a flexible and robust organizational structure, with the purpose of identifying the individual characteristics that play an important part in the decision making process. Effects-Based Terminology was used to integrate the diplomatic, informational, military, and economic instruments to create the conditions for success. (Smith, 2002). Coordinating all these instruments into a comprehensive approach can be done with the help of several collaborative tools that will help us gain and maintain an integrated understanding of the problem and come up with comprehensive solutions.

The concept of comprehensive approach unifies all actors in an integrated manner making them act in close cooperation. Comprehensive Approach means that an organization should try to co-ordinate with other organizations, not coordinate them. Effective comprehensive approach requires unity of effort and shared vision among the agencies, organizations, institutions and forces participating in a mission. This requires forging a comprehensive approach with a shared understanding and appreciation for the intended end state.

Comprehensive approach is an approach that integrates all collaborative efforts of all entities to achieve unity of effort towards a shared goal. Comprehensive Approach is framed by three underlying tenets: understanding, cooperation and joint effort. The approach promotes a shared understanding of the situation towards accomplishing a shared goal and obtaining the desired end results. Understanding does not imply conformity, each actor contributing a distinct set of professional, technical or cultural values and competences to mission accomplishment. The approach is based on a cooperative effort reinforced by institutional trust and transparency.
This culture would deliver the best effects if it were implemented not only at the top level, but also at the lower (organizational and individual) level. Comprehensive Approach is not an end in itself but a means to an end. It is a tool that helps us obtain the desired effects, promote and develop a mechanism and culture based on trust, collaboration and cooperation both vertically between nations and international organizations and horizontally, within nations and organizations.

Applying comprehensive approach would mean implementing a mechanism and culture of cooperation that would allow information to flow smoothly both internally, between the members of an organization, and externally, between the organization and its operating environment (Figure 1).

![Diagram](image_url)

People working in international organizations should make themselves familiar with the concept of Comprehensive Approach, which, after all, is more a mindset than a formalized way of working. The activities from the physical, informational and cognitive domains should be interdependent, and performed concurrently not sequentially, to identify coordinated, shared and comprehensive solutions. Optimizing the flow of information from the physical towards the informational and cognitive domain should not be an end in itself but a necessity because the activities in the three fields tend to be interdependent. Thus, achieving a culture of cooperation and coordination between actors at all levels – a comprehensive approach - becomes mandatory, the development of more structured relations between and within structures being a first step to that end. This is not an easy task to achieve we can, though, start by correctly assessing both competences and pitfalls of the organization and the members comprising it, and by identifying the most appropriate way for actors to act in order to complement each other’s efforts. Comprehensive Approach should leverage the disparate capabilities of all actors, and not by compelling them to work together towards a common goal, but by making them participate out of a shared understanding and appreciation of what that goal represents. Achieving this outcome will enable a smooth flow of information between actors who gain a comprehensive situational awareness, and an increased strategic planning and decision making capability.

3 ASSIGNING DECISION RIGHTS IN THE CONTEXT OF COMPREHENSIVE APPROACH

Assigning decision rights in an organization can fall between two diametrically opposing practices: on the one hand there is total centralization – all decision rights are assigned to one actor alone- and on the other hand there is total decentralization – all the entities in an organization share equal decision rights. The implementation of modern concepts such as EBO (Effects- Based Organizations), KM (Knowledge
Management) or NEC (Networking Enabled Capabilities) has enabled a dynamic assignment of decision rights, where depending on the situation, various actors, can at different stages, gain access to the decision making process (Alberts et al., 2006). This becomes possible due to an increased level of situational awareness shared by all the members of an organization which expresses the self-synchronization capability of the organization referred to. It means that an actor can temporarily acquire decision-making rights of a flexible coverage, depending on the responsibility he/she assumes. From this perspective, the distribution of in-depth and in-width agents becomes decisive. An agent with a good in-width capacity will be an efficient decision-maker whereas an agent with a good in-depth capacity will be an efficient performer, able to put decisions into practice. (Levchuk et al., 2006).

Applying dynamic assignment to military organizations might as well be a viable solution, especially since such organizations are very homogenous and a combination of responsibilities between experienced and beginner agents can have significant consequences upon organizations operating in complex environments. This ensures plurality of perspectives and entails a constant combination of available pieces of information in ever newer ways, by valorizing the relevant information and the qualitative resources. This approach enables the accomplishment and maintenance of the observe-monitor-decide-act cycle, by engaging all the actors participating in the activity of an organization, at the three levels: physical, informational and cognitive. (Smith, 2002). In KM terms, the physical domain is characterized by the high capacity of state-of-the-art technology to observe and analyze, the informational domain by the capacity to process information, whereas the cognitive domain by actors’ ability to extract the relevant information and make the optimum decision.

The key element is interaction, which on the one hand enables actors to recognize, distribute, use, access and share data, i.e. to achieve the informational cycle, and on the other hand ensures organizational cohesion, in that it generates knowledge. The quality of information and of the action itself is influenced by the nature of interactions occurring at the social, informational and cognitive levels, the purpose of which is to achieve collaboration towards a common goal. Collaboration refers to a wide spectrum of activities, including exchange of information, coordination, consultation, synchronization and integration. Increased interactions within or even outside the organization can significantly influence collaboration. Within the organization, an exchange of information arising out of an increased capacity to understand the information signals an increased level of cohesion. Outside the organization, information exchange expresses the capacity of an organization to adapt to complex environments characterized by an increased level of uncertainty and risk. (Bechet et al., 2009).

As far as information exchange is concerned, interaction within and outside the organization entails identifying those elements which give relevance to the informational gain, i.e. generate results, and achieve organizational objectives. The agent with the highest in-width capacity is the decision-maker, whereas at the opposite end there is the performer, with an increased in-depth capacity. Complex military actions require team members to have differentiated experience and understanding capacities. Team structure, in terms of the optimum ratio between in-depth and in-width competences as arising from a thorough analysis of the interactions occurring within the team, depends on the degree of complexity of team activities and on the distribution of these activities. Valuable information made available through individual actions may be turned into relevant information only in so far as the interaction mechanism allows team members to express themselves, by dynamically assigning rights and responsibilities. The collaborative environment is the perfect solution, as it constantly monitors the organizational state and signals whenever a valuable piece of information becomes available. All team members should have permanent access to the signaling channel, each member having to constantly update the available information. This does not rule out the assignment of certain levels of priority within the team.

Information exchange implies a source agent which generates the information and an addressee, a decision-making agent which understands and applies that information. We can speak of informational gain only when the source agent knows how to process the information and how to extract only those relevant bits of information the addressee needs in order to understand the message. In other words, the performer (specialist) adds value to information by “summarizing” it. We are dealing here with information processing useful for the transfer of information. Informational gain can also be analyzed from the perspective of the decision-maker and his capacity to process and understand the information he receives. This exchange of information between agents can also be analyzed in terms of loss, i.e. valuable information lost during the processing. As a consequence, for resource management to be as effective as possible, responsibilities among team members should be assigned depending not only on individual competences (suited for the specific activity to be performed) but also on team collaboration.
3.1 Competences and Interaction between Organizational Actors

The model we have used to quantify the value of the informational flow is the one based on the theory of multiple agents (Levchuk et al., 2006). To what extent agents can understand each other is an important part of the information transfer. The absolute value of the information processed by a specific agent represents the informational gain. To what extent is the absolute value of a piece of information, produced by an agent, relevant, depends on the interaction established among organization agents. It follows that an agent can “produce” extremely relevant information which can not be valorized due to a mismatch between the two communicating agents. We are dealing here with informational loss caused by an interaction between two agents with very different levels of understanding, a case in which the organizational resources can be said to have been used extremely erroneously. It can even be argued that the information created through individual actions can not be put to the common good use of the organization because the latter lacks an effective mechanism of interaction that would help organizational agents share a common understanding of valuable information. Such situations are frequent in static organizations where information is usually blocked because decision-making agents are unable to process and understand the valuable information received from the in-depth agents which do not have decision rights. There is a certain degree of congruence between each and every pair of organizational components, congruence which depends on the extent to which the needs, requirements, objectives and elements of one structure matches the needs, requirements, objectives and elements of another. Congruence can thus be said to measure the “matching” between each pair of organizational components.

The relation between actors’ competence and interaction will be analyzed based on the theory of multiple agents (Levchuk et al., 2006), the interaction mechanism including 8 agents, one decision-maker, three in-width agents and four in-depth agents. For demonstration purposes, we will consider that only two competences are needed from an agent to perform an activity. It follows that the vector describing the experience of each agent will comprise only two components, as shown in the expression below:

\[ A = [c_1, c_2] \]  

(1)

where: \( c_1 \) represents the competence to process type 1 information and \( c_2 \) the competence to process type 2 information.

The in-depth and in-width capacity will be reduced to one unitary value (i.e. the sum of the two components will be the same for all agents). Thus, an agent having an equal/level distribution of the two competences will have a high in-width capacity, whereas an agent having a higher value for one of the two competences will have an increased in-depth capacity. Further on, we will discuss several situations depending on competence values, on the capacity of agents to process information (i.e. to reduce redundant information) and on decision-makers capacity to understand the information they receive. To that end, the agents of our analysis are either extremely specialized in one of the two competences (as for instance agent \( A_1 \) who has a very high capacity to process type 2 information) or relatively specialized in both competences, as is the case of agents \( A_3 \) and \( A_4 \) in expression 2. In the case of in-width agents/experienced agents (\( A_5, A_6 \) and \( A_7 \)) their capacity to process information is the same for the two types of information.

\[
\begin{align*}
A_1 &= \begin{bmatrix} 1 & 8 \\ 9 & 9 \end{bmatrix}, & A_2 &= \begin{bmatrix} 2 & 7 \\ 9 & 9 \end{bmatrix}, & A_3 &= \begin{bmatrix} 3 & 6 \\ 9 & 9 \end{bmatrix} \\
A_4 &= \begin{bmatrix} 4 & 5 \\ 9 & 9 \end{bmatrix}, & A_5 &= \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}, & A_6 &= \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix} \\
A_7 &= \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}
\end{align*}
\]  

(2)

As far as the decision-makers are concerned, their capacity to process the two types of information has been reduced as shown in expression 3 below, because the decision maker, as the key element of all organizations, will also have other types of information to process.

\[ A_d = \begin{bmatrix} 1 \\ 4 \\ 1 \\ 4 \end{bmatrix} \]  

(3)

Simulations will reveal two situations, a first situation in which specialized agents, through their capacity to process information will extract the relevant information reducing the total flow of information to 20% and a second situation in which agents reduce the informational flow to 50% of the initial amount.

The analysis will then focus on the relation between the decision-maker and the other agents from three different perspectives. A first one in which the decision-maker makes decisions relying on the competence of a single agent, a second one in which the decision-maker considers the contributions of all agents for each type of information and a third one in which the decision-maker decides based on the competences of agents for both types of information.
Figures 2, 3, 4, and 5 present the results for the situation in which only 20% of the total amount of information is processed and forwarded to the decision making agent. It can be noticed that the best result in terms of informational gain is obtained by the in-depth agent 4. As expected, in-width agents 5, 6, and 7 have too a relatively good informational gain of a 2/1 ratio. Figure 3 suggests that the best suited agent to process information of the 2 type is agent 1, with a loss/gain ratio of approximately 4/1. This result remains valid provided no additional informational loss distorting the flow of information between the decision making and the in-depth agents, occurs in the interaction mechanism. Moreover, this situation also entails a high degree of trust between the two agents in that even if the decision-maker doesn’t entirely understand all the information he receives, he should trust the agent to have given him enough relevant information, and thus successfully valorize the competence of agent 1. If, for various reasons, additional perturbations occur in the interaction mechanism, the above mentioned relevant pieces of information may be lost, and in that situation we are dealing with a piece of valuable information which is “produced” by the in-depth agent but which can not be valorized because the decision-making agent can not understand it as the competence levels of the two agents referred to are completely out of tune/sync. The informational gain obtained by grounding the decision on the agent which has the best competence is approximately 50% higher than the informational gain obtained by grounding the decision on the contribution of all agents, regardless of their competence (Figures 4 and 5). However, this is only the case if the “communication channel” is very good and if there are no perturbations. If on the contrary, there are strong perturbations, then it is recommended to make the decision based on the contributions of all agents, regardless of their competence level, in which case the gain/loss ratio is higher (1/0.32 as compared to 1.44/0.61).

Figures 2, 3, 4, and 5 present the results obtained when 50% of the total amount of information is processed. The best loss/gain ratio is obtained by in-width agents 5, 6 and 7. The increased competence of agent 2 to process type 2 information can no longer be valorized (Figure 7). This happens because the decision-making agent can not accurately understand the information sent to him by the in-depth agent, and will generate huge errors if he were to forward such information.
The interaction mechanism emphasizes the important part played both by the relevant information and by the decision-maker who should be at all times able to filter the information he receives both quantitatively and qualitatively. The results presented in figures 8 and 9 show that the decision-maker is even more incapable to valorize the information coming from the agent that has the best competence.

5 CONCLUSION

At present NATO is trying to develop a Comprehensive Approach based on the operational concept of effects based operations. Although there is no commonly accepted definition for Comprehensive Approach, the term can be said to imply a joint effort of cooperation between all the actors of an organization towards a common goal. In this context, the informational domain grows in importance, not just because smooth informational flows have to be ensured but also, more importantly, because relevant information has to be valorized and shared by all the members of an organization. It is along these lines that this paper has been developed to analyze the competences, interaction mechanisms and dynamic assignment of decision rights in organizations.

Valuable pieces of information made available through individual actions will be valorized and turned into relevant information in so far as the interaction mechanisms allow organization members to express themselves through a dynamic assignment of decision rights and responsibilities. As a consequence, we speak of informational gain in communication between agents if the valuable information produced by an in-depth agent (by processing it) can be transposed into a format that lies within the understanding range of the decision maker. If however, not all the pieces of information can be transposed into such a format, everything exceeding the decision maker’s range of understanding is considered to be informational loss.

The issue of achieving organizational performance depends upon ensuring those operational pairs of agents within the team that work with maximum informational gain and minimum loss. A signaling mechanism could be really helpful in optimizing the interaction mechanisms by choosing those organizational pairs able to work to work at optimum parameters and produce maximum informational gain and minimum loss. All agents, independent of the informational flow should have
access to the signaling channel. Moreover, it is
dynamically recommended that the priority to this channel
should be dynamic, i.e. consideration should always
be given to the agent with the best informational
gain/loss ratio. Data gathering could thus be oriented
towards those pairs of agents generating valuable
information that can be shared among organization
members.

The study has been developed on a simplified
model and emphasized the importance of the
interaction mechanism between the organizational
pairs of actors by evaluating the informational
loss/gain ratio in terms of information relevance
within the decision-making process. The selection
criteria we have used emphasized the need for a
dynamic assignment of responsibilities and rights
within an organization. The model can also be
extended to larger organizations by dividing the
organization into clusters, each cluster having a high
dynamic and a smaller area of action, both the
mechanisms within and between clusters being
subject to optimization.

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