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PROJECT EVALUATION & SELECTION METHODOLOGY FOR TURKISH ARMED FORCES

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1. Introduction

This study intends to introduce an alternative approach for the project evaluation and selection process for Turkish Armed Forces. The needs are always tend to be endless, but can we meet all of them? If this is the case, how should scarce resources be allocated to different all kinds of projects in order to be certain for the future of the Armed Forces' performance?

There are different stakeholders involved in the process. Since this is a cooperative effort and zero sum game, the consensus is vital among them. The main stakeholders for the project evaluation and selection in the military are (1) Government, (2) Chief of Staff, (3) Department of Defense, (4) Army, (5) Navy, (6) Air Force.

Goverment is the main authority for the allocation of the procurement budget and defining the national strategy. Given this procurement budget, and defined strategy, Joint Stuff HQ along with the department of Defense attempts to select the best among the candidate projects all three forces of Army, Navy and Air Force. There are mainly three deriving forces that define the needs of the Armed Forces. These are :

- *Threat*; Possible changes in the unstable dynamics of the international relations may cause changes in threat definitions. These changes in threat definition force armed forces to reevaluate their needs and strategic plans. For that reason, threat appears as a main factor in the need assessment process.
- *Doctrine;* It is another important factor that derives the future needs of the Armed Forces since it dictates the required capabilities for different levels of units.
- *Technology;* It is a merit to catch up with technology in the world we live in. Technological power of an Armed Force is a competitive advantage for a nation. For that reason the technology will unquestionably continue to be a deriving force for defining the needs of the Armed Forces.

2. Project Evaluation and Selection:

Project evaluation and selection decision process attracted large area of interest among the academicians and practitioners. For that reason, serious numbers of models are introduced to the literature. When those models are analyzed, those can be categorized into two main groups. These categories separated from each other at the mid 1970's by Baker et al's. [1975] paper. They defined the limitations of the classical models being used as;

1. Inadequate treatment of risk and uncertainty
2. Inadequate use of multiple criteria

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3. Inadequate treatment of project interactions
4. Insufficient involvement of R&D manager
5. Insufficient usage of nonmonetary criteria
6. Inadequate handling of time variant property of data

Schmidt et al. [1992] defined classical models as decision-event models. As they stated, project selection decision was considered traditionally in the classical group as a constrained optimization problem. There are some debates on this question in the literature. The authors defined the common properties of classical approaches, and these are;

i. Classical models were mainly focused on outcomes at a particular organisational level and at a particular point in time.
ii. They assumed fixed criteria and fixed number of alternatives. There was no mechanism embedded to the model, which allowed altering the problem.
iii. Most of the time benefit measurement techniques were used but rarely allocation methods were used.
iv. As Baker et al. [1975] mentioned, there was inadequate treatment of uncertainty and multiple criteria.
v. Classical models generally assumed that decisions are made at a single instant in time by a single decision-maker.
vi. There was lack of participation and consensus leaded to a result of failing to build support and acceptance.
vii. They ignored the organisational decision process and organisational dynamics.
viii. There was lack of behavioural and organisational considerations.

Given the deficiencies of classical models, Baker et al. [1975] concluded that classical models are only adequate for routine decisions with a highly analytical content. However, Winkofsky et al. [1981] claimed that even though there were adequate models in certain areas, they were not widely used. He suggested that the lack of usage could be due to the way models are introduced rather than to deficiencies in the models.

Intensity of project evaluation and selection papers decreased after Mid-1970's even though the need for a sound project selection methodology increased. People looked at back and began questioning "why are so much models created and why are so less models are used?"

It is claimed that most of the studies focused only on the mechanics and unfortunately could not sense and incorporate the all inherent dynamics of project evaluation and selection process, prior to mid 1970's. There was a race to apply almost all-possible techniques to the core problem of "allocating scarce resources to available projects" without even paying attention to those stakeholders who are involved in the process. It seems that they focused on too much on details and techniques and lost the insight of the big picture?

After Baker et al. [1975] mentioned about the limitations of the previous models people began to pay attention to those inadequately treated areas. In classical approach the tendency was to treat project selection as a single decision-maker, single criterion at a certain point of time and with certainty of outcomes.

Oral et al. [1991] studied on a new methodology for collective evaluation and selection of industrial R&D projects. They took a position of sectorial and national levels and selection process, which is mainly based on relative values, is done through a model-based outranking method. Their study introduces a new approach to project evaluation and selection. The methodology used intends to increase acceptance of the model and the results by introducing democratic and resentment avoiding principles. This study is multi-stakeholder, multicriteria data envelopment analysis.

3. Quantifying the future needs:

The vital process for any organization to visualize their future needs and take necessary steps through new projects. Creativity and visionary leadership plays an important role for quantifying the future of organization. In the implementation of project evaluation and selection methodology, the main stakeholders will be encouraged to provide their well-defined projects of which they believe that they will benefit from in the short and long term. Each has to consider the effects of possible changes in threat, technology and doctrine in the long run and determine their future needs by comparing their actual capabilities with the desired level of future capabilities.

Although, this process is the most difficult part, it is at the same time the most important part of the whole process. If you can not make sound and effective need assessments, then it means that you are gambling on the future of the nation's security. For that reason the methodology suggested in this study, do not consider putting on any kind of limitation in project definitions, and intends to gather all creative opinions which are supposedly well defined as projects in a pool. These projects will play a vital role for shaping the future of the Armed Forces. This study will not go into the detail of the methodology for quantifying the future needs. It is assumed that, all those three forces defined properly and sufficiently their future needs and these needs are quantified in terms of projects, and gathered in a pool. Then the main question arises:

> " What type of decision process should authorities follow for the project evaluation and selection procedure in which they acquire maximum consensus without creating any resentment among different stakeholders and at the same time assure the selection of the best combination of projects for the future of Armed Forces?"

After the selection process, selected projects are scheduled in the next 10-year implementation plan. It is inevitable that there will be some project backlogs, because of limited resources.

4. Criteria determination

The selection of criteria that will be used to evaluate projects is another step in the project evaluation and selection process. If too less criteria are used, then the model may not reflect the reality. On the other hand, if too many criteria are used, then model may become too complicated and unmanageable. For that reason, it is suggested in the study that each criterion should be defined with its relevant subcriteria as summarized in Figure 1. This in depth criteria determination will eliminate or at least decrease the level of inconsistency among the people who are in

the project evaluation and selection process and at the same time capture the essence of the project values for the organization. Total number of criteria in this study will be limited and assumed to be at a manageable level of ten.

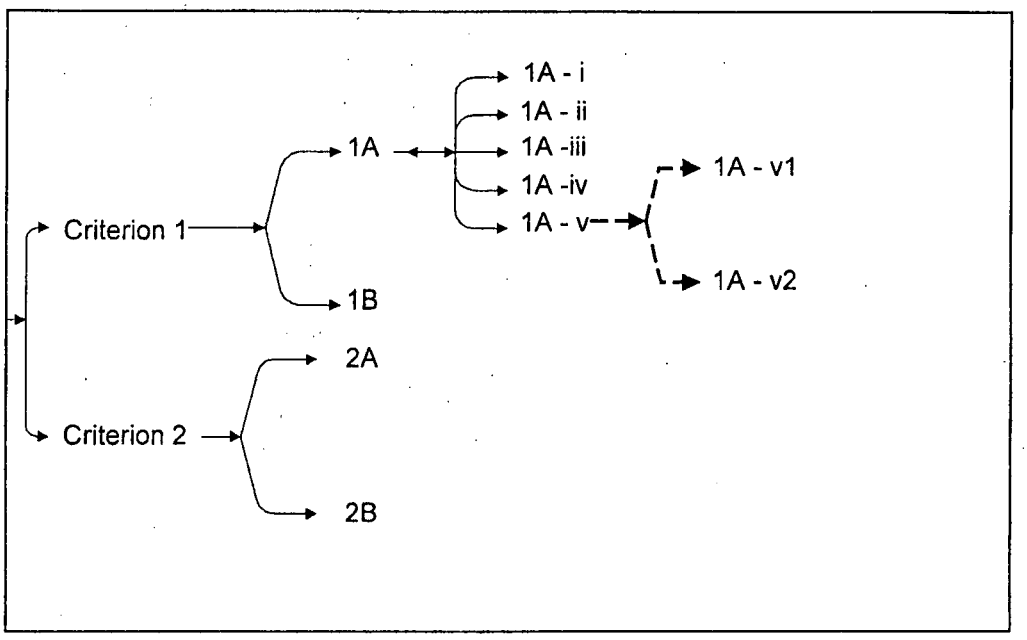

Figure 1 Criteria Branch

5. Screening phase:

This phase intends to eliminate the projects, which are ill defined and do not meet the basic a few prominent criteria. Checklist type of screening model can be implemented in order to see whether each project has completed properly the predefined project proposal process and satisfy the minimum acceptable level of a few prominent criteria. This will save some of the time and effort and at the same time force project owners to propose well-defined and coordinated projects. Screening phase is assumed to be done prior to acceptance of each project.

6. Score Assignment:

In this phase a group of expertise will be gathered to assign score to each criterion of the projects. The evolution committee will be established by two representatives from each forces, and seven representatives from the headquarter of General Staff. These 15 people of expertise will shape the future of the Armed Forces. The suggested score assignment process intends to incorporate group interaction and dynamism.

Score assignment process is considered as a several step procedure. The steps will continue until predefined consistency level is reached among committee members. At first, each member of the group will assign scores and after then these scores will distribute to all members and each member will defend his/her reasoning behind each score. This way each member will introduce his/her different viewpoint

on the subject. This interaction process will supposedly increase the understanding and interpretation of each criterion at the project basis and decrease the inconsistencies among the group members. For that reason following model is suggested to measure the inconsistency among the group members.

Consistency will be checked before the final phase. Consistency measure is like quality control, and as in the total quality management point of view, quality must be checked all over the process. For that reason quality check, consistency measure will be held at the most important phase of score determination. If scores are given in a consistent manner, then the leading findings will be consistent with the overall procedure. Consistency measure will be defined in terms of each criterion scores of a single project. Scores between "0 and 100" will be assigned to each criterion of a single project, it is needed to analyze the consistency level of those given scores. In order to measure the inconsistency, statistics that measure the spread or variation in the data will be used.

8. Oral et. al. 's [1991] project selection model:

Oral et al. [1991] introduced selection model for R&D projects. This study does respect everyone involved in the process and give same level of importance. This democratic approach of the authors intend to eliminate or at least resentment among the stakeholders. Their methodology creates incentives for the stakeholders to reach maximum consensus during the selection process. They try to reach maximum consensus among the stakeholders while selecting the best projects among the available ones at some given constraint, which is basically budget. This is a derivation of data envelopment analysis by using whole matrix values, instead of diagonal terms in their study.

The main difficulty in the project selection process is deciding on the weights of each criterion. Criteria are predefined by stakeholders with some compromises, and the associated weights are determined by the stakeholders individually. The superiority of the model is hidden at the point of volatile weights, which are determined by in terms of each project.

Oral et al. [1991] allowed each stakeholder to decide on his/her own criteria weights. However, in this study the weights of criteria will be determined on a project basis. For that reason it is allowed that each project will decide on its own weight combination.

9. Weight Determination:

Oral et al.'s [1991] self-evaluation model basically creates incentives for the stakeholders to maximize the value of their own projects. For that reason they are allowed to determine their own weights for each criteria. However, they are not so autonomous, and are restricted at a point in which their weights can not make the overall value of the other projects more than one.

Oral et al. considered budget needed for each project. However, in this study budget requirements will be kept out of the concern until the last selection process. Because, when scores are divided with budget requirement figures, this leads to underestimate those projects who need high monetary figures. All of the projects that

are gathered in a pool will be ranked with predefined set of criteria but volatile criteria weights.

Let the overall rating value of a project k will be determined by R_k and

$$R_k = \sum_{p=1}^{m} w_p s_{kp} \qquad (1)$$

Where;

w_p : Weight of the criterion p with m numbers of them

s_{kp} : Score of a project k from p criterion.

Thus, the model:

$$Maximize \sum_{p=1}^{m} w_{kp} s_{kp} \qquad (2)$$

subject to:

$$\sum_{p=1}^{m} w_{kp} s_{jp} \le 1, \quad for\ j = 1, \ldots, n \qquad (3)$$

$$w_{kp} \ge 0, \quad for\ p = 1, \ldots, m \qquad (4)$$

Figure 2 Self-Rating Model

However, self-rating model may lead to multiple solutions of the criteria weights. The methodology treats this possibility with positive attitude. In this phase, the weights of each criterion will be determined by the project owners without harming the maximum value attained by project k, and increasing the overall value of the other projects more than one. Thus, each project will be evaluated by project k, and most favourable criteria weights will be determined. The cross-rating model is summarized in Figure 2.

$$Maximize \sum_{p=1}^{m} w_{jkp} s_{jp} \quad (5)$$

subject to:

$$\sum_{p=1}^{m} w_{jkp} s_{ip} \leq 1, \quad for\ i=1,.....,n \quad (6)$$

$$\sum_{p=1}^{m} w_{jkp} s_{kip} = R_{kk} \quad (7)$$

$$w_{kp} \geq 0, \quad for\ p=1,.....,m \quad (8)$$

Figure 3 Cross-Rating Model

This model will provide new criteria weights for different projects and as a result of these optimal w^*_{jkp} values, new overall rating value will be calculated with a formula of;

$$R_{jk} = \sum_{p=1}^{m} w^*_{jkp} s_{jp} \quad for\ \forall j,\ j \neq k \quad (9)$$

All of these overall rating values form a square efficiency matrix "R".

$$R = \|R_{jk}\|$$

This square efficiency matrix of R will help to compare and rank the projects among themselves. Sum of project rating values, are used for ranking them.

10. Conclusions:

This study intends to suggest a methodological alternative to project evaluation and selection process in Turkish Armed Forces. The conclusions, which are driven so far studies, are:

If we allow each project to rate his own project, then it leads that some project weights become zero. This may not be a desirable case in general. For that reason, it is intended to search a methodology to define minimum acceptable criteria weights and incorporate those values to the model. For that reason, $w_{kp} \geq \delta_k$ for all criteria weights. However, δ_k must be defined in some interval. $\alpha^- \leq \delta_k \leq \alpha^+$ When you bound some criteria weights with some positive value, it is likely that, an infeasible solution may occur. In order to get rid of infeasibility, some flexibility is needed related with minimum acceptable criteria weights.

This methodology allowed maximum consensus among the stakeholders and lead to a better ranking among the available projects. Every project is very important fir its end user and end users may not appreciate the values of other projects. For that reason, this methodology, provides a common understanding and base for all projects

of different stakeholders. After the execution of methodology, every stakeholder who is involved in the process becomes convinced and resentments are minimized. In addition to other benefits, during the group interaction stage, intense communication lead to occurrence of shared vision among the representatives of different organizations.

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