JOURNAL OF SYSTEMS AND INDUSTRIAL PROJECT ENGINEERING
JSIPE

Vol. 2, N° 1, December 2016
pp. 68-76
ISSN: 2411-7226

Identifying Process to Reengineer by Multi Criteria Analysis: the case of the Military Training in Madagascar

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ABSTRACT

The main purpose of this study is to identify or to prioritize the process to reengineer in the case of Malagasy military training.At the same time, the process of Malagasy military training management is identified and the Skinner metrics related to the Plan National de Développement are identified. Then Multi Criteria Analysis is utilized to undertake prioritization. Multi Criteria Analysis is the appropriate method to sort process to reengineer. The main results are: the "management of identification of military training needs" is the process to reengineer, and it is also the focal process.

Keywords: *Malagasy, Military, Multi Criteria Analysis, Process, Reengineering, Training.*

1. INTRODUCTION

Many questions arise concerning the Malagasy military mission upon the present insecurity issues. Every day, a case of insecurity happened and reported by local journals. Besides, military trainings are continuously organized but so far the impact on development is not felt.

A relevant research question arises "what is the process to reengineer in the system of management of Malagasy training?". The present research will identify such process through Multi Criteria Analysis.

2. LITERATURE REVIEW

Multi-Criteria Analysis (MCA) is a decision-making tool developed for complex multi-criteria problems that include qualitative and/or quantitative aspects of the problem in the decision-making process. In a situation where multiple criteria are involved, confusion can arise if a logical well-structured decision-making process is not followed. Another difficulty in decision making is that reaching a general consensus in a multidisciplinary team can be very difficult to achieve. By using MCA the members don't have to agree on the relative importance of the Criteria or the rankings of the alternatives. Each member enters his or her own judgments, and makes a distinct, identifiable contribution to a jointly reached conclusion.

2.1 Analytic Hierarchy Process or AHP

AHP was developed by Saaty (1977, 1980). It is a particularly useful method when the decision maker is unable to construct a utility function. To use AHP, the user needs to complete four steps to obtain the ranking of the alternatives. As with any other Multi Criteria Decision Analysis(MCDA) method, the problem first has to be structured.

Following this, scoresor priorities, as they are known in AHP, are calculated based on the pairwise comparisons provided by the user. The decision maker does not need to provide a numerical judgment; instead a relative verbal appreciation, more familiar to our daily live, is sufficient. There are two additional steps that can be carried out: a consistency check and a sensitivity analysis. Both steps are optional but recommended as confirmation of the robustness of the results. The consistency check is common in all methods based on pairwise comparisons like AHP.

2.2 Analytic Network Process or ANP

ANP is a generalization of AHP which deals with dependencies. In AHP, we assume that criteria are independent. If they are not independent, correlated criteria would result in an overevaluated weight in the decision, as will be illustrated. For example, if we want to buy a car, the criteria of *speed* and *engine power* are correlated. In the traditional MCDA methods, this dependency implies a heavier weight of these joint criteria. The ANP method allows these dependencies, also called feedbacks, to be modeled; they are closer to reality and, as a result, yield more accurate results. As dependencies can arise between any of the elements in the decision problem (i.e. alternatives, criteria, sub-criteria, the goal), the model is no longer linear as in AHP (figure 1), where the elements are arranged in levels.

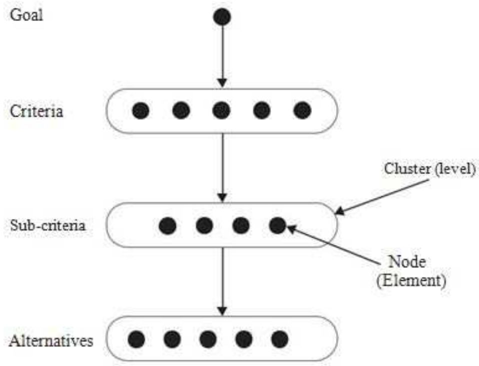

Figure 1: Analytic Hierarchy Process model

A hierarchy is not necessary in the ANP model, where clusters replace the levels and each cluster contains nodes or elements (figure 2).

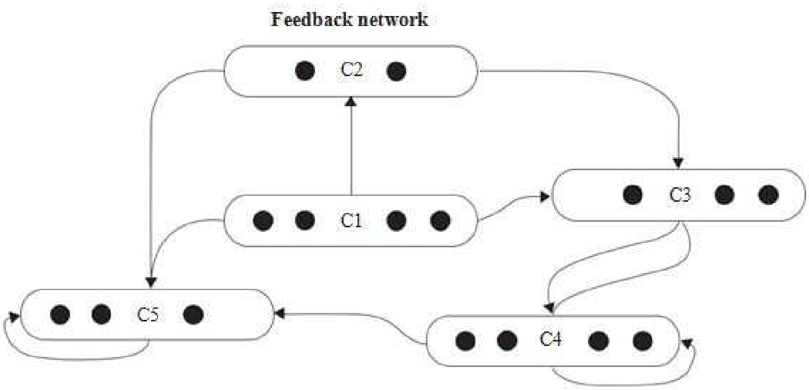

Figure 2: Analytic Network Process

The clusters are connected by a line, which in turn means that the elements or nodes contained are connected.

2.3 Essential concepts of the PROMETHEE method

The acronym PROMETHEE stands for “Preference Ranking Organization METHod for Enriched Evaluation”. Thus the PROMETHEE method will provide the decision maker with a ranking of actions (choices or alternatives) based on *preference degrees*. The method falls into three main steps:

- the computation of preference degrees for every ordered pair of actions on each criterion;
- the computation of unicriterion flows;
- the computation of global flows.

Based on the global flows, a ranking of the actions will be obtained as well as a graphical representation of the decision problem.

The PROMETHEE ranking is based on the positive and the negative flows. In this ranking, there are four different scenarii when analyzing the flows of two actions:

Scenario 1:

One action has a better rank than another if its global positive and negative flows are simultaneously better (i.e. if the global positive score is higher and the global negative flow is lower).

Scenario 2:

One action has a worse rank than another if both global positive and the negative scores are worse.

Scenario 3:

Two actions are said to be incomparable if one action has a better global positive score but worse global negative score (or vice versa). Economic and Luxury are incomparable since Luxury has a lower positive score and a lower negative score. This can be easily detected graphically as the two actions cross each other.

Scenario 4:

Two actions are called indifferent if they have identical positive and negative flows.

2.4 Essentials of the ELECTRE methods

The *ELiminationEtChoixTraduisant la REalite´* (elimination and choice expressing reality) methods, referred to as ELECTRE, belong to the outranking methods. They constitute one of the main branches of this family despite their relative complexity (due to many technical parameters and a complex algorithm).

The outranking methods are based on pairwise comparisons of the options. This means that every option is compared to all other options. Based on these pairwise comparisons, final recommendations can be drawn.

The main characteristic and advantage of the ELECTRE methods is that they avoid compensation between criteria and any normalization process, which distorts the original data.

B. Roy, the father of the outranking methods, presented ELECTRE I for the first time at a conference in 1965 and published the first paper on this topic in 1968 (Roy 1968). This initiated a long series of improvements, research and developments.

3. METHODOLOGY

The research process is presented by the following figure 3.

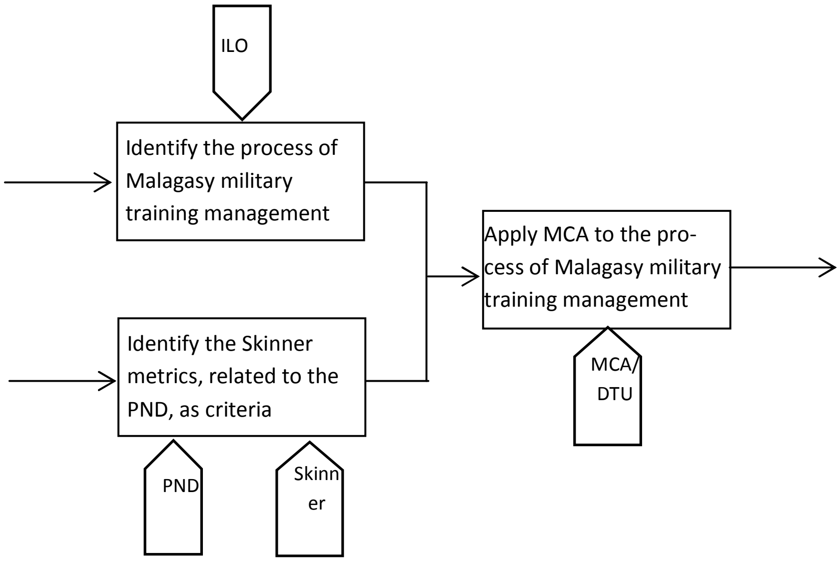

Figure 3: Research process

At the same time, two processes are undertaken: identification of the process of Malagasy military training management and identification of Skinner metrics, related to the Plan National de Développement or PND, as criteria. For the first process, International Labor Office or ILO's Training for the Rural Economic Empowerment (TREE) format is utilized to map the Malagasy military process in terms of organizing training. Beneath, figure 4 shows such process.

For the second process, indicators concerning Malagasy military intervention quality, in the PND, are taken in account: “ratio of military frequency per population frequency” and “percentage of persons feels in security” of sub objective “territory security system rehabilitated”. Then, each step of the process of Malagasy military training management is evaluated through Skinner's metrics, quality-cost-timing in order to identify the step to reengineer.

Last, the Multi Criteria Analysis software tool the Denmark Technical University (DTU) is utilized to simulate what step should be reengineered.

The process to survey is the following.

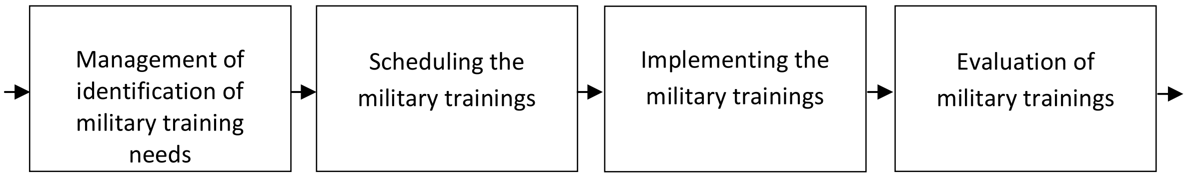

Figure 4: Process of Malagasy military management

The processes composed by management of identification of military training needs, scheduling the military trainings, implementing the military training and evaluation of military trainings. Based on the above research question, present work will determine the process to reengineer.

4. RESULTS

Simulation with MCA/DTU software, under option selection, gives the following results.

Table 1: Processes under survey

	Process title
Process 1	Management of identification of military training needs
Process 2	Scheduling the military trainings
Process 3	Implementing the military trainings
Process 4	Evaluation of military trainings

In the table 1, option according to MCA/DTU software is process. So four processes are concerned: Management of identification of military training needs, Scheduling the military trainings, Implementing the military trainings and Evaluation of military trainings. Then criteria for assessing the consequences of each process are chosen according Skinner. So those criteria are quality, cost delay and flexibility. The following table 2 shows

Table 1: Criteria selection

	Criterion	Unit Chosen	Value Preferred (High, Low)	Comments, details
Criterion 1	Quality	1-5 scale	High	1 if the quality is good , 5 if the quality is bad
Criterion 2	Cost	1-5 scale	High	1 if the cost low , 5 if the cost is high
Criterion 3	Delay	1-5 scale	High	1 if the delay is reasonable, 5 the delay is not reasonable
Criterion 4	Flexibility	1-5 scale	High	1 if the training is flexible, 5 if the training is not flexible

Each criterion is evaluated on Likert scale 1-5. For all criteria, value preferred is high. Concerning the criterion “quality”, if the quality is good, the score is 1. And if it is bad, the score is 5. For the cost, if the cost is low, the score is 1. And if it is high, the score is 5. When the delay is reasonable, the score is 1 and if it is not, the score is 5. Finally, if the training is flexible, the score is 1 and in the opposite case it is 5.

Each option or process on the criteria is evaluated. Depending on the units or scale selected in the previous result, a score will be assigned to each process which will reflect how it performs on the particular criterion. The following table presents the related activities.

Table 2: Process evaluation

Processes \ Criterion	Quality	Cost	Delay	Flexibility
Units Preferred value	1-5 scale High	1-5 scale High	1-5 scale High	1-5 scale High
Management of identification of military training needs	5	4	4	4
Scheduling the military trainings	4	2	3	4
Implementing the military trainings	4	3	2	3
Evaluation of military trainings	2	3	3	3

During two workshops, each participant has scored each process. For example for the criterion "quality", each participant has scored it from 1 through 5. Then the mean of all scores was calculated and gave the scores in the above table.

Then, an assessment of weights of each criterion was undertaken to reflect its relative importance to the decision. The table 4 shows the related result.

Table 3: Weighting of criterion

	Criterion	**Allocation of budget (total = 100)**	**Weight, %**
Criterion 1	Quality	40	40%
Criterion 2	Cost	35	35%
Criterion 3	Delay	15	15%
Criterion 4	Flexibility	10	10%
	Total allocated	**100**	
	Budget usage	**OK**	

Quality is important for participants of the above workshops. And the majority has allocated 40 to it. Then, for cost, delay and flexibility, they have allocated respectively 35, 15 and 10. The total should be 100. So if total does not match 100, allocation is reviewed.

After the above result, automatically, the MCA/DTU software generates the calculation of score for each process at each criterion.

Table 4: Calculation of score

Criteria / Processes	Quality	Cost	Delay	Flexibility	Weighted scores of each option
Units Preferred value	1-5 scale High	1-5 scale High	1-5 scale High	1-5 scale High	
Weight	40%	35%	15%	10%	
Management of identification of military training needs	100,00	100,00	100,00	100,00	100,00
Scheduling the military trainings	66,67	0,00	50,00	100,00	44,17
Implementing the military trainings	66,67	50,00	0,00	0,00	44,17
Evaluation of military trainings	0,00	50,00	50,00	0,00	25,00

The table shows that the process "management of identification of military training needs" gets 100 points, the processes "scheduling the military trainings" and "implementing the military trainings" obtain 44.17 points and the process "evaluation of military trainings" has 25 points. Then, MCA/DTU software provides a summary of results of the scoring. It gives a score which include criteria in all categories, as a weighted average. So, the following table 6 presents the corresponding results.

Table 5: Summary of results

Option scores

Option	Weighted Score
Management of identification of military training	100,0
Scheduling the military trainings	44,2
Implementing the military trainings	44,2
Evaluation of military trainings	25,0

Ranking of options

Rank	Option	Weighted Score
1	Management of identification of military training	100,0
2	Scheduling the military trainings	44,2
3	Implementing the military trainings	44,2
4	Evaluation of military trainings	25,0

The table shows that the process to reengineer is "management of identification of military training needs. It is ranked in first position.

5. DISCUSSION

The process to reengineer is "management of identification of military training needs" to assure tangible impact in the development of Madagascar. Its final score, 100 points, is high related to other processes' scores. Reengineer the first three processes is feasible but expensive.The research method is appropriate and is too practical than developed by Ishizaka (Ishizaka, 2012). But compared to the method developed by Roy (Roy, 1993), the research method is acceptable. It needs other improvements to target a satisfactory result.

The innovation is having determined process to reengineer by Multi Criteria Analysis. Generally, process to reengineer is according to enablers of reengineering (Ravalison and al., 2008). But according to (Hammer and Champy, 1993), identification of process to reengineer may need a mathematical approach as far astakt time in value stream mapping of training is concerned. This is confirmed by (Hammer, 1990).

6. CONCLUSION

The present research points out that a format in Training for Rural Economic Empowerment of the International Labor Office could map the Malagasy military training management process. For that a process of four steps is obtained.

Multi Criteria Analysis has permitted to sort process to reengineer. The related result is acceptable. And precision is also suitable in terms of quality.

Some lessons learned could be extracting from that survey:

- Multi Criteria Analysis should be followed by a discussion between stakeholders to assure that the final result is appropriate to the research question,
- Likert scale should be coupled with another scoring, for example precise value, to obtain precise results.

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