Proposing a banking model in the customer service sector through social networks using the beyond-integrated approach and fuzzy AHP technique

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Abstract

The main purpose of this study is to shape, design and present a model that can be used to develop the level of customer service through social networks in the banking system. For this purpose, a large part of the mentioned structures was extracted using the ultracomposite method. Therefore, in the first step, an extensive search was conducted among various sources (including books, book summaries, periodicals, case studies, doctoral dissertations, etc. based on keywords) and more than four hundred sources were collected. Then, by separating the categories, themes and coding, using qualitative data analysis software, the results will be extracted and finally, multiple structures will be extracted to compile the model. In the following, by using "content validity indices and content validity ratio", the validity of the desired measures was measured by the opinions of the experts and then with the limited use of questionnaire items, the reliability of the items that make up the functional structures, as well as the reliability of the questionnaire tool (alpha Cronbach's) calculation and the result was 0.89.

Keywords: banking, technology management, social network, customer oriented
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1 Introduction

Providing better services to customers is one of the most important goals of banks and financial institutions for attracting customers. In recent years, banks have used various statistical methods to measure the quality of their services to customers. If we accept that banks owe a significant portion of their success to focusing on new businesses, it can be argued that new approaches are needed for banks to have a banking model in the customer service sector. With the increasing proliferation of banking services, the importance of stable banking infrastructures, their accessibility, the provision of round-the-clock payment services 7 days a week, the quality of banking services, and innovation in providing services that can meet customer needs have increased. Given that the country's banking

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network is currently centralized, the interaction between banks, internal communications, and the mutual influence of various system components on the stability of payment systems is effective and causes instability to occur in a harmful way, targeting customer satisfaction. Factors such as lack of accessibility and instability in banking payment services, as well as financial stress and costs, are undeniable and create and increase financial disparities in society. Urban travel and in-person visits to banks result in double the costs for both citizens and banks. One of the common methods for examining the quality of services in various industries and the economy is to examine customer behavior patterns [1].

Banks are under the influence of changes caused by globalization and financial liberalization, and in response to these changes, banks are expanding their services to customers. While competition for banking services has increased. Yee-Loong Chong et al. [14], social media-based banking has now become a necessity for banks, and Iranian banks need to launch these services as soon as possible. Banks, as service providers to different social groups, can benefit from this platform, which has a high penetration rate among different layers. However, this presence on social media comes with challenges and issues, each of which requires its own discussion and investigation. Generally speaking, the necessity of serious planning by banks at a macro level for official presence on social media, the necessity of advertising, and the exploitation of information and public taste measurement can be mentioned. The important role of bank employees, on the one hand, and their loyal customers in promoting bank brands on social media, is undeniable, and in current conditions, the provision of services through social media is important for citizens.

In the age of customer orientation, survival, and maintaining competitive positions with less reliance on traditional marketing tactics, understanding the role of technology in forming the market space, and, most importantly, using social media as part of marketing tools has become a strategic need [6]. If we accept that banks owe a large part of their success to attention to new businesses, we can say that new approaches are needed for banks to have a banking model in providing services to customers.

In the field of financial technology (fintech), we also observe such phenomena. Emerging fintech businesses are emphasizing social circles as concentrated groups of clients, striving to manage financial relationships among individuals in these networks smoothly and act as facilitators in this field, focusing not only on verbal, telephone, textual, visual, and other forms of communication but also on peer-to-peer financial relationships within a social network. In this research, using qualitative research methods to examine effective relationships within social circles, we identify dependable and influential factors in designing social banking systems in the customer service sector through social media, and by presenting a model, we determine the importance and impact of these factors.

2 Literature review

Social networks, a term coined by John Barnes in [2], who worked in the field of social anthropology, were invented. Barnes was conducting research on social groups in a part of Norway and used the term "social network" to describe the relationship between individuals and analyze their communication mechanisms and decision-making processes. If we refer to Barnes' definition of social networks (1954), we can say that social networks are created when "a structure of related nodes" is formed. Each node represents an individual, group, or organization [2].

From family and kinship communication to business market communications, traditional interactions in all sectors developed rapidly into online social networks with the advent of the Internet, and its widespread adoption keeps growing at the moment. It is also important to note that user interactions in social media are a key factor in marketing. Social media provides various values for companies such as increasing credibility and brand name recognition, facilitating verbal communication, increasing company sales, sharing business-related information, providing a type of social support for consumers, and in addition, grouping individuals by social media provides common values for consumers and has positive effects on consumer confidence in the company [10].

Organizational social networks that are exclusively formed on the bank's domains or on the web and intranet (internal internet) are an acceptable option that banks can use to differentiate themselves from their competitors. The method of customer service by using social media is described below.

1. Handling Complaints: In order to enhance the popularity of our brand on social media, we must pay attention to not neglecting the priority of responding to complaints and addressing their needs as quickly as possible.
2. Increased Customer Interaction for Brand Loyalty: We should avoid posting irrelevant and non-useful content on social media as it can tire customers. We should instead use popular social networks such as Twitter and Facebook and engage in two-way interaction with our users. Focusing on this approach can help us stay ahead of our competitors.

3. Educating Our Customers: We should be present online on social media to provide education to our customers. This method can generate income, promote good feelings among customers, and increase customer satisfaction.
4. Attention to Customer Suggestions: After seeing a complaint from a customer, we should seek a solution to resolve the issue. This can create a sense of security and trust among our customers. By focusing on the resolution of problems, we can attract more attention to our business [13].

Fisher [8] was the first to propose the idea of concentrating on customer groups. He suggested a model of customer typology and subsequently concentrated the groups. In this typology, he presented examples of insurance and banking industry customers and categorized them into different groups based on factors such as the prospect of progress and financial status, ability to pay debts, risk of dealing with the customer, the kind of value chain that comes with the transaction with the customer, and more. The credibility of each group of customers was first validated in the United States in 1980 based on David Rand's model and later completed using Fisher's pattern. Zabkowski [15] demonstrated the application of the RFM method in identifying customer behavior in communication systems that are on the verge of bankruptcy. This model is now highly utilized in American banks. In Abiodun's [1] research, customer satisfaction and performance in the bank's service system were measured using linear and nonlinear mathematical models. Customers were assigned to the queue system based on their level of importance, allowing unnecessary delays to be prevented.

Abiodun [1], in a study, explored the predictive factors of customer behavior in banking services by examining the factors shaping customer needs, the formation of customer identity, and how customers interact with service providers. He concluded that service companies expect to gain customer lifetime value through loyalty by providing benefit-focused and pleasure-oriented services and establishing quality relationships with their customers. Previous research has often examined the relationship between service quality and the quality of the relationship with customer loyalty separately (especially in the online environment). While many marketing principles remain constant each year, the marketing tools used by businesses to achieve success vary greatly from year to year. Newspaper advertising used to be commonplace. Now, digital advertising and artificial intelligence play an important role in marketing tactics for businesses. Some of these technological advancements are usually used among larger companies, but small businesses can learn a lot from the marketing strategies used by larger companies. Business Daily spoke to marketing experts to learn which marketing trends small businesses can use in 2021 [5].

Social media is evolving faster than the marketing industry can keep up with, with changing algorithms, new advanced features, and a constant stream of updates making it difficult to stay on top of the latest social trends. However, this doesn't mean that being aware of these trends is impossible. Goi [9] has investigated the factors affecting the development of electronic banking in Malaysia, revealing that the low cost of computers and communication devices has encouraged customers to use electronic banking, and banks that cannot meet their customer's needs risk losing a significant portion of their business in the next 5 to 10 years. Chae and Ko [4] examined customer social participation in network services and its impact on the value of global fashion brands. Their social network service (SNS) research shows that the relationship between customer motivation in these services and social participation is always positive.

Enda et al [7] presented a framework for marketing social network banking, which focuses on creating value for customers, the type of social networks, stakeholders, social network marketing content, and social marketing activities. Masuabi and Erasmus [12] investigated innovative social media services in retail banking in South Africa, revealing that social media is a viable option for banks to differentiate themselves from competitors. The main function of social media for banks is as a marketing and advertising tool that provides information to customers to encourage them to visit branches or advertise their services. However, as mentioned, social media is not only a marketing tool but also offers many opportunities for customer engagement that are not available in other media.

3 Research methodology

The present study is descriptive-exploratory in terms of goals, applicability, and method of data collection. To conduct this research, after conducting library studies, searching various sources, and determining the model, a call was made to all experts at the national level, especially in the provinces of Isfahan and Tehran, to provide their opinions on the internal (strengths and weaknesses) and external (opportunities and threats) factors affecting the banking services and social networks in the country.

From the implementation point of view, this study is carried out in three general stages (model design, model validation, and model testing). In fact, the model is designed using a qualitative method, and then a panel of experts is used to validate the obtained model. Finally, the validated and accredited model is tested to follow an action-oriented and density-oriented research approach in two fields and executive areas. Therefore, in each of the three stages of the study, the following quantitative and statistical methods are used:

1. Model construction (synthesis) stage: The qualitative approach, conceptual typologies (phenomenology), empirical typologies (taxonomy), as well as limited use of cognitive and content data available in this field, will be used in the analysis and methods used in this stage.

2. Model validation stage (validation of the operational quality of conceptual models): To use the density-oriented and action-oriented approach in research, which will be presented using a mixed (qualitative and quantitative) method, a panel of experts is asked to compare and answer the items and matrix of the questionnaire by comparing the various factors and aspects of the presented model (different strategies) with criteria and patterns derived from experiences, cognitive data, etc. Then, with the emphasis on the qualitative content of the survey data obtained from the expert panel, the qualitative data analysis software is used to analyze and prepare an extensive report on the validation of the conceptual model, as well as present validity indices of the model (such as Cohen's Kappa and Fleiss' Kappa), which are indices used to measure agreement among rates and full rates. These indices confirm or reject the operational quality of the conceptual model. It should be mentioned that one of the objectives, approaches, and tools of this research (which is very important in study design and planning) is the use of the expert method for weighting and final selection of strategies at the banking and customer service level through social networks.

3. Next, we will move on to one of the most sensitive stages of this research, which is the analysis of pattern deviations. The goal of this stage is to compare the conceptual model with all its related features with various real government and public sector companies. Essentially, the expert group, recognizing that the model must be prepared for the final stage (testing and validating the model), will use a method called pattern deviations, which have significant use, particularly in cluster analysis and mixed and qualitative approaches, where typology and taxonomy are performed. They will search for optimal categories in real-life samples and analyze and investigate the use of these ideal categories (ideal samples) in the real world (in banking and customer service through social networks). The aforementioned three stages will be examined and compared in detail in the following.

The research population will include managers, experts, and members of the board of directors of banks, managers of the Ministry of Communications and Information Technology, the Radio Regulations Organization, managers of the field, members of the academic faculty of management and social sciences, and universities' faculties who are familiar with banking services, social networks, virtual space, and regulations and policies in the internet, virtual space, and related areas, who will be targeted for selection.

The snowball sampling method will be used by experts to develop the structure and variables of the research model for providing banking services through social networks. In this method, the researcher asks the first participants, who are usually selected through an easy method, to introduce other individuals who have relevant experiences and opinions in the field of study, if they know any. Qualitative content analysis is used to analyze the gathered data in the qualitative section, while descriptive statistical methods such as the mean, percentage, and frequency distribution table, and inferential statistical methods such as cluster analysis, Smirnov-Kolmogorov test, and confirmatory factor analysis are utilized in the quantitative section.

Then, 120 identified strategies from the qualitative meta-synthesis process were combined and merged in a panel of 25 experts from the Ministry of Communications and Information Technology, including managers, deputies, and specialists from Tehran and Isfahan provinces. Duplicate and repetitive opinions with common meanings were removed to finally identify 5 strengths, 5 weaknesses, 5 opportunities, and 5 threats. A researcher-made questionnaire with 20 identified items in the relevant field was used to identify internal and external factors affecting banking services and social networks in the province. Content validity was confirmed by experts in the field, and reliability was obtained with a Cronbach's alpha of 0.89.

In this stage, the weight of each indicator and its ranking were calculated using the analytic hierarchy process (AHP), which is one of the subset methods, in comparison to other methods. For this purpose, a MasterAHP software-compatible questionnaire was designed and distributed to relevant experts and professionals across the country and university professors. All indicators were compared pairwise using the fuzzy two-level and three-level model development approach, and the software outputted the weight and rank of each indicator, along with the weight of each factor by combining the weights and rank of its components. Since the AHP-based data analysis method was used, the inconsistency ratio of pairwise comparisons for each respondent was controlled, and after ensuring the existence of an acceptable inconsistency ratio (less than 0.1), the responses of the participants were combined, and the pairwise comparison matrix of the group was extracted.

In this step, pairwise inconsistency rates must be examined and if this rate is less than 0.1, it means that the pairwise comparison is stable and has appropriate consistency. Pairwise inconsistency rates in fuzzy matrices can be calculated in two ways. The first method is to defuzzify the fuzzy pairwise comparison matrix and then calculate

its inconsistency rate definitively, or calculate the inconsistency rate using the Gauss and Boucher method. When multiple respondents have responded to pairwise comparisons, the geometric mean method is used to integrate them into a consolidated pairwise comparison matrix. Fuzzy matrices are integrated such that for the first element, the geometric mean of all comparisons is taken, for the second element, the geometric mean of the second element is taken, and for the third element, the geometric mean of the third element is taken. First, according to formula (3.1), we obtain the values of S_i for each row of the fuzzy pairwise comparison matrix:

$$S_i = \sum_{j=1}^{m} M_{gi}^j \bigotimes \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{gi}^j \right]^{-1} \tag{3.1}$$

in which gi is the target set, and M_{gi}^j are triangular fuzzy numbers. Then, according to the following equation, we obtain the degree of preference (preference level) of each S_i over S_k:

$$V(S_i > S_k) = \begin{cases} 1, & m_i \geq m_k \\ 0, & l_k \geq u_i \\ \frac{l_k - u_l}{(m_i - u_i) - (m_k - l_k)}, & \text{otherwise} \end{cases} \tag{3.2}$$

In the final stage, the raw weights are calculated using the following equation, where the normal weight is obtained by dividing each raw weight by the total raw weights:

$$\begin{aligned} V(S \geq S_1, S_2, ..., S_k) &= V((S \geq S_1), (S \geq S_2), ..., (S, S_k)) \\ &= \min V((S \geq S_1), (S \geq S_2), ..., (S, S_k)) \\ &= \min V(S \geq S_i) \qquad i = 1, 2, ..., k \end{aligned} \tag{3.3}$$

4 Results and data analysis

4.1 Fuzzy clustering and fuzzy AHP data analysis method

Regarding the use of the fuzzy AHP method for selecting and weighting alternatives and prioritizing them for the development of research model structures in the literature, no publication has been made, although many studies and articles have been conducted on the use of multi-criteria approaches in different fields of decision-making from providing services to customers to production and operations. Kahraman et al. [11] used a fuzzy hierarchical process analysis method to select the best supplier in a product factory. Decision-makers could determine preference and superiority based on the importance of each evaluation criterion using linguistic fuzzy variables.

4.2 Fuzzy spectrum and corresponding linguistic expressions for pairwise comparisons

As mentioned, in the fuzzy method, experts and decision-makers prefer to provide a range instead of a fixed number in their judgments. Linguistic variables and fuzzy spectra can be in various forms, but one of the most complete spectra is the 9-point spectrum (which we use in our analyses), with fuzzy numbers and linguistic expressions as follows.

Table 1: Fuzzy Spectrum and Corresponding Linguistic Expressions for Pairwise Comparisons.

Code	Fuzzy numbers	Linguistic expressions
1	Equal preference	(1, 1, 1)
2	Low to moderate preference	(5, 1, 5, 1, 1)
3	Moderate preference	(2, 2, 1)
4	Moderate to high preference	(4, 5, 3, 3)
5	High preference	(5, 4, 4, 3)
6	Much to very much preferred	(5, 5, 4, 3)
7	Very much preferred	(6, 5, 5, 5)
8	Very much preferred quite a lot	(7, 6, 5)
9	Quite a lot	(9, 7, 5)

The main objective of this study is to shape and design a model or pattern that enables the provision of services to customers through social networks in the banking system. In fact, it is necessary to have a pattern for all officials,

policymakers, and system executives to develop their specific strategies at any level and at any time, according to any phenomenon and priority (as well as any potential changes that may occur). Therefore, one of the two major goals of this research has been designing this pattern.

To achieve this goal, the identification of the structures forming the mentioned model in the first step will be very important and fundamental. To this end, a large part of these structures was obtained using a combined method. Therefore, in the first step, more than 400 sources were collected by conducting extensive searches from various sources (including books, abstracts, historical journals, case studies, doctoral theses, etc. based on keywords). Then, the data were analyzed using qualitative data analysis software, by dividing them into themes and coding, and finally, multiple structures were obtained for designing the model. In the next step, by using the "content validity index and content validity ratio," the desired validity indicators were evaluated through the opinions of experts and then by applying the limited questionnaire items, the reliability of the functional structures and also the reliability of the questionnaire instrument (Cronbach's alpha) were calculated. As mentioned, due to employing one of the elements and parameters of mass approach and strategy in this research (to add to the accuracy, precision, validity, and reliability of the research), the conceptual model will be tested simultaneously in multiple areas and contexts.

4.3 Fuzzy clustering (FCM)

In the Fuzzy Clustering Algorithm (FCM), the number and centers of clusters must be determined beforehand. The quality of this algorithm heavily depends on the initial number and centers of clusters. The fuzzy c-Mean algorithm is an improved and easy-to-use method, which is one of the most famous fuzzy algorithms and is used in many fields. This technique was introduced by Professor Bezdek et al. [3]. In fuzzy clustering, each data point has a degree of membership to all clusters, as in fuzzy logic, rather than belonging completely to a single cluster. Therefore, the edge points of a cluster may have a lower degree than the center points. For each point x, we have a degree of membership to cluster k. Usually, the sum of their degrees of membership is 1. The goal of fuzzy clustering is to extract fuzzy models from data. The numerous applications of fuzzy clustering in data analysis, and pattern recognition, and the existing research areas in this field, including its use in solving routing, allocation, and scheduling problems, make the need to study existing algorithms and improve and modify them more evident. It should be noted that the membership function of a fuzzy set differs from probability functions and these two concepts should not be confused.
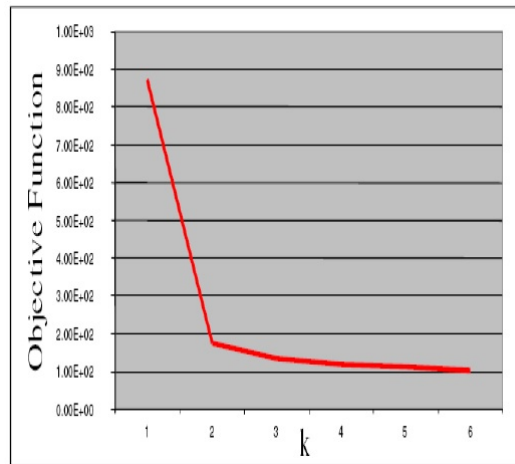

Figure 1: The relationship between the number of clusters and the performance of the objective function

4.3.1 Compilation of the objective function

The objective function in Brusch fuzzy clustering is as follows:

$$Minimize: \qquad E(U,V) = \sum_{i=1}^{k}\sum_{j=1}^{n}(u_{ij})^{m}\|\bar{x}_j - \bar{v}_i\|^2 \qquad (4.1)$$

subject to:

$$\sum_{i=1}^{k} u_{ij} = 1 \qquad \forall j = 1,...,n \qquad (4.2)$$

$$Minimize: \qquad E(U,V) = \sum_{i=1}^{k}\sum_{j=1}^{n}(u_{ij})^{m}\|\bar{x}_j - \bar{v}_i\|^2 \qquad (4.3)$$

4.3.2 The objective function is formulated based on the conceptual research model

To formulate the objective function based on the model, the distance of each activity (item) J from the centers of each of the four clusters I1-6 is calculated. The number of activities is equal to 100. The membership function coefficient, Expo, is a fuzzy function usually set to 2.

$$E = \sum_{k=100}^{1}\sum_{k=6}^{1}(\text{the membership function coefficient of one of the activities of each cluster})^{expo}$$
$$* (\text{the distance of activity i} - \text{the centers of the quartet clusters})^2 \qquad (4.4)$$

$$E = \sum_{k=100}^{1}\sum_{k=6}^{1}(\text{the membership function coefficient of one of the activities of each cluster})^{2}$$
$$* (\text{the distance of activity i} - \text{the centers of the quartet clusters})^2 \qquad (4.5)$$
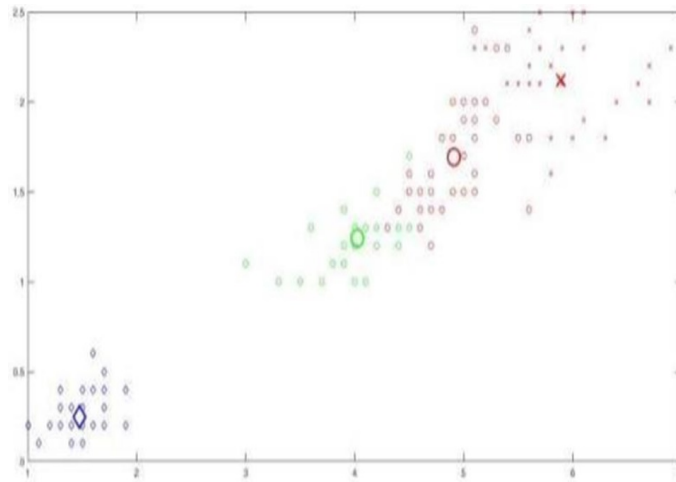

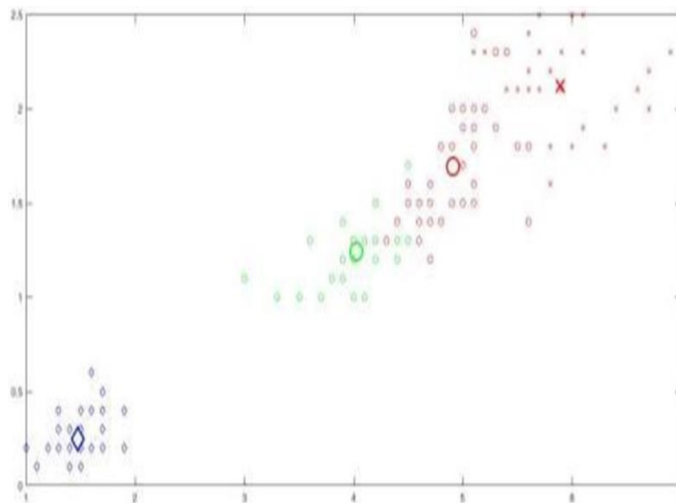Figure 2: shows the plotted points in the clusters (categories) (output of Matlab software)

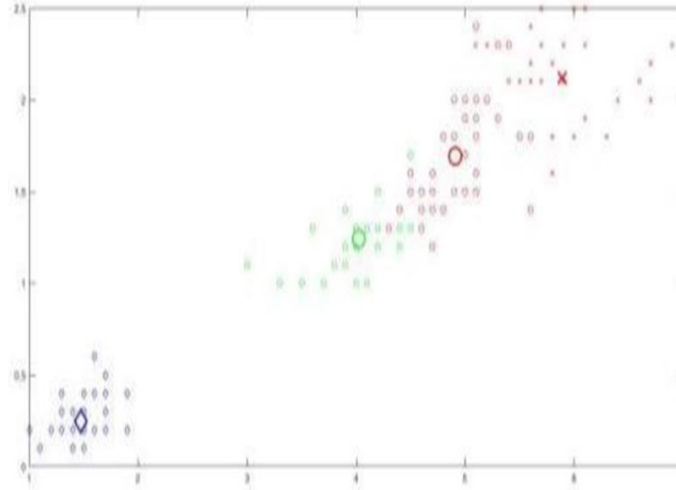Figure 3: Developed quadruple clusters (bunches) (bundles)

Figure 4: Centers of developed clusters (bundles)

4.4 Results of the operationalized conceptual model test in government and private banks

The non-conformity and deviation between the existing models (the actual ones used) and the four ideal categories will be calculated using deviation indicators. This shows a spectrum of results ranging from zero (perfect match) to 100 (complete deviation) for each bank in the sample. Appendix 2 provides these scores for all 175 bank branches. In this method, the cut-off point (for example, when the deviation is so low that the opinions can be considered a match) is important for selection. We decided to classify scores based on 0-40 as representatives of the four categories and consider 40 and above as outside the four categories.

The results show that in this sample, a total of 65 banks match (almost) one of the proposed ideal categories. Four banks have scored around or below 40 for two combinations. Here, the lowest score is used for bank classification (so only the lowest deviation score is considered). Therefore, the four categorical models of creating social networks observed in 18 organizations with limited and effective ideal social network categories, 46 organizations with limited and effective social network categories, and one organization with a comprehensive and effective social network category have been classified.

The t-tests have been performed on the 65 banks that have shown a match between the actual and ideal categories and the 110 banks that do not have this match in terms of outcome indicators.

Table 2: Various developed models

various developed social network models	Average Kv	Maximum Kv	Minimum Kv	Overall reliability between Kv rates
Comprehensive and productive social networks	0.36	0.49**	0.34**	0.81
Limited and effective social networks	0.35	0.36**	0.31**	0.82
Comprehensive and effective social networks	0.37	0.35**	0.32**	0.85
Limited and effective social networks	0.37	0.45**	0.40**	0.83

5 Discussion and conclusion

The main objective of this study is to design a model or pattern that can be used to provide services to customers through social networks in the banking system. In fact, having a pattern for all policymakers and implementers of the banking system is necessary to develop their specific strategies at any level and at any time, according to any phenomenon and priority (as well as possible changes). Therefore, one of the two main objectives of this research was to design this pattern.

To accomplish this task, in the first step, determining the structures that make up the mentioned model will be fundamental. To this end, a large part of these structures was obtained using the meta-synthesis method. Then,

by dividing the concepts, themes, and coding, and using qualitative data analysis software, results were extracted and ultimately multiple structures were obtained to develop the model. Based on this, using inspired methods and tools from an inductive approach (such as concept-based typologies, empirical classifications, and simultaneous use of typologies and construction of ideal types with cluster analyses), a composite model of four categories (combinations) (clusters) was created and approved by experts and specialists in an evaluation. Although the field study results showed that two out of four developed categories (in the ideal type model) significantly reflect social network systems (in the general sense) observed at the level of Iranian private and government banks, two more balanced categories representing flexible and committed styles were seen with very limited frequency in government banks.

Among the 39 private and government banks examined, only seven banks used non-similar categories (a different combination of combinations of ideal types), while the remaining 39 banks used similar categories to ideal categories, which shows good operationalization of the conceptual model that had been previously determined.

5.1 Practical recommendations

In light of identifying the reasons and factors that hinder the horizontal alignment between social network system factors on the one hand (horizontal alignment) and the compatibility of social network model usage with industry-level strategies (banking), organizational strategies, customer service strategies, and vertical alignment on the other hand, the following recommendations are presented to address these issues:

1. Confrontation of the Information Technology and Virtual Space Commissions of the Parliament, the Ministry of Communications and Information Technology, regulatory organizations for radio regulations, administrative and employment affairs, and the Organization for Management and Planning (which is responsible for the indicators and arrangements related to social networks) with the conventional imitation of management-technical practices. This includes specific measures to regulate virtual space and greater supervision over the approval and implementation of activities.
2. Efforts by the Administrative and Employment Affairs Organization of the country, the Management and Planning Organization, or ministries or holding companies, which regulate and legislate for public and government banks to facilitate and support these banks to establish a scientific and systematic strategic management system at the level of these banks (unfortunately, many government and public banks do not have a strategic plan or have a flawed, plagiarized strategic plan).
3. Moving away from a global approach to the best activity and approaching a combined and contextual approach. Unfortunately, the prevailing mentality of technical managers (in the field of FAO) is that the relationship between management models and practices and performance enhancement is a defined, certain, and linear relationship. In this process, managers' mindset must be directed towards the complexity and multiple interactions of management-technical activities, especially towards combined and contextual approaches, and away from simplistic, linear perceptions.

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