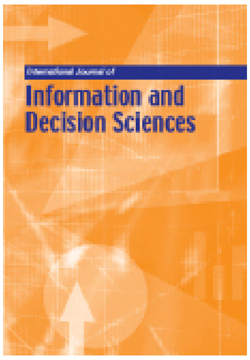

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Ameneh Khadivar, Hamideh Nazarian, Sanaz Bodaghi

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Proposing a model for accepting core banking system in Iran using fuzzy DEMATEL technique: a case study

Ameneh Khadivar*, Hamideh Nazarian and Sanaz Bodaghi

Department of Management,
Alzahra University, Iran
Email: a.khadivar@alzahra.ac.ir
Email: Nazarian.it@gmail.com
Email: Sanazbodaghi1398@gmail.com
*Corresponding author

Abstract: Core banking system (CBS) implementation is a time-consuming, cost-intensive, and complex task. As a result, plenty of CBS projects have failed. This research proposes a model for accepting the CBS using the fuzzy DEMATEL technique at Parsian Bank, Iran. Identified from the users' standpoint, factors affecting the acceptance of the CBS have been prioritised through the questionnaire. Moreover, the involved criteria of CBS are separated into the cause and effect groups to help decision-makers focus on those criteria providing great influence. The findings indicate that three of the influencing factors are identified as critical ones; within the cause group, the criterion of 'the output quality of the CBS' is the most important factor for accepting the CBS, whereas 'the quality of the CBS' has the best effect on the other criteria. By contrast, 'adequate training for employees to use the CBS' is the most easily improved of the effect group criteria.

Keywords: core banking system; CBS; technology acceptance; accepting the CBS; fuzzy DEMATEL technique; Iran.

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Biographical notes: Ameneh Khadivar is an Associate Professor at the Department of Management in Alzahra University in Iran. She received her PhD in Systems Management from the Tarbiat Modares University in Iran. She received her MSc in Information Technology Management from the Tarbiat Modares University in Iran, and BSc in Industrial Engineering from Iran University of Science and Technology. Her research interests include business intelligence, expert systems (ES), decision support systems (DSS) and knowledge management (KM).

Hamideh Nazarian holds a Master's degree in IT Management from Alzahra University, Tehran, Iran. She also holds a Bachelor's degree in Computer Engineering. Her research interests include disruptive technologies, fuzzy systems, optimisation, evolutionary computation, intelligent supply chain management, and smart health information systems.

Sanaz Bodaghi received her Bachelor's degree in Chemical Engineering from Islamic Azad University. She also received a Master's degree in Information Technology Management from Alzahra University. Her research interests are banking information systems, online financial markets, and core banking.

1 Introduction

Now that the technology is advancing rapidly, each organisation has to use the modern technologies in the world to survive and continue its activity. New technologies enter the organisations by spending heavy expenses. Accepting these technologies and using them properly by users is very substantial, since not accepting the new technologies by users leads to not using them or to their limited and partial use. As a result, this will not have economic justification, and initial costs for purchasing and implementing the new technology are wasted. Here, the issue of accepting the new technology by employees, managers and others, who deal with it, is proposed.

In the current advanced banking, passive banking is no longer smart. Thus, banks will not wait for the new needs of customers to cover them subsequently. A customer-oriented bank which protects the shareholders' benefits will create need in the customer. By creating such a service for the customer, a new need is created, and then, the above-mentioned services will be launched to the market and hidden benefits will be appropriated timely.

Core banking is the result of these changes and needs in the market so that a bank can offer integrated services to the customers by the lowest implementation cost and without wasting time and resources. Core banking will offer its services through specialised channels to the customers via observing customers' needs and classification of such needs (Malekzadeh and Khalilloo, 2016).

Many methods have been used in extracting and identifying factors affecting adoption of the core banking system (CBS) such as Grey theory, two-stage fuzzy piecewise regression analysis method, quality function deployment (QFD), data mining, and analytic hierarchy process (AHP). However, these methods need more data. Besides, few methods have capable of demonstrating the relationship between factors affecting the adoption of CBS. Therefore, this study uses the fuzzy decision-making trial and evaluation laboratory (DEMATEL) method to select which factors are more influencing in the acceptance of CBS. The advantage of the DEMATEL method is the capability of revealing the relationship between these factors which influence other factors in the adoption of CBS. This study obtains influence among criteria using the DEMATEL technique, and computes the causal relationship and strength among revealed factors. The DEMATEL technique does not need large amounts of data (Chang et al., 2011).

2 Statement of the problem

The CBS implementation project is a time consuming, cost-intensive and complex task like other investments in information technology. Hence, just 25% of the CBS projects have successfully been accomplished (Adamson et al., 2003). There are several challenges in the CBS implementation, and not eliminating such challenges will lead to the failure of such a system. There is still a large gap between banking in Iran and international banking; such a technological gap has led to an increase in transaction costs for the public and also the chance of errors in e-payments; therefore, this gap must be eliminated. For policymaking in this scope, it is necessary to see how banking and business models in banking scope are congruous or similar to models of international banks. Indeed, core banking is a re-engineering in traditional bank constructs that requires serious will and determination of managers in the banking system.

Taking account of these failures and problems in the CBS implementation as well as the importance of accepting such systems in Iranian banks, this survey explores the influencing factors on accepting these systems and how they affect each other.

Since decision-makers look forward to a causal analytical method which can do with the group decision-making problem in the fuzzy environments of practical situations, we have developed a fuzzy DEMATEL method, so that the complex interactions between ambiguous, qualitative and, linguistic factors can be transformed into a visible structural model, making it easier to capture the core of a problem, whereby excellent decisions can be made. The proposed fuzzy DEMATEL method can also be applied to problems such as manufacture, environmental engineering, financial analysis, social science, and many other decision-making problems with multiple criteria in a fuzzy environment (Lin and Wu, 2008). In summary, the proposed approach presents the following advantages compared to traditional methods for accepting CBS:

1 A major advantage of DEMATEL over other systems is its reliance on its ability to produce possible results with minimum data. The employment scope of this system has reached industry, social activities, agriculture, economy, ecology, energy, and other areas, and has solved a great number of practical problems in production, life, and scientific research successfully (Bouzon et al., 2017).

2 The proposed method illustrates the interrelationships among critical factors by constructing causal relationships among influencing factors (Seker and Zavadskas, 2017).

3 Identifying each factor using triangular fuzzy numbers gives better and more reliable results, as the uncertainty and vagueness of the data can be managed with a fuzzy approach (Seker and Zavadskas, 2017).

4 The matrices or digraphs portray a contextual relationship between system elements, where a numeral represents the strength of influence (Bouzon et al., 2017).

5 The proposed method offers highly accurate and effective material to support the identification procedure because influencing factors can be better ranked and well evaluated to improve acceptance of the core systems (Seker and Zavadskas, 2017).

3 Theoretical literature

3.1 Definitions of CBS

CBS has various definitions, based on the centre which offers it. They are as below:

1 CBS is the software used to sustain banks, most common dealings which include providing service loans, opening new accounts, processing cash deposits, withdrawals, calculating interests, client relationship management actions and maintenance of records for the bank's transactions (Hariharan and Reeshma, 2015).

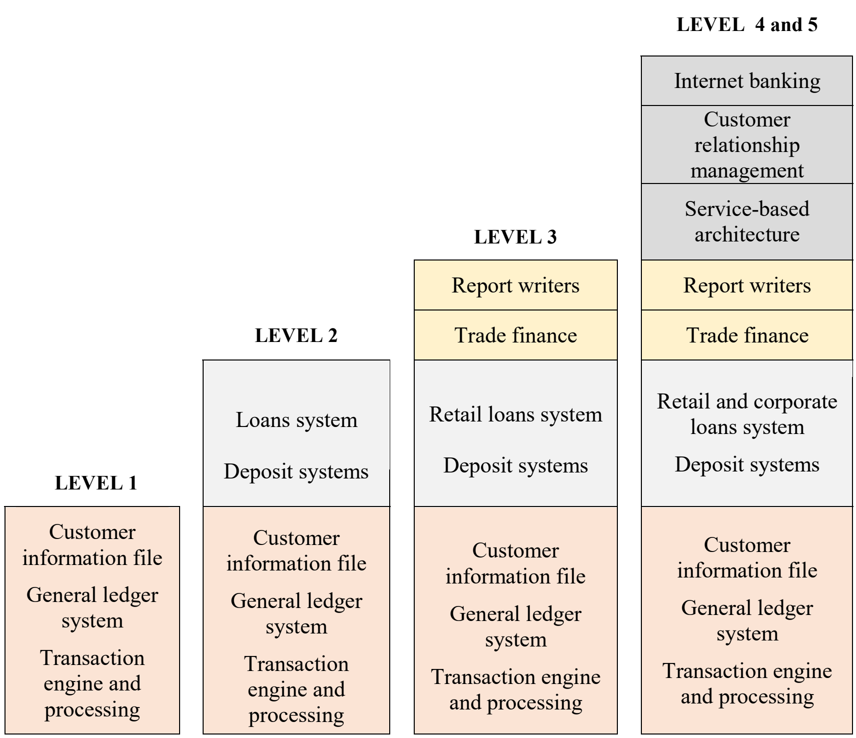
2 A program for processing of data related to transactions of the bank in one day, behind the counter and automation of operations in front of the counter (Gartner, 2011).

3 Core banking is a general expression to describe the offered services by bank branches. Actually, a core banking solution is a forward step to improve customer services anywhere and anytime (Manjushree, 2014).

4 CBS is a strategic information technology system with the required capabilities to perform operations of the bank or the credit institution in which connection to different payment gateways on the one hand and communications with various types of technology system, on the other hand, are proposed (Zimmerman, 2011).

By summarising the above-mentioned definitions, CBS provides the possibility to improve operations and decrease costs. In other words, it helps banks have a comprehensive viewpoint and real-time information of customers.

Figure 1 Main levels of core banking software (see online version for colours)



Source: Zineldin (2009)

3.2 Main levels of CBS

Four main levels have been mentioned for the CBS. Each level has more capabilities than its previous level. Each bank or financial institution has to determine the labour force, current and future infrastructures of modules, capabilities that are expected from the CBS, and as a result, its level based on the current products and services that it offers and intends to offer in the future (Zineldin, 2009).

CBS, like all other systems, requires constant updating for more efficiency and responsiveness. Besides, it requires to take an independent platform and adds a new module for responding to new demands, and also needs less system shutdown (Blanchard, 2008; Zineldin, 2009).

3.3 General problems and obstacles for the new technology in banking

Function of the highly advanced technology in banking environment can be an opportunity to enhance systemic environment of the bank for concentration on more business opportunities and offering better services to customers despite its several challenges. Among the general obstacles, the below ones can be mentioned:

1 Cost of implementing new technologies in the banking industry is usually high.

2 New risks, related to job operations, security, and maintenance, will be created by accepting the new technology.

3 Implementing the new technology in banks is not mainly an easy task due to the unavailability of the required experts and lack of the essential competencies in employees to extract the new technology for covering the activities and various banking operations.

4 Employees at the operational, middle and top levels of cooperative banks do not usually tend absolute use of the information technology in all their daily activities. Thus, this issue is one of the main reasons for the gap in the implementation of information technology (Muniraja Sekhar and Sudhir, 2012).

3.4 Key failure factors in enterprise resource planning (ERP) system

CBSs can be regarded as a solution originating from ERP systems peculiar to the banking industry. Hence, implementing CBSs is a complex and costly process as much as implementing ERP systems, and also, key failure factors for ERP systems can be considered as key failure factors for CBSs.

ERP systems are computer-based information systems designed to perform organisational processes, facilitate integration, planning, and production, and respond to customers in real-time (O'Leary, 2000). Organisations' purpose of implementing ERP systems is to achieve a general view of the processes of the organisation, and play a serious role in dynamic environments (Malhotra and Temponi, 2010).

Although ERP systems can bring competitive advantage for an organisation, 75% of these projects failed (Kumar et al., 2003). Therefore, many studies have examined the key factors influencing the success and failure of these systems. As a result of the studies, the key failure factors in ERP systems can be divided into seven groups, namely the vendor and consultant, human resources, managerial resources, project management, processes, organisational, and technical resources. Human factors refer to factors such as high resistance of employees to change, inadequate training to employees, inadequate participation of employees, lack of change management, and lack of motivation and morale in employees toward the use of the new system (Amid et al., 2012).

3.5 Technology acceptance model (TAM)

The TAM has been designed in the field of information systems to predict technology acceptance and its use in jobs. It has been used extensively for various groups of technologies and users. Perceived ease of use and perceived usefulness are the two main constructs of TAM (Gangwar et al., 2015; Venkatesh and Davis, 2000).

3.6 Technology acceptance model 2 (TAM 2)

TAM 2 specifically explains people's behaviour toward computer use and different types of computer technologies (Venkatesh and Davis, 2000). Venkatesh and Davis (2000) employed three components of image, voluntariness, and subjective norm in TAM 2 to show the effect of social influence processes. In the same vein, Venkatesh and Davis (2000) developed the TAM 2 by adding cognitive instrumental processes such as job relevance, output quality, and result demonstrability (Hartwick and Barki, 1994).

3.7 Integrating the technology acceptance theory and theory of planned behaviour

This model integrates the predictors of the theory of planned behaviour and usefulness from the technology acceptance theory to provide a mixed model (Taylor and Todd, 1995). Its major constructs are attitude toward behaviour, subjective norm, perceived behavioural control, and usefulness.

3.8 Innovation diffusion theory (IDT)

IDT roots in sociology (Rogers, 1995). It has been used to study various innovations from agricultural tools to organisational innovation since the 1960s. Its core constructs are relative advantage, compatibility, ease of use, result demonstrability, image, visibility, and voluntariness of use (Moor and Benbasat, 1991).

3.9 The unified theory of acceptance and use of technology

This mixed model has been created to present a more complete picture of the acceptance process than the previous single models. Eight models, i.e., the theory of reasoned action, TAM, theory of planned behaviour, motivational model, a model integrating TAM and theory of planned behaviour, model of PC utilisation, innovation diffusion theory, and social cognitive theory have appeared in one model. Each model attempts to explain the user behaviour using independent variables. An integrated model has been created based on the conceptual and empirical similarities existing between these eight models. Through integrating and enhancing these TAMs, it is expressed that the unified theory of acceptance and use of technology should now be used as a criterion for acceptance literature (Venkatesh et al., 2003). The unified theory of acceptance and use of technology includes five direct indexes of behavioural intention and usage behaviour that are: performance expectancy, effort expectancy, social influence, voluntariness, and facilitating conditions.

3.10 Other influencing factors on technology acceptance

It is believed that four factors of user satisfaction, ease of learning, system quality, and trust in the proposed acceptance model are influencing on technology acceptance (Kassim et al., 2012).

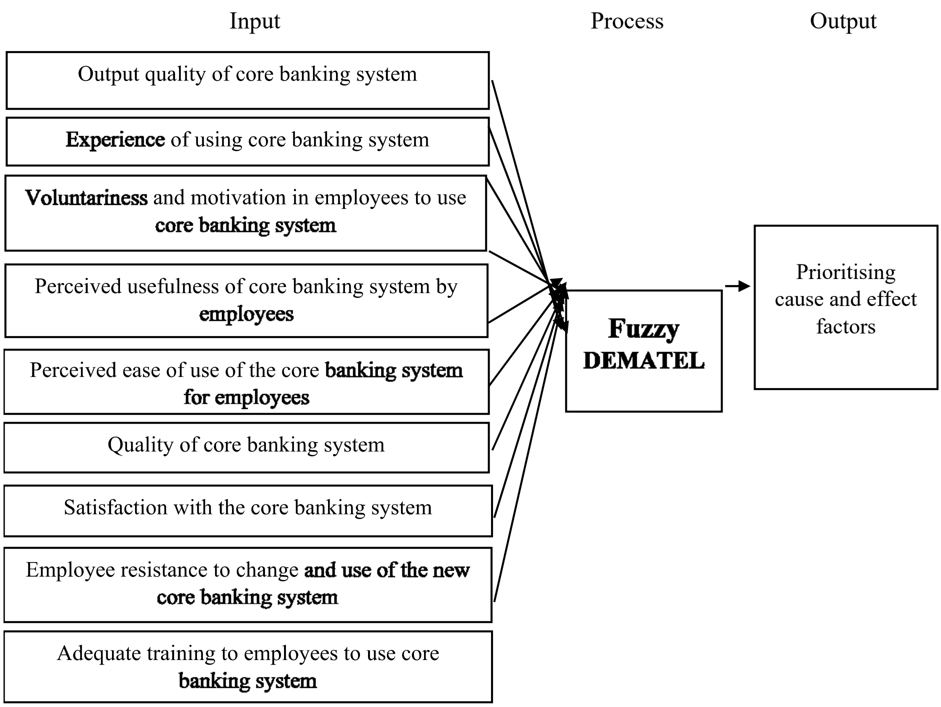
4 Literature review

In this section, we will only look at some of the papers used in this study. Nallathambi (2019) performed research on the adoption pattern of alternative banking channels by customers to identify the usage pattern of customers concerning the different banking channels in India. Khan and Chaudhuri (2017) focused to identify in moderate digital banking culture the challenges that Indian commercial banks encountered in the implementation process of CBS. Kumar and Sharma (2017) examined the interrelation among customer's demographical characteristics, adoption and usage pattern, and service quality gaps in the case of Alternate banking channels. The findings state that the demographic characteristics of the customers have a direct and significant impact on the adoption/usage of the alternate banking channel services. Rahman and Qi (2016) investigated the challenges that commercial banks in Bangladesh encounter in the process of the CBS implementation or upgrade. Their study found three primary sources (factors) of CBS implementation challenges: management, technology and vendor. Shaikh and Karjaluoto (2015) analysed and synthesised existing studies of m-banking adoption, and mapped the major theories that researchers had used to predict consumers' adoption intentions. The findings indicate that the m-banking adoption literature commonly relies on the TAM and its modifications. This reveals that compatibility (with lifestyle and device), perceived usefulness and attitude were the most significant drivers of intentions to adopt m-banking services in developed and developing countries. Patil and Kant (2014) proposed a prediction framework based on the DEMATEL and fuzzy multi-criteria decision-making (FMCDM) for knowledge management (KM) adoption in the supply chain (SC). The proposed approach is helpful to predict the success of KM adoption in SC without actually adopted KM in SC. It also enables organisations to decide whether to initiate KM, restrain adoption, or undertake remedial improvements to increase the possibility of successful KM adoption in SC. Gangwar et al. (2015) conducted a study to extend TAM using a set of TOE framework variables relevant to cloud computing adoption as external variables of TAM so that they developed an integrated TAM-TOE framework for cloud computing adoption. Findings showed that perceived usefulness, perceived ease of use, relative advantage, compatibility, complexity, organisational readiness, training and education, top management commitment, competitive pressure, and trading partner support are important determinants for cloud computing adoption in organisations.

5 The research model

The research model is shown below, given previous studies, the research literature and interviews with the experts via exploring other acceptance models and the influencing factors on each one by integrating and inspiring from TAMs 1 and 2, integrating the technology acceptance theory and theory of planned behaviour, innovation diffusion theory, the unified theory of acceptance and use of technology and integrating these with the proposed acceptance model for information system acceptance and user satisfaction by Kassim et al. (2012) as well as the key failure factors on failure of ERP systems and considering the concept of CBS as a subset of these systems.

Figure 2 Conceptual model



The proposed method is superior to conventional techniques because of exposing the relationships between factors and ranking the criteria relating to the type of relationships and intensity of their effects on each criterion. Also, by using a fuzzy linguistic scale, imprecise and inaccurate information has been handled. Due to these advantages, DEMATEL is used to reveal a better knowledge of the influences of the analysis of cause and effect criteria, and to increase the model applicability. Thus, the proposed method can represent the causal relationship of criteria and is favourable to handle group decision making in a fuzzy environment (Seker and Zavadskas, 2017).

5.1 Definitions of model constructs

1 *Output quality* – TAM2 posits that, over and above considerations of what tasks a system is capable of performing and the degree to which those tasks match their job goals (job relevance), people will take into consideration how well the system performs those tasks, which we refer to as perceptions of output quality (Venkatesh and Davis, 2000).

2 *Experience of using CBS* – having practical knowledge of using CBS as a back-end system that processes daily banking transactions, and posts updates to accounts and other financial records (Murphy, 2014).

3 *Perceived usefulness* – is defined as the degree to which a person believes that using a particular system would enhance his or her job performance (Al-Smadi, 2012).

4 *Perceived ease of use* – defined as the extent to which a person believes that using the system will be free of effort (Venkatesh and Davis, 2000).

5 *Voluntariness and motivation in employees to use CBS* – as a moderating variable, defined as 'the extent to which potential adopters perceive the adoption decision to be non-mandatory. Even when users perceive system use to be organisationally mandated, usage intentions vary because some users are unwilling to comply with such mandates (Venkatesh and Davis, 2000).

6 *System quality* – the desirable characteristics of an information system. For example: ease of use, system flexibility, system reliability, and ease of learning, as well as system features of intuitiveness, sophistication, flexibility, and response times (DeLone and McLean, 1992; Mahdavian et al., 2014; Petter et al., 2008).

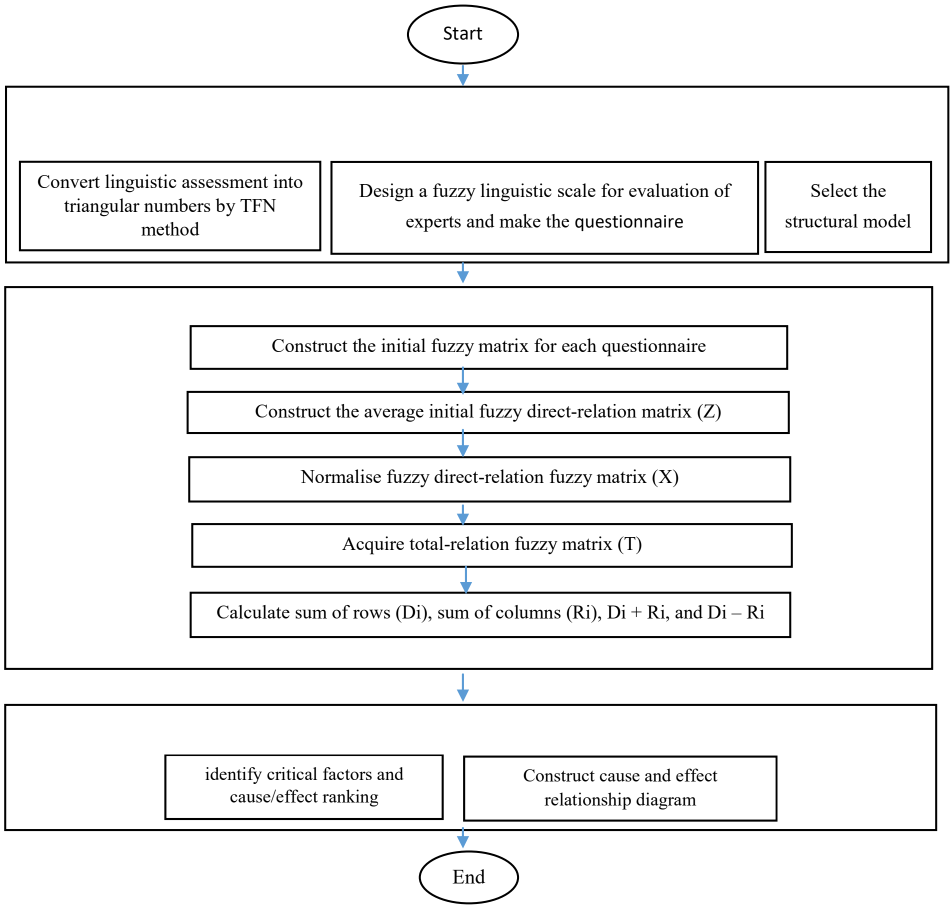
7 *User satisfaction* – users' level of satisfaction with reports, Web sites, and support services. For example, the most widely used multi-attribute instrument for measuring user information satisfaction can be found in Ives et al. (1983) (Petter et al., 2008).

8 *Employee resistance to change and use of the new CBS* – employees' refusal to accept changes and use the new system because the existing CBS was familiar to them. Additionally, they feared that the new system would require fewer employees due to process automation (Murphy, 2014).

9 *Adequate training to employees to use CBS* – training and development (T&D) is one of the significant HR practices widely used in the organisational setting to ensure optimal use of resources (Faridi et al., 2017).

Figure 3 provides a summary presentation of the analytical procedure of our proposed fuzzy DEMATEL method.

Figure 3 Implementation of a fuzzy DEMATEL approach (see online version for colours)



5.2 *The steps of the fuzzy DEMATEL method*

Step 1 Define the decision goal and form expert panel.

The first step is identifying the decision goal. Besides, it is necessary to form a panel of experts, which provides group knowledge for related issues (Patil and Kant, 2013).

Step 2 Develop the evaluation criteria and design the fuzzy linguistic scale.

In this step, it is needed to establish sets of criteria for evaluation. However, evaluation criteria have the nature of causal relationships and usually comprise several complicated aspects. To deal with the ambiguities of human assessments, we apply the fuzzy linguistic scale used in the group decision-making based on trapezoidal fuzzy numbers (TFN) method (Lin and Wu, 2008). The different degrees of 'influence' are expressed with five linguistic terms as {very high, high, low, very low, no} and their corresponding positive triangular fuzzy numbers (l_{ij}, m_{ij}, u_{ij}) are shown in Table 1.

Table 1 The fuzzy linguistic scale

Linguistic terms	*Triangular fuzzy numbers (l, m, u)*
Very high influence (VH)	(8, 9, 9)
High influence (VH)	(6, 7, 8)
Low influence (L)	(4, 5, 6)
Very low influence (VL)	(2, 3, 4)
No influence (No)	(1, 1, 1)

Step 3 Acquire initial direct relation matrix.

To measure the relationship between criteria $C = \{C_i | \, i = 1, 2, \ldots, n\}$, a decision group of p experts was asked to make sets of pair-wise comparisons in terms of linguistic terms. Hence, p fuzzy matrices $\left\{\tilde{Z}^{<1>}, \tilde{Z}^{<2>}, \ldots, \tilde{Z}^{<P>}\right\}$, each corresponding to an expert and with triangular fuzzy numbers as its elements, were obtained. Denote $\tilde{Z}^{<k>}$ as:

$$\tilde{Z}^{<k>} = \begin{bmatrix} 0 & \tilde{Z}_{12}^{<k>} & \cdots & \tilde{Z}_{1n}^{<k>} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{Z}_{n1}^{<k>} & \tilde{Z}_{n2}^{<k>} & \cdots & 0 \end{bmatrix}; k = 1, 2, \ldots, p$$

where $\tilde{Z}_{ij}^{<k>} = \left(\tilde{l}_{ij}^{<k>}, \tilde{m}_{ij}^{<k>}, \tilde{u}_{ij}^{<k>}\right)$. Without loss of generality, elements $\tilde{Z}_{ii}^{<k>}$ ($i = 1, 2, \ldots, n$) will be regarded as a triangular fuzzy number (0, 0, 0) whenever it is necessary. Fuzzy matrix $\tilde{Z}^{<k>}$ is called the initial direct-relation fuzzy matrix of expert k (Lin and Wu, 2008). Then, by using equation (1), those fuzzy assessments are aggregated which is Z_{ij}. Hence, the initial direct-relation matrix $Z = [z_{ij}]_{n \times n}$ is obtained.

$$Z = \left[\frac{\tilde{Z}^{<1>} \oplus \tilde{Z}^{<2>} \oplus \ldots \oplus \tilde{Z}^{<P>}}{P}\right]_{n \times n} \tag{1}$$

Step 4 Normalise direct relation matrix.

Based on the initial direct-relation matrix (Z), the normalised direct relation matrix (X) can be obtained through equations (2), (3) and (4) (Patil and Kant, 2013).

Let $\tilde{a}_i^{<k>}$ be the triangular fuzzy numbers

$$\tilde{a}_i = \sum\nolimits_{j=1}^{n} \tilde{Z}_{ij} = \left(\sum\nolimits_{j=1}^{n} l_{ij}\right), \left(\sum\nolimits_{j=1}^{n} l_{ij} m\right), \left(\sum\nolimits_{j=1}^{n} u_{ij}\right) \tag{2}$$

$$r = \frac{1}{\max_{1 \le i \le n} \left(\sum\nolimits_{j=1}^{n} u_{ij}\right)} \tag{3}$$

The linear scale transformation is then used as a normalisation formula to transform the criteria scales into comparable scales (Lin and Wu, 2008). The normalised direct-relation fuzzy matrix, denoted as $\tilde{X}$, is given by:

$$\tilde{X} = \begin{bmatrix} 0 & \tilde{X}_{12} & \cdots & \tilde{X}_{1n} \\ \tilde{X}_{21} & 0 & \cdots & \tilde{X}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{X}_{n1} & \tilde{X}_{n2} & \cdots & 0 \end{bmatrix}; k = 1, 2, ..., p$$

where

$$\tilde{X}_{ij} = r * \tilde{Z}_{ij} = r\left(l_{ij}, m_{ij}, u_{ij}\right) \quad (4)$$

Step 5 Acquire total-relation matrix.

Then, the total-relation matrix (T) can be acquired through equations (5), (6), (7), (8), and (9).

$$T = \lim_{k \to \infty} \left(X^{<1>} + X^{<2>} + \cdots + X^{<k>}\right) = X(I - X)^{-1} \quad (5)$$

$$T_l = X_l \times \left(I - X_l\right)^{-1}, \quad (6)$$

$$T_m = X_m \times \left(I - X_m\right)^{-1}, \quad (7)$$

$$T_u = X_u \times \left(I - X_u\right)^{-1}, \quad (8)$$

$$\tilde{T}_{ij} = \left(T_{ij}^{<l>}, T_{ij}^{<m>}, T_{ij}^{<u>}\right) \quad (9)$$

Step 6 Defuzzify the direct relation matrix.

As that of the most fuzzy models, we had to convert the final fuzzy data into a crisp value. Here, the relation $\frac{l + u + 2 * m}{4}$ is used to defuzzify the total-relation matrix (T).

Step 7 Calculate the sum of the values in each column and each row.

This step entails summing the values of each column and row in the total relation matrix (T), where D_i is the sum of the i^{th} row and R_j is the sum of the j^{th} column. The D_i and R_j values represent both the direct and indirect influences between factors (Tsai et al., 2017). The value of D_i represents the total degree to which element 'i' exerted influence on other elements while R_i shows the degree by which element 'i' is impacted by other elements (Tsai et al., 2017).

$$D_i = \sum_{j=1}^{n} t_{ij} \ (i = 1, 2, ..., n), \quad (10)$$

$$R_j = \sum_{i=1}^{n} t_{ij} \ (j = 1, 2, ..., n). \quad (11)$$

Step 8 Construct the cause-effect relationship diagram and identify affecting factors on the adoption of CBS.

The causal diagram as a tangible product of the DEMATEL method can be drawn using equations (10) and (11). The value of Di+Ri on the horizontal axis is defined as prominence, indicates the total degree to which an element exerts influence on and is influenced by other elements. Therefore, Di+Ri shows the degree to which element 'i' is at the core of all problems. Also, the value of Di-Ri on the vertical axis is defined as relation, representing the difference in the degree to which an element affects and is affected by other elements. Thus, Di-Ri shows the causal degree of element 'i' in all problems (Ren and Luo, 2018).

6 Data analysis

6.1 Demographic characteristics

The statistical population included managers, deputies, and users of Parsian Bank. Seventy questionnaires were collected. Frequency of respondents has been investigated based on gender, age, education level, and work experience, job position. Table 2 shows the statistical information regarding demographic characteristics of the respondents.

Table 2 Demographic information of samples

Demographic categories	*Percentage (%)*	*Frequency*
Gender		
Male	52.9%	37
Female	47.1%	33
Age (year)		
Less than 30	15.00%	10
30–40	76.43%	54
40–50	8.57%	6
Education level		
BA	55.7%	39
MA	44.3%	31
Work experience (year)		
Less than 3	12.8%	9
More than 3	87.2%	61
Job position		
Director	4.3%	3
Deputy	8.3%	6
Senior manager	34.4%	24
User	53.0%	37

6.2 Practical case of the proposed model

In the first step, the indexes were identified and selected. A total of nine indexes have been identified. Also, indexes and sub-indexes have been represented in Table 3 with numerical indexes; hence, they can be traced and studied during the research process.

Table 3 Research indexes

Symbols	*Indexes*
C1	Output quality of core banking system
C2	Experience of using core banking system
C3	Voluntariness and motivation in employees to use core banking system
C4	Perceived usefulness of core banking system by employees
C5	Perceived ease of use of the core banking system for employees
C6	Quality of core banking system
C7	Satisfaction with the core banking system
C8	Employee resistance to change and use of the new core banking system
C9	Adequate training to employees to use core banking system

Table 4 The linguistic assessment data of a respondent

	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*
C1	-	H	L	L	H	VH	L	H	VH
C2	H	-	VL	H	VH	NO	VH	VH	VH
C3	L	VL	-	H	VH	NO	VH	VH	VH
C4	L	L	H	-	H	NO	H	VH	L
C5	H	H	VH	H	-	NO	VH	VH	H
C6	VH	NO	VH	VH	VH	-	VH	VH	VH
C7	L	VL	VH	NO	L	NO	-	VH	NO
C8	H	L	VH	NO	H	NO	H	-	NO
C9	VH	VH	VH	VH	VH	NO	VH	VH	-

Table 5 The fuzzy matrix for each questionnaire

	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*
C1	0 0 0	6 7 8	4 5 6	4 5 6	6 7 8	8 9 9	4 5 6	6 7 8	8 9 9
C2	6 7 8	0 0 0	2 3 4	4 5 6	6 7 8	1 1 1	2 3 4	4 5 6	8 9 9
C3	4 5 6	2 3 4	0 0 0	6 7 8	8 9 9	1 1 1	8 9 9	8 9 9	8 9 9
C4	4 5 6	4 5 6	6 7 8	0 0 0	6 7 8	1 1 1	6 7 8	8 9 9	4 5 6
C5	6 7 8	6 7 8	8 9 9	6 7 8	0 0 0	1 1 1	8 9 9	8 9 9	6 7 8
C6	8 9 9	1 1 1	8 9 9	8 9 9	8 9 9	0 0 0	8 9 9	8 9 9	8 9 9
C7	4 5 6	2 3 4	8 9 9	1 1 1	4 5 6	1 1 1	0 0 0	8 9 9	1 1 1
C8	6 7 8	4 5 6	8 9 9	1 1 1	6 7 8	1 1 1	6 7 8	0 0 0	1 1 1
C9	8 9 9	8 9 9	8 9 9	8 9 9	8 9 9	1 1 1	8 9 9	8 9 9	0 0 0

Table 6 The average initial fuzzy direct-relation matrix (Z)

	C1			*C2*			*C3*			*C4*			*C5*			*C6*			*C7*			*C8*			*C9*		
C1	0	0	0	6.29	7.26	7.77	6.09	7.09	7.74	6.31	7.29	7.84	5.71	6.67	7.34	6.17	7.14	7.66	6	6.97	7.57	5.56	6.49	7.13	6.2	7.2	7.81
C2	5.46	6.46	7.14	0	0	0	6.17	7.17	7.77	5.9	6.89	7.56	5.99	6.96	7.67	3.91	4.77	5.51	5.27	6.2	6.84	5.51	6.49	7.2	6.06	7.03	7.6
C3	5.79	6.71	7.23	5.6	6.57	7.24	0	0	0	5.74	6.71	7.34	5.69	6.66	7.4	4.27	5.11	5.83	5.97	6.94	7.59	5.51	6.51	7.29	6.09	7.09	7.67
C4	5.77	6.71	7.27	5.73	6.71	7.44	5.46	6.43	7.23	0	0	0	5.56	6.54	7.26	3.73	4.51	5.19	5.94	6.94	7.56	5.01	6	6.77	5.74	6.74	7.36
C5	5.64	6.6	7.29	5.69	6.66	7.37	5.3	6.26	6.94	5.3	6.26	7.04	0	0	0	3.49	4.29	5.01	5.69	6.69	7.4	5.56	6.54	7.26	5.87	6.83	7.46
C6	6.11	7.11	7.66	4.99	5.91	6.63	5.23	6.17	6.87	5.34	6.31	7.11	5.67	6.66	7.31	0	0	0	5.71	6.69	7.33	5.56	6.51	7.16	5.81	6.77	7.37
C7	5.74	6.73	7.33	5.76	6.74	7.47	5.86	6.83	7.39	5.7	6.69	7.37	5.46	6.43	7.11	3.53	4.29	4.96	0	0	0	5.79	6.77	7.39	6.01	6.97	7.56
C8	5.66	6.59	7.21	5.39	6.34	7.06	5.31	6.26	6.94	5.19	6.11	6.74	5.53	6.49	7.14	3.43	4.17	4.83	5.43	6.37	7.01	0	0	0	5.04	5.97	6.59
C9	5.94	6.91	7.37	5.69	6.66	7.29	5.69	6.66	7.27	5.86	6.83	7.4	5.83	6.77	7.34	3.83	4.6	5.23	5.73	6.71	7.37	5.36	6.31	6.9	0	0	0

Table 7 The normalised fuzzy direct-relation matrix $(\tilde{X})$

	C1			*C2*			*C3*			*C4*			*C5*			*C6*			*C7*			*C8*			*C9*		
C1	0	0	0	0.1	0.12	0.13	0.1	0.12	0.13	0.1	0.12	0.13	0.09	0.11	0.12	0.1	0.12	0.13	0.1	0.11	0.12	0.09	0.11	0.12	0.1	0.12	0.13
C2	0.09	0.11	0.12	0	0	0	0.1	0.12	0.13	0.1	0.11	0.12	0.1	0.11	0.13	0.06	0.08	0.09	0.09	0.1	0.11	0.09	0.11	0.12	0.1	0.12	0.12
C3	0.1	0.11	0.12	0.09	0.11	0.12	0	0	0	0.09	0.11	0.12	0.09	0.11	0.12	0.07	0.08	0.1	0.1	0.11	0.12	0.09	0.11	0.12	0.1	0.12	0.13
C4	0.09	0.11	0.12	0.09	0.11	0.12	0.09	0.11	0.12	0	0	0	0.09	0.11	0.12	0.06	0.07	0.09	0.1	0.11	0.12	0.08	0.1	0.11	0.09	0.11	0.12
C5	0.09	0.11	0.12	0.09	0.11	0.12	0.09	0.1	0.11	0.09	0.1	0.12	0	0	0	0.06	0.07	0.08	0.09	0.11	0.12	0.09	0.11	0.12	0.1	0.11	0.12
C6	0.1	0.12	0.13	0.08	0.1	0.11	0.09	0.1	0.11	0.09	0.1	0.12	0.09	0.11	0.12	0	0	0	0.09	0.11	0.12	0.09	0.11	0.12	0.1	0.11	0.12
C7	0.09	0.11	0.12	0.09	0.11	0.12	0.1	0.11	0.12	0.09	0.11	0.12	0.09	0.11	0.12	0.06	0.07	0.08	0	0	0	0.1	0.11	0.12	0.1	0.11	0.12
C8	0.09	0.11	0.12	0.09	0.1	0.12	0.09	0.1	0.11	0.09	0.1	0.11	0.09	0.11	0.12	0.06	0.07	0.08	0.09	0.1	0.12	0	0	0	0.08	0.1	0.11
C9	0.1	0.11	0.12	0.09	0.11	0.12	0.09	0.11	0.12	0.1	0.11	0.12	0.1	0.11	0.12	0.06	0.08	0.09	0.09	0.11	0.12	0.09	0.1	0.11	0	0	0

Table 8 Total-relation matrix (T) of main indexes

	C1			*C2*			*C3*			*C4*			*C5*			*C6*			*C7*			*C8*			*C9*		
C1	0.25	0.6	1.59	0.34	0.7	1.7	0.33	0.69	1.7	0.34	0.7	1.71	0.33	0.69	1.7	0.27	0.55	1.35	0.33	0.7	1.71	0.32	0.67	1.66	0.34	0.71	1.73
C2	0.31	0.65	1.61	0.22	0.55	1.51	0.31	0.65	1.62	0.31	0.65	1.62	0.31	0.65	1.62	0.22	0.49	1.25	0.3	0.65	1.61	0.3	0.63	1.58	0.32	0.67	1.64
C3	0.31	0.66	1.62	0.31	0.65	1.62	0.22	0.55	1.51	0.31	0.65	1.62	0.31	0.65	1.63	0.23	0.49	1.26	0.32	0.66	1.63	0.3	0.64	1.59	0.32	0.67	1.65
C4	0.31	0.64	1.59	0.3	0.64	1.59	0.3	0.63	1.58	0.22	0.54	1.48	0.3	0.64	1.59	0.22	0.47	1.23	0.31	0.64	1.59	0.29	0.61	1.55	0.31	0.65	1.61
C5	0.3	0.64	1.58	0.3	0.63	1.58	0.29	0.63	1.57	0.3	0.63	1.58	0.22	0.53	1.47	0.21	0.47	1.22	0.3	0.64	1.59	0.29	0.62	1.55	0.31	0.65	1.6
C6	0.32	0.66	1.62	0.3	0.64	1.61	0.3	0.64	1.61	0.31	0.65	1.62	0.31	0.65	1.62	0.16	0.42	1.17	0.31	0.66	1.62	0.3	0.64	1.59	0.32	0.67	1.64
C7	0.31	0.65	1.6	0.31	0.65	1.6	0.31	0.65	1.59	0.31	0.65	1.6	0.3	0.64	1.6	0.22	0.48	1.23	0.22	0.55	1.5	0.3	0.63	1.57	0.32	0.66	1.62
C8	0.3	0.62	1.52	0.29	0.61	1.52	0.29	0.61	1.52	0.29	0.61	1.52	0.29	0.61	1.53	0.21	0.45	1.18	0.29	0.61	1.53	0.2	0.5	1.39	0.29	0.62	1.54
C9	0.31	0.65	1.59	0.31	0.64	1.59	0.31	0.64	1.58	0.31	0.65	1.59	0.31	0.65	1.59	0.22	0.48	1.23	0.31	0.65	1.59	0.3	0.63	1.55	0.23	0.56	1.5

Then, assessments of decision-makers are obtained. Through the fuzzy linguistic scale (see Table 1), the relationships between each pair of criteria were measured and each assessment of seventy respondents can be obtained. For example, the assessment data of one of the respondents is shown in Table 4. Then, we get fuzzy matrices $\{\tilde{Z}^{<1>}, \tilde{Z}^{<2>}, ..., \tilde{Z}^{<P>}\}$, $p = 1, \ldots, 70$ through the correspondence of Table 1. Then the collected questionnaires were converted into triangular fuzzy numbers. Each triangular fuzzy number includes three sections, i.e., *l*, *m* and *u*. For instance, one of the questionnaires is displayed in Table 5.

Then, the arithmetic mean of opinions is calculated, and the direct relation matrix or Z is formed using equation (1). This is displayed in Table 6.

$$Z = \left[\frac{\tilde{Z}^{<1>} \oplus \tilde{Z}^{<2>} \oplus \ldots \oplus \tilde{Z}^{<P>}}{P} \right]_{n \times n}$$

Calculating normal direct-relation matrix $(\tilde{X} = r * Z)$ through equations (2), (3), and (4).

$$\tilde{a}_i = \sum_{j=1}^{n} \tilde{Z}_{ij} = \left(\sum_{j=1}^{n} l_{ij}\right), \left(\sum_{j=1}^{n} m_{ij}\right), \left(\sum_{j=1}^{n} u_{ij}\right)$$

$$r = \frac{1}{\max_{1 \le i \le n} \left(\sum_{j=1}^{n} u_{ij}\right)} = \frac{1}{60.9}$$

$$\tilde{X}_{ij} = r * \tilde{Z}_{ij} = r\left(l_{ij}, m_{ij}, u_{ij}\right) = \frac{1}{60.9} * Z$$

To calculate the total-relation matrix, relation $X(I - X)^{-1}$ is applied. For this purpose, the fuzzy normalised direct-relation matrix $(\tilde{X})$ in fuzzy DEMATEL technique is partitioned into the following three definite matrices:

$$X_l = \begin{bmatrix} 0 & l_{12} & \cdots & l_{1n} \\ l_{21} & 0 & \cdots & l_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ l_{n1} & l_{n2} & \cdots & 0 \end{bmatrix} X_m = \begin{bmatrix} 0 & m_{12} & \cdots & m_{1n} \\ m_{21} & 0 & \cdots & m_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ m_{n1} & m_{n2} & \cdots & 0 \end{bmatrix} X_u = \begin{bmatrix} 0 & u_{12} & \cdots & u_{1n} \\ u_{21} & 0 & \cdots & u_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ u_{n1} & u_{n2} & \cdots & 0 \end{bmatrix}$$

Then, the identity matrix I_{n*n} is composed and the below operations [equations (5), (6), (7), (8), and (9)] are applied.

$$T_l = X_l \times \left(I - X_l\right)^{-1}$$

$$T_m = X_m \times \left(I - X_m\right)^{-1}$$

$$T_u = X_u \times \left(I - X_u\right)^{-1}$$

$$\tilde{t}_{ij} = \left(t_{ij}^{l}, t_{ij}^{m}, t_{ij}^{u}\right)$$

Relation $\frac{l+u+2*m}{4}$ is used to defuzzify the direct relation matrix. Given this relation, the definite values of the direct relation matrix (*M*) are as below.

Table 9 Total relation matrix (*M*) for definite main indexes

	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*
C1	0.76	0.86	0.85	0.86	0.85	0.68	0.86	0.83	0.87
C2	0.81	0.71	0.81	0.81	0.81	0.61	0.8	0.79	0.82
C3	0.81	0.81	0.71	0.81	0.81	0.62	0.82	0.79	0.83
C4	0.79	0.79	0.79	0.69	0.79	0.6	0.8	0.77	0.81
C5	0.79	0.79	0.78	0.78	0.69	0.59	0.79	0.77	0.8
C6	0.82	0.8	0.8	0.8	0.81	0.54	0.81	0.79	0.82
C7	0.8	0.8	0.8	0.8	0.8	0.6	0.7	0.78	0.82
C8	0.76	0.76	0.76	0.76	0.76	0.57	0.76	0.65	0.77
C9	0.8	0.8	0.79	0.8	0.8	0.6	0.8	0.78	0.71

Calculating the values of Di+Ri and Di-Ri through equations (10) and (11), and identifying pattern of causal relationships of the indexes under study.

Table 10 Pattern of causal relationships of the indexes under study

Indexes	*Symbols*	*D*	*R*	*D+R*	*D-R*	*Cause/effect*
Output quality of CBS	C1	7.43	7.15	14.58	0.28	Cause
Experience of using CBS	C2	6.97	7.1	14.07	–0.13	Effect
Voluntariness and motivation in employees to use CBS	C3	7.01	7.09	14.1	–0.08	Effect
Perceived usefulness of CBS by employees	C4	6.82	7.11	13.93	–0.29	Effect
Perceived ease of use of the CBS for employees	C5	6.77	7.12	13.89	–0.35	Effect
Quality of CBS	C6	7	5.42	12.42	1.58	Cause
Satisfaction with the CBS	C7	6.9	7.15	14.05	–0.25	Effect
Employee resistance to change and use of the new CBS	C8	6.54	6.94	13.48	–0.4	Effect
Adequate training to employees to use CBS	C9	6.88	7.26	14.14	–0.38	Effect

The results presented in Table 10 show the prominence and net cause/effect of all the factors.

6.3 Prominence analysis of factors

Factors are ranked, on the basis of the prominence Di+Ri score as follows: 'output quality of CBS' (C1), 'adequate training to employees to use CBS' (C9), 'voluntariness and motivation in employees to use CBS' (C3), 'experience of using CBS' (C2), 'satisfaction with the CBS' (C7), 'perceived usefulness of CBS by employees' (C4), 'perceived ease of use of the CBS for employees' (C5), 'employee resistance to change and use of the new CBS' (C8), and 'quality of CBS' (C6) (see Table 10). Among the factors, C1, C9, and C3 are the top factors based on the prominence score. 'Output quality of CBS' (C1) is identified as the top factor based on the interaction analysis.

6.4 Cause/effect factors analysis

Table 10, on the other hand, shows the net cause/effect value (Di-Ri) of each factor. A factor with Di-Ri > 0 is classified as a cause factor while a factor with Di-Ri < 0 is classified as an effect factor (Kirupanandan et al., 2018). A total of two factors, namely, C1 and C6 are classified as cause factors. 'Output quality of CBS' (C1) is also confirmed as a prominent factor based on the prominence score (Table 10). However, the degree of influenced impact index (Ri) of C6 is low despite its high degree of influential impact index (Di) suggesting C6 has considerable effect on other factors while it does not receive notable effects from them. This means C6 is difficult to be changed by other influencing factors.

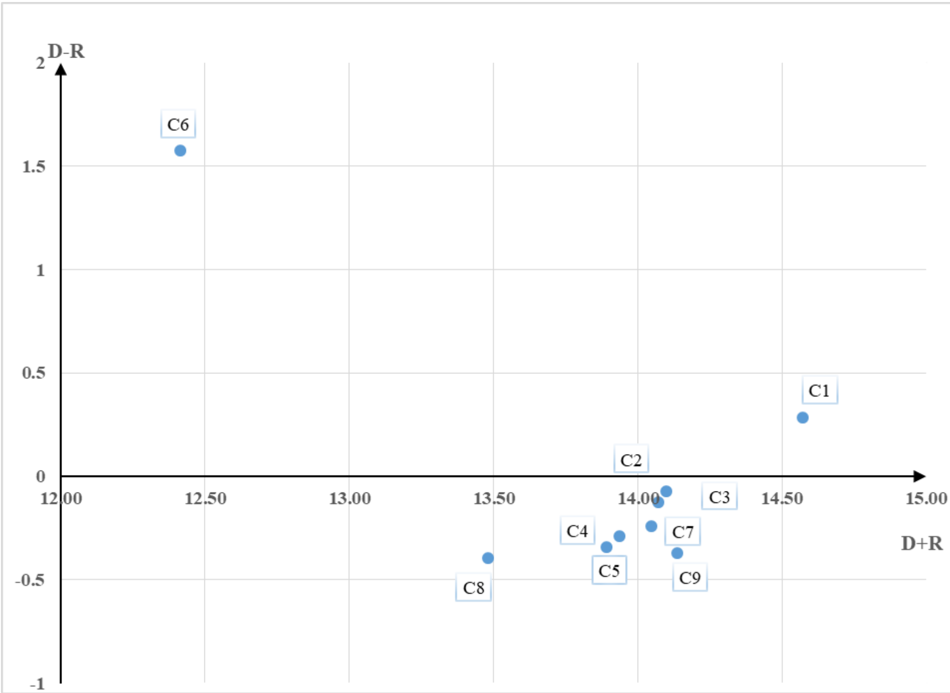
Factors C2, C3, C4, C5, C7, C8, and C9 are classified as effect factors based on the Di-Ri score. These factors are influenced by the cause factors which facilitate the adoption of the CBS. The lesser score of –0.4 for 'employee resistance to change and use of the new CBS' (C8) implies that it is the least influencing factor in the adoption of the CBS. Similarly, 'adequate training to employees to use CBS' (C9) with Di-Ri score of –0.38 is an effect factor that can easily be impacted by cause factors.

6.5 The casual diagram

The causal diagram is constructed with the horizontal axis shows how much importance the criterion has, whereas the vertical axis can divide criteria into cause group and effect group. Generally, when the Di-Ri axis is positive, the criterion belongs to the cause group. Otherwise, if the Di-Ri axis is negative, the criterion belongs to the effect group. Hence, causal diagrams can visualise the complicated causal relationships of criteria into a visible structural model, providing valuable insight for problem-solving. Furthermore, with the help of a causal diagram decision-makers can figure out the factors which have more impact on the system and which can greatly improve the efficiency of the system if these factors are paid attention to. And factors of this kind are CSFs that are extremely important for the whole system (Patil and Kant, 2013; Wu and Lee, 2007).

Through this causal diagram (Figure 4.); several valuable cues can be obviously obtained for making profound decisions. For example, factor C6 is located at the highest point of the vertical axis, which means that this factor belongs to the cause group, and has a significant effect on other factors. On the other hand, C6 is located at the leftmost point of the horizontal axis. This means that, according to experts, among all factors, C6 has the least degree to which a factor exerts influence on and is influenced by other ones. Moreover, the right-most factor 'output quality of CBS' (C1) is the most important factor by the highest Di+Ri priority of 14.58. Also, it is the most influencing factor by the second-highest Di-Ri priority of 0.28. Besides, 'employee resistance to change and use of the new CBS' (C8) is the most easily influenced and moved factor because it has the lowest Di-Ri priority of –0.4. We can directly look at those factors scattered in the causal diagram and perceive that the key critical factor for accepting the CBS is: 'output quality of CBS' (C1).

Figure 4 The cause-effect relationship diagram (see online version for colours)



It is necessary to control and pay a great deal of attention to the cause group factors beforehand. From the result of segmenting the list of critical factors, it means that successful adoption requires a high level of focus on the cause group (C1, C6) rather than the effect group (C2, C3, C4, C5, C7, C8, and C9) because while the cause group factors are difficult to move, the effect group factors are easily moved (Wu and Lee, 2007).

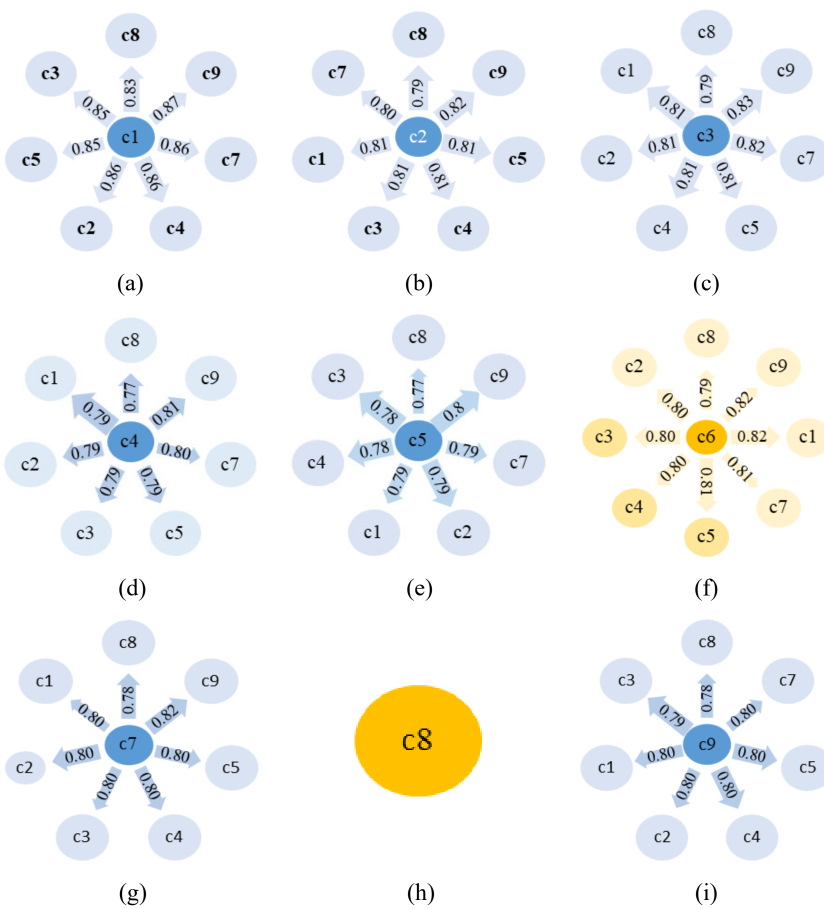
6.6 *Inner-dependency relationships*

The inner-dependency matrix is developed for getting an understanding of the significant relationships by eliminating the least significant relationships. For this purpose, the α value which is the average of all entries in the total relationship matrix (T) is computed (Kirupanandan et al., 2018). The α value is computed as 0.77, and the values lower than α were eliminated for obtaining the inner-relationship matrix. This is shown in Table 11. Based on the inner-relationship matrix, 57 relationships among factors are formed. The interrelationships are developed for all factors to ensure improved visibility, as shown in Figure 5. From Figure 5(h), it is clear that C8 does not have any significant relationship (cause) with the other factors while C6 [Figure 5(f)] is the most correlated factor.

Table 11 Inner relationships matrix

	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*
C1	0	1	1	1	1	0	1	1	1
C2	1	0	1	1	1	0	1	1	1
C3	1	1	0	1	1	0	1	1	1
C4	1	1	1	0	1	0	1	0	1
C5	1	1	1	1	0	0	1	0	1
C6	1	1	1	1	1	0	1	1	1
C7	1	1	1	1	1	0	0	1	1
C8	0	0	0	0	0	0	0	0	0
C9	1	1	1	1	1	0	1	1	0

Figure 5 Causal interaction of C1–C9 (see online version for colours)



Notes: (a) Causal interaction of C1, (b) causal interaction of C2, (c) causal interaction of C3, (d) causal interaction of C4, (e) causal interaction of C5, (f) causal interaction of C6, (g) causal interaction of C7, (h)causal interaction of C8, (i) causal interaction of C9.

7 Discussion

This study aims to identify and prioritise factors affecting the adoption of CBS, and investigate the interrelationship among them at Parsian Bank. The data for the pairwise comparison matrix is obtained from the designated expert team, and the DEMATEL method is applied to understand the causal interrelationships.

Since cause factors have net impact on the whole system, their performance can greatly influence the overall goal. Hence, it is generally accepted that factors in cause group should be paid more attention (Patil and Kant, 2013). Among all factors in the cause group, 'quality of CBS' (C6) has the highest Di-Ri, which means that C6 dispatches more impact on the whole system than that it receives from other factors. Although experts did not consider C6 as a very important evaluation criterion of significance (the value of its D+R is 12.42 which is the least one among all factors), this criterion frequently interacted with other criteria. A closer look at the degree of influenced impact index (Ri) of C6, which is considerably low (5.42), reveals that it can be influenced by only a few other attributes. That is to say, C6 affects a large number of other factors while is hardly influenced and changed by other factors; hence, it is recognised as a critical factor, requiring more attention and effort to be changed. DeLone and McLean (1992) developed their model of IS success named 'the DeLone and McLean information systems success model'. The model provides six interrelated dimensions of IS success including system quality, information quality, service quality, (intention to) use, user satisfaction, and net benefits explaining and predicting the success of information technology. In the present study, this is confirmed that 'system quality' has a considerable influence on the adoption of CBS, requiring more attention and effort to be changed. Therefore, the present study provides support for D&M IS success model.

The factor having the second highest Di-Ri (0.28) is factor C1, 'output quality of CBS'. Table 10 shows that the degree of influential impact index of C1 (Di) is 7.43, which ranks top among all causal factors. This indicates that C1 has remarkable impact on other factors. So, to improve the acceptance rate of the CBS, 'output quality of CBS' is decisive. Previous research (Venkatesh and Davis, 2000) has considered this factor as one of the main constructs of the TAM model and concluded that this is an influencing factor in explaining and predicting user acceptance of information technology at work. In the present study, this argument has been confirmed, demonstrating that 'the output quality of the CBS' is a critical influencing factor in the adoption of CBS that worth much more attention in the adoption of CBS. To sum up, these two factors (C1 and C6) have the best effect on the other criteria and should catch the first concern.

Factors in effect group are tending to be easily impacted by others. This makes an effect factor unsuitable to be a critical one. Nevertheless, it is still necessary to discuss effect factors to find out the features of each factor (Patil and Kant, 2013). Just one effect factors out of seven are recognised as critical factors after further analysis of effect factors. When it comes to C8, 'Employee resistance to change and use of the new CBS', its negative value of Di-Ri means that it classified in 'effect group'. Besides, it has the lowest Di-Ri score of –0.4, meaning that among seven effect factors, C8 has the highest degree to which it is affected by other factors. Further analysis reveals that C8 has the least degree of influential impact index Di (6.54) indicating that C8 is a net receiver, whiteout any notable effects on other factors. Therefore, C8 cannot be recognised as a critical factor.

'Adequate training to employees to use CBS' (C9) has the second rank score of Di+Ri, showing that it is of the most importance for the adoption of CBS. However, in Table 10 we can see that the Di-Ri score of C3 is –0.38, a value less than zero announcing C9 as a net effect factor. To further illustrate this phenomenon, its degree of influential impact index (Di) and degree of influenced impact (Ri), which are 6.88 and 7.26 respectively, are both relatively higher. This suggests that although C9 is a net receiver, it has an apparent impact on other factors and on the whole system. Therefore, considering the important position of C9 in the adoption of CBS, we identify C9 as a critical factor. Thus, this article supports the ideas of Gangwar et al. (2015), conducted a study to extend TAM using a set of TOE framework variables relevant to cloud computing adoption as external variables of TAM so that they developed an integrated TAM-TOE framework for cloud computing adoption; findings showed that training and education is one of the most important determinants for cloud computing adoption in organisations.

The effect factor, 'Perceived usefulness of CBS by employees' (C4) has the value of Di-Ri equal to –0.29, indicating that it is easily affected by other factors. Besides, low value of index 'Di' suggest that C4 has a low impact on the whole system; however, it is susceptible to other factors, and adjustment of other factors can lead to the improvement of it. From the analysis of the results, it can be concluded that C4 is not a critical factor. Similarly, 'experience of using CBS' (C2), 'satisfaction with the CBS' (C7), 'voluntariness and motivation in employees to use CBS' (C3), and 'Perceived ease of use of the CBS for employees' (C5) are not critical factors.

8 Conclusions

This study uses the DEMATEL method to identify and prioritise factors affecting adoption of the CBS at Parsian Bank operating in Iran. Our research results show that, three of the influencing factors are identified as critical ones; within the cause group, the criterion of 'the output quality of the CBS' is the most important factor for accepting the CBS, whereas 'the quality of the CBS' has the best effect on the other criteria. By contrast, 'adequate training for employees to use the CBS' is the most easily improved of the effect group criteria. The proposed model divides influencing factors to the 'cause' and 'effect' groups so that it will help to understand the most critical factors affecting acceptance of the CBS and interactions among them. This understanding will be helpful to the managers in improving their awareness about the factors. Thus, the conducted study will serve as a roadmap for managers to enhance the implementation of the CBS in their organisations. Since the factors used in the proposed model of this research are derived from a combination of several different models, the finding can be largely generalised and extended to banks in other countries. However, with the application of the demonstrated method and inclusion or removal of the factors, the practicing managers can extend the study to banks in other geographical locations more accurately. Obviously, influencing factors could be various based on organisational characteristics, organisational culture, and so forth.

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