

A hybrid SEM-FUZZY TOPSIS Approach for Performance Evaluation of Electronic Customer Relationship Management: Banking Industry

Mahdi Riahi¹, Farshid Abdi*², Majid Nojavan³

^{1,2,3} Department of Industrial Engineering, South Tehran Branch, Islamic Azad University, Tehran, Iran

Corresponding author: Farshid Abdi, Fa_ie@yahoo.com

mriahi.ie@gmail.com

mnojavan@azad.ac.ir

Abstract

In this study, the indicators and variables of the electronic customer relationship management (E-CRM) system were first extracted from the literature based on the four aspects of the balanced scorecard (BSC) using the meta-synthesis method. At this stage, 27 indicators were identified. In the next step, the experts were interviewed to find other possible components and indicators that were not identified by reviewing the literature. At this stage, the content analysis method was used and 15 new categories were identified. In the third stage, the indicators identified from meta-synthesis and content analysis methods were combined and, as a result, 31 indicators or variables were identified. In the fourth stage, important indicators were classified and determined using the PCA method. In the next step, the structural model and the relationships between the model variables were plotted using SmartPLS software. At this stage, it was found that the factor loading of all items except item 14 was higher than 0.4 from the perspective of the internal process related to the customer factor. So, this item was excluded from the model and questionnaire. In the next step, the relationship between the final indicators was determined by the ISM technique using the six variables of PCA. The results of this stage suggested that the variables customer orientation, organizational learning, organizational capabilities, adoption of technology to achieve the target market, and revenue growth had high influence and dependency and were considered communication variables. Moreover, the variable customer satisfaction had high dependency and low influence, indicating that it was more dependent on other variables. Therefore, its selection was influenced by other variables, and it was considered a dependent variable. In the last step, the BSC perspectives in Bank Mellat's E-CRM system were ranked using the fuzzy TOPSIS technique.

Keywords: electronic customer relationship management (E-CRM), performance evaluation, ISM, E-CRM.

Introduction

Nowadays, organizations look to use IT-based solutions to better understand the expectations and needs of customers, which are constantly changing and have complexities. In the meantime, customer relationship management (CRM) strategy plays an important role in achieving this (Ahmed et al., 2015). CRM is a suitable approach to establish and effectively manage customer relationships through accurate analysis of customer data using IT. CRM seeks to achieve a competitive advantage in customer management and, ultimately, to make more profit. With the rapid development of the Internet and information technologies, it is divided into two categories: electronic customer relationship management (E-CRM) and mobile customer relationship management (mobile CRM) (Rezaei Noor and Dimazar, 2016). E-CRM is another extension of relationship marketing and is based on IT to increase its power and capabilities (Chen and Ching, 2007). E-CRM is one of the most modern IT systems and serves to communicate effectively with customers and increase their satisfaction. It can play an important role in the widespread success of banks by providing electronic services. Banks can take an effective step in attracting more customers and providing better services with higher quality by implementing an E-CRM system (Dalir et al., 2017).

Evaluating the performance of the CRM system is one of the strategic issues for organizations. The main issue in the field of CRM is evaluating the performance of multidimensional and balanced system design. One of the reasons for the failure of CRM is the lack of appropriate tools and criteria for measuring and evaluating customer relationships. This attitude makes the issue of CRM evaluation out of its traditional form. Thus, organizational performance concerning the customer relationship is evaluated by considering different aspects. Traditional financial methods are not suitable for evaluating CRM, many of the benefits of which are indirect and intangible (Kahreh et al., 2012). Accordingly, this study was mainly conducted to design a comprehensive developed model to evaluate the performance the of E-CRM system in Bank Mellat branches using a combined approach of the balanced scorecard (BSC), interpretive structural modeling (ISM), and multi-attitude decision making (MADM) method in a fuzzy environment.

Theoretical Foundations

CRM

CRM is an organizational approach to understand customer behavior and influence it through an appropriate and continuous relationship and also the development of long-term relationships to strengthen loyalty and attract and retain customers and profitability (Salehi Sedghiani and Akhavan, 2006). CRM is a set of customer-related processes and strategies supported by specific software to increase customer loyalty and, ultimately, the company's profitability. Some of the requirements of CRM include attracting the right customer, creating the right offer and value, institutionalizing the best processes, motivating employees, and learning to retain customers (Winer, 2001).

CRM focuses on strengthening closer and deeper customer relationships. In other words, CRM refers to the determination and ability to change the behavior of a customer based on what the customer says to the organization and everything the organization knows about the customer

(Adili, 2003). Existing customers are more profitable than new ones because the cross-selling of the emerging product of existing customers is low cost. The likelihood of customer retention is maximized by bringing products and service levels closer to customer expectations while attracting new customers is costly. Therefore, the main goal of CRM is to maximize the long-term value of the customer for the organization (Samadi Rad, 2001).

E-CRM

CRM has undergone many changes recently due to developments resulting from the transfer and adoption of new technologies. According to Bull (2003), as long as CRM is considered as a business process based on effective communication management, its technological orientation is one of the important indicators of evaluation.

Among the powerful technological advances, the need to use the Internet may be paramount as it affects the world of CRM. This business area has created a very appropriate step for CRM that leads to continuous and high-quality communication with the customer due to its interactive nature. Its high speed, cost-effectiveness, consistent accessibility, efficient data transfer, and integrated nature are the main drivers and forces for CRM applications (Bauer et al., 2002). According to Winer (2001), the web environment has the power to establish better customer relationships than the offline world. Although the Internet provides such a promising area for the implementation of CRM, success in E-CRM can only be achieved through a specific program that is worthy of this environment (Zanjirchi et al., 2012). So, the performance of the E-CRM activities in Internet exchanges should be evaluated. E-CRM is an integrated marketing, sales, and online services strategy that is involved in identifying, acquiring, and retaining customers who are the company's largest asset (Bull, 2003). Similarly, Chen and Popovich (2003) described customer relationship management as an integrated view of combining the three components of people, process, and technology.

Simply stated, the main goal of E-CRM is to better understand the values and behavior of customers to increase their loyalty and, consequently, the profitability of the company. In other words, companies should rely on "rebuilding the relationship between companies and customers" instead of the traditional "try to sell more" model (Tan et al., 2002). E-CRM improves the relationship between the company and its customers by creating and increasing customer relationships through new technology (Zanjirchi et al., 2012). The main goal of E-CRM is to attract better customers to increase loyalty and profits (Zablah, 2002). E-CRM is a combination of hardware, software, applications, and management commitments. It takes different forms according to organizational goals and does not only include software and technology but also includes business processes based on a customer-centric strategy that is supported by various software and technologies (Zanjirchi et al., 2012).

Literature Review

In a study titled *The Strategy Formulation for Customer Relationship Management System with Balanced Score Card Approach (CRM SCORECARD) in Sapco Company* by Haghight Monfared and Sarai Nia (2011), the mission, current perspectives and strategies of the organization, and the strategic goals of the CRM system were identified for each aspect of BSC.

The key success factors in the CRM system were then identified and screened by the fuzzy method. In the next step, the key performance indicators for each of these factors were identified and prioritized using the analytic hierarchy process (AHP) method. Next, a BSC, a CRM system strategy plan, and an executive action plan for each of the key success factors were developed.

In a study by Heidarpour et al. (2013), uncertainty conditions were modeled logically and practically by combining the AHP method and fuzzy theory. Because the importance of financial ratios varies for different groups, the weight of the indicators was calculated by distributing questionnaires among the various groups affecting investor decisions, including professors, independent auditors, and investment advisors. Finally, the banks listed on the Tehran Stock Exchange in 2010 were ranked using the TOPSIS method. The results showed that the mentioned ranking is not the same as the ranking of the Tehran Stock Exchange due to the use of different ranking methods.

Mozoon et al. (2014) found the performance of private banks listed on the Tehran Stock Exchange desirable in four perspectives and considered the existence of a strategic view and long-term planning necessary to remove barriers to optimizing the performance of the studied banks. The tools used in this study were BSC, fuzzy TOPSIS, and fuzzy inference system.

In a study titled Evaluation of Bank Branches Performance by Combining Two System: Balance Scorecard and Fuzzy DEA (Case Study: Tabriz Selected Branches of Bank Sepah), Bafandeh Zنده and Rafiei (2015) presented a model for evaluating the performance of bank branches. Data were analyzed and branch performance was assessed by fuzzy data envelopment analysis (SEA). The results showed that 10 branches out of the total number of active branches in the city of Tabriz are strongly efficient, 27 are efficient, and the remaining 5 are inefficient.

Fathi et al. (2016) conducted a study titled Performance Evaluation of Ansar Bank Branches based on Balanced Scorecard Approach and ANP-VIKOR Methods. According to the results, the branch of Amin Boulevard has the best performance, and the branches of "Masoumiyeh" and "Markazi" rank second and third. A case study was conducted on Ansar Bank branches.

In a study titled Designing Performance Evaluation Indicators by Using AHP and BSC Approaches (Case of Study: Social Security Organization of Mashhad), Rojuee et al. (2017) showed that the coefficient of compatibility of the criteria in the AHP model was less than 0.1, indicating the acceptable compatibility of the system. The results also indicated that customer, learning and growth, financial, and internal process perspectives were prioritized, respectively. The most important indicators are customer satisfaction from the customer perspective, establishing in-service training from the learning and growth perspective, increasing receivables from the financial perspective, and updating the rules of the Social Security Organization according to the requirements of the time from the internal process perspective.

Lehman et al. (2013) examined how to evaluate the effectiveness of CRM using the BSC and provide developed goals and criteria. Customer knowledge, customer interaction, customer value, and customer satisfaction were considered as four perspectives based on customer orientation in the proposed model by analyzing causal relationships. This study can help managers determine CRM strategies.

Yanvarifiani and Badiarjoo (2014) provided a model for measuring the effectiveness of CRM in XYZ. The results indicated that the model was suitable for evaluating CRM. In this study, the areas that lead to improving the effectiveness of CRM and managers should strive to strengthen them were identified. The case study in this study was Bandung Gas Distribution and Transportation Company, Indonesia. The tools used were the analytic network processing (ANP), most of which was communication between the four BSC perspectives.

Mozaheb et al. (2015) argued that CRM has a significant effect on firm performance. Technology is a key factor that affects small and medium-sized enterprises (SMEs) and leads to the superiority of competitors. Besides, companies need to focus on the market and customers to achieve better performance. The case study in this study was active managers in Mashhad Industrial Estate. The tools used in this study were correlation analysis and structural equation modeling (SEM).

In their study, Wang and Chien (2016) provided a new framework for Taiwanese LED manufacturers: (1) BSC with DEA on the effect of operational efficiency on performance results, (2) inclusion of non-financial indicators in the performance measurement process (3) recording the complexities between key performance indicators (KPIs) and multiple outcomes (i.e. earnings per share and equity return), and (4) and managerial insights to adjust compliance show significant KPIs. The case study in this study was the Indian banking industry.

Toranjanski et al. (2017) conducted a study on measuring the performance of CRM using the BSC and customized ANP-BOCR approaches. They developed performance measurement methods based on the ANP-BOCR model and introduced a new approach based on customized scale measurement to overcome the main drawback of the ANP-BOCR method, which deals with the pairwise comparison process. Findings showed the developed aspects of CRM in banking. Moreover, the applied methodological approach can be useful for measurement criteria goals in remote geographical areas, which further helps to facilitate the development of strategies for achieving business excellence.

Saxena and Taneja (2018) examined the effectiveness of CRM in public and private banks. The results of factor analysis showed four dimensions for CRM: customer experience, technological orientation, organizational commitment, and process- and reliability-based approach. Identifying parameters helps bank managers implement CRM effectively to increase customer satisfaction and loyalty. A case study was conducted on public and private banks in New Delhi, and the tools used were the impact technique and the correlation method.

Methodology

This is an applied study in terms of purpose because its results can be used by Tehran food industry companies. Besides, this is a descriptive survey study in terms of data collection and analysis. The documentary study method was used to develop the theoretical foundations and review the literature so that the latest material related to the subject was reviewed by referring to scientific sources such as books, articles, dissertations, and reputable websites. Data were collected using questionnaires and interviews with experts. The following figure shows the study flowchart.

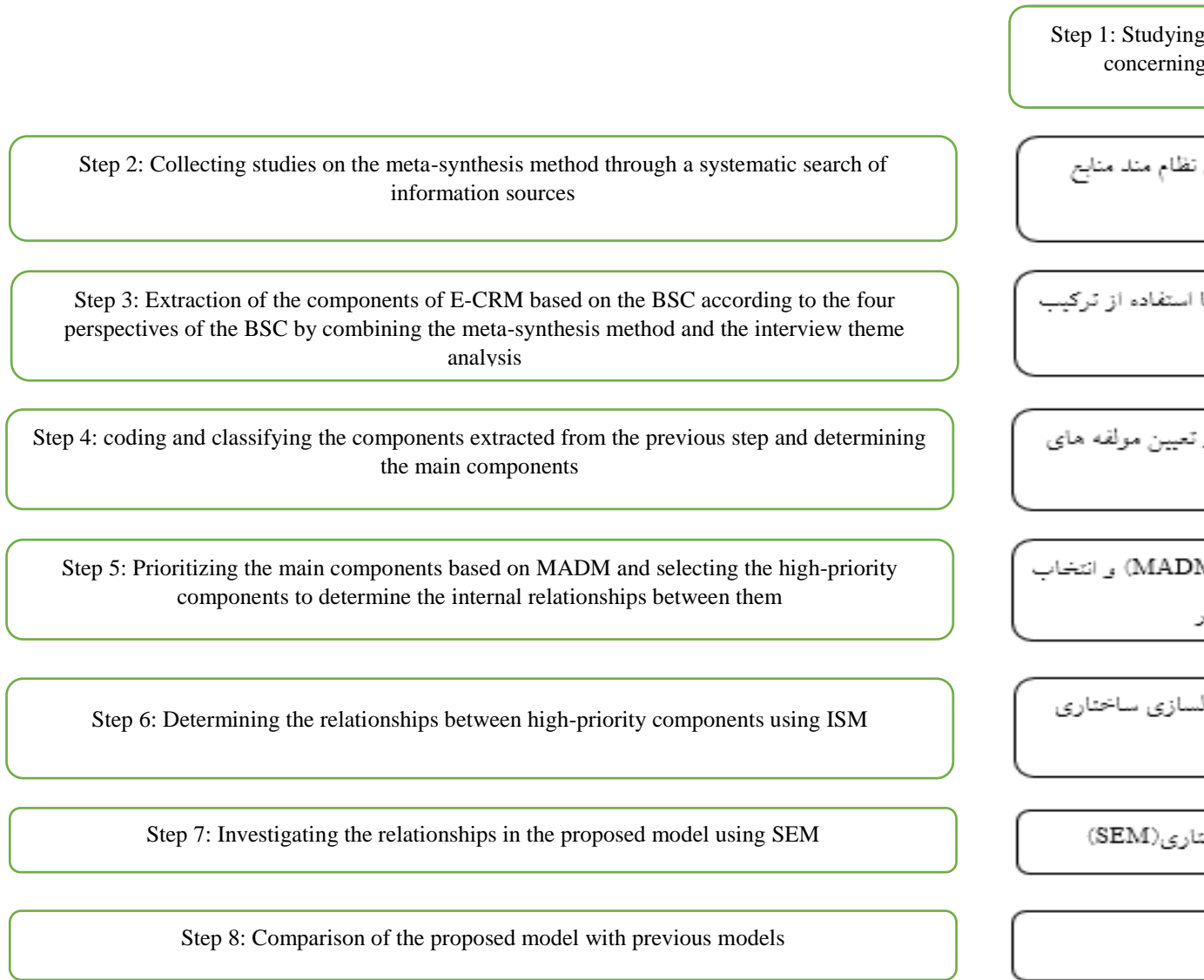


Figure 1. The study flowchart

Results

In the first step, the evaluation components of the E-CRM system were identified using the meta-synthesis method. The table below shows these results.

Table 1. Indicators and concepts of evaluation of E-CRM system extracted from meta-synthesis method

BSC perspective	Codes	Concepts	Categories	Category code	Source code
Financial perspective	Increasing the profit after tax to total operating income The gross ratio of assets of the organization	1. Increasing profit margin 2. Asset value growth 3. Increasing market share	1. Reducing operating costs	M-FC1	1-2-4-8-14
	Increasing profits from online transactions and provide Internet services The use of the information in the database to identify customer transactions and increase sales Increasing public awareness of the brand of the organization Increasing the number of new customers using online services Accelerating the purchase decision for ease of receiving services	4. Increasing the profit from online transactions 5. Increasing the use rate of financial transactions 6. Increasing the volume of transactions 7. Reducing the cost of financial transactions 8. Increasing profits from increasing the number of customers 9. Value-added services	2. Increasing revenue from customer repurchases	M-FC2	3-5-8-12-25-26-27-28-78
Customer perspective	All organizational activities should be to increase customer satisfaction and loyalty.	10. customer retention rate 11. Customer satisfaction 13. Electronic loyalty 13. Rewarding the customer	3. Increasing customer satisfaction	M-CP1	1-3-4-5-7-11-12-14-15-17-19-27-28-38-39-40-41-42-43-44-45-46-47-48-49-50
	Companies need to share and create customer knowledge and anticipate customer needs more. Understanding customer needs and gathering its information in a competitive environment are very important.	14. Customer knowledge	4. Customer knowledge	M-CP2	21
	Providing more and better information on the web to increase information and providing sufficient and complete information to the customer Recording customers' transactions to manage them across communication channels	15. Increasing customer awareness 16. Increase customer experience 17. Increasing customer transactions	5. Customer experience	M-CP3	3-8-9-25-26-78
	The use of face-to-face communication for high quality and high-value transactions	18. Face-to-face communication	6. Customer interaction	M-CP3	78

BSC perspective	Codes	Concepts	Categories	Category code	Source code
	Increasing the speed of service delivery and reducing the customer waiting time for service delivery	19. Timely delivery of electronic service information to the customer 20. Increasing the value of the customer's life cycle	7. Reducing waiting time	M-CP4	3-4-6-14-27-28-31-32-35-68-75
Internal business processes perspective	Developing a service to respond to new customer demands for increasing customer satisfaction Providing appropriate services to reduce process cycle time	21. Advanced services 22. High-speed services	8. Quality of service	M-IP1	1-17
		23. Reducing the cost of support services	9. Reducing the cost of support services	M-IP2	3
	Organizational structure: flat organization, controls, accountability, and independence Business process: process planning, process ownership, process monitoring Continuous improvement: Practices, using customer feedback, openness	24. Structural	10. Organizational structure	M-IP3	38-39-41-42-66
	Ease of access to enterprise services through online services and increase the speed of providing appropriate services. Increasing the use of technology and the Internet	25. Increasing the use of technology by the customer IT experience 26. Increasing the speed in Service delivery 27. Providing pre-sale service One-stop service Providing information on terms of purchase 28. Providing after-sales services 29. Providing during-sale services 30. Ease of customer log in/logout 31. Ease of navigation 32. Innovation in IT 33. Technical support 34. Organizational support	11. Easy access to services	M-IP4	3-9-16-18-25-16-27-28-29-31-36-38-39-64-65-24-21

BSC perspective	Codes	Concepts	Categories	Category code	Source code
	Integration of traditional and new media and channels	35. Technology integration	12. Technology integration	M-IP5	21
	Management efforts to manage business interaction with customers through a combination of technology and business processes that seek to understand the customer.	36. Combining technology and business processes to gain customer understanding	13. Interaction management	M-IP6	31-37
	The use of appropriate programs to improve the site content to provide appropriate information and ease of access to the frequently used parts of the customer	37. Improving site content management 38. Timely warning of weak operational programs 39. Providing relevant information 40. Providing accurate information 41. Data stability	14. Content management	M-IP7	3-8-25-26-68-72-71-69-79-24
	Capabilities of banking hardware equipment	25. Organizational capabilities	15. Organizational capabilities	M-IP8	19
	Equipping electronic channels for marketing, transferring, and rapid feedback of customer complaints to important and main centers	26. Customer retention through the website 27. Sending appropriate SMS and automatic emails to the customer 28. Optimizing customer relationship 29. Integrated marketing channels -30Online forum for discussion	16. Increasing communication channels	M-IP9	3-8-12-15-16-17-18-19-78-28-27-31-32-67-68-69-70
	Customer information system: process, information quality, information use Communication via the Internet: Internet promotion, Internet support, customer assistance, monitoring, customer interactions via the Internet Readiness to provide personal attention and service to each customer	31. Quality of information and services 32. Customer orientation 33. Personalization 34. Empathy	17. Customer orientation	M-IP10	27-28-38-39-49-61-62-63-75-68-69-21
	Online payment security, reliability, and privacy policy	35. Site security 36. Understandable trust	18. Increasing security	M-IP11	20-27-28

BSC perspective	Codes	Concepts	Categories	Category code	Source code
Learning and growth perspective	Variable payments based on the level of performance of employees to improve their performance and increase their skills and abilities	37. Incentive costs 38. Enhancing expertise of staff	19. Staff promotion	M-LaG1	1
	A set of positive and negative responses is defined as a set of factors and an employee's enjoyable emotional state concerning his/her job position, supervisor, job duties, and organization.	39. Organizational culture 40. Organizational strategy 41. Organizational flexibility	20. Employee satisfaction	M-LaG2	29
	Increasing the ease of collecting customer information for better analysis	42. Establishing a comprehensive customer database 43. Updating information	21. Database improvement	M-LaG3	2-16-68-76-77-78
	Market research and analysis Promotion of Services	44. Marketing support function	22. Marketing support	M-LaG4	24
	It is a function of three interactions: (1) ease of use (does the system do what is needed functionally), (2) usability (can users work with the system successfully), (3) User-friendliness (do users feel that the system is appropriate).	45. Easy to use 46. E-learning systems 47. Implementation of virtual systems 48. Infrastructure capabilities (use of telecommunication networks based on telecommunication)	23. Adopting technology	M-LaG5	29
	Leadership: commitment, empowerment, communication Interaction: multi-skill team, work interdependence, common goals Learning: training, willingness to learn, learning to fail	49. Change management	24. Change management	M-LaG6	38-39-42-53-55-56-57-58-59
	The use of information from customer activity on web pages to learn how to get customer feedback Increasing and strengthening the openness of employees to gain experience	50. Organizational learning	25. Organizational learning	M-LaG7	3-8
	Providing fast and convenient online services	51. Enhancing brand image quality	26. Brand image quality	M-LaG8	3

BSC perspective	Codes	Concepts	Categories	Category code	Source code
	enhances the organization's brand image quality and reputation.				
	Accessing to target customer information and increasing the number of customers Understanding the customer, and accurate analysis of customer information	52. Accurate determination of the target market 53. Identifying basic customer needs	27. The target market	M-LaG9	3-5-7-18-31-34

Step 2: Identifying the indicators from the perspective of experts using content analysis

In this method, a semi-structured interview with an exploratory approach was used. For this purpose, key experts of the E-CRM system of the bank were identified and 5 of them were interviewed. The questions were designed to identify the indicators associated with the electronic customer relationship management system. After each interview, the data collected in Word format were entered into MAXqda software and coded for analysis. In the 5th interview, the data was saturated and the interview was stopped. The concepts and categories resulting from this step can be seen in the table below.

Table 2. Interview codes

Raw	Concepts	E_CRM categories	Indicator code	BSC dimensions
1	The customers of the branch are known by the number of visits to the branch, the number of their activities, and the number of services provided to them. Customers are monitored and ranked based on various elements according to the systems that the bank has and provides. This ranking was done according to the customers' balances in the bank.	1. Creating integrated customer databases	C- LaG1	Learning and growth perspective
2	The bank has merely differentiated the category of customer resources and placed customers in four levels: first-ranked customers, second-ranked customers, third-ranked customers, and fourth-ranked customers. Customers with a percentage of resources rank first, customers with a 0.1 of resources rank second, those with 0.01 rank third, and the rest rank fourth.	2. Improving knowledge process training	C- LaG2	
3	Training managers and employees to increase expertise in financial, industry, business, and web-based information issues	3. Strengthening and creating a customer rating system	C- LaG3	
4	The customers of the branch are known by the number of visits to the branch, the number of their activities, and the number of services provided to them. Customers are monitored and ranked based on various elements according to the systems that the bank has and provides. This ranking was done according to the customers' balances in the bank.	4. Increasing customer satisfaction	C- CP1	Customer perspective

Raw	Concepts	E_CRM categories	Indicator code	BSC dimensions
5	Customers are more willing to increase the amount of money they can transfer from their accounts to other accounts. However, this is not possible at the moment due to the restrictions imposed by the central bank. Customers need to spend less time in monetary and banking exchanges and transactions in the shortest possible time in a context that makes these transactions easier and ensures increased network security.	5. Increasing transfer volume and security	C- CP2	
6	E-CRM increases customer interaction with the bank and creates their ranking.	6. Increasing customer interaction	C- CP3	
7	The use and launch of E-CRM have a very positive effect on retaining great customers as well as increasing the number of customers and profitability.	7. Retaining and creating great customers	C- CP4	
8	E-CRM will reduce operating costs and customer visits to branches	8. Reducing operating costs	C-FC1	Financial perspective
9	The use and launch of E-CRM have a very positive effect on retaining great customers as well as increasing the number of customers and profitability.	9. Increasing revenue from customer repurchase	C-FC2	
10	The bank should design a web-based site where the customer can more easily search and obtain information in the web-based site space with more motivation.	10. Increasing customer presence on the web	C- IP1	Business perspective
11	The bank should design a web-based site where the customer can more easily search and obtain information in the web-based site space with more motivation. E-CRM will reduce operating costs and customer visits to branches.	11. Reducing customer repeated requests	C- IP2	
12	E-CRM will reduce operating costs and customer visits to branches	12. Reducing visits to branches	C- IP3	
13	By creating a positive mindset in employees and encouraging them to communicate effectively with the customer, the bank should provide the basis for increasing the speed of complaint handling.	13. Increasing the speed of handling complaints	C- IP4	
14	The rules of the system must be defined and customers must be trained because they must understand the meaning of each other's behavior, that is, they must not go against the rules of the customer bank. Also, the bank should not go against the wishes of the customer. These must be clear and transparent.	14. Redefining system rules based on customer feedback	C- IP5	
15	Like facilitation services, these services should be considered as additional services that complement other banking operations.	15. Providing a platform for support services	C- IP6	

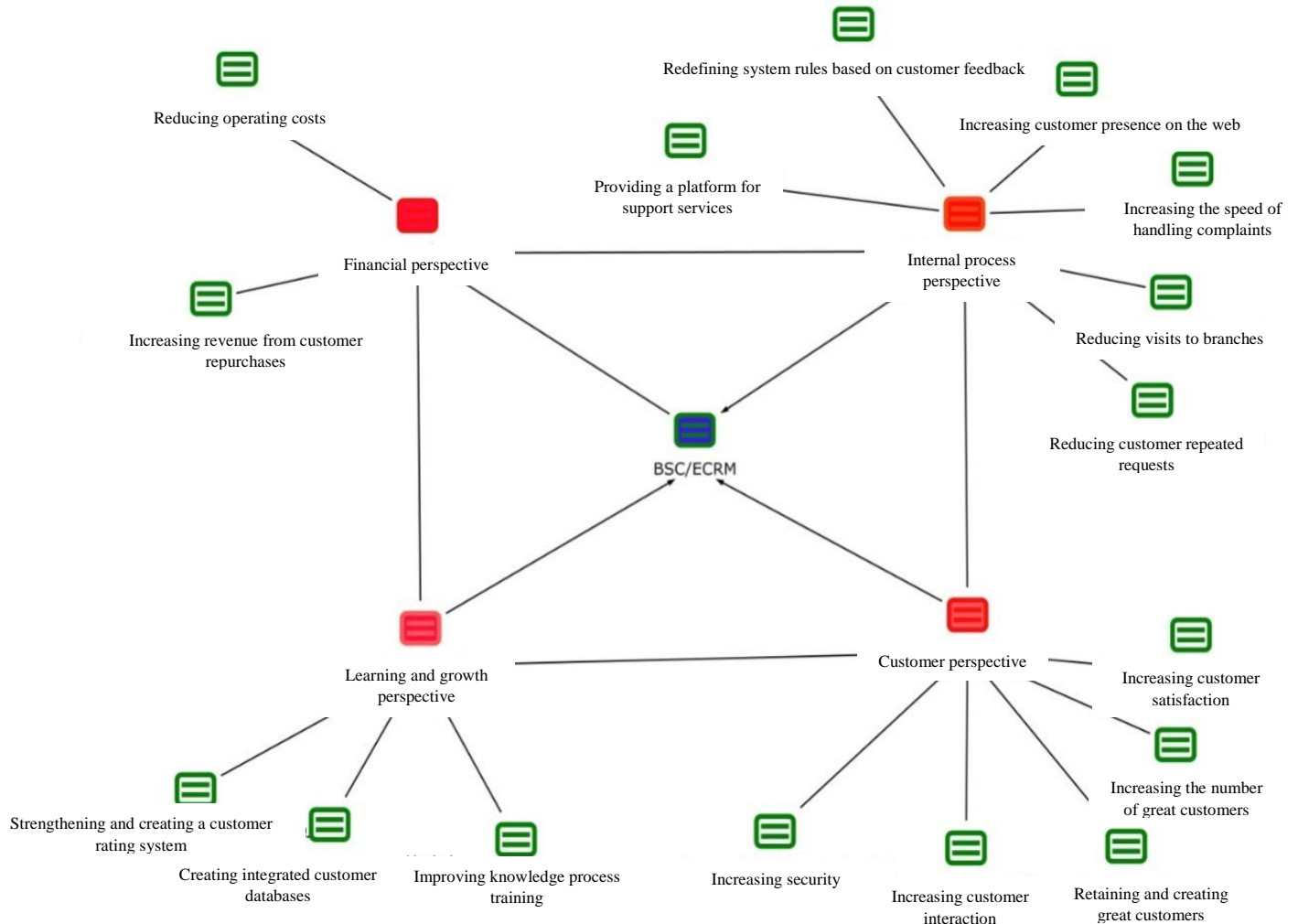


Figure 2. The MAXqda software output

Step 3: Combining the initial indicators of the two methods and determining the final list of indicators

In two qualitative steps, these indicators were extracted through meta-synthesis and content analysis, and a list of 31 variables was obtained after comparing and putting them together. The final list of components extracted from both methods is shown in Table 3.

Table 3. Extracted indicators of the CRM system from the BSC perspective in the qualitative part

BSC perspective	Indicator code	Final components
Financial perspective	FC1	Reducing operating costs
	FC2	Increasing revenue from customer repurchase
	CP1	Increasing customer satisfaction

BSC perspective	Indicator code	Final components	
Customer perspective	CP2	Customer knowledge	Customer knowledge
		Customer experience	
	CP3	Reducing waiting time	
	CP4	Increasing customer interaction	Customer interaction
		Retaining and creating great customers	
CP5	Increasing transfer volume and security		
Internal process perspective	IP1	Increasing customer presence on the web	
	IP2	Reducing customer repeated requests	Reducing customer repeated requests
		Reducing visits to branches	
	IP3	Increasing the speed of handling complaints	
	IP4	Redefining system rules based on customer feedback	
	IP5	Providing a platform for support services	
	IP6	Reducing the cost of support services	
	IP7	Quality of services	
	IP8	Easy access to services	
	IP9	Technology integration	
	IP10	Content management	
	IP11	Organizational capabilities	Organizational capabilities
		Organizational structure	
	IP12	Increasing communication channels	
IP13	Customer orientation	Customer orientation	
	Interaction management		
IP14	Increasing security		
Learning and growth perspective	LaG1	Creating integrated customer databases	
	LaG2	Improving knowledge process training	
	LaG3	Strengthening and creating a customer rating system	
	LaG4	Staff promotion	Staff promotion
		Employee satisfaction	
	LaG5	Database improvement	
LaG6	Marketing support		

BSC perspective	Indicator code	Final components	
	LaG7	Adoption of technology	
	LaG8	Change management	Organizational learning
		Organizational learning	
	LaG9	Brand image quality	
	LaG10	Target market	

After identifying the components using meta-synthesis and content analysis techniques and receiving the output of Maxqda software, the main factors were classified and extracted using exploratory factor analysis (EFA) and principal component analysis (PCA) due to a large number of extracted components.

Extraction of principal components by the PCA method

The PCA method reduces the dimensions of all observations based on the combined indicator and classification of similar observations. The final components after eliminating the weak factors can be seen in Table 4.

Table 4. The principal factors extracted from the BSC perspective

BSC perspective	Indicator code	Principal components	Factors	
Financial perspective	IR	Increasing revenue	Reducing operating costs	
			Increasing revenue from customer repurchase	
Customer perspective	CS	Customer satisfaction	Increasing customer satisfaction	
			Customer knowledge	Customer knowledge
			Customer experience	
			Reducing waiting time	
			Increasing customer interaction	Customer interaction
			Retaining and creating great customers	
			Increasing transfer volume and security	
Internal process perspective	CO	Support for customer-centric processes	Increasing customer presence on the web (IP1)	
			Reducing customer repeated requests	Reducing customer repeated requests (IP2)
			Reducing visits to branches	
			Increasing the speed of handling complaints (IP3)	
			Redefining system rules based on customer feedback (IP4)	

BSC perspective	Indicator code	Principal components	Factors	
			Providing a platform for support services (IP5)	
			Reducing the cost of support services (IP6)	
			Quality of services (IP7)	
			Technology integration (IP9)	
			Customer orientation	Customer orientation (IP14)
			Interaction management	
	OC	Organizational capabilities	Easy access to services (IP10)	
			Increasing security (IP11)	
			Content management (IP12)	
			Organizational capabilities	Organizational capabilities (IP13)
Organizational structure				
Learning and growth perspective	OL	Organizational learning	Improving knowledge process training (LaG2)	
			Strengthening and creating a customer rating system (LaG3)	
			Staff promotion	Staff promotion (LaG4)
			Employee satisfaction	
			Database improvement (LaG5)	
			Marketing support (LaG6)	
			Change management	Organizational learning (LaG8)
			Organizational learning	
	Brand image quality (LaG9)			
	AM	Adopting technology to achieve the target market	Target market (LaG7)	
			Adoption of technology (LaG0)	

Accordingly, the financial perspective and the customer perspective entered the next phase of the study with only one principal component, the internal process perspective, and the learning and growth perspective with two principal components and, finally, 6 principal components entered the next phase (table below).

Table 5. The principal components of the BSC to enter the ISM phase

BSC perspective	Component code	Principal components
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Financial perspective	IR	Increasing revenue
Customer perspective	CS	Customer satisfaction
Internal process perspective	CO	Support for customer-centric processes
	OC	Organizational capabilities
Learning and growth perspective	OL	Organizational learning
	AM	Adopting technology to achieve the target market

Step 5: Evaluating the model of indicators using SEM

Review the general model

Before evaluating the proposed structural model, the significance of regression weight (factor loading) of different constructs of the questionnaire in predicting the relevant items should be checked to ensure the fit of measurement models and the acceptability of their indicators in measuring structures. This was done using the CFA technique and PLS software. Each measurement model was then examined separately, and the overall measurement model was examined. Figure 3 shows the results of CFA for the questionnaire items.

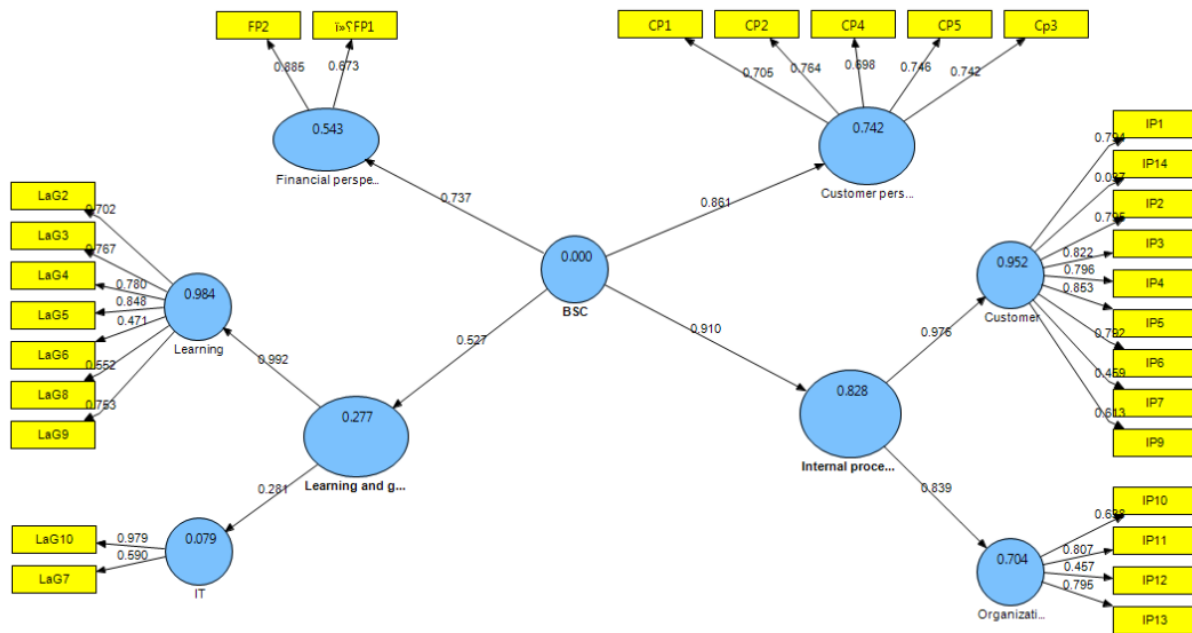


Figure 3. Measurement model

As shown in the figure above, the factor loading of all items except item 14 from the internal process perspective concerning the customer-oriented factor (IP14 = 0.037) was higher than 0.4. So, only this item was excluded from the model and questionnaire.

Investigating the fit of measurement models

A) factor loading coefficients

Factor loadings are calculated by calculating the correlation value of the indicators of a structure with that structure. The value of 0.4 for these coefficients confirms that the variance between the structure and its indicators is greater than the variance of the measurement error of that structure and that the reliability of the model is acceptable (Davari and Rezazadeh, 2013). The values of the factor loading coefficients can be seen in Figure 4, so the reliability of the measurement model is acceptable.

B) Cronbach's alpha and combined reliability

According to the PLS algorithm, after factor loading measurement, Cronbach's alpha coefficients and combined reliability of structures, which expresses the ratio of the variance between each structure and its indicators to the variance of the whole structure (variance of each structure with its indicators plus the variance of measurement error), are reported. A reliability coefficient higher than 0.7 is known as an acceptable value. According to the table below, all factors have an acceptable combined reliability coefficient. Cronbach's reliability coefficient is also acceptable in all factors, and it can be concluded that the questionnaires are reliable. The combined reliability coefficient has an acceptable value for all factors, indicating the appropriate reliability of the model.

Table 6. Questionnaire reliability coefficients

Subcomponents	Number of questions	Cronbach's alpha	Combined reliability
Increasing revenue	2	0.701	0.7607
Customer satisfaction	5	0.784	0.742
Customer orientation	9	0.883	0.909
Organizational capabilities	4	0.726	0.775
Organizational learning	7	0.824	0.871
Adopting technology to achieve the target market	2	0.783	0.779

Structural model fit

According to the data analysis algorithm in the PLS method, it is time to fit the structural model after fitting the measurement models. In this section, the significance coefficients t, R Squares criterion, and Q2 criterion are used to fit the structural model and are examined below.

Significance coefficients t

The significance of all relationships between variables must be confirmed to examine the existence or non-existence of relationships between variables. For this purpose, the t-value of all paths must be greater than 1.96 at the 95% confidence level, and this is a reason to reject the null hypothesis. If these values are greater than 1.96, the relationship between the structures is significant at the 95% confidence level¹. It should be noted that t-values show only the significance of the relationships rather than their intensity (Davari and Rezazadeh, 2013).

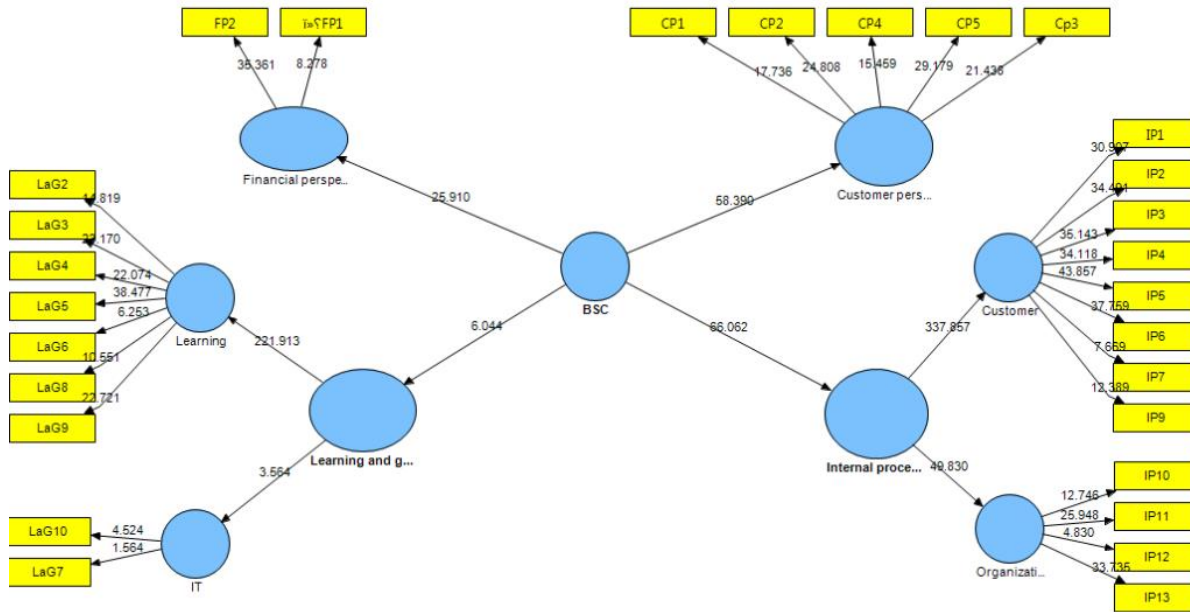


Figure 4. t-values

Based on the above figure, the significance level t is determined in all paths of the model, and in a path with a t-value of greater than 1.96, the relevant hypothesis is confirmed, and, otherwise, rejected. Therefore, all communication paths in the model are confirmed.

R Squares criterion

These values are given for each of the endogenous variables in the table below.

Table 7. R² value

Endogenous variables	Financial perspective	Customer perspective	Internal process perspective		Learning and growth perspective	
R ²	0.543	0.742	0.828		0.277	
Endogenous variables	Increasing revenue	Customer satisfaction	Customer orientation	Organizational capabilities	Organizational learning	Adoption of technology
R ²	0.543	0.742	0.952	0.704	0.992	0.079

¹ Significant values at the 95%, 99%, and 99.9% confidence levels are 1.96, 2.58, and 3.27, respectively.

Chin (1998) introduced 0.19, 0.33, and 0.67 as the criterion values for weak, medium, and strong values (Delavari and Rezazadeh, 1392, 91-92). According to these values, the R^2 value was evaluated as strong for all variables except for the learning and growth perspective ($R^2 = 0.277$) which was medium.

Q² criterion

Q² value must be calculated for all endogenous structures of the model. If this value is zero or less for an endogenous structure, the relationships between the other structures and that structure are not well explained and, as a result, the model needs to be modified. Hensler et al. (2009) determined the values of the predictive power of the model for endogenous structures as 0.02, 0.15, and 0.35, indicating low, medium, and strong values, respectively (Davari and Rezazadeh, 2013, 96). Q² values for all endogenous variables are given in the table below.

Table 8. Q² values

Endogenous variables	Financial perspective	Customer perspective	Internal process perspective		Learning and growth perspective	
Q ²	0.263	0.372	0.448		0.297	
Endogenous variables	Increasing revenue	Customer satisfaction	Customer orientation	Organizational capabilities	Organizational learning	Adoption of technology
Q ²	0.353	0.372	0.432	0.334	0.422	0.372

Step 6: Determining the relationship between the indicators using ISM

Here, the steps for determining the variables are obtaining the structural self-interaction matrix (SSIM), forming the initial access matrix, adapting the access matrix, determining the level of the variables, and forming the conic matrix. They were not mentioned for summarization. In the last step, i.e. drawing the relationships, the following figure was obtained.

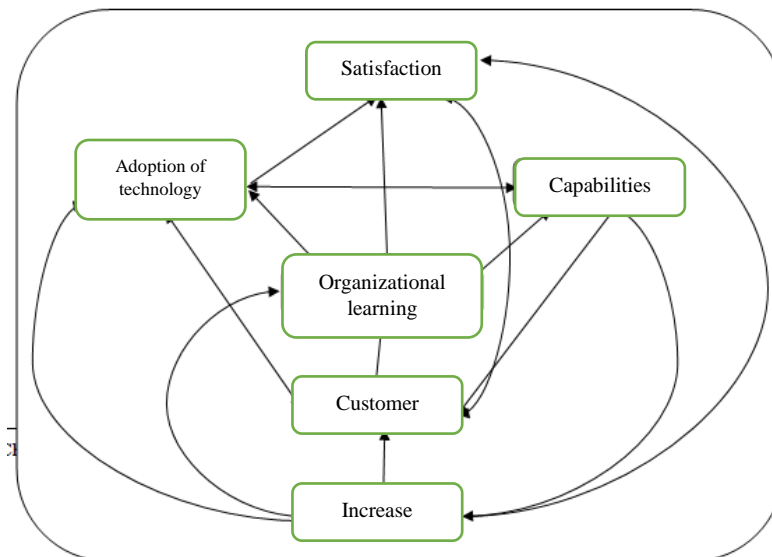


Figure 5. ISM graph

As shown in Figure 7, the ISM graph shows the interrelationship and influence between the criteria and the relationship between the criteria at different levels. This graph helps to gain more understanding for making decisions. The fifth or last level criteria (which make up the bottom of the graph) have the greatest effect on the system, and as they change, the system changes. This factor is "increasing revenue ". On the other hand, the first level criterion, which is the highest part of the graph and includes "customer satisfaction", is dependent on other system factors and has less effect. Knowledge of how the relationships between the criteria and how they are placed in a sequence, provides a better understanding of the conditions for the evaluation criteria of the E-CRM system based on the BSC.

Step 7: MICMAC analysis

Influence and dependence of each variable are required to place the variables in the table of coordinates of influence and dependence power (Table 9).

Table 9. Influence and dependency table

Criteria	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	Influence
X ₁	1	1	1	1	1	1	6
X ₂	0	1	1	0	1	0	3
X ₃	0	1	1	0	1	1	4
X ₄	1	0	1	1	0	1	4
X ₅	1	1	0	1	1	1	5
X ₆	1	1	1	1	1	1	6
Dependence	3	5	5	4	5	5	

The coordination table was then formed based on influence and dependence. Variables were calculated by influence and dependence.

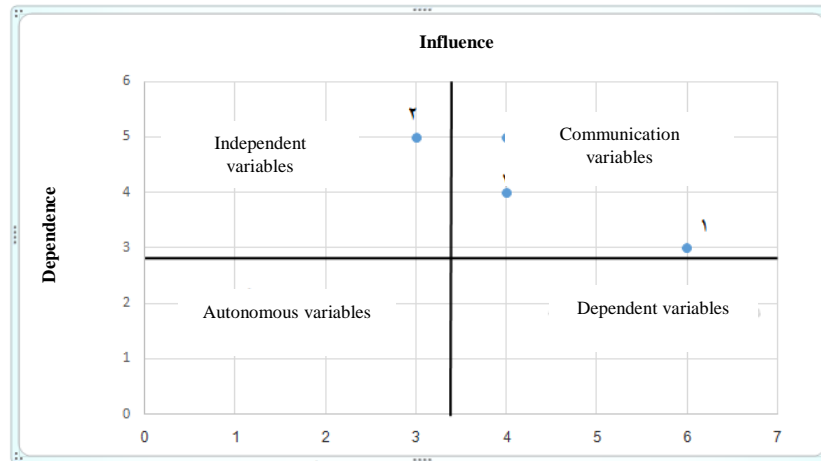


Figure 6. Influence and dependence graph

As can be seen in the figure above, the variables customer orientation, organizational learning, organizational capabilities, adoption of technology to achieve the target market, and increasing revenue have high influence and dependence and are considered communication variables that in addition to affecting other variables are also affected by them. For this reason, they must be considered in decision-making. Customer satisfaction has a high dependency and low influence, indicating that it is more dependent on other variables. Therefore, its selection is affected by other variables and is considered a dependent variable.

Step 7: Determining the weight of the indicators using Shannon's Entropy and ranking

The weights of the indices were calculated using Shannon's Entropy. Entropy is a very important concept in social sciences, physics, and information theory. The idea of this method is that the greater the dispersion in the values of an indicator, the more important that indicator is.

Table 10. Calculation of weights

	w_{ij}
Financial perspective	0.0288
Customer perspective	0.1393
Internal perspective	0.76075
Learning and growth perspective	0.07097

Introducing the sets

Table 11. Set of perspectives

Financial perspective	M₁
Customer perspective	M₂
Internal process perspective	M₃
Learning and growth perspective	M₄

The set of options is displayed with X_i and weights with W_j .

Component ranking by fuzzy TOPSIS method

The values a, b, and c were obtained to obtain the fuzzy decision matrix according to the degree of importance that the interviewees stated for each of the questions. At this stage, the scale-less decision matrix, the weighted decision matrix, the fuzzy ideal solution, the similarity index, and ranking were calculated, with only the ideal and anti-ideal solution table, similarity index, and ranking listed for brevity.

Table 12. Fuzzy ideal and anti-ideal solutions, similarity index, and ranking

BSC perspective	S^*	S^-	Similarity index	Ranking
Financial perspective	0.04	0.11	0.7160	2
Customer perspective	0.256	0.49	0.6558	4
Internal process perspective	1.256	2.729	0.6848	3
Learning and growth perspective	0.091	0.271	0.7481	1

As can be seen in the table above, the highest priority was related to the learning and growth perspective, financial perspective, internal process perspective, and customer perspective, respectively, based on the fuzzy TOPSIS technique in the E-CRM system and the BSC perspective according to experts.

Conclusion

In this study, the indicators and variables of the E-CRM system were first extracted from the literature based on the four aspects of BSC using the meta-synthesis method. At this stage, 27 indicators were identified. In the next step, the experts were interviewed to find other possible components and indicators that were not identified by reviewing the literature. At this stage, the content analysis method was used and 15 new categories were identified. In the third stage, the indicators identified from meta-synthesis and content analysis methods were combined and, as a result, 31 indicators or variables were identified. In the fourth stage, important indicators were classified and determined using the PCA method. In the next step, the structural model and the

relationships between the model variables were plotted. In the next step, the relationship between the final indicators was determined by the ISM technique using the six variables of PCA. The results of this stage suggested that the variables customer orientation, organizational learning, organizational capabilities, adoption of technology to achieve the target market, and revenue growth had high influence and dependency and were considered communication variables. Moreover, the variable customer satisfaction had high dependency and low influence, indicating that it was more dependent on other variables. Therefore, its selection was influenced by other variables, and it was considered a dependent variable. In the last step, the BSC perspectives in Bank Mellat's E-CRM system were ranked using the fuzzy TOPSIS technique. According to the results, the following recommendations are provided now:

- The use of up-to-date technologies: According to various studies, up-to-date technologies play an important role in this field. Appropriateness of technology for an organization means that the technology is appropriate to the needs and scope of the organization and its customers and can be developed with the development of the organization. Up-to-date and appropriate technologies are recognized as one of the most important factors affecting the development of E-CRM. E-CRM will not be very effective without the support of IT and, in particular, web-based technologies. Therefore, Bank Mellat executives and similar organizations are recommended to pay attention to IT infrastructure, and in particular, web-based technologies, before developing any type of system in their organization. Constant updating of these technologies can save companies from security and non-security problems. It is also recommended that the used technologies be customized according to their type of activity. Using only the best hardware and software technologies does not guarantee the success of the deployment, but their compatibility with the characteristics of these companies along with their up-to-dateness guarantees a part of the success.
- Implementing knowledge management and information sharing systems plays an important role in the successful development of an E-CRM system. Knowledge management plays an important role in the successful establishment of E-CRM. By utilizing all dimensions of knowledge, including the acquisition, application, distribution, dissemination, storage, and, ultimately, preservation, knowledge management can combine these dimensions with the components considered in E-CRM and make the most of the customer database by creating a kind of synergy.
- Training and preparation of human resources play an important role in the development of the E-CRM system. Establishing E-CRM requires huge investments in training and preparation of human resources. The importance of human resources in the success of projects, especially CRM projects, is obvious to everyone today. Since the human resources of the organization are closest to the customer, they play a vital role in its satisfaction and loyalty to the extent that they are considered the front line of the organization in resources. Although skilled and trained human resources play an important role in the successful implementation of E-CRM, this role is less considered by managers of organizations. So, it is recommended that special attention be paid to human factors (such as training, development, and empowerment) in the implementation of organizational systems,

including E-CRM in addition to IT-related hardware and software factors. These systems will not be very efficient regardless of the human factor.

- Interaction with key customers is another important factor. This interaction indicates the importance of key customers in the establishment of organizational systems, including the E-CRM system. Paying attention to principles such as the 80/20 rule also confirms this. Thus, the rule of 20% of a company's customers, which form the same key customers, makes the company 80% profitable. Therefore, organizations and, here, Bank Mellat are suggested to interact more effectively with their key customers, both corporate and non-corporate customers, and rely on the components they consider for designing and developing their communication system. In CRM, it should be attempted to identify, attract, and maintain the most beneficial customers. Focusing on key customers involves the attention of the organization to customers, providing superior services to them, and creating value-added for them through customized services. In this regard, it is recommended that customer behavior is understood and analyzed to maximize customer value.

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