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EVALUATING RETAIL BANKING QUALITY SERVICE AND CONVENIENCE WITH MCDA TECHNIQUES: A CASE STUDY AT THE BANK BRANCH LEVEL

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Abstract: The intangibility of banking services makes the evaluation of service quality and customer convenience difficult to measure. Bankers obviously recognize the importance of intangible factors, but because of pressures placed on operating margins caused by the current economic climate and chronically low margins, the evaluation of factors related to quality service becomes paramount for bank managers. Bankers, by necessity, seek to promote improvement initiatives, which will assist banks in improving their perceived costumer portfolio quality. This paper aims to construct an integrated evaluation system for retail banking service quality and convenience at the bank branch level. By combining cognitive mapping with measuring attractiveness by a categorical based evaluation technique, we strive to introduce transparency in the decision making process and add to the performance literature in retail banking. Strengths, weaknesses and practical applications of our multiple criteria evaluation system are also discussed.

KEYWORDS: Bank Branch, Quality Service and Convenience, Cognitive Mapping, MCDA, Performance Evaluation, Retail Banking.

JEL Classification: C44, G21, L25, M10.

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1. INTRODUCTION

Retail banking service quality and convenience at the bank branch level is difficult to measure because of its intrinsic intangibility and difficulty in identifying appropriate measurement factors. Bankers obviously recognize the importance of intangible factors, but under conditions of increasing competition, instability and pressures placed on operating margins, the evaluation of customer perceived service quality is fundamental to improvement initiatives. It is generally agreed that intensification of competition resulting from the recent world-wide economic crisis places additional pressure on already chronically low operating margins (*cf.* Arslan and Karan, 2009). Recent pressures have had direct implications in the way banks manage their service quality and define their customer approach. Also, as defended by Serna (2005) and Ferreira *et al.* (2011a), few would contest that bank branches still maintain an important role in retail banking. Thus, it is generally agreed that retail banking success depends strongly on the competitiveness and improvement of branch service systems where bank branch evaluation may be the primary tool in determining how to improve service quality and convenience.

Because of the importance of bank branch service quality and convenience to retail banking, significant literature exists regarding bank branch in retail banking performance (*e.g.* Athanassopoulos, 1997; Jackson III *et al.*, 2003; Karatepea *et al.*, 2005; Arbore and Busacca, 2009; Lee *et al.*, 2011; Oliveira and von Hippelb, 2011, – these contributions are further discussed in *Section 2*). Nevertheless, despite the strengths and widespread application of current methodologies, each has specific shortcomings where clarification is required on a number of issues. According to Ferreira *et al.* (2011a), there are technical issues related to the method by which evaluation criteria are selected, and the way trade-offs among those same criteria are made explicit. By integrating cognitive mapping with Measuring Attractiveness by a Categorical based Evaluation Technique (MACBETH) (Bana e Costa and Vansnick, 1994; Bana e Costa *et al.*, 2005), we aim to support the development of an integrated evaluation system for bank branch quality service and convenience, and overcome some current methodological limitations. Following Ferreira *et al*. (2011b), our integrated evaluation system will also add to the literature on performance evaluation in retail banking.

The multiple criteria evaluation system framework, applied in this paper, extends the work of Ferreira *et al.* (2011a) which was a result of several working sessions with a panel of five directors from the most representative banks in Portugal. We know no prior work integrating the use of cognitive mapping and MACBETH to support the conception of evaluation systems for retail banking quality service and convenience at the bank branch level.

Section 2 of this paper includes an overview of the literature on the evaluation of bank branch service quality and convenience, and Section 3 describes and illustrates the evaluation system designed in our study. Section 4 concludes the paper by discussing advantages and disadvantages of our framework, and presenting lines for future research.

2. BANK BRANCH QUALITY SERVICE AND CONVENIENCE EVALUATION

A number of different approaches have been developed to deal explicitly with bank branch performance evaluation, where Ferreira *et al.* (2011a) categorize these approaches in four major groups of methods: (1) *traditional coefficients* or *ratios*; (2) *parametric* or *econometric models*; (3) *non-parametric techniques* and (4) *integrated systems for performance evaluation*. According to the authors, remarkable progress in bank branch evaluation has occurred over the last few decades; however, none of these methods is without limitations. Traditional coefficients (or ratios), for example, have been criticized for being operationally limited when dealing with multiple criteria and provide lagged information (Lau and Sholihin, 2005; Wu *et al*., 2006). On the other hand, parametric (or econometric) models have been criticised for requiring *a prior* specification of a cost or production function and its limitation in explaining causal relations among criteria. Following this line, non-parametric techniques (or distribution free tests as they are also categorized) have been recognized as a step forward by the performance measurement literature, namely in terms of bank branch performance evaluation (*cf.* Dekker and Post, 2001; Halkos and Salamouris, 2004; Paradi and Schaffnit, 2004; Camanho and Dyson, 2005; Portela and Thanassoulis, 2007; Yang, 2009). One of the most widely and successfully applied non-parametric techniques is Data Envelopment Analysis (DEA), which was introduced by Charnes *et al*. (1978), and allows handling multiple input and multiple output variables without requiring the *a prior* definition of a production function. Still, standard DEA models have been criticized for associating all deviations from the frontier to inefficiency, ignoring possible stochastic noise in the data and, even knowing that some outputs are not easily measurable, they accept the possibility of fully characterizing the production function. As a result of the perceived dissatisfaction with some of the previous identified shortcomings, integrated systems for performance evaluation have been conceived and improved over the years (for a broader discussion on business performance evaluation methodologies, see, for instance, Urbonavičius and Ivanauskas, 2005; Strandskov, 2006; Zinkevičiūte, 2007; Acar and Zehir, 2010). However, in the banking context, integrated performance evaluation systems such as the Balanced Scorecard (BSC) (Kaplan and Norton, 1992) have been largely unexplored. Except for

a few essays in the banking context (*e.g.* Suwignjo *et al.*, 2000; Ferreira *et al.*, 2011a), integrated systems for performance measurement, with special emphasis on the BSC, are generally criticised for, among other things, over simplicity and not specifying how compensations among evaluation criteria are made explicit (*cf.* Brignall, 1992; Neely *et al.*, 1995; Brown, 1996; Otley, 1999; Davis and Albright, 2004). As a complement to this discussion, *Table 1* presents a synopsis of the literature on bank branch quality service and convenience performance evaluation. As is evident, despite the progress achieved, most limitations discussed are still present.

Author/s and Date	Methodology	Main Contribution and Main Limitation
Athanassopoulos (1997)	▪ Data envelopment analysis methods enhanced by the value judgements of individual branch managers.	▪ Empirical results are discussed from a sample of sixty eight commercial bank branches in Greece. ▪ DEA major limitations have been recognized.
Jackson III *et al.* (2003)	▪ Game theoretic model to investigate the influence of differing market structures, or competitive conditions, on the bank's decision to increase the level of quality of the retail or consumer services it offers.	▪ Optional level of a bank's service quality depends critically on the competitive structure of the market, the degree of demand interaction between banks and the ease of imitation of competitors' service quality innovations. ▪ Limited to a game theory application.
Karatepea *et al.* (2005)	▪ Multi-stage, multi-phase and multi-sample approach.	▪ Construction of a parsimonious 20-item four-dimensional service quality scale. ▪ Results can hardly be considered conclusive and, according to the authors, more studies are needed to further validate the four-factor service quality measure derived in the study.
Arbore and Busacca (2009)	▪ Revised version of the traditional analyses based on derived measures of attribute importance.	▪ The results of an extensive study on the determinants of customer satisfaction in Italy are presented. ▪ Exploratory nature of the research, whose main goal was to illustrate a different approach for an improved analysis of satisfaction and dissatisfaction drivers.

Lee *et al.* (2011)	▪ Hypothesis tests and surveys.	▪ The study offers a unique integration of three distinct domains of the management literature (*i.e.* banking operations, transformational leadership and quality management). ▪ Relatively small sample size, and the data of the study were collected through cross-sectional surveys.
Oliveira and von Hippelb (2011)	▪ Locus of innovation determinations.	▪ First quantitative exploration of the importance of services innovation by users, focusing on the field of commercial and retail banking services. ▪ Different types of sample limitation.

Table 1 – Previous work on bank branch quality service and convenience performance evaluation

Based on the information in *Table 1* and previous discussion, two major lines of criticism have been pointed out with regard to the four categories of methods. First, the method by which performance measures are often selected may lead to the omission of relevant evaluation criteria (*cf.* Lovell and Pastor, 1997; Manandhar and Tang, 2002; Jahanshahloo *et al*., 2004; Camanho and Dyson, 2005). Second, according to Suwignjo *et al*. (2000), Mihelis *et al*. (2001) and Wu *et al*. (2006), among others, a lack of transparency exists in the way compensations among those criteria are obtained. We illustrate, in the following sections of the paper, how the integrated use of cognitive mapping and the MACBETH process may improve the selection of performance measurements and/or the calculation of compensations among evaluation criteria.

3. A "NEW" SYSTEM FOR BANK BRANCH QUALITY SERVICE AND CONVENIENCE EVALUATION

In this section, we discuss how the integrated use of cognitive mapping and MACBETH may be useful in the construction of a performance measurement framework for bank branch quality and convenience evaluation. We are unaware of any previous documented evidence reporting the application of these approaches to evaluate the quality service and convenience performance of bank branches.

It is generally recognized in the cognitive mapping literature that cognitive maps are important instruments for the structuring process of complex problems (*cf.* Ackermann and Eden, 2001; Eden and Ackermann, 2001b; Belton and Stewart, 2002; Eden and Banville, 2003; Eden,

2004). Because cognitive maps are simple, interactive and extremely versatile, they promote discussion among the agents involved in a decision making process. This allows increased transparency and a reduction in omitted criteria. Thus, simplicity and transparency lead to a better understanding of the problem under consideration.

MACBETH, also an interactive approach, was created in the 1990s by Bana e Costa and Vansnick (*cf.* Bana e Costa and Vansnick, 1994; Bana e Costa *et al.*, 2005). Technically, it is an interactive procedure conceived to quantify differences of attractiveness among elements of a certain set. Through a constructive learning process supported by a visual interactive software (M-MACBETH), MACBETH is based on numerical scales of intervals, and the fulfilment of value judgement matrices not only allows for the definition of local preference scales for the different criteria involved in the decision process but also assists the definition of cardinal value functions for the descriptors created (Bana e Costa *et al.*, 2005). In our study, numerical interval scales are important to assist the calculation of trade-offs among criteria. As a particular technique in Multiple Criteria Decision Analysis (MCDA), MACBETH supports a constructivist based analysis, and uses a simple qualitative question-answer procedure that allows decision makers to enter the domain of cardinal measurement (Belton and Stewart, 2002) (for other examples of MCDA techniques, see also Korsakienë, 2004; Podvezko, 2009). From this perspective, and given that MACBETH takes into account the professional experience of the decision makers involved in the process, it brings together humanistic, interactive and constructivist insights. Thus, the technique has great potential in dealing with weighted measurements in bank branch quality service and convenience evaluation, where most of the variables are intangible.

Following a constructivist approach, this study is organized in three phases. The *structuring phase* is concerned with the development of cognitive and strategic maps, and allows us to identify important performance measurements for bank branch quality service and convenience evaluation. The *evaluation phase* focuses on the application of MACBETH to allow for trade-offs among explicit criteria, and the *recommendations phase* discusses the major advantages and shortcomings of the integrated use of these methods (*i.e.* cognitive maps and MACBETH) for bank branch quality service and convenience evaluation.

3.1. The Structuring Phase

During the structuring phase, a panel of decision makers and actors were organized, in several work sessions, to address the formulation of a “trigger question”; the conception of cognitive and strategic maps; and the definition of a tree of evaluation criteria, with associated

descriptors and respective impact levels.

3.1.1. Actors Involved

The identification of a panel of relevant decision makers is a crucial procedure in the structuring process of complex problems, since decision makers are responsible for assisting the facilitator (*i.e.* scientist or researcher) during the conception of the performance framework.

In our study, the selection of the decision makers faced two major constraints: (1) limited availability of the decision makers and, consequently, (2) difficulties in getting the group together. Because of these constraints, contact was established with the Portuguese Association of Professional Economists (*i.e. Ordem dos Economistas* before translation), which facilitated the selection of a panel composed of six top directors from the five largest banks in Portugal. It is important to point out that due to the different origins and backgrounds of the directors, we received differing opinions regarding current practices of bank branch quality service evaluation. The facilitator was also assisted by a psychologist and a communication technician, who helped in conducting the sessions and registering the results.

3.1.2. Problem Definition

This study integrates cognitive maps and MACBETH to construct an evaluation framework for bank branch quality service and convenience. Thus, this integrated evaluation system will allow us to better assess bank branch performance in terms of quality service and convenience, and will provide improvement suggestions for each of the branches under evaluation.

3.1.3. Individual Cognitive Maps

Considering the limited availability of the experts involved, we decided to begin the structuring process following a technical procedure known as SODA I (illustrated in *Figure 1*) – a variant of the strategic options development and analysis (SODA) approach – (Eden and Ackermann, 2001a; 2001b).

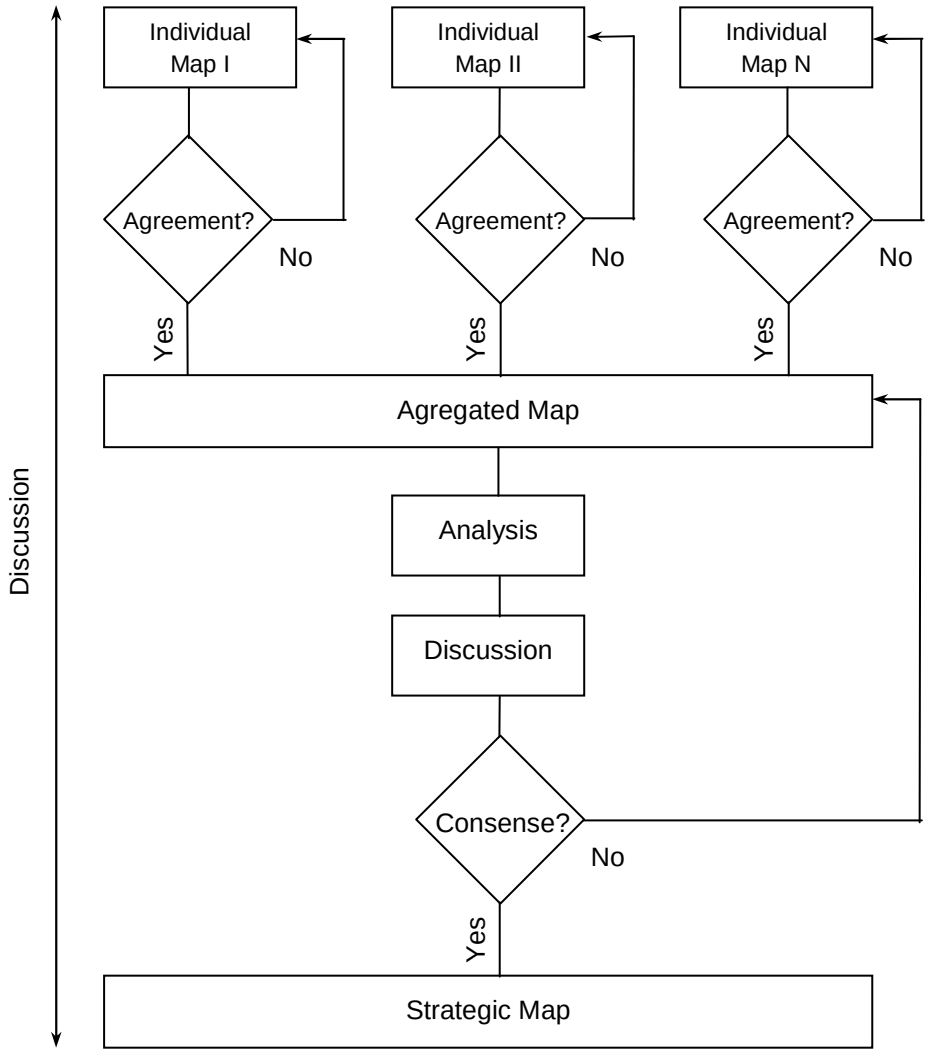


Figure 1 – SODA I conceptual scheme

Following *Figure 1*, each individual session with decision makers began with detailed explanations concerning the role of cognitive maps to avoid confusion among decision makers and the facilitator's team. After these explanations, the operational phase began with the following "trigger question": *"Based on your own values and professional experience, what are the main characteristics of a good bank branch quality service and convenience?"*. The "post-its technique" was applied on a table (130 cm x 80 cm) especially designed for our study. As reported in the literature (*cf.* Ackermann and Eden, 2001), the "post-its technique" consists of writing evaluation criteria on stickers – one post-it per criterion – and repeat the process until no more criteria are to be considered. The post-its are then organized by clusters (*i.e.* each cluster representing an area of concern), followed by additional discussion on their significance.

3.1.4. Analyzing the Linkages between Criteria

The next step after discussing the significance of each evaluation criteria is an internal analysis of each cluster's homogeneity (represented by post-its). The internal analysis is interactive and aims to identify and better understand the relationships among criteria. The final step in this procedure is for decision makers and the communication technician to register all links (represented by arrows) in the individual cognitive map. As defended by Ackermann and Eden (2001), this last procedure should be accompanied by the opportunity to reflect, reshape and/or even restart the entire process.

3.1.5. "Aggregated" and "Strategic" Maps

Following the SODA I methodological guidelines, the task of aggregating the individual cognitive maps resulting from the individual sessions is the responsibility of the research team. The research team then proposes a single collective map (also known as "aggregated map") to be discussed with the panel members in a group workshop. Since criteria are frequently associated with different definitions for the same evaluation criteria and panelists may have different lines of thinking, the aggregation process of the evaluation concepts may be challenging. Therefore, Cossette and Audet (2003) defend that this technical procedure is often considered more of an art than a science and, as such, strongly depends on the facilitator/s' technical skills.

During the group meeting, the aggregated map should be presented to the panel members for discussion because it should serve as a negotiation tool to reach a compromise solution. The

constructivist approach is omnipresent during the process, and interactivity among actors allows the panel members to achieve convergence of opinions. As highlighted by Ackermann and Eden (2001) and Cossette and Audet (2003), when this convergence of opinions is achieved in terms of form and content, the collective map is designated as "congregated" or "strategic" map. *Figure 2* presents part of the congregated map developed in this study.

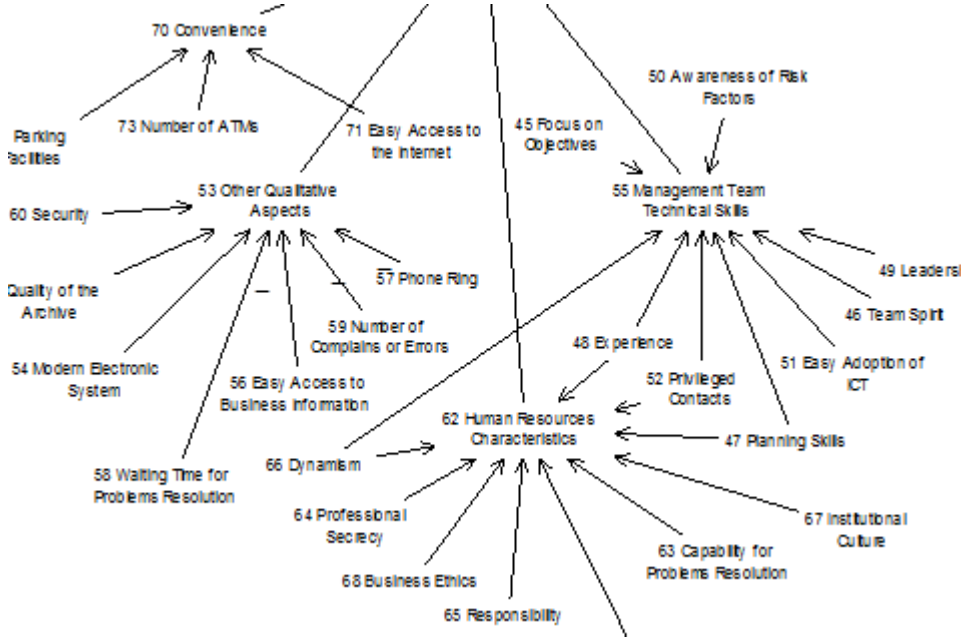


Figure 2 - Part of the strategic map

Accompanying this procedural step, one should bear in mind that the final form and/or content of a congregated map depends, among other things, on the facilitators' skills, actors involved, duration of the group meetings and circumstances undertaken. As such, it should be understood that the map represented in *Figure 2* is an instrument meant to create consolidated information on the problem. The outcome of this procedure strongly depends on the perceptions of the group.

3.1.6. Criteria, Descriptors and Impact Levels

Keeney's (1992) methodological guidelines allowed us to pass from the congregated map to the tree of performance measures. At this stage, it seems opportune to underline the support of the M-MACBETH software, which played an important role in the structuring phase of our performance evaluation framework. *Figure 3* illustrates the final version of our quality service and

convenience performance measures tree, which results from the agreement reached by the decision makers after testing for the respective properties (for further details, see Bana e Costa *et al.*, 2008).

Figure 3 – Quality service and convenience performance measures tree

As recognized in the literature, the construction of a tree of criteria through a strategic map assumes a subjective nature strongly dependent on the facilitators' skills. Nonetheless, based on the high volume of information discussed and contained in the map, this transition allows to improve the problem's clarification and the understanding of the relationships among criteria. As such, this operational step is not smooth, but clearly compensates for the efforts made by the actors involved in the decision process.

Based on the cognitive branches identified in the congregated map and, sequentially, on the tree structure presented in *Figure 3*, the decision makers defined four major evaluation criteria (identified as CRT_n, with n= {1, 2, 3, 4}). The construction of descriptors and impact levels for each one of the four criteria was the next technical procedure, and resulted from the direct interaction with the panel members. As an illustrative example, CRT_2 (*Human Resources Characteristics*) is conceived to evaluate a bank branch's quality service strictly based on the characteristics of its internal collaborators. Those characteristics are assessed (and considered good or bad) based on a coefficient (*i.e.* descriptor) that balances the number of complains or errors and the number of daily operations per collaborator (*i.e.* the lower the ratio the better the bank branch will be). To make the CRT_2's descriptor operational, eight ordered reference levels (L_i with i =1, 2, ..., 8) (including a good level and a neutral level), were defined. As illustrated in *Table 2*, this procedure allows for a better evaluation of the human resources characteristics of a certain bank branch.

Impact Level	Reference Level	Description
L_1		Total absence of complains or errors.
L_2	Good	N.º compl. or errors / [N.º daily oper. / colaborator] ∈]0%–1%].
L_3		N.º compl. or errors / [N.º daily oper. / colaborator] ∈]1%–1.5%].
L_4		N.º compl. or errors / [N.º daily oper. / colaborator] ∈]1.5%–2%].
L_5	Neutral	N.º compl. or errors / [N.º daily oper. / colaborator] ∈]2%–2.5%].
L_6		N.º compl. or errors / [N.º daily oper. / colaborator] ∈]2.5%–3%].
L_7		N.º compl. or errors / [N.º daily oper. / colaborator] ∈]3%–3.5%].
L_8		N.º compl. or errors / [N.º daily oper. / colaborator] > 3.5%.

Table 2 – Impact levels of the descriptor of the CRT_2 (human resources characteristics)

Following *Table 2*, one should bear in mind that the technical procedure adopted to turn the CRT_2's descriptor operational allowed ordering the impact levels to obtain a value function. As is recognized by the MCDA literature (*cf.* Ferreira *et al.*, 2011a), the evaluation phase may be started as soon as impact levels for all descriptors have been defined.

3.2. The Evaluation Phase

Weighting criteria is a pre-requisite for our performance evaluation framework. In this way, a group meeting was organized to obtain the experts' value judgements and consequent trade-offs among criteria (*section 3.2.1*). The work group session was also considered as critical in our decision process because a sample of four bank branches was evaluated and the results were discussed with and among the panel members.

3.2.1. Value Judgements and Local Preferences

As stated by Bana e Costa and Vansnick (1994), MACBETH's initial framework is based on numerical representations of semi-orders for multiple thresholds. Based on a certain point of view PV_j and supported on the mathematical principles of Doignon, the authors defend that in a structure of m binary relations $[P^{(1)}, \ldots, P^{(k)}, \ldots, P^{(m)}]$ (where $P^{(k)}$ stands for a preference as stronger as k is greater), the numerical codification of preferences is possible. As such, the MACBETH procedure consists in the association of each action of X (with $X = \{a, b, \ldots, n\}$ being a finite set of n actions), to a value x (resulting from $v(.)$: X→R) such that differences as $v(a) - v(b)$ (with a more attractive than b (*i.e.* $a\ P\ b$)), are as compatible as possible with the decision makers' judgements of value. This means that for all pairs of actions (a, b) allocated to a certain category of difference of attractiveness C, the differences $v(a) - v(b)$ will belong, without overlaps, to the same interval (*cf.* Bana e Costa and Vansnick, 1994). Accordingly, whereas two contiguous ranges correspond to two consecutive categories, the procedure consists in associating asymmetric partitions of the ray of positive reals to partition classes of ordered pairs (a, b) (with $a\ P\ b$) (see *Figure 4*).

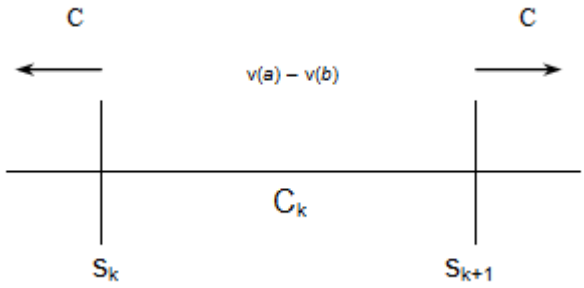


Figure 4 – Allocation of *v(a) – v(b)* to a Category C_k

Following *Figure 4*, and in order to define the intervals between categories of consecutive differences of attractiveness, the next technical step consists in calculating the limits s_k, which can be understood as transition thresholds. Recalling the problem of numerical representations of semi-orders for multiple thresholds, semi-multiple orders can be easily introduced as long as we wish to represent value preferences by a value function v and function thresholds s_k, such as:

$$a\ P^{(k)}\ b: \quad s_k < v(a) - v(b) < s_{k+1} \qquad [1]$$

Being the thresholds s_k positive real constants, the definition of intervals between semantic differences of attractiveness becomes easier. Theoretically, being *a* $P^{(m)}$ *b*, it is always possible to add a level of preference by introducing a real or fictitious action *c*, such that *c* is more attractive than *b*, more than *a* is more attractive than *b*. However, as discussed by Bana e Costa and Vansnick (1994), a range of differences of attractiveness has to be limited on its left by "its" zero. As such, between the origin (*i.e.* $s_1 = 0$) and s_m, an infinite number of categories and thresholds can be defined, but the last semantic category C_m cannot be limited on its right. An illustrative example of a range of categories of difference of attractiveness is presented in *Figure 5*.

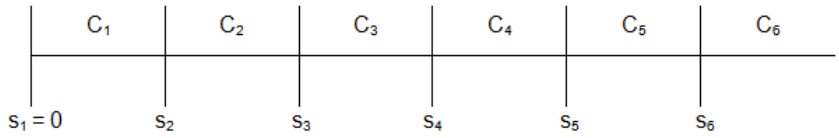


Figure 5 – Scale of categories of difference of attractiveness

Recalling Bana e Costa *et al.* (2005: 413), *"the basic idea underlying the initial development of MACBETH was that limits of these intervals should not be arbitrarily fixed a priori, but determined simultaneously with numerical value scores for the elements of X"*. Following this remark, and based on the decision-maker/s' value judgements, the MACBETH technique consists in allocating the difference of attractiveness between each pair of actions (*a*, *b*) ∈ *X* to one of the following categories: C_0=Null; C_1=Very weak; C_2=Weak; C_3=Moderate; C_4=Strong; C_5=Very strong; and C_6=Extreme (*cf.* Bana e Costa *et al.*, 2005). Illustratively, if a decision maker considers *a* more attractive than *b* and the difference between both actions is *weak*, then (*a*, *b*) ∈C_2.

Following Bana e Costa *et al.* (1999) guidelines, we applied the MACBETH technique to our framework, considering the previously mentioned categories. For consistency purposes (*cf.* Junior, 2008), formulations [2] and [3] given below were also analyzed based on the experts' value judgements.

$$\forall a,b \in X : v(a) > v(b) \Leftrightarrow aPb \qquad [2]$$

$$\forall k,k^* \in \{1,2,3,4,5,6\}, \forall a,b,c,d \in X \text{ with } (a,b) \in C_k$$
$$\text{and } (c,d) \in C_{k^*} : k \geq k^* + 1 \Rightarrow v(a) - v(b) \geq v(c) - v(d) \qquad [3]$$

Linear programming is then applied according to [4] (*cf.* Junior, 2008), and an initial scale is generated and presented for discussion.

$$
\begin{aligned}
&Min\, v(n)\\
&S.T.: \forall a,b \in X : aPb \Rightarrow v(a) \geq v(b)+1\\
&\qquad \forall a,b \in X : aIb \Rightarrow v(a) = v(b)\\
&\qquad \forall (a,b),(c,d) \in P, \text{if the difference of attractiveness between}\\
&\qquad\qquad a \text{ and } b \text{ is bigger than between } c \text{ and } d, \text{then}:\\
&\qquad\qquad v(a) - v(b) \geq v(c) - v(d) + 1 + \delta(a,b,c,d)\\
&v(a^{-}) = 0\\
&\text{where}:\\
&n \text{ is an element of } X \text{ so that } \forall a,b,c,... \in X : n\,(P \cup I)\, a,b,c,...\\
&a^{-} \text{ is an element of } X \text{ so that } \forall a,b,c,... \in X : a,b,c,...(P \cup I)\, a^{-}\\
&\delta(a,b,c,d) \text{ is the } \min \text{imal number of categories of difference of attractiveness}\\
&\qquad \text{between the difference of attractiveness between } a \text{ and } b \text{ and the}\\
&\qquad \text{difference of attractiveness between } c \text{ and } d.
\end{aligned}
\qquad [4]
$$

Methodologically, MACBETH is based on a direct question-answer procedure, where panel members pair-wise compare alternatives and give a qualitative judgement on their difference of attractiveness. In assisting the process, value judgement matrices are repeatedly executed, and the filling process continues until a local preference scale is defined for each descriptor included in the model. The matrix and value function obtained for CRT_4 is presented in *Figure 6*, which allowed for further discussion with and among decision makers.

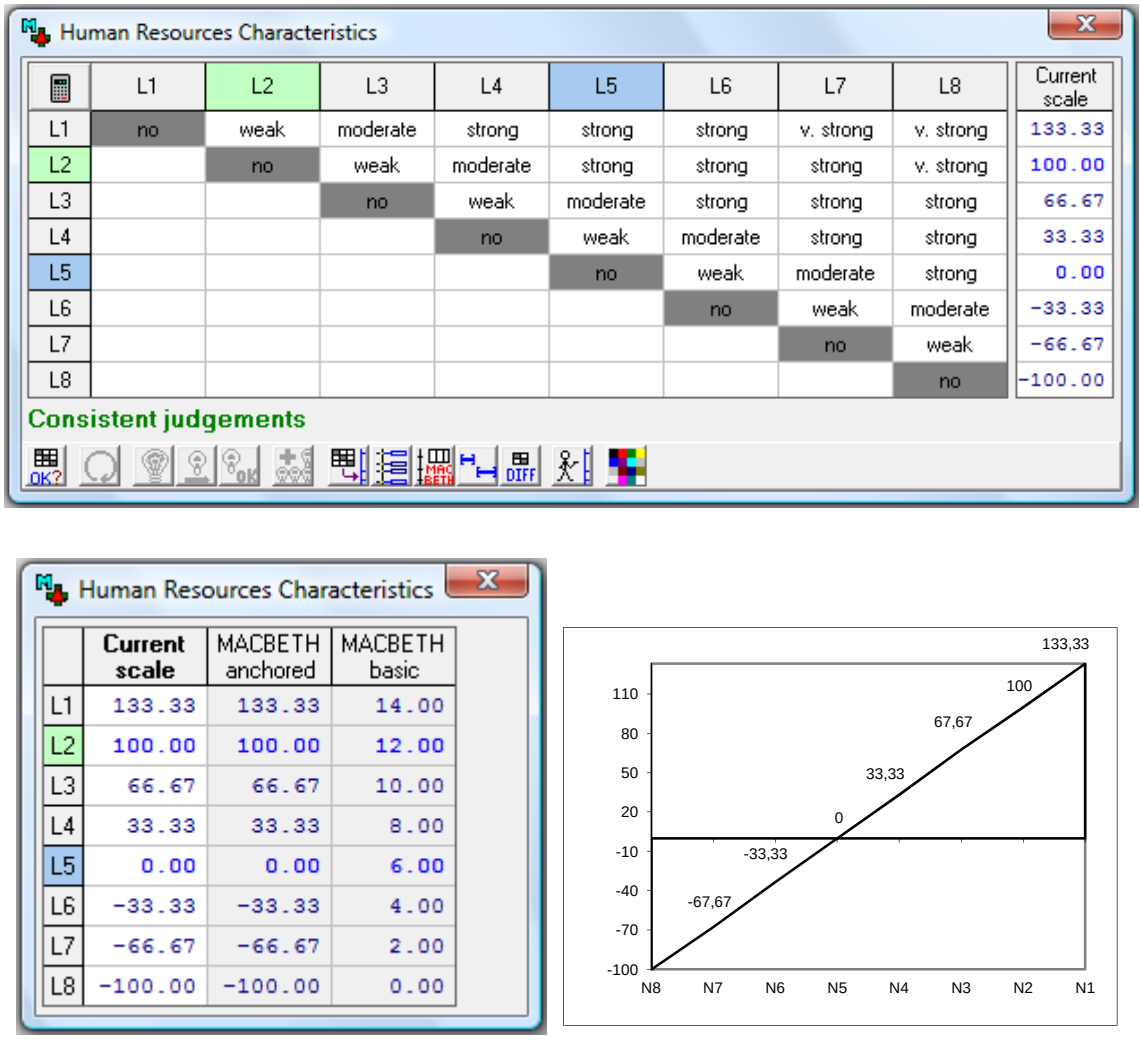


Figure 6 – Value judgements, proposed scales and value function of the CRT_4

It seems important to underline, however, that the M-MACBETH software was extremely helpful in dealing with inconsistencies resulting from the decision maker's value judgements, which were promptly overcome by further discussion and/or judgements reconsideration. According to Bana e Costa and Chagas (2004) and Bana e Costa *et al.* (2005), mutual preferential independence tests were also conducted to guarantee preferential independence among evaluation criteria.

The definition of cardinal value scales for all descriptors is an important technical step that allows partial assessment of bank branches. However, to get an overall evaluation, trade-offs (also known as substitution rates, weights or compensations among criteria) need to be calculated.

3.2.2. The Trade-Offs Procedures

To obtain the compensation rates among criteria, decision makers were asked to rank the four criteria in terms of overall attractiveness. To support the ranking procedure, an alternative a_0 (composed of the worst impact levels) was compared to an alternative a_n (composed of the best impact levels), and the different preferences of the decision makers were registered in a matrix of comparisons (for further details on this technical procedure, see Bana e Costa and Chagas, 2004). Once ordered the criteria, with CRT_2 being considered overall preferable to the others, the panel members were invited to express their value judgements in terms of difference of attractiveness among criteria. Based on the same procedure previously followed for the local scales (*cf. Figure 6*), an initial scale and respective trade-offs were made explicit and proposed for discussion (*Figure 7*).

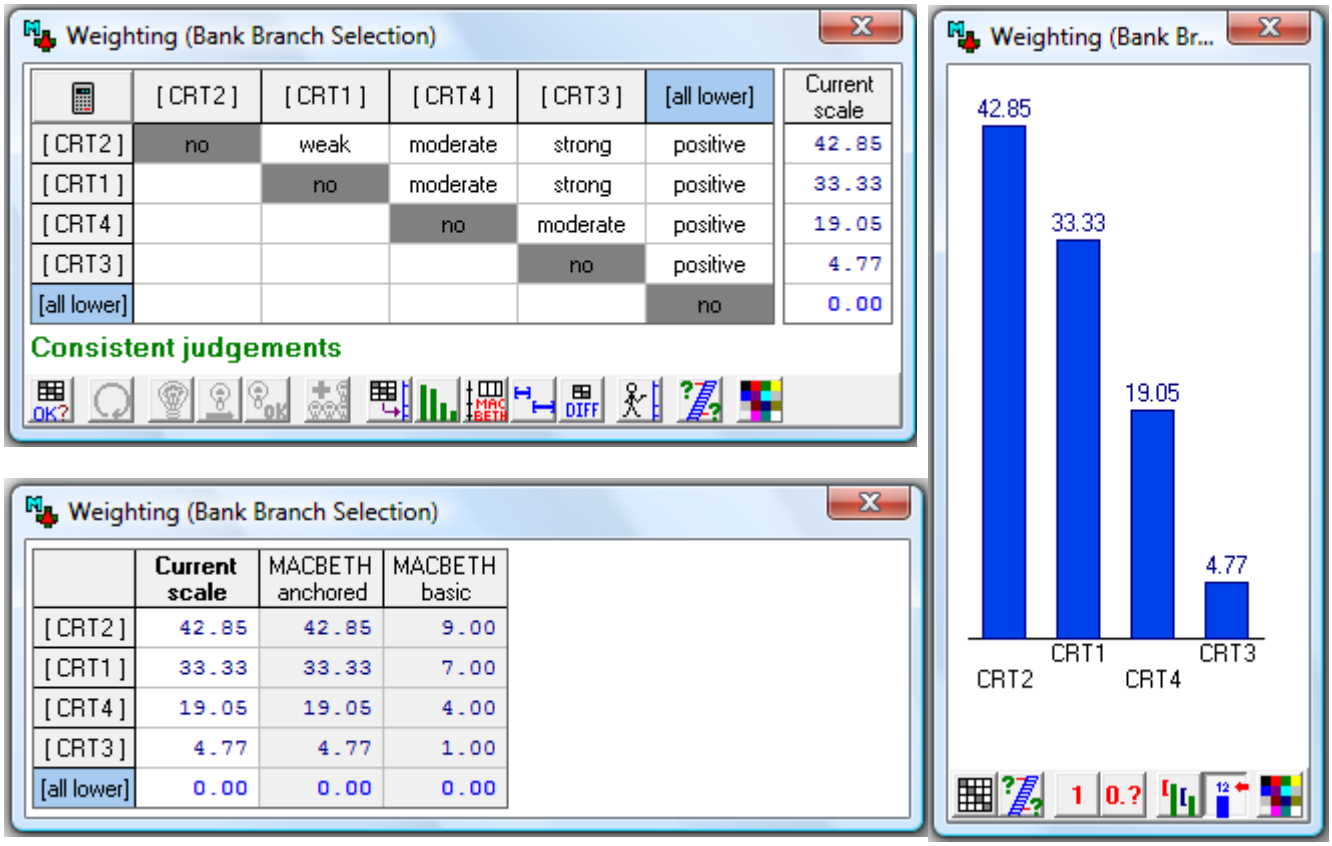


Figure 7 – Value judgements, proposed scales and criteria weights

As can be seen in *Figure 7*, the M-MACBETH software turned easier the trade-offs calculi and enabled the construction of an additive value model as presented in [5] (Bana e Costa *et al.*, 2008).

$$V(a) = \sum_{i=1}^{n} x_i . v_i(a) \quad with \quad \sum_{i=1}^{n} x_i = 1 \quad and \quad x_i > 0,\ v_i(good_i) = 100 \, and \, v_i(neutral_i) = 0 \qquad [5]$$

As can be easily deduced, this additive model allows for the aggregation of the partial scores $v_i(a)$ and the calculation of the overall score $V(a)$. Therefore, based on the discussion with the decision makers, it became possible to approve the trade-offs and assess bank branches' partial and overall quality service and convenience.

3.2.3. Measuring Bank Branch Quality Service and Convenience

For testing our quality service and convenience evaluation framework, data on bank branch performance were formally requested from the largest bank operating in Portugal. It seems relevant to point out that the information on four bank branches (called Alphas from now on) was randomly and anonymously provided by the bank's administration, and resulted from internal surveys and referred to a single period of time (month). Despite these limitations, the information provided was extremely useful, not only to test our quality service and convenience evaluation system but also to augment the interest and discussion among the decision makers involved in the process.

Considering the descriptors and the value functions previously obtained for each criterion, the first measurement step was to calculate partial performance values for each one of the alphas (*Figures 8 and Table 3*).

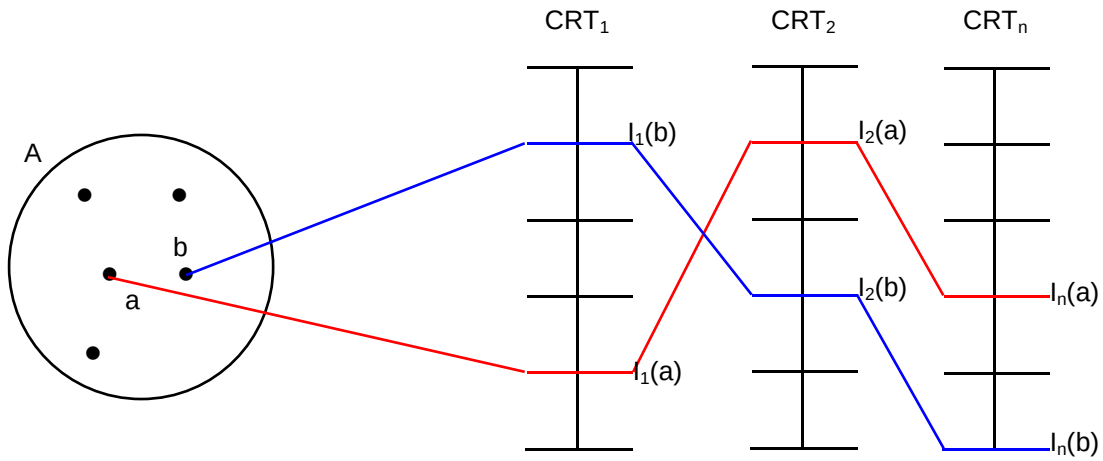
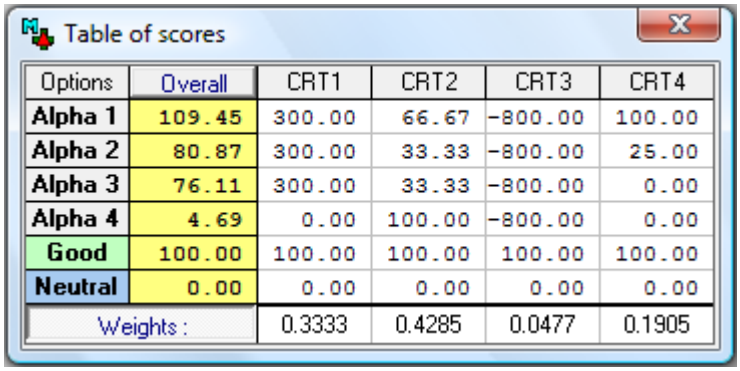


Figure 8 – Partial performance conceptual scheme

	CRT_1		CRT_2		CRT_3		CRT_4	
Alpha 1	L_2	300	L_3	66.67	L_6	-800	L_2	100
Alpha 2	L_2	300	L_4	33.33	L_6	-800	L_5	25
Alpha 3	L_2	300	L_4	33.33	L_6	-800	L_6	0
Alpha 4	L_5	0	L_2	100	L_6	-800	L_6	0
Good	L_4	100	L_2	100	L_2	100	L_2	100
Neutral	L_5	0	L_5	0	L_3	0	L_6	0

Table 3 – Levels and partial values revealed by the alphas

To facilitate the analysis of *Table 3*, it is appropriated to point out that *Good* and *Neutral* are two fictitious bank branches introduced in the model to simplify cognitive comparisons. *Good* stands for a bank branch that performs at a good level for all the criteria, and *Neutral* represents a bank branch that performs at neutral levels (*i.e.* neither attractive nor unattractive) for those same evaluation criteria. By following this procedure, performance comparisons among branches became possible (*e.g.* Alpha 4 is the worst performer on CRT_1, which corresponds to the neutral level, but it is also the best performer on CRT_2). These comparisons among performances are useful not only because they enable the panel members to better understand the evaluation process but also because they allow proposing and/or implementing well localized improvement suggestions. Naturally, local improvements will influence the overall performance of each one of the alphas. The partial and overall performance values of the six bank branches evaluated (*Good* and *Neutral* included) are presented in *Table 4*. One should highlight that to obtain the global attractiveness values, local ratings were aggregated according to the additive model presented in [5].



Options	Overall	CRT1	CRT2	CRT3	CRT4
Alpha 1	109.45	300.00	66.67	-800.00	100.00
Alpha 2	80.87	300.00	33.33	-800.00	25.00
Alpha 3	76.11	300.00	33.33	-800.00	0.00
Alpha 4	4.69	0.00	100.00	-800.00	0.00
Good	100.00	100.00	100.00	100.00	100.00
Neutral	0.00	0.00	0.00	0.00	0.00
Weights :		0.3333	0.4285	0.0477	0.1905

Table 4 – Partial values and overall attractiveness revealed by the alphas

Basing our discussion on *Table 4*, Alpha 1 appears to be the best bank branch with an overall score of 109.45, while Alpha 4 may be considered the worst performer with an overall score of 4.69. Nonetheless, these results should be faced with proper reservation. As stated by Nowak (2011), the emphasis should be placed on the constructive analysis and discussion that emerged from the panel members.

3.2.4. Analysing Results

The bank branch quality service and convenience evaluation system developed above allowed the panel members to: (1) discriminate the alphas according to their own value judgements; (2) compare the alphas with the *Good* and *Neutral* references; (3) promote discussion and increase transparency in the decision framework; (4) serve as learning mechanism for improvement suggestions; and (5) show how cognitive maps and MCDA can be integrated in a bank branch quality service evaluation context.

Once a final ranking is approved by the decision makers, the evaluation phase is considered complete (*cf.* Bana e Costa and Chagas, 2004); however, additional analysis such as sensitivity and robustness analysis are encouraged to validate results and analyze their stability, which should serve as basis for further discussion. *Figure 9* shows the sensitivity analysis carried out for CRT_2.

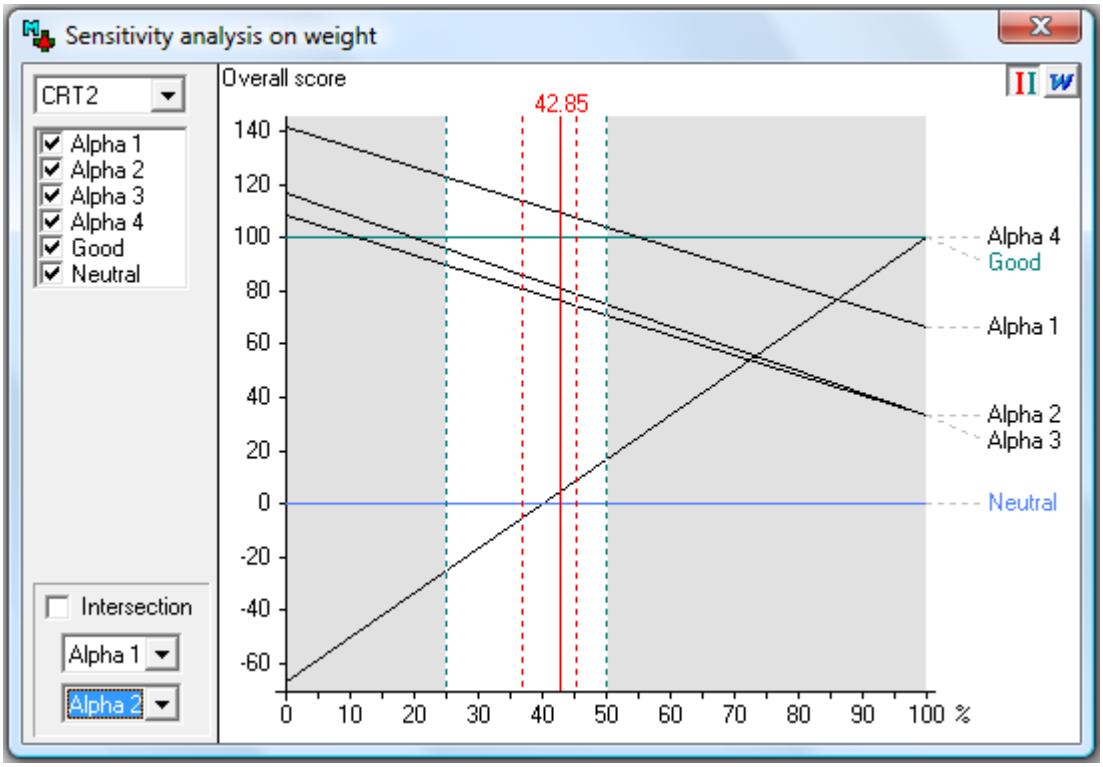


Figure 9 – Sensitivity analysis on CRT_2's weight

Based on *Figure 9* and recalling previous discussion, the weight attributed to CRT_2 is 42.85. However, the sensitivity analysis carried out for this criterion allows us to conclude that the model is strong because the criterion's weight can vary between 25 and 50 points without violating the alphas' ranking position and, consequently, the judgement values of the decision makers. However, because sensitivity analysis deals with variations of isolated variables, other types of analyses were carried out. *Figure 10* illustrates the robustness analysis developed, which considers possible variations of different variables at the same time.

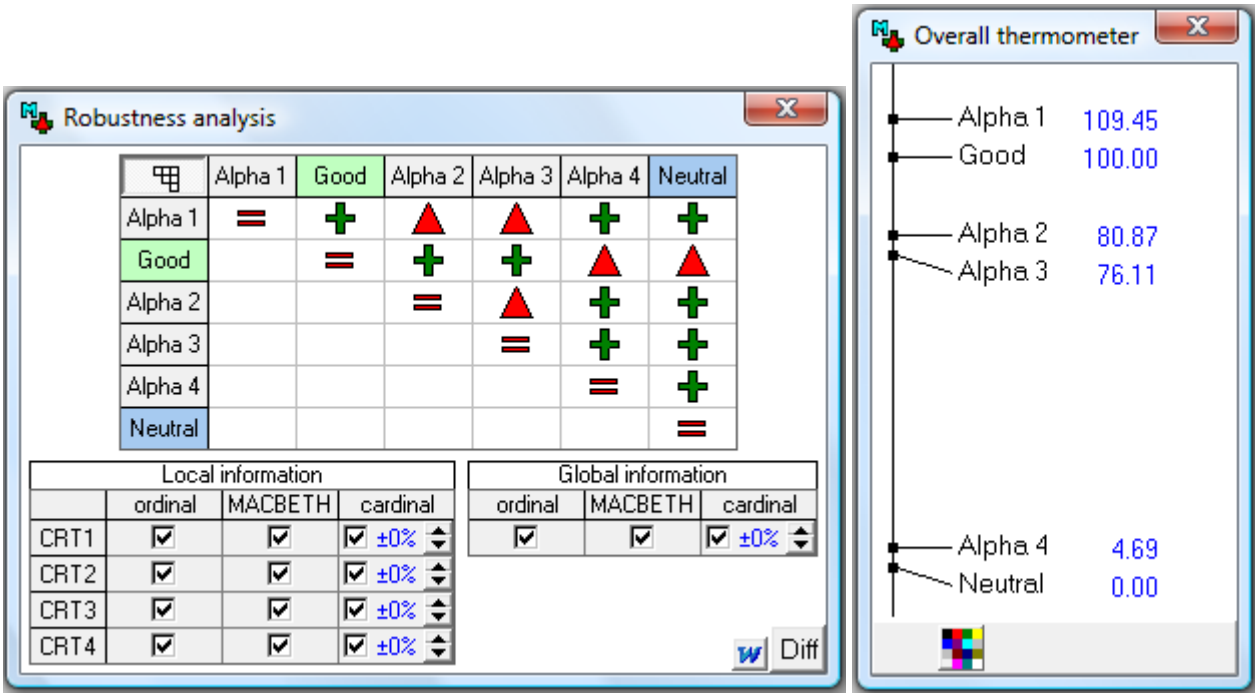


Figure 10 – Robustness analysis and overall thermometer

Both sensitive and robustness analyses were supported by the M-MACBETH software. However, in the particular case of the robustness analysis, one should clarify that each cross represents a typical situation of additive dominance, which means that despite of a better overall performance, a certain alpha does not present the best local performance in all the criteria (*e.g.* Alpha 2 (with an overall score of 80.87) is overall more attractive than Alpha 4 (with an overall score of 4.69), but Alpha 2 performs worse than Alpha 4 on CTR_2 (*cf. Table 4*)). On the other hand, each triangle represents a situation of classic dominance (*i.e.* no matter which trade-offs are obtained, a certain alpha dominates the others in terms of partial and overall performance *i.e.* Alpha 1 is always better or at least equal than Alpha 2).

Our previous analysis indicates that the evaluation framework developed is strong and robust, and presents encouraging results. Nonetheless, these results should be treated with appropriate reservation. Some of the reasons why our results should be treated with reservation are discussed in the recommendations phase of the study.

3.3. The Recommendations Phase of the Study

Our bank branch quality service and convenience evaluation framework is encouraging based on the satisfaction expressed by the decision makers. Nevertheless, it should be emphasized that our evaluation procedure is process-oriented, where a non-prescriptive position has always been assumed. From this perspective, our performance evaluation system should be primarily seen as a learning mechanism and not as a final solution and/or tool to reach optimal solutions. Since the results depend on the context and actors involved, any generalization should be questioned before implementation. This may be considered a shortcoming. However, the integrated use of cognitive maps and MCDA techniques also offers adjustment possibilities and this, on its turn, increases the potentialities of the framework.

4. DISCUSSION AND CONCLUSION

Service quality and convenience at retail bank branch levels are inherently difficult to measure; however, we have presented an MCDA framework that attempts to evaluate bank branches. Considering the recent progress that has taken place, it seems generally agreed that several aspects still require discussion and clarification. With that purpose in mind, we extend the research in Ferreira *et al.* (2011a) and report a few outcomes of the interaction maintained with directors from the five largest banks in Portugal. In particular, our framework allowed us to deal with two of the major limitations of the existing methodologies for performance measurement: (1) the way performance measures are often selected may lead to the omission of relevant evaluation criteria and (2) there seems to be lack of transparency in the way compensations among those same criteria are obtained. By using cognitive maps integrated with the MACBETH approach we were able to support criteria selection and obtain compensation rates. To the best of our knowledge, we are unaware of any prior evidence reporting the integrated use of these two methodologies to support the conception of bank branch quality service and convenience evaluation systems.

Among other things, our performance evaluation system may be particularly useful to: (1) track the progress of the branches over time; (2) identify and desirably implement corrective actions; (3) increase transparency in criteria selection and trade-offs calculation; and (4) incorporate the professional know-how and experience in the decision making process, in order to increase the realism of the evaluation process.

As previously stated, our results depend on the context and decision makers involved. As

such, they should be analyzed with reservations, and further research (including case studies) is necessarily encouraged. We then recommend conducting: (1) a different panel study and within a different country and (2) a survey to receive feedback from more than just a few experts. We are confident that possible improvements will help us strengthen the potential and interest of the proposal presented herein.

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