Abstract

Cellular telephony system has been one of the most growing areas in telecommunications during the last years worldwide. This fact is more critical in developing countries, especially in Brazilian case where there is an expanding market and the services are in the state-owned enterprise’s hands. Several aspects influence the decisions and increase the concern about the competitiveness. In this paper a discussion about the structuring of a decision-making process is presented. Moreover, we emphasize the decision aid system, for helping the problem structuring and we use a cognitive mapping to provide learning to the involved actors, which together gives a more clear answer to the fundamental question in structuring: “What is the problem ?”. The final constructed structure for the problem was called of Points of View Tree.

Key-words: Multicriteria Decision Aid, Cellular telephony, Structuring.

1.Introduction

The Multicriteria Decision Aid - MCDA methodologies stands out like a new attitude of Operational Research for tackling complex problems. The limitation on objectivity that exists in these kinds of problems enables this methodologies to enhance the degree of conformity and coherence between the evolution of a decision-making process and the value systems and objectives of those involved in this process (Roy, 1992). One of the main MCDA objectives is to construct, or create, some framework for structure the problem and evaluate the potential actions. This structure will be a collective path in which one involved actor will share his understanding about the problem, his objectives and his systems of values. Moreover, this constructed structure is viewed like an entity that helps an actor, either to shape, and/or argue, and/or transform his preferences, or to make decisions in conformity his goals (Roy and Vanderpooten, 1996).

In this paper we present a real-case application using some concepts, models and procedures that are present in a MCDA methodology, with the intention of structuring a complex problem. We show some procedures that enable an analyst, that will be called facilitator, to work with the evolved actors in a decision-making process, and permits that
the structuring could be processed. As a result we will construct a clear and formal structure for Telesc Cellular decision process.

2. Identification of Problematic Situation

Telesc Cellular is a TELESC S/A business unit, a state company which is responsible for Santa Catarina state phone services, in the southern Brazil. In the last years, the Brazilian Government has been concerning about his phone services companies privatization. Mainly in the case of cellular services such changes will be deeper. By next year, the Telecommunication Ministry will sell conceptions to a new frequency zone, called “b” band, which will be held by the private sector companies. Besides that, on a short term, Telesc Cellular, working as a business unit, will be changed into a self-employed company and after that it will be privatized too. The whole changing process has increasingly worried Telesc Cellular managers on its competitiveness, due to the fact in a short period, that department will move from monopoly to a market economy situation, in which there is a competition, and will change from a simple business unit to a entire self-employed company.

Its main concern is the subject of this study. It is referred to the Telesc Cellular actions planning in order to expand the cellular service through all the region where the company works. Every year such planning is done based upon a capital amount to be invested during the year, demanded by the company board of directors. Until now this planning has been done in an intuitive matter by the five managers involved on the decision making process. They have chosen the main localities which will receive the cellular system expansion. Those choices were based in several factors, some of them were formally or even informally known, but they were explicit. Others factors were considered in a totally subjective way, they were closely related to each manager value system, their goals and their perception about the problem.

From the concern if the company was performing in a competitive way, came out a necessity of clearly establishing which were the most important aspects that have to be considered in this decision making process, and structure the problem in a way that a coherent family of criteria (called in this work fundamental points of view) over which the potential actions (localities) could be evaluated.

3. The Decision Aid System

From a general way, a system is a set of interdependent elements, that forms a whole organized unit, in which its result is bigger than the simply add of each element (Chiavenatto, 1993). In the same way Tomlinson and Kiss (apud Bana e Costa, 1995b) stated that the decision aid activity is an open system, composed by subsystems, as the actors subsystem; formed by the value systems and objectives of involved actors, and the actions subsystems, formed by the actions and their characteristics that take place in the problem.

The decisions aid activity could be viewed as an interactive process between this two subsystems, with an initial ill defined problematic situation. From this interaction will emerge some elements in a non clear way. Those elements will look like to what we call a “cloud of primary elements of evaluation”. The first steps for structuring the problem begin with establishing relations and the possible hierarchical structure between those “primary elements of evaluation”. For helping to structure we used a Problem Structuring Method (Rosenhead, 1994) called cognitive maps. Figure 1 shows the decision aid system and a representation of how could emerge the “cloud” of primary elements of evaluation.
4. The Cognitive Maps Construction

In a general manner a cognitive map is a graphical representation of expressed ideas from one individual to a problem. The facilitator work is to construct this graphical representation from a lecture done by the decision-maker. This technique is a soft approach (Checkland, 1993) developed by Eden (1983) that tries to represent the relations as an hierarchical structure of the problem elements.

In the Telesc Cellular case this technique was used. As there were five managers involved in the decision-making process, initially five cognitive maps were done. This fact contributed for a better understanding due to a great learning is provided by such a methodology. The software Graphics COPE was used for the maps construction. Such software helped on the technical analysis that enable a the comprehension of the elements relations and links on the constructed maps.

After the individual maps were constructed, an aggregated map was presented by the facilitator and, at this moment, there was a negotiation process involving the decision-makers in order to include some new concepts and/or relations, or even exclude these ones from the map. Figure 2 presents the central part of aggregated cognitive map.
After defining a map for the problem, some technical analysis have been carried out, using the software for a better understanding of the map structure. A helpful one was the cluster analysis. Figure 3 shows an identified cluster.

Figure 2 - Cognitive Map for Telesc Cellular Case

Figure 3 - Cluster Identification

This procedure is very useful for defining the branching off points of view which represent the final structure of the problem raised by this study. Thus, in general, a cluster may represent one of the dimensions, as well as one or more of the principal concepts, and when placed in a multicriteria model, they may represent a point of view.

However, it is important to point out that the construction of a point of view tree from a cognitive map still more art than science since the map has a different structure from the one of a tree. There are links on the map which could be eliminated on the tree. Also, some concepts may be considered as a direct links to form a point of view. Such transition is not a simple and easy task to be processed and requires great experience from the facilitator (Belton et al., 1995). So the facilitator must be aware of the fact that building a points of view tree requires some previous discussion and, if necessary, the facilitator...
must be aware for the recursive aspect, for instance, going back to the map for clarifying the doubts.

5. Building a Tree of Points of View

The points of view may be obtained after establishing a comprehensive decision-making situation using cognitive maps. A point of view is an explanation for a value to be taken into account when evaluating actions. However some points of view may be more fundamental than others, i.e., some decision-makers may see some points of view more important than others.

It is important to distinguish Elementary points of view - EPV and Fundamental Points of View - FPV. A FPV is often a group of EPV, i.e., an ultimate objective that involves several elementary values. A point of view is said fundamental when the two following factors exist: (i) the decision-makers must be willing to undergo the action to a partial evaluation according to the elementary aspects that form the FPV, i.e., the decision makers feel that the value represented through the FPV is important and that the action must be evaluated in relation to this single value, (ii) the independence hypothesis must be proved during the structuring process (Bana e Costa, 1992). Thus a point of view must reflect single fundamental value for being considered a FPV, once it is possible and desirable to evaluate actions according to this FPV independently from its impacts in relation to other point of view. In Telesc Cellular case a point of view tree was built and is shown in Figure 4. Therefore according to the same author some properties must be verified:

• Clearness: a FPV must serve either as a tool which allows for modeling the decision maker’s preferences or as a basis for communication, discussion and comparison of values.

• Agreement: a FPV must be agreed on by all the decision-makers as important enough to affect the decision making process and therefore to be used in the model.

• Operation: a FPV must allow for the existence of a partial preference scale in association with the impact levels of such a FPV to be able to be operated. It must also count on an impact indicator - the indicator shows the impact of certain action upon the FPV. The first condition is necessary but not sufficient since it is inseparable from the second one.

• Isolation: a FPV is subjected to be isolated when it is possible for it to be evaluated considering all the other FPVs as constant.
Therefore, nine FPVs have been identified as to be operated by the multicriteria methodology by transforming this FPVs in evaluation axes. These axes will be constructed in further works, through the definition of measurable attributes that express the value-function of each FPV. Table 1 shows the nine FPVs.

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<thead>
<tr>
<th>FPV1 - Costs</th>
<th>FPV6 - Policies and Strategies</th>
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<td>FPV2 - Income Forecasts</td>
<td>FPV7 - Local Infrastructure</td>
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<tr>
<td>FPV3 - Road Axes</td>
<td>FPV8 - Client Satisfaction</td>
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<td>FPV4 - Economic Poles</td>
<td>FPV9 - Technical Quality</td>
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<td>FPV5 - Tourism Poles</td>
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Table 1 - Fundamental Points of View
The MCDA methodologies really refer to a new position in order to consider all aspects that have to be contemplated in complex problems. The facilitator role is generally to help on providing the correct tools in a better possible technical activity that enable he/she to depict a framing to the problem that makes confortable the decision-makers. In this context, the understanding of decision aid system and the use of cognitive mapping approach could be very helpful for developing a good decision aid activity that looks for helping the structuring of complex problems.

We consider that the study of structuring a complex problem through the MCDA methodology was successfully, due to, now they have a formal model to evaluate the expansions actions considering criteria that can help the company competitiveness and, the most important, they know more about their problem than before.

7. References


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