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EMPIRICAL ARTICLE

Understanding the dynamics behind bank branch service quality in Portugal: pursuing a holistic view using fuzzy cognitive mapping

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Abstract Using fuzzy cognitive mapping, this study aims to create a holistic framework whereby the determinants of bank branch service quality and their cause-and-effect relationships can be identified and dynamically analyzed. The methodology is applied using a group of experts from the banking industry in Portugal. Our results not only indicate the applicability and usefulness of the proposed approach, but identify *human resource characteristics* (which include collaborators' personal and professional training) and *management team technical skills* as particularly relevant driving forces of bank branch service quality. The

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proposal holds great potential for the operational planning and improvement of bank branch service quality, which is a prime concern for bank administrators, bank branch collaborators, and society at large. Advantages and shortcomings of the framework are also reported.

Keywords Bank branch · Determinants of service quality · Dynamics · Fuzzy cognitive maps · Holistic view

1 Introduction

Consistently at the core of research in service industries, service quality has long been recognized as a critical determinant of business performance for firms wishing to gain sustainable competitive advantages (Lee and Chulhyun 2014). For service institutions, service quality is a prerequisite for survival; but in addition, high levels of customer service quality can also allow firms to differentiate themselves in increasingly competitive markets, leading to fewer customer complaints, greater customer satisfaction and loyalty, and, thus, improved customer retention rates, which in turn generate greater customer willingness to recommend the service to someone else (cf. Karatepe et al. 2005; Culiberg and Rojsek 2010; Zalatar 2012). Due to the recent economic downturn and resulting conjuncture of increased competitiveness and price sensitivity, the importance of service quality appears higher than ever, and has, as such, been commanding the attention of academics and practitioners alike (Karatepe et al. 2005).

As far as the banking industry is concerned, the globalization of markets, evolving regulations and the socio-economic repercussions caused by the recent world-wide crisis have forced substantial changes and reforms on banking institutions. Essentially, these changes highlight the need for banks to mobilize, explore, and evaluate tangible and intangible resources and capabilities (Ferreira et al. 2012, 2014a). Following a top-down process, this awareness culminates at the bank branch level, where service quality and convenience are seen as a driving force for fostering a sustained competitive advantage. This is supported by Serna (2005), who argues that bank branches play a critical role in banking sustainability, materializing the way banks define their market approach and manage their service quality.

As with other services, however, service quality at the bank branch level and the value gained from it are difficult to measure, due to their intangibility. This is further aggravated by the difficulty of identifying appropriate measurement factors within this context—i.e., defining what needs to be measured and how (cf. Ferreira et al. 2014b). In this sense, and given that the branch level can be expected to continue to constitute a primary point for the betterment of overall bank service quality, there has been great demand for improvement initiatives in this regard. This has led to a substantial amount of literature regarding bank branch service quality evaluation (e.g. Jackson III et al. 2003; Arbore and Busacca 2009; Lee et al. 2011; Momparler et al. 2013), and important advances have been made with respect to such evaluations over the years as a result.

Nonetheless, every methodological approach has its weaknesses and further investigation on a number of issues is still required. For instance, progress is still

needed with regard to the identification of evaluation criteria, because the existing work defining the relevant indicators of bank branch service quality is still mostly speculative (Ferreira et al. 2014b). Given this need, and bearing in mind that fuzzy cognitive maps (FCMs) have proven very useful in handling this type of limitation (cf. Carlucci et al. 2013; Gavrilova et al. 2013), this paper aims to develop a FCM-based framework to identify key determinants of bank branch service quality and dynamically analyze the intensity of the cause-and-effect relationships between them, revealing the dynamics behind this business phenomenon.

FCMs constitute an important decision tool and are *"a well-established artificial intelligence technique, incorporating ideas from artificial neural networks and fuzzy logic, which can be effectively applied in the domain of management science"* (Carlucci et al. 2013, p. 208). Because they help reduce the number of omitted criteria, while allowing the dynamics between the concepts identified to be revealed, FCMs hold great potential for modeling and dynamically analyzing the key determinants of bank branch service quality, as well as testing the reciprocal influences between them.

In this paper, the methodological application developed has a primarily internal accountability purpose, because the knowledge-based framework created comes from the banks' point of view. Although customer perceptions are extremely important and considered in several aspects of our framework, the construction of a FCM from the customer perspective would imply and require informed and concerned consumers, when in reality, it is known that most consumers care only about a few aspects of service quality (cf. Vega-Vazquez et al. 2013; Ferreira et al. 2014b). Our framework was therefore developed from the bank perspective, specifically, using the knowledge and experience of bank branch front office employees operating in the Central-West region of Portugal. We know of no other study applying FCMs to bank branch service quality evaluation.

The remainder of the paper is organized as follows: the next section provides an overview of previous work related to bank branch service quality; section three presents the methodological background of our application; the ensuing section describes the process followed for the construction of our FCM; and the final section presents concluding remarks and possibilities for future research.

2 Related work

Due to the unique features of services (e.g., intangibility, inseparability of production and consumption, and heterogeneity), the evaluation of quality in this domain is a very complex endeavor, unlike with goods, where quality *"can be measured with some objectivity"* (Karatepe et al. 2005, p. 373). In the absence of objective measurement systems, then, the evaluation of service quality often relies on consumers' perceptions to identify services' strengths and weaknesses. This in turn assumes informed and concerned customers; however, it has been acknowledged that most consumers are not very much informed and, as individuals, care only about a few aspects of service quality (cf. Ferreira et al. 2014b). According to Karatepe et al. (2005, p. 373), *"this makes the development*

of psychometrically sound and managerially useful instruments to measure service quality imperative."

Lee and Chulhyun (2014) highlight the existence of an extensive body of knowledge on service quality evaluation, which includes its definition, typology, models, and operationalization. Following Karatepe et al. (2005), two schools of thought dominate the extant thinking: (1) the Nordic school of thought based on Grönroos's (1984) two-dimensional model; and (2) the North American school of thought based on Parasuraman et al. (1988) five-dimensional SERVQUAL model. This second school of thought, in particular, has been extensively followed and developed *"in studies dealing with service quality in various service industries such as banking, retailing, hotels, airlines, and health services, among others"* (Zalatar 2012, p. 269).

In Grönroos's (1984) model, the focus is on what the author terms the *technical quality* dimension of the service—*"what the consumer receives as a result of his interactions with a service firm"*; but also on the *functional quality dimension*, the *how*: *"the way in which the technical quality is transferred to him* [the consumer] *functionally."*

The more commonly used SERVQUAL (Parasuraman et al. 1988) started out with ten dimensions (*access*, *communication*, *competence*, *courtesy*, *credibility*, *reliability*, *responsiveness*, *security*, *understanding,* and *tangibles*), later collapsed into five (*tangibles*, *reliability*, *responsiveness*, *assurance,* and *empathy*), measured on the basis of 22 items. It is worth noting, however, that despite their wide application and forming *"the basis for a considerable amount of research and application in the field of service management*, […] *these dimensions have been the subject of some criticism"* (Johnston 1995, p. 54). In addition, different authors have proposed further alternatives. Seth et al. (2005), for instance, conclude from their review of 19 service quality models that the key elements for better service quality are *clear market and customer focus*; *motivated staff*; *clear understanding of concepts of service quality and factors affecting the same*; *effective measurement and feedback system*; *effective implementation system*; and *efficient customer care system*. Armistead (1990) distinguished between what he termed the "firm" and "soft" determinants of service quality, where the first includes *time*, *fault freeness,* and *flexibility*; and the latter soft dimensions are *style*, *steering,* and *safety*.

It is clear, then, that despite much progress in the field, there is far from a consensus as what and how to measure service quality. The same is true in the banking industry. Despite significant progress in bank branch performance evaluations, including service quality analysis over the past years, the discussion on bank branch service quality evaluation is yet to be put to rest.

Ferreira et al. (2011a) categorize the research in bank branch service quality into four major categories, according to the type of method used to determine the factors influencing service quality and their respective impacts: (1) *traditional coefficients* or *ratios*; (2) *parametric* or *econometric models*; (3) *non-parametric approaches*; and (4) *integrated systems for performance evaluation*. The first category (i.e., traditional coefficients) has been criticized for providing lagged data and being operationally limited when dealing with multiple criteria (cf. Wu et al. 2006;

Ferreira et al. 2014b). The second category (i.e., parametric models) requires an a priori specification of cost/production functions, and falls short of comprehensively explaining the cause-and-effect relationships between variables. Considered by many as a step forward over parametric approaches (e.g., Halkos and Salamouris 2004; Paradi and Schaffnit 2004; Camanho and Dyson 2005; Portela and Thanassoulis 2007; Yang 2009; Lee and Chulhyun 2014), the third category (i.e., non-parametric techniques or distribution-free tools) allows multiple dimensions to be handled without requiring an a priori definition of cost/production functions. On the other hand, these techniques ignore possible stochastic noise in the data, and have further been criticized for accepting the possibility of fully characterizing the production function (cf. Ferreira et al. 2014b). As for the fourth category (i.e., integrated systems for performance evaluation), its limitations are bound with its over-simplicity and lack of transparency. Furthermore, with regard to the context of the present study, these systems have been left largely unexplored for banking purposes (cf. Brignall 1992; Neely et al. 1995; Brown 1996; Otley 1999; Davis and Albright 2004; Ferreira et al. 2011a; Bivainis and Morkvėnas 2012).

Indeed, in what concerns bank branch service quality in particular, there is a significant amount of research showing that despite the progress achieved, most of the limitations discussed above are still present (see also Ferreira et al. 2011b; Stankevičiene and Mencaitė 2012). Athanassopoulos (1997), for instance, highlighted the major limitations of Data Envelopment Analysis (DEA) as a non-parametric technique; Lee et al. (2011) and Oliveira and von Hippel (2011) reported on several types of sample limitation; and Karatepe et al. (2005) argued the need for more studies to address the issues discussed above. Thus, while remarkable progress has been taking place in banking service quality evaluation, the literature highlights the need for methodological advances which might help surpass the limitations of the methods traditionally used in this regard.

For instance, Karatepe et al. (2005), Zalatar (2012), and Lee and Chulhyun (2014) argue that simple aggregated measures provide little guidance to what extent service quality should be improved, and that there is a need to develop service quality evaluation frameworks that are country/culture specific. From this premise, and considering that *"knowledge engineering is one of the most important tasks in developing expert systems. One of the primary objectives* […] *is to develop a complete, consistent and unambiguous description of the knowledge base"* (Kim and Lee 1998, p. 303), this paper proposes the use of FCMs to pursue a holistic view of this phenomenon. This knowledge base is arguably increasingly needed in domains characterized as subjective and fuzzy, which seems to be the case of banking service quality evaluation. There is, therefore, both a theoretical and a practical need for a better understanding of bank branch performance as a determinant of banks' success and sustained competitive advantage. As such, this paper discusses the use of fuzzy cognitive mapping to support the selection of appropriate criteria for bank branch service quality evaluation and, at the same time, how such a methodology might overcome some of the current shortcomings.

3 Background on fuzzy cognitive mapping

Cognitive maps as decision support tools are of particular utility *"for modelling the complex relationships among variables of a problem/phenomenon, even if complex"* (Carlucci et al. 2013, p. 212). This is because such maps *"facilitate the representation and communication, support the identification and the interpretation of information, facilitate consultation and codification, and stimulate mental associations"* (Gavrilova et al. 2013, p. 1758). Indeed, cognitive maps can be extremely versatile and advantageous, in particular because depending on the degree of involvement of the participants, they can boost discussion and increase understanding of the relationships among criteria and of the decision situation itself (Filipe et al. 2015).

The term FCM was initially introduced by Kosko (1986, 1992), who enhanced the power of cognitive maps by considering fuzzy values for the concepts, as well as fuzzy degrees for the cause-and-effect relationships between them (cf. Carlucci et al. 2013). This type of cognitive mapping has since been applied in a wide range of different decision situations (an extensive deliberation falls outside of the scope of this paper; but for further discussion, see Tsadiras et al. 2003; Kok 2009; Salmeron 2009; Yaman and Polat 2009; Papageorgiou et al. 2012; Salmeron 2012).

FCMs have two distinctive characteristics: (a) the relationships between concepts (also known as criteria or nodes) are simultaneously represented by a sign of positive/negative causality and by an intensity/influence value which ranges between [−1, 1]; and (b) the system follows a fuzzy logic: there are feedback links among concepts and temporal aspects can be dynamically considered (Carvalho 2013). These characteristics can be observed in Fig. 1, where C_i represents concept i and W_{ij} stands for the intensity value of the relationship between concepts i and j.

Conceptually, all the values in the map can be fuzzy. This means that there is a state value A_i for each concept i that can be a fuzzy value in the range between [0, 1]

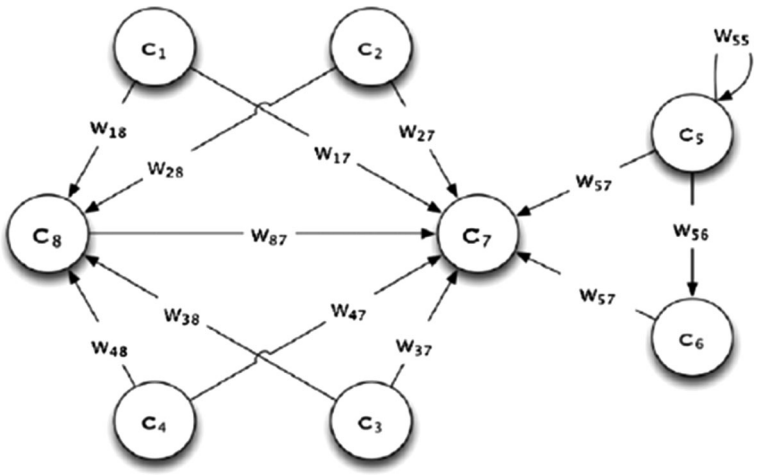

Fig. 1 Typical structure of a FCM. *Source* Salmeron (2012, p. 3706)

(or follow a bivalent logic in {0, 1}). The weights of the links (or arcs) can also be a fuzzy value within [−1, 1] (or follow a trivalent logic within {−1, 0, 1}). As such, there are three types of causal relationships between concepts: (a) *negative causality* ($W_{ij} < 0$), meaning that an increase (decrease) in the value of C_i will lead to a decrease (increase) in the value of C_j; (b) *null causality* ($W_{ij} = 0$), meaning that no relationship exists between C_i and C_j; and (c) *positive causality* ($W_{ij} > 0$), which occurs when an increase (decrease) in the value of C_i leads to an increase (decrease) in the value of C_j (for details, see Kim and Lee 1998; Mazlack 2009; Kok 2009; Salmeron 2009; Yaman and Polat 2009).

From a mathematical perspective, there is a $1 \times n$ state vector A that gathers the values of the n concepts; and a $n \times n$ weight matrix W (commonly known as the *adjacency matrix*) which gathers the weights W_{ij} of the links. Although non-zero values on the main diagonal can be considered, the adjacency matrix typically presents all the entries on the main diagonal as equal to zero, under the assumption that a concept will not cause itself (cf. Kok 2009). In this regard, it is worth noting that the value of each single concept is influenced by the values of its interconnected concepts (appropriately weighted) and by its own previous value. This can be summarized according to formulation (1), where $A_i^{(t+1)}$ is the activation level of concept C_i at time $t + 1$; f represents a threshold activation function; $A_i^{(t)}$ is the activation level of concept C_i at time t; $A_j^{(t)}$ stands for the activation level of concept C_j at time t; and, finally, W_{ji} is the weight of the relationship between both concepts:

$$A_i^{(t+1)} = f\left(A_i^{(t)} + \sum_{\substack{j \neq i \\ j=1}}^{n} A_j^{(t)}.W_{ji}\right). \tag{1}$$

Following Mazlack (2009), the overall impact of a change in the value of one concept is given by a transformed state vector A_{new}, which is calculated by multiplying the previous state vector A_{old} by the adjacency matrix W. Next, as described by Carlucci et al. (2013, p. 213), *"the resulting transformed vector is then repeatedly multiplied by the adjacency matrix and transformed until the system converges to a fixed point. Typically it converges in less than 30 simulation time*

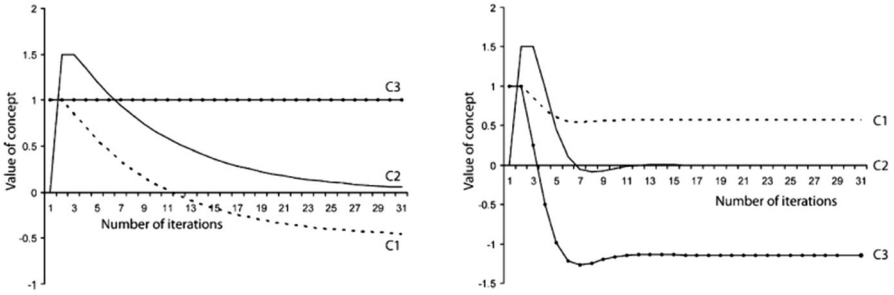

Fig. 2 FCM stabilization and value convergence points. *Source* Kok (2009, p. 125)

steps." Figure 2 exemplifies this exercise based on the results of a simulation conducted by Kok (2009).

A "strength of impact"-based ranking can then be obtained, revealing how the system is perceived in the FCM. Furthermore, by formulating a series of "what-if" questions, the impact on the system as whole of changes in some criteria can be assessed. FCMs thus have *"powerful and far-reaching consequences as a mathematical tool for modeling complex systems"* (Mazlack 2009, p. 5); and there is considerable scope for exploring this methodological approach to further our understanding of the dynamics behind bank branch service quality.

4 Constructing the fuzzy cognitive map

In this section, we discuss how the FCM approach can be a valuable tool for identifying key determinants of bank branch service quality and understanding the dynamics behind them. Figure 3 presents the sequence of technical procedures that were applied in the current study.

The details of this application are presented in the following subsections, and the advantages and disadvantages of this methodological approach are discussed.

4.1 Participants

Given their constructivist stance, and the typically deep involvement of participants in their development, FCMs should ideally rely on an informed and knowledgeable panel. Where possible, experts from the field in question should be recruited, as *"using a group of experts has the benefit of improving the reliability of the final model"* (Yaman and Polat 2009, p. 387). At the same time, practical issues should

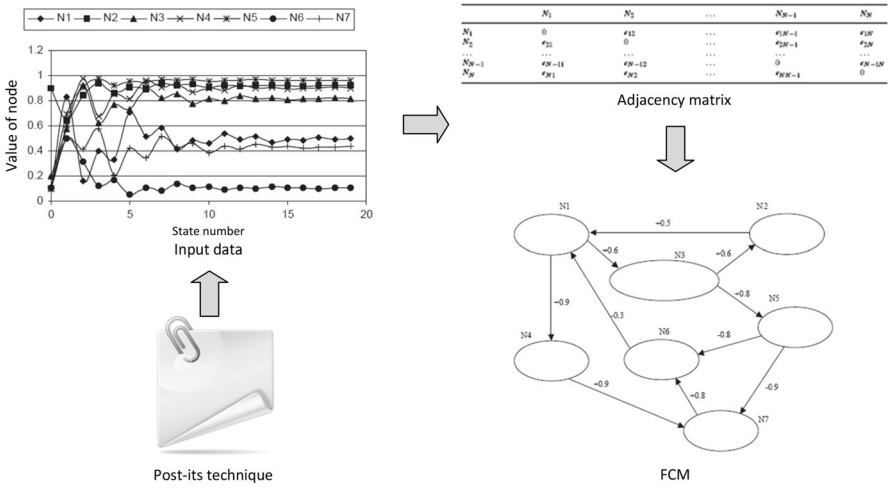

Fig. 3 Sequence of technical procedures followed. *Source* Adapted from Stach et al. (2010, p. 2519)

also be considered, namely the ability to bring such a group together, and the fact that *"the consultant* [i.e. facilitator] *will relate personally to a small number (say, three to ten persons)"* (Eden and Ackermann 2001, p. 22). Bana e Costa et al. (2002, p. 227) similarly specify an ideal number of *"5 to 7 experts and other key-players"*.

Given these guidelines, and after contacting different banking institutions, we were able to form an expert panel composed of five bank branch front office employees from the largest banks operating in Portugal. Specifically, the group members who took part in our study operate in the Central-West region of Portugal, and were selected based on their willingness to participate and their number of years of experience (i.e., all of them have been involved in this activity over the past 20–30 years). It is worth noting that our study is process-oriented, and should not be seen as an end in itself or a tool to prescribe optimal solutions. Methodologically, this means that, with adjustments, the process followed can work well with a different panel of decision makers.

The construction of the group's FCM took place during an intensive 7-hour group workshop, which was conducted by a senior facilitator, assisted by an ICT technician responsible for registering the research outcomes. Figure 4 illustrates the layout of the conference room used.

The intrinsic heterogeneity of the panel members, given that they were from different banks, allowed us to collect and confront different perceptions for a large portion of the Portuguese banking system.

4.2 Identifying concepts and quantifying relationships

The session started with a presentation of the study objectives and a careful clarification of the principles of FCM. This is an important procedural step to avoid misunderstandings between the facilitator's team and the panel members. The group members were then presented with the following trigger question: *"Based on your*

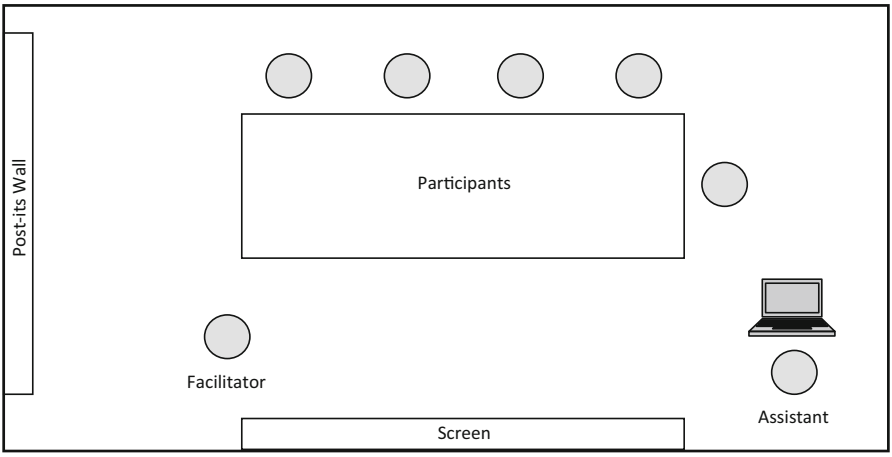

Fig. 4 Layout of the decision conferencing room. *Source* Adapted from Bana e Costa et al. (2014, p. 11)

own values and professional experience, how would you describe a good bank branch in terms of service quality?" This question provided the focus for the discussions that followed and allowed the "post-its technique" to be applied. This technique consists in writing what the expert panel considers as relevant concepts on post-its (one concept per post-it), to be stuck on a wall, board, or large piece of paper (Ackermann and Eden 2001; Ferreira et al. 2015; Filipe et al. 2015). Grounded on permanent debate among panel members (termed "negotiation" in the literature), this procedure is repeatedly executed until the group expresses collective satisfaction with the outcomes.

In the next step, the post-its are then organized by clusters, known as areas of concern, and there is additional debate about the significance of each concept. The clusters are then carefully analyzed, one by one, and their post-its repositioned following a means-end-based structure. Figure 5 presents two snapshots of the application of this technique in the present study.

In order for this phase of the process to be finalized, the group has to reach an agreement regarding the form and content of the map, resulting in what is frequently called a "strategic" or "collective" map. In the current study, the visualization of the final version of this map was supported by the *Decision Explorer* software (www.banxia.com), and part of it is illustrated in Fig. 6. This map essentially materializes the group's consensus on the key determinants of bank branch service quality.

The final version of the map contained 226 concepts, and as such it could not be fully displayed in this paper (but is available upon request from the corresponding author). However, as recognized by Ferreira et al. (2014b), the main contribution from the construction of a collective cognitive map results from the insights brought to the process by the participants involved in its development. Indeed, the high volume of information discussed and projected on the map arguably more than compensates the subjective nature of the process, which obviously depends on the facilitator's skills and is deeply influenced by the perceptions of the panel members. The construction of the cognitive map in our study gave the group members a holistic picture of bank branch service quality, as well as an opportunity to discuss its determinants, which all of the participants considered extremely useful.

Fig. 5 Snapshots of the "post-its session"

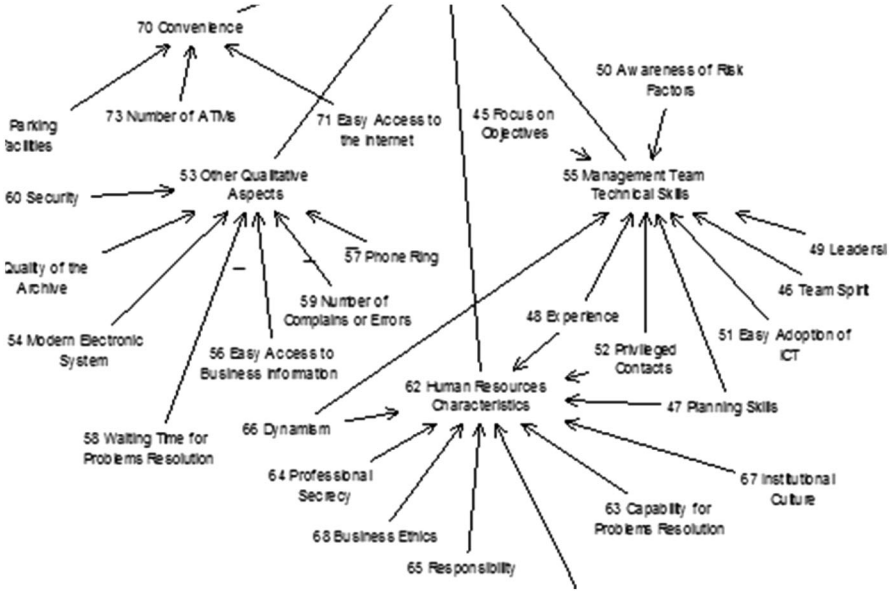

Fig. 6 Part of the collective map developed

As the next step in the construction of the FCM, the agreed upon group map was rebuilt with the support of the *FCMapper* (http://www.fcmappers.net) and *Pajek* software (http://pajek.imfm.si/doku.php), which allowed the intensity of the previously identified links to be dynamically analyzed. Figure 7 reveals the new layout of the cognitive structure. The concepts related to bank branch service quality are represented by numbers for simplification purposes (interested readers can please request a copy of the complete list of concepts and corresponding numbers via the corresponding author).

Given the structure outlined in Fig. 7, the panel members were then asked to examine the intensity of the links. This analysis was performed for all the clusters contemplated in the framework, as exemplified in Fig. 8, where, as outlined in Sect. 3, the intensity of each link ranged between -1 and 1.

The next step then consisted in filling in the adjacency matrix containing the degrees of intensity expressed by the group. The size of the map again prevents us from displaying the complete 226 × 226 adjacency matrix. However, an example of the type of matrix used is presented in Fig. 9, where N_i represents the node/concept i and e_{ij} stands for the degree of intensity between nodes/concepts i and j, as defined by the group members on a collective basis.

It is worth underlining the importance of this procedure, as it serves to promote further discussion of the results and defines the basis for recommendations (cf. Yaman and Polat 2009; Salmeron 2012; Carlucci et al. 2013).

Given the size and complexity of the framework created, it cannot, as previously noted, be represented in its entirety in this paper. However, it should be highlighted that the full FCM (also available upon request) allows the interactions between

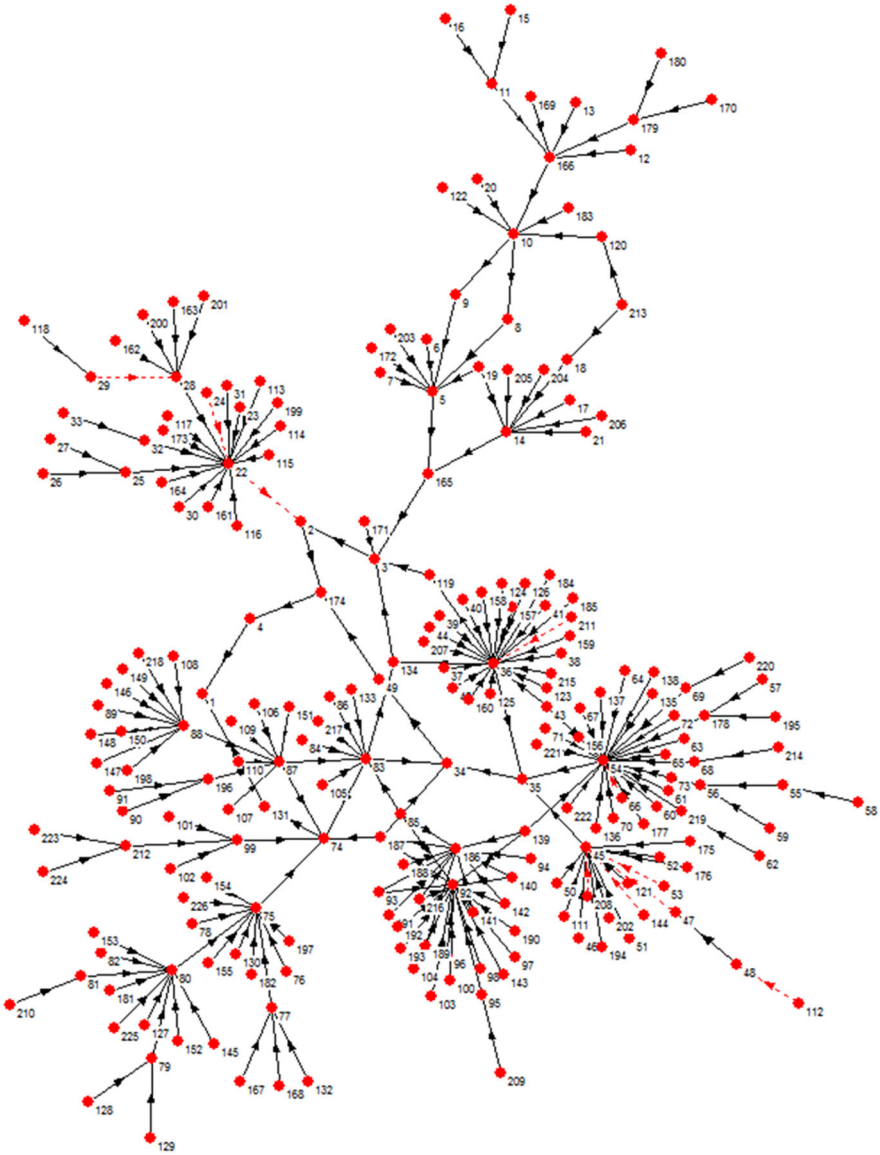

Fig. 7 [Initial] structure of the FCM

concepts to be observed, and the effects of changes in one determinant on others. In this sense, more important than the particular results of this application is understanding the potential of this methodology in general, and the theoretical and practical contributions its application can provide to our understanding of bank branch service quality.

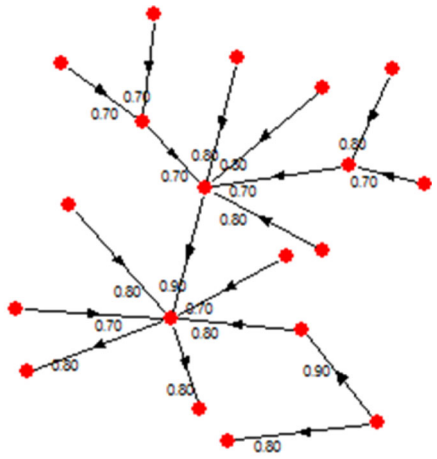

Fig. 8 Quantification of relationships

	N_1	N_2	…	N_{N-1}	N_N
N_1	0	$e12$	…	$e1N-1$	$e1N$
N_2	$e21$	0	…	$e2N-1$	$e2N$
…	…	…	…	…	…
N_{N-1}	$eN-11$	$eN-12$	…	0	$eN-1N$
N_N	$eN1$	$eN2$	…	$eNN-1$	0

Fig. 9 Adjacency matrix

4.3 Interpreting the research outputs

The group members had the opportunity to analyze and discuss the FCM resulting from their work session, which was approved by all and represented the consensus achieved. As previously noted, this map was context-dependent: the results could have been different had the participants involved been others or the session lasted longer, for instance. However, it should be recalled that the principal aim of the cognitive structure obtained was to encourage discussion among the participants, and promote a better understanding of the variables that influence a particular issue, in this case, bank branch service quality. In this sense, the construction of the FCM allowed the participants to identify the key determinants of bank branch service quality, as well as the dynamics and feedback loops between them; it stimulated rich debate between the participants throughout the session; allowed both objective and subjective measures and attributes of service quality to be considered, compared and/or combined; and, finally, provided insights which could be used by both participants and third parties (with due adjustments) to improve bank branch service quality.

Additionally, a battery of static and dynamic tests was carried out throughout the study, which *"through a proper neural network computational model"* allowed us to get *"an idea of the ranking of the variables in relationship to each other*

according to how the system is perceived in the FCM" (Carlucci et al. 2013, p. 216). This allowed the most significant determinants of bank branch service quality resulting from the concept interaction presented in the FCM to be identified, as shown in Table 1.

All the concepts comprised in the FCM have an intensity index associated, which, as exemplified in Fig. 8, is a measure of centrality obtained by the intensity values of the interconnected concepts (i.e., out- and in- degrees). The high number of these indices (i.e., 226), however, prevented us from including all the values in Table 1. Still, from the main determinants represented in the table, it can be seen that *human resource characteristics* (which include collaborators' personal and professional training) and *management team technical skills* were identified as particularly relevant driving forces of bank branch service quality, with intensity indices of 22.20 and 18.80, respectively. Although following a different approach, our findings are consistent with Culiberg and Rojsek (2010) and Lee et al. (2011) with regard to the importance of the characteristics of the human resources, in so far as this was the criterion identified by the panel members displaying the highest level of centrality. Our results are also in accordance with the findings of Karatepe et al. (2005), Arbore and Busacca (2009), and Ferreira et al. (2014b) and (2015), who underline the importance of *human resources' professional training* and *relational quality* and *convenience offered* in the assessment of bank customer loyalty.

While most of these determinants are not new, in so far as they have been identified in previous measures of bank branch service quality, the novelty here is that these should stand out, from the over 200 criteria identified, as the most influential from the banks' perspective. In addition, the completeness of the collective map often allows the detection (and correction) of small but potentially consequential details, which might otherwise go undetected. In this case, the *phone ringing* while a client is being attended to was identified as a negative influence on *other qualitative aspects* (cf. Fig. 6). This is a potentially significant issue, but which is, at the same time, likely to have simple solutions. In this sense, it is worth noting that the FCM approach further identified a large number of other concepts or criteria, of which our focus was on the ones with the highest levels of centrality (see Table 1), and which are not, in our opinion, without consequence. Indeed, as pointed out by one of the participants, some of the criteria included in the FCM are rarely taken into account in the current evaluation practices, but *"the FCM allowed*

Table 1 Major determinants of bank branch service quality and respective intensity (based on centrality)

Concepts	Outdegree	Indegree	Intensity
Human resources characteristics	0.90	21.30	22.20
Management team technical skills	2.40	16.40	18.80
Branch's internal layout	0.90	14.30	15.20
Other qualitative aspects	0.70	11.70	12.40
Branch's external layout	0.90	8.90	9.80
Convenience offered	2.40	5.70	8.10
Location	1.40	4.90	6.30

for their identification, reducing the rate of omitted criteria" (quoting the participant's own words). This is a single example of how the FCM presented in this paper can offer real insight into the dynamics behind bank branch service quality, supporting the postulate that *"FCMs are simple, yet powerful tools for modeling and simulation of dynamic systems, based on domain-specific knowledge and experience"* (Papageorgiou et al. 2012, p. 45).

From a managerial standpoint, more important than the ranking of variables provided is the ability to dynamically understand how the determinants of bank branch service quality relate to each other and how their cause-and-effect relationships support the calculation of each index, allowing information about this phenomenon to be more structured and, therefore, potentiate improvement suggestions, which in turn is a prime concern for bank administrators, bank branch collaborators, and society at large. Because it is intrinsically dynamic, the resulting framework allowed for a better understanding of the impact that any change in the variables considered can bring to the overall assessment of bank branch service quality. In addition, the construction of a FCM allows often omitted determinants to be contemplated. In this case, very specific, but potentially significant factors such as easy access to business information or the management team's ability to be open-minded and deal with sporadic situations, for instance, were identified, contributing significantly to a fuller view of the problem at hand. Indeed, by using the input and knowledge of a group of experts from the field, the construction of the FCM—underlined in the evolving discussion and negotiation it created—allowed a holistic understanding of the determinants of bank branch service quality and of the relationships between them to be obtained, which might otherwise have gone undetected through the mere application of conventional correlational methods (cf. Stach et al. 2010).

This study takes a non-prescriptive and process-oriented stand. As such, we recommend that extrapolation of the results be treated with caution. Although this can be interpreted as a limitation, it offers, in compensation, great potential in terms of flexibility and practical applications. As argued by Salmeron (2009, p. 275), *"from an Artificial Intelligence perspective, FCMs are supervised learning neural systems, where as more and more data is available to model the problem, the system becomes better at adapting itself and reaching a solution"*. In light of these considerations, our proposal holds great potential for the operational planning and improvement of bank branch service quality, and thus banks' ability to achieve higher levels of competitiveness.

5 Conclusion

The framework presented in this paper provides important insights for the operational planning and improvement of bank branch service quality by assisting a better understanding of the dynamics behind this phenomenon. This is important because our knowledge of the all-important cause-and-effect relationships between determinants of bank branch service quality is still very limited, which in turn limits our ability to generalize from existing research findings.

Having identified this need, at both the theoretical (in terms of the application of new methodologies to the issue) and the practical level (in terms of aiding banks' decision processes in this respect), for a better understanding of bank branch service quality, we assumed a non-prescriptive process-oriented position, using FCMs to address the issue. This type of cognitive maps, known as neuro-fuzzy systems, is able to incorporate expert knowledge in the decision-making framework, thus revealing powerful and far-reaching consequences in the modeling of complex decision problems (Mazlack 2009). We are unaware of any other attempts to analyze bank branch service quality using FCMs.

In the current study, the construction of a FCM allowed the participants (bank branch front office employees from the largest banks in Portugal) to: (1) identify the key feedback loops in the system and analyze the dynamics behind bank branch service quality; (2) engage in debate throughout the workshop; (3) identify objective and subjective measures and attributes of service quality; and (4) provide insights that can improve our understanding of bank branch service quality. In addition, as pointed out by one of the panel members, some of the criteria included in the map are rarely taken into account in the current evaluation systems, but *"the map allowed for their identification, reducing the rate of omitted criteria"* (in the participant's own words), thus contributing significantly to a fuller/holistic view of the determinants of bank branch service quality and of the relationships between them.

The results achieved are very encouraging, both from the standpoint of the feedback received from the participants and from the resulting FCM itself, which was able to map over 200 concepts, as well as their relative importance and the linkages between them. Indeed, the negotiation established among the participants allowed action priorities to be determined, which of course is extremely useful in terms of improvement initiatives. The resulting framework therefore not only represents a theoretical/methodological advance in the area, but has practical implications for bank collaborators wanting to improve their personal and branch performance levels; for bank administrators seeking to increase the institution's competitiveness; and even, given the important role banks have to play for economic growth, for society at large.

In addition to the results obtained themselves, the process through which the framework was developed, and the discussions and negotiations it involved, allowed for a gradual construction of knowledge and learning. As such, the application of FCMs to bank branch service quality assessment has the potential to allow for practical improvements to that service quality, through the identification of its key determinants and the elements upon which they in turn are dependent. In allowing such increments to bank branch service quality, the methodology presented narrows the gap between theory and practice; and as the framework is repeatedly applied and perfected, its constructivist nature allows the learning obtained to be fed back into our theoretical knowledge of the phenomenon at hand.

Notwithstanding, as with all methodologies, the framework adopted in this research is not without its limitations. The process followed is subjective in nature, and although such context-dependence is an inherent characteristic of all constructivist research, it means that extrapolations without adjustments should be

discouraged. In addition, *"FCM development methods are far from being complete and well-defined* […] *the development of FCM models almost always relies on human knowledge* [… and] *strongly depend on subjective beliefs of expert(s) from a given domain"* (Stach et al. 2005, p. 372). Nevertheless, it is important to note that these shortfalls are more than compensated by the experiences shared and by the insights brought to the system by the experts, which might otherwise have gone undetected through the mere application of statistical methods. Following this, and in order to strengthen the proposal presented in this study, further research might want to: (1) conduct a panel study with a different set of bank branch collaborators to determine the robustness of the results; (2) replicate the study in a different country; or (3) compare the results obtained from the application of different methods in this context. Improvements and updates will strengthen our knowledge of bank branch service quality, which can be incorporated within different strategies and interventions.

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