DEFENSE RESOURCES MANAGEMENT FOR MISSIONS ABROAD AS AN ENTERPRISE RESOURCE PLANNING SYSTEM

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Abstract

The emergence and widespread adoption of integrated resource planning systems (Enterprise Resource Planning - ERP) is one of the most pervasive changes in the operational environment in the last decades. The indicators of effectiveness of the organization used in integrated resource planning systems for international missions should be classified according to criteria such as categories of resources, types of missions for which the evaluation is done, the types of military actions, etc. This paper presents a method of quantifying the effectiveness of defense resource management for international missions starting from the classification of indicators and parameters to be taken into account.

The emergence and widespread adoption of Enterprise Resource Planning (ERP) systems undoubtedly constitutes one of the most pervasive changes in the operational environment over the past decades. The term ERP can be interpreted in two ways [1].

From the point of view of the IT community, the emphasis is on *integration*: an ERP system is a software tool enabling to integrate the different application programs (HR, finance, acquisition, operation planning,…) in a military organization, by efficiently tracking all operations in real time and sharing them across all functions through a common database. In the light of today's operational environment, one can view the integration aspect of ERP as a prerequisite for further improvement of defense resources management, especially when analyzing this activity coming to the support of the organization, planning and development of the international setting operations. Organizations are increasingly aware that the next step in increasing effectiveness and efficiency consists in engaging in effective supply chain management. The emergence of the specialized organization to do this type of management has led to a surge in the number of partners contained in a single chain. And, these partners tend to be spread around the globe, as far as the international NATO led missions are supported by different country detachments, not of Romanian origin only. The success and widespread implementation of ERP systems has laid the groundwork for further integration across the entire supply chain.

On the other hand, managers and the decision making community tend to emphasize the planning aspect: an ERP system should be able to support decisions regarding the planning and execution of the international missions. The operation planning is one of the most important modules supporting ERP systems. It is well known that the strength of ERP is not situated in the planning area. That is largely because ERP nowadays still exhibits many weaknesses of MRP (Material Requirements Planning), as its operation modules are made up of standard MRP logic. The core planning and control assumptions underpinning ERP have less rapidly developed than the new software capabilities within ERP systems.

So instead of concentrating on the decision-support capabilities for the planning and execution, ERP systems have tended to focus on their integration aspect for which it is primarily known, and should have this feature well developed. Although the decision-making support is considered fairly important as a reason for adopting ERP, it is clear that additional decision-support in the planning area of ERP is necessary.

ERP systems evolved out of traditional Manufacturing Planning and Control (MPC) systems [2]. As shown in figure bellow, the MPC system still constitutes the core of any ERP system. It reflects the hierarchy of planning, with Standard Operation Planning (SOP) on the long term level, Master Operation Scheduling (MOS) and Material Requirements Planning (MRP) at the midterm level, and Real-time Theatre Control (RTC) and Supplier Systems at the short term level.

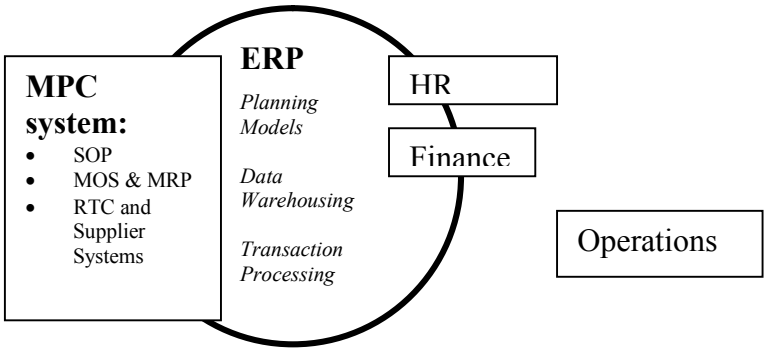

Fig.1 The scope of the ERP system.

The feasibility of the operational improvements that managers expect from an ERP implementation (such as lead time reductions, realistic capacity planning, and improved on-time delivery) largely depends upon the effectiveness of the embedded MPC system.

At this point in time, one can see that there is a possibility to make adjustments, both in plans and current operations by using tools and levers one can find inside data warehousing module of the ERP systems one might wish to apply to any international mission. The idea of applying the ERP system concept

to any military activity is feasible as long as one can find indicators and parameters to quantify the efforts, resources, and energy spent (and saved). By directly interpreting the above parameters, a system of real-time quantifying the activity to support the international missions would be ideal to the mission needs any NATO member country would use to effectively handle the resources it provides.

In this respect, the indicators that the set of routines to be applied inside the ERP system for an international mission promotes, should be categorized according to criteria as: type of resources handled (human, material, financial, technical, information, and/or time), type of mission to be assessed for (single NATO member or several NATO member countries, mixed compound of countries, consisting of both NATO members and non-NATO members), type of military action (peace support, peace enforcement, war prevention, warlike actions, antiterrorist actions, reconstruction actions, etc). It will also contain the type of communication systems used to make sure the mission has the information conveyed in a timely manner in both directions, from and to the detachments in the operation theatre, and to and from the national/international command. It will also take into account the entire volume of resources to be provided, their location, the transportation means and an optimization pattern for the "just-in-time" providing of immediately needed goods, forces, and communication.

Of course, it will always be taken care of having the necessary reserve amount of resources as usually planned for inside any national defense planning situation.

One important thing to be remembered is that the quantifying subsystem inside the ERP system that is to be applied for international missions, when several countries are participating, has to be deployed ONLY after the agreements of each of the attending country are in place so that one cannot be troubled by the political factors later when implementing the mission provisions.

The current paper, presents a way of quantifying the effectiveness of the international missions defense resources management, starting from the above classification of indicators and parameters to be taken into account.

A team of experts that would be tasked to deal with the issue of both controlling the effectiveness and making the most out of the measures to be applied to provide everything necessary has to look for obtaining the best payoff in managing the temporary (subject for analysis) organization that is to be set whenever an international mission is designed, organized, planned for and applied in practice in different areas of conflict, theatres of operations and Romania is implied through people attending under different positions.

Assessing the effectiveness of an organization is a difficult task. Although the literature on organizational effectiveness is large and growing, there seems to be little consensus on how to conceptualize, measure, and explain effectiveness. The three main models of effectiveness are the "behavioral-attitudinal" model, the "processual" model, and the "goal attainment" model.

Additionally, there are several methods of implementing a goal-attainment model for assessing effectiveness. The different models exist due to the difficulty in defining what the goals of an organization should be. Thus, the measures of effectiveness are independent of the methods used to achieve the goals.

The differences in measuring effectiveness and measuring performance should also be noted. Measures of performance (MOP) are "related to inherent parameters (physical and structural) but measure attributes of system behavior". The measure of effectiveness is the criterion by which solutions will be judged – proposed solutions, solutions under test, or solutions in being. MOPs are measures depicting how well an entity performed in accomplishing a mission, whereas MOEs depict how well the mission was accomplished without looking at the method in which it was accomplished. Thus, it does not necessarily matter

how the mission was accomplished, rather *how well* it was accomplished. This is of course evaluating it from a macro scale point of view.

The MOEs issues to be addressed are: "(1) aggregating the measures, (2) ensuring that the measurements have consistent units and a 'direction of improvement', that is, measurements need to be formulated so improvements add to the overall improvement of the system; and (3) being able to combine quantitative and qualitative measures [3]".

Use of a multi-criteria system (MCS) involves frequent and often difficult comparisons. Decision-makers, for instance, have to consider the relative importance of chosen objectives whenever tradeoffs are necessary due to limited organizational resources or the existence of inverse relationships among the objectives (e.g., certain cost vs. quality decisions). Further, assessment of overall organizational performance at the end of a period brings the need for decision-makers to, somehow, reconcile measurements of the multiple criteria, which vary in nature (e.g., customer-related vs. human resource-related), time frame (historical vs. future-oriented), and measurement unit (e.g., dollars vs. time).

The lack of a formal method for prioritizing and comparing strategic objectives and measures limits the usefulness of the MCS. Without reliably weighing of strategic objectives, for instance, an MCS does not precisely communicate the organization's strategy, including the intensity of effort that should be devoted to each objective. Additionally, for the purpose of performance evaluation, lack of a formal decision-support system leaves individuals with an extremely difficult judgment task to be repeatedly developed each time there is a case for such an assessment. In these cases, an extended research demonstrates that decision-makers may take suboptimal steps to reduce their cognitive burden.

The Analytic Hierarchy Process (AHP) is a well-known method for assessing multiple criteria and deriving priorities for decision-making purposes.

Major companies (e.g., Ford, General Electric), public accounting firms (e.g., KPMG, PricewaterhouseCoopers) and government agencies (e.g., United States Treasury Department, United States State Department) already utilize AHP for various purposes. Additionally, academics have employed AHP in over 2,000 studies. In the accounting literature, for instance, researchers have applied AHP to a number of complex problems such as analytical review, internal control evaluation, and assessment of management frauds' "red flags".

AHP begins with the organization of performance criteria into a "hierarchy", in order to structure and simplify the decisions. As applied to organizational performance measurement, this means that the organization must relate overall performance to strategic objectives and individual performance measures. Just as important, the process of designing a hierarchy and selecting performance measures forces the organization to link each performance measure to a strategic objective and, ultimately, each strategic objective to overall performance.

The second step in applying AHP to performance measurement is for one or more knowledgeable experts to make pair-wise assessments of the relative importance of the items on each level of the hierarchy. The relative importance scale allows the user to refine judgments by selecting numbers between 0 and 9 - 1.5, 2.3 and so forth - as necessary.

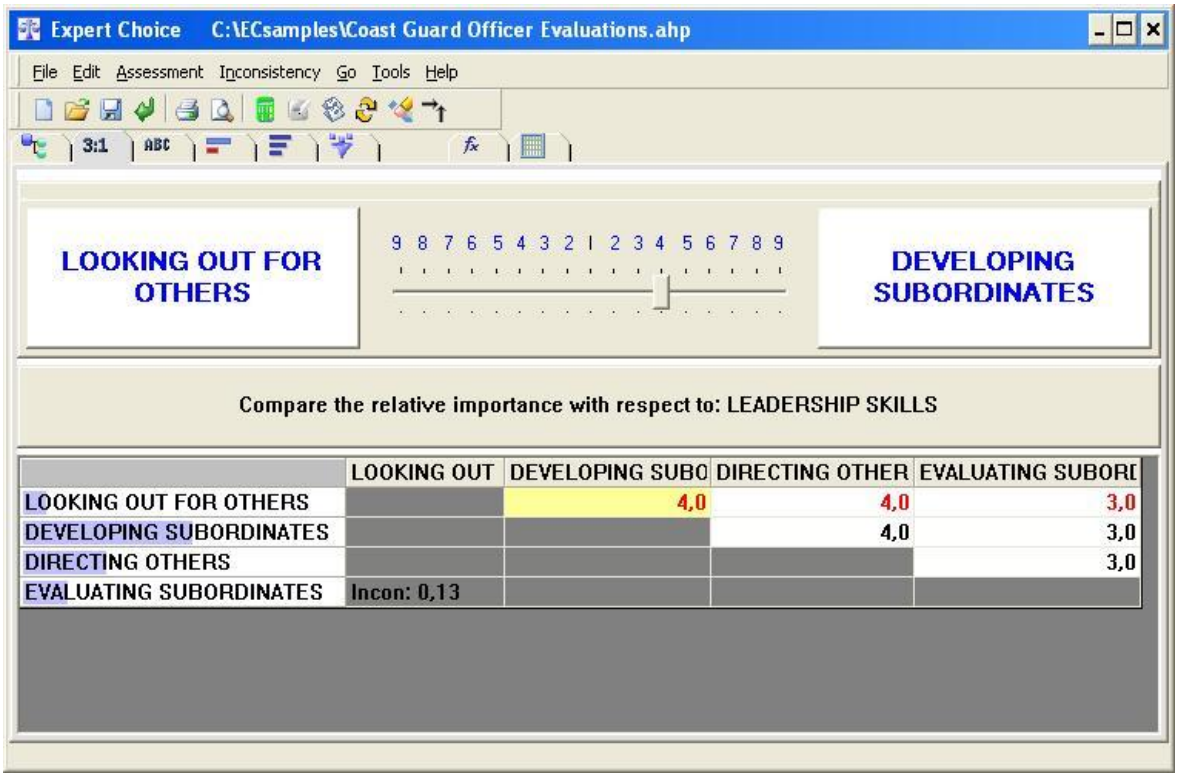

Fig.2 The pair-wise assessments of the relative importance using Expert Choice software.

As applied to the implementation of an MCS, the relative importance scale has several advantages over other methods for recording judgments. First, because the scale allows comparison of items measured in different units, such as dollars vs. time, it is ideal to comparing varied items within an MCS. Second, humans are more capable of making relative judgments than absolute judgments. Third, unlike many absolute judgments, the relative importance judgments yield ratio-scale data, which is more flexible and meaningful than ordinal or interval data. It is mathematically appropriate, for instance, to average the relative importance judgments of multiple members of an MCS design team. Finally, and most important, in situations where results are verifiable, the relative importance scale yields extremely accurate weighing systems.

Fig.3 The pair-wise assessments of the relative importance using Expert Choice software.

A key benefit of the pair-wise comparison approach is that it significantly reduces the computational burden on the individual making judgments. The use of a hierarchy further simplifies the judgment process by ensuring that the expert(s) need not compare excessively heterogeneous performance measures.

A critical advantage of AHP is its ability to measure the extent to which expert judgments are consistent. Logically, if an expert rates item A twice as important as item B and item B twice as important as item C, then the expert should rate item A four times as important as item C. To the extent that the expert violates this logic, a measure termed the “consistency ratio” (CR) increases. An obvious benefit of the CR is that it highlights careless errors in judgment. Additionally, the CR contributes to the learning process by revealing to an expert his or her unconscious bias in one or more pair-wise comparisons.

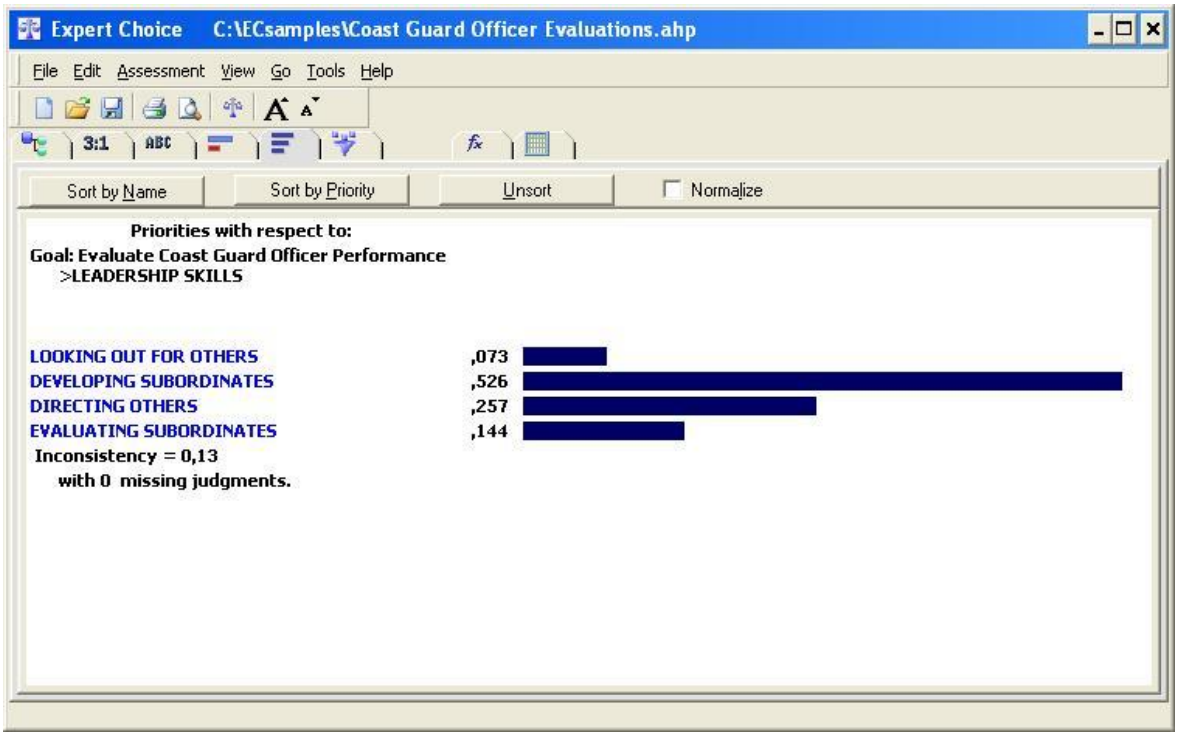

Fig.4 The weights as result of the pair-wise assessments of the relative importance.

In most applications, experts should revisit their pair-wise comparisons when the CR exceeds 0.10. Roughly speaking, a CR greater than 0.10 indicates that there is a ten percent likelihood that the expert judgments were random. Software, such as Expert Choice©, automatically calculates CRs for the full set of pair-wise comparisons as well as the subset of pair-wise comparisons within each level of the hierarchy, thus simplifying the identification of any problematic judgments. In sum, while scales such as the relative importance scale might not be precise, the use of redundant judgments and CRs lead to the derivation of highly accurate priorities.

Once the pair-wise comparisons are complete, software calculates relative weights for all items at all levels of the hierarchy. Though the matrix algebra involved in the calculation of weights can be complex, the logic is straightforward. The complexity arises when there are small, and thus acceptable, inconsistencies in the pair-wise comparisons. In such cases, the matrix algebra yields weights that minimize the impact of those inconsistencies.

As noted earlier, organizations need reliable weights to accurately communicate strategy and to measure overall performance. In addition, the ability to weight and aggregate performance measures via an AHP-based MCS gives organizations the ability to test their strategic hypotheses. To the extent that achievement of MCS objectives is not consistent with achievement of organization goals, the organization has evidence that its strategy might need adjustment. Furthermore, to facilitate adjustments, the organization could generate, ex-post (after the fact), ideal weights for comparison to the ex ante (before hand) model. Similarly, the organization can perform sensitivity analyses to determine how incremental improvements on individual objectives might impact overall results.

AHP is a well-established, theoretically sound methodology that organizations can easily adapt for the purpose of generating and maximizing the utility of an MCS.

Consequently, and conclusively, for the purpose of measuring and generating reports regarding the effectiveness of the Romanian troops' actions assigned for different international missions, there is a final attribution remaining for the people assessing this operational preparedness level: gathering data on each and every area of activity that supports the fulfillment of the mission at the highest level of responsibility. Setting the channels for gathering data is going to be the next step in our scientific research so that on can have a reliable tool at one's disposition not only for the current framework (international missions of the Romanian detachments) but also something to be possibly generalized to the level of the entire military organization effectiveness and efficiency control management.

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