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Analysis of the modeling of indicators affecting bank runs in the banking industry

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Abstract

This article aims to identify indicators affecting bank runs for their modeling in the banking industry (to predict, prevent, prepare, restrain, recover, improve, learn, and increase accuracy in bank run processes). For this purpose, the data extracted by the researchers from their previous research, which was collected with the theme analysis method, was used to test the 20 main indicators of this model using Interpretive Structural Modeling (ISM). Economic crises, microeconomic problems, and tax laws are the most effective indicators of a bank run. The lack of management of the 8 triggers intensifies the political crisis. With neglect and lack of planning in curbing previous crises, internal technology disruptions and technology crises occur. Ultimately, the combined pressure of the three previous crises brings the final blow to the social structure, and a social crisis occurs. It is suggested that banks use the proposed model of this research by forming bank-run management in their organizational chart and considering the 3 actions of pre-bank run, during bank run, and after bank run, the process of preparing and managing any emergency or unexpected situation. Plan the banks' business, shareholders, employees, customers, and income. Bank-run management helps banks maintain their professional reputation with customers, competitors, and industry managers during and after a crisis, ultimately increasing productivity during and after a crisis.

Keywords: banking crisis, bank run, bank run management
2020 MSC: 68V30

1 Introduction

Continuous changes in the environment and society will inevitably affect the status and function of various economic and social institutions. Any institution may face emergencies depending on the type and number of potential risks that threaten it. The lack of proper and strong management in normal conditions causes the management of emergencies caused by the emergence of an effective risk in the organization to be ineffective, and the organization enters a critical situation. Whether public, private, or cooperative, service organizations are justified and survive by considering the market demand for their services. The arrival of any economic, social, and political shocks can expose the organizations

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related to these changes to emergencies and bring them into the abyss of various crises and bankruptcy. Banks are no exception to this rule, and when their ability to perform their intermediary role is damaged, they experience a banking crisis [10].

A banking crisis is a financial crisis that can occur on three levels. When a large number of customers withdraw from their deposits in a bank at the same time and either keep the money in cash, buy government bonds and precious metals, or transfer their money to another bank or safer financial institution because they believe that the bank either cannot pay its debt or may not have it, a bank run occurs. Suppose people suddenly try to convert their threatened fuel deposits into cash or try to get out of the domestic banking system together. In that case, a bank panic will occur, and finally, when almost all banking capital in a country disappears, systemic banking. Crisis occurs [11].

Although the occurrence of banking crises is always considered unexpected and unconventional, scientific research from 1970 to 2017 shows that the number of systemic banking crises has reached more than 271 cases, according to the International Monetary Fund's report on the management of this crisis has imposed an average cost of 12% of GDP on the involved countries [17]. In the last decade, with the increase in the use of information technology and the acceleration of the information transfer process, the emergence of new financial instruments, the increase in the complexity of the interactions of financial institutions, the ever-increasing expansion of financial markets, and other such factors, the number of financial crises, especially systemic banking crises, has increased; So that in the last 52 years, it has affected more than 70 economies of the world, which own 95% of the world's gross domestic product. The great impact of these crises caused a wave of research to study the causes and consequences of bank fragility in the economy in the near and distant years, so the researchers of this research categorized these studies from distant years and recent years into several groups. The first group: the effect of banking crises on the real sector [6, 8, 12, 18, 19, 22, 24, 28]. The second group is the spread of banking crises among different countries and markets [7, 21, 23]. The third group: examination of empirical models on the evaluation of leading indicators and prediction of banking crisis [1, 2, 9, 16, 25, 27].

A review of the foreign literature shows that no systemic banking crisis has been reported in the world's banking crisis statistics from Iran, while the signs of this type of crisis are evident in Iran's financial system. Like other developing countries, banks in Iran have a more sensitive role in financing due to the limitation of other financial activities, so a crisis in this sector can endanger financial stability. On the other hand, although various foreign and domestic research has been conducted in the systemic banking crisis field, a focused study has yet to be conducted on bank runs. Also, internal research indicates that Iran's banking sector has never faced bank runs and failures due to government support [29]. Therefore, this article tries to solve the existing research gap in the literature.

This research aims to provide a practical model that can predict, prevent, prepare, restrain, recover, improve, learn, and increase accuracy in bank run processes in Iran's banking industry. As long as we do not have indicators to measure bank runs in the banking industry, we cannot have good and professional control in this field. For this purpose, "Interpretive Structural Modeling (ISM)" has been used to test 20 indicators affecting bank run Because this method can consider the change in the sales strategies of the banking industry (private commercial banks) at different levels and suggest strategic management measures in each area for bank run.

According to the purpose, this article is organized into five parts: after the introduction, in the second part, the literature on the subject is reviewed; In the third part, the research method is presented; and in the fourth part, the findings and the fifth part are devoted to conclusions and suggestions.

2 Review of literature

2.1 Theoretical Foundations

2.1.1 Banking crisis cycle (bank run, bank panic, systemic banking crisis)

One of the key indicators of sales performance in the banking industry is the health and continuity of the bank's activity, the increase in the absorption of the bank's financial resources, and the increase in the bank's reputation in granting interest on depositors' deposits. When banks face a sudden influx of depositors to withdraw their deposits, a bank run occurs [17]. In a more comprehensive classification, a bank run is the main subset and, in a way, the most initial event in the category of banking crisis, which in turn is the first type of five types of financial crises (banking crisis, balance of payments crisis, currency crisis and debt crisis).

Bank runs are usually the result of people panicking rather than an actual bank failure. A bank run is caused by the fear that drives the bank towards its bankruptcy. A bank run occurs when macroeconomic structures in a country are weak, the economic growth rate is low, or inflation is high. The increase in the granting of credits to the private

sector and the growth and volume of credits also increase the intensity of bank runs. This type of crisis is accompanied by a decrease in trust in the performance of domestic financial institutions and causes a decrease in domestic savings and a significant increase in capital outflows.

When this bank run spreads from one bank to another, and many banks suffer from a bank run simultaneously, bank panic occurs, and if almost all banking capital in a country disappears, then a systemic banking crisis occurs. The chain of bankruptcies can lead to a long-term economic recession, and domestic consumers and businesses will suffer from shortages and eventually capital famine; at the same time, the domestic banking system will also be closed [17].

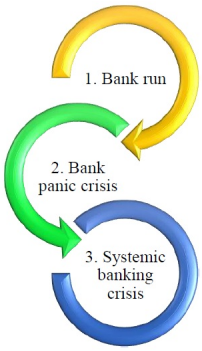

Figure 1: Banking crisis cycle [17]

2.1.2 Interpretive structural modeling (ISM)

Today, the banking industry is connected with a large and diverse amount of information inside and outside the organization. "If we cannot measure, we cannot control; If we cannot control; If we cannot manage; We cannot make continuous improvement". This sentence beautifully shows the importance of data analysis and the role of measuring and monitoring organizational indicators. As long as we do not have indicators to measure bank runs in the banking industry, we cannot have good and professional control in this field. Therefore, the contemporary banking industry must use strong decision-making tools to facilitate the process of effective data processing and extensive analyses, as well as specify how they interact.

Interpretive Structural Modeling (ISM) is one of the methods of designing systems, especially economic and social systems, which designs large and complex systems by exploiting mathematics, computers, and the participation of experts [26]. Interpretive Structural Modeling (ISM) was first presented by Warfield in [26]. Then he developed it. This technique helps to draw complex relationships between a large number of elements in a complex situation and also helps to transform discontinuous and opaque mental models into observable and transparent models [3]. Considering these direct and indirect connections between decision-making components makes the situation seem much more real and accurate than when someone decides about them alone [5].

One of the main logic of this method is that elements that have a greater effect on other elements in a system are always more important. The model obtained using this methodology shows the structure of a complex problem or subject, a system or field of study, and a carefully designed model [13].

2.2 Experimental background of the research

In the following, some of the most important related investigations are examined.

Basic banking crises usually start with a not-so-huge shock. However, the weak structure of the banking system spreads these low-volatility shocks to all real sectors of the banking economy. In emerging markets, banking crises usually lead to currency and government debt crises. The story of crisis banking in different countries usually has a common storyline in the first few chapters. Financial instability usually occurs after a long period of rapid and unbalanced credit expansion and toxic asset growth. Many studies have focused on the banking crisis, but little attention has been paid to the theoretical consensus in identifying all the influencing factors in the bank run. Most of the research has investigated the occurrence of banking crises in different countries, and in the general analysis, the researchers show the use of various methods to investigate and model the banking crisis. The difference between this research and other research is the focus on modeling indicators affecting bank runs in the strategic management of the

banking industry in private commercial banks. Most of the research only in the theoretical literature has categorized various banking crises in different countries as follows and identified a series of general common factors, but they have not comprehensively investigated the bank run and the factors affecting the bank run:

- Latin American debt crisis in the 1980s
- The crisis of the Scandinavian countries at the beginning of the 1990s
- Tequila crisis in Mexico in 1994
- The crisis of East and Southeast Asian countries in 1997 (including Thailand, Indonesia, Korea and Japan)
- Russian crisis in 1998
- Türkiye crisis in 2000
- Argentine peso crisis in 2001
- American financial crisis in 2007
- Contagion of the 2007 financial crisis of America to Europe and other regions
- Venezuela banking crisis 2009
- Russian crisis in 2014

With a review of the mentioned crises, it can be briefly stated that the first banking crisis in the mentioned period is related to the Latin American debt crisis in the 1980s. After that, the crisis of the Scandinavian countries in 1992 (including Finland, Norway, and Sweden) was in second place. The third crisis, Tequila, occurred in Mexico in 1994, the main reason for which was the sudden devaluation of the country's currency. The fourth crisis was related to the countries of East and Southeast Asia (including Indonesia, Korea, and Thailand) in 1997. The Russian crisis in 1998 is on the next level of banking crises, created due to the loss of most banks' currency, the fall in the value of the Russian currency, and the country's default in repaying short-term domestic government debts. In 2000, the Turkish crisis started with cutting credit lines from a large bank to several small banks. As a result, these small banks were forced to liquidate government bonds. This, in turn, caused a spiraling decline in the price of government bonds and huge losses for state-owned banks. After that, the crisis of the Argentine peso in 2001 was formed due to distrust in the government's ability to manage resources and expenses, the country's currency situation, and the influx of depositors withdrawing their savings from banks. Also, the American and European crisis in 2007 and 2008 was caused by the default of risky loans.

In their research, Levieuge et al. [18] investigated the effect of policy frameworks on the cost of the banking crisis. This study used unbalanced panel data from 146 countries from 1970 to 2013. Their research showed that four types of losses in the GDP can occur during a banking crisis, and policy frameworks are very important in explaining the expected costs of banking crises. Finally, with the combination of order and flexibility, it is possible to limit the expected cost of the banking crisis significantly.

In the 10th edition of McKinsey Global Banking Annual Review, which reviewed the data set including 1640 banks and 3820 companies from other industries in 2020, it sought to test the resilience of banking during and after the crisis stage. The research showed that COVID-19 is not a purely banking crisis, unlike many previous shocks. This crisis has affected the real economy. In almost all COVID-19 scenarios, most banks will continue to operate. In the 2000s, among the world's 30 most valuable banks, there were 8 American banks, 14 European banks, and only 4 Asian banks, but in November 2020, only 4 European banks remained on this list. Now, 15 Asian banks and 10 North American banks are present in this list. The important achievement of this research is that 77% of banks cannot cover the cost of their capital in 2020. Finally, by considering the following three measures, the banking system during the unexpected crisis of Corona not only the ability to face different types of banking crises (bank risk, bank run) but will be the peak of new prosperity in this industry: planning to operate with low-interest rates in the long term / creating new fee-based income streams / adapting to the rules of the challenging conditions provocative

In the literature related to systemic banking crises, Laeven and Valencia [17] reviewed the database of systemic banking crises in their study. Researchers analyzed all types of financial crises, especially banking crises, and were able to provide a database for financial crises. In this study, the database included information about the dating of banking, currency and debt crises, policy responses to solving banking crises, and financial costs and production losses caused by

banking crises. In this study, they identified 151 systemic banking crises for 118 countries in the period of 1970-2017, of which 22 were related to low-income countries, 28 were related to low-middle-income countries, 32 were related to high-middle-income countries, and 36 cases were related to high-income countries. The results showed that the crisis was more permanent in high-income countries and was accompanied by higher production losses, more public debts, extensive use of bank guarantees, and expansionary policies compared to low- and middle-income countries. In order to create a banking crisis, three criteria out of six indicators are needed: freezing of deposits or bank closures/significant nationalization of banks/central bank's liquidity support to the extent of 5% of deposits and debt to individuals/gross costs of bank restructuring be at least 3% of GDP/ special government guarantee of bank debts/ purchase of assets from financial institutions by the central bank, or a government entity so that it is at least 5% of GDP.

In 2020, Hartmann and Lussier [15] conducted interviews with key experts in B2B (Business in their research on sales force management during the unexpected and external crisis of COVID-19, which was expert-oriented research. The number of interviewees was 8 managers and experts in this field. From the organizational change model of Levitt and March [20] and the theory of socio-technical systems to the importance of considering four interdependent social (in other words, human factor and structure) and technical (in other words, task and technology) variables in They were inspired when examining organizational changes. Their findings indicated that the COVID-19 pandemic has created widespread, severe, and obvious challenges and problems for many B2B sales forces. Considering the importance of the sales force and the relationship between the sales force and the customer in the quality of communication with the customer, customer loyalty, and the business's financial performance, these factors were included in the model. Among the factors: the expectations of stakeholders (for example, customers, employees, investors), their knowledge and access to information, globalization, technological developments, competitive products, complexity in the buying and selling process, and other changes have increased, which, if not planned A correct strategy, no change in business models and also no design of innovative business models will provide bank run of businesses.

Domestic literature review on the effect of currency crisis on the dynamics of GDP - panel generalized square approach by Mahin Aslaninia and et al. in [22] using data from 159 countries from 1970 through 2016 and the generalized least squares econometric method panel stated: Variables that indicate the freedom of the foreign capital market, such as the flow of foreign capital, can be considered as factors that aggravate the effect of currency crisis on the GDP in the short term, and variables that are directly related to the level of foreign trade of countries. Like the growth rate of exports, they are considered as factors that moderate the effect of currency crisis on GDP. They proved that the increase in liquidity, interest rate, increase in the supply of national currency, and the increase in government spending and the budget deficit aggravated the effects of the crisis.

In 2018, Adelopo et al. [2] studied the factors determining bank profitability before, during, and after the financial crisis to investigate the relationship between bank-specific factors, macroeconomics, and bank profitability before (1999-2006), during (2007-2009) and then the financial crisis (2013-2010). The researchers extracted data from 1999 to 2013 using the West African Economic Community Bank panel (1673 observations) and used fixed models. The panel model includes determinants (size, cost management, and liquidity), industry level, and macroeconomic variables of a particular bank. The sample of this research included all 123 commercial banks in ECOWAS member countries in Bankscope. Their research showed that bank-specific factors mainly determine the bank's profitability. This means that banks were still profitable during the financial crisis despite the loan reduction and the liquidity increase. Also, there is a significant relationship between the determining factors (size, cost management, and liquidity) and bank profitability (ROA) before, during, and after the financial crisis.

Reviewing the domestic literature on banking crises in many previous years (2015) to the research that Zarei et al. [29]. We succeeded in identifying and predicting banking crises in Iran. Their achievements showed that Iran's banking sector has never faced bank runs and failures due to the government's support. However, evaluating the money market pressure index using the Markov cycle model approach from 1990 to 2013 with seasonal frequency shows that Iran has experienced a banking crisis in some periods. Also, the early warning test shows that the variables of real exchange rate growth, the growth rate of facilities granted to the non-governmental sector, the growth rate of real GDP, the growth rate of housing prices, and the growth of the average real interest rate of facilities can predict the probability of a banking crisis in Iran. The model specified in this method has been able to predict the occurrence of the crisis with a high probability of 40% in 77% of the cases where the crisis has occurred, and only 12% had a wrong signal.

3 Research methodology

This research is applied in terms of purpose and descriptive survey in terms of method. Descriptive research can effectively understand the current situation and help the decision-making process. The survey method can provide suitable solutions to improve practical solutions. The current research is applied in terms of its purpose and data

collection method, which is mixed (documents, interviews, and questionnaires). In the first step, by studying the theories, models, and approaches and using the resources available in the presented literature and the research history, first, a general list of indicators related to each dimension of the bank run was prepared, then the pattern of causal relationships between the indicators was identified. In the previous research, the two main reasons for the absence of a clear crisis in Iran's economy were the state-owned banks and the financial support of the Central Bank. Therefore, the statistical population of this research includes the study of 17 private commercial banks in Iran. The researchers communicated with 74 branch managers, marketing managers, research and development managers, public relations managers, and corporate banking managers, from which 12 outputs were collected.

The Interpretive Structural Modeling (ISM) method has been used in this research. The ISM model is a systematic method to identify the relationship between specific items to identify the problem. For any complex problem, several factors may be related to the problem or issue under discussion. However, direct and indirect relationships between factors provide a more accurate description than individual factors. Therefore, ISM provides a comprehensive understanding of that relationship [5]. The ISM model is a completely systematic, effective, and efficient process. Using the transfer source can reduce the number of logical QUERIES between 50 and 80 percent, depending on the text content type. In this model, focusing on participants in a specific topic and time increases the quality of interdisciplinary communication between people in line with the CONTEXT of the issue.

The reason for using this model is its high ability to establish communication between science and politics in line with the use of tools that have both scientific characteristics and communication between science and society and can establish a scientific connection between elements and connections that show the structure of the system. are used. Asgharpour [4] suggests that the number of members participating in the ISM process is between 4 and 132 people. Considering the difficulty of answering the ISM questionnaire and the time it takes, the number of them returning from the number sent is also completely acceptable. This section aims to extract the relationship between the identified factors and develop a research model.

3.1 Formation of a decision matrix

This method's decision matrix is criterion-option, specifically, criteria are placed in columns and options in rows, and each cell is the score of each option relative to each criterion.

3.2 Determining hypothetical ideal value

In this stage, a hypothetical ideal option called AO is created. Its values for positive criteria are the maximum value of the benchmark column and for negative criteria are equal to the minimum value.

$$T_{0j} = \min_i x_{ij}, \quad \text{for beneficial criteria} \tag{3.1}$$

$$T_{0j} = \min_i x_{ij}, \quad \text{for non-beneficial criteria} \tag{3.2}$$

3.3 Converting negative criteria to positive

In this step, the negative criteria must be reversed to positive criteria. This process turns the decision matrix into a positive decision matrix.

$$x_{ij} = \frac{1}{x^*_{ij}} \tag{3.3}$$

3.4 Normalization of decision matrix

In this step, via the following equation we normalize the decision matrix.

$$x^*_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} \tag{3.4}$$

3.5 Weighing normal decision matrix

In this step, we multiply normal matrix values to the weight of the criteria to obtain the weighted matrix.

$$\hat{x}_{ij} = x^*_{ij} \times w_j \tag{3.5}$$

In this step, via the following relationships, we calculate the ARAS index and the degree of desirability of options. Henceforth, the final ranking is undertaken.

$$S_i = \sum_{j=1}^{n} \hat{x}_{ij} \tag{3.6}$$

$$k_i = \frac{S_i}{S_0}. \tag{3.7}$$

4 Research findings

In order to start the ISM process, we needed to identify the research indicators, and we reached 20 final indicators based on previous research and theme analysis methods, which are: weaknesses in knowledge and systems related to a bank runs, inappropriate understanding of bank run, lack of effective role-playing. and government support, lack of effective support of the central bank for banks, approval of new tax laws, political problems and international restrictions, Iran's general economic crises, decrease in the financial power and attractiveness of banks, the attractiveness of the alternative financial markets, weakness in banking technologies, the slowness and weakness of the process of digitalization of banks, negative outlook on Iran's economy, people's negative attitude towards banks, not updating the banking business model, weakness in banking products and services, the complexity of banking processes, lack of human capital development, low motivation of bank staff, lack of adequate provision of customer needs and weakness in customer care and maintenance (in the software calculations, for the sake of brevity in the tables and charts, numbers 1 to 20 are assigned to these indicators we gave).

For each of the obtained questionnaires, we created a structural self-interaction matrix and by converting SISM (Structural-Self-Interaction-Matrix) to the numbers zero and one, we reached the achievement matrix. We performed this operation for each of the 12 obtained matrices. Since the research is not limited to a questionnaire, the continuation of the analysis required the integration of the obtained matrices. The number of obtained matrices is 12 (as many experts). Therefore, at this stage, it is necessary to integrate the obtained access matrices with each other. In this way, after converting each SSIM matrix to RM (Reachability matrix) in the form of zero and one, we added the corresponding values of each matrix together and the mode value was taken from the resulting matrix. Any number that is equal to or smaller than the mod will take the value of zero, and if it is greater than the mod, it will take the value of one. The resulting matrix is the result of merging the 12 primary access matrices into a single matrix. Then we continued the analysis with the obtained matrix. Therefore, the corresponding sum matrix of the sums was calculated and the matching matrix was designed. The law of compatibility is that if A affects B and B affects C, then A affects C.

Therefore, in the above matrix, hierarchical effects were checked and modified in this way. This method is known as the Warfield [26] method. Since Warfield's method is primitive and it is difficult for matrices with larger dimensions and the probability of error increases greatly, here we used the method provided by Asgharpour [4]. This method is more complicated and longer, but it is highly accurate. In this method, we multiply the achievement matrix by itself until it becomes stable. i.e.:

$$A^{(n-1)} = A^n. \tag{4.1}$$

Then, the final achievement matrix is calculated using the following method:

$$SSIM = Boolean(A^n + A^{(n-1)} + ... + A^0). \tag{4.2}$$

The result of calculating the adapted final access matrix is as follows: After specifying the set of Advanced

Table 1: Adapted final access matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1		1	0	1	1	0	0	0	1	1	1	0	1	1*	0	0	1	1	0	0
2	1		0	1	1	0	0	0	1	1	1	0	1	1	0	0	1	1	0	0
3	0	0		0	0	1	1	1	0	0	1	0	1	0	0	0	1	1	0	0
4	1	1	0		1	0	0	0	1	1	1	0	1	1	0	0	1	1	0	0
5	1	1	0	1		0	0	0	1	1	1	0	1	1	0	0	1	1	0	0
6	1	1	1	0	0		1	1	0	0	1	0	1	0	0	0	1	1	0	0
7	1	1	1	1*	1*	1		1	1*	1*	1	1*	1	1*	0	0	1	1	0	0
8	0	1*	1	1	1*	1	1		1*	1*	1	1*	1	1*	0	0	1	1	0	0
9	1	1	0	1	1	0	0	0		1	1	1*	1	1	0	0	1	1	0	0
10	1	1	0	1	1	0	0	0	1		1	1*	1	1	0	0	1	1	0	0
11	0	0	0	0	0	0	0	0	0	0		1*	1	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0
14	1	1	0	1	1	0	0	0	1	1	1	1*	1		0	0	1	1	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	1*	1	0	0		0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1*	1	0	0	0		0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	1*	1	0	0	0	0		0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

variables and Reachability variables, the leveling of the criteria was done. Each variable's received and preceding sets were extracted from the final received matrix in this step. The received set for a particular variable is that variable itself, including other variables that contributed to its creation. The antecedent set for each variable includes that variable and other variable that contributed to its creation. After that, the share of these two sets was obtained for each variable. The variables whose common set is the same as the received set are considered high-level variables in the ISM hierarchy, so these variables are ineffective in creating other variables. After identifying the highest-level variable, that variable is removed from the list of variables. These repetitions continued until the level of all variables was determined. By summarizing the classifications made based on the opinion of experts, the obtained variables were classified into 4 levels (fig. 2).

In this model, higher levels affect lower levels. For example, the fourth level affects the third level. Also, because the third level affects the second level, the fourth level affects the third level, the fourth level affects the second level, and so on.

To obtain the influence and dependence of each index in the above model, the direct and indirect impact analysis algorithm is used to determine the position of each variable on the effects maps. The most important maps of direct and indirect effects, which help to interpret the results faster and more accurately, locate the sum of the effects resulting from the sum of rows and columns on the two axes of influence and influence, which can be a good criterion. to evaluate the model. In this research, MicMac was used (fig. 3).

Figure 3 shows that the indicators of economic crises, microeconomics (domestic), lack of effective support of the central bank for banks, and approval of new tax laws are among the variables with the least dependence and the most influence, and they are in a way effective drivers of bank run, which we call Driver variables. The indicators that have the most influence or dependence on other variables and also have the most influence on other variables is inappropriate understanding of bank runs, lack of effective role-playing and government support, alternative financial market, and weakness in banking technologies, which are called Linage We call variables or trust. The variables with the least influence and the most dependence include the slowness and weakness of the process of digitalization of banks, low public trust, increase in social concerns, lack of human capital development, and low motivation of bank staff, which are also included in the research model The second and first levels are located. These are indicators in the bank run in the banking industry that are most affected by changes in the conditions of the banking system. These variables are called dependent variables. Finally, autonomous variables with low influence and dependence include weakness in banking products and services, the complexity of banking processes, not meeting customers' needs, and weakness in retaining customers.

4.1 Analysis of the modeling of indicators affecting bank runs in the banking industry

As shown schematically in Figure 4, the model of indicators affecting bank runs includes 4 levels. The fourth level is the level that has the greatest impact on other levels and is less affected. If we compare the obtained model with the

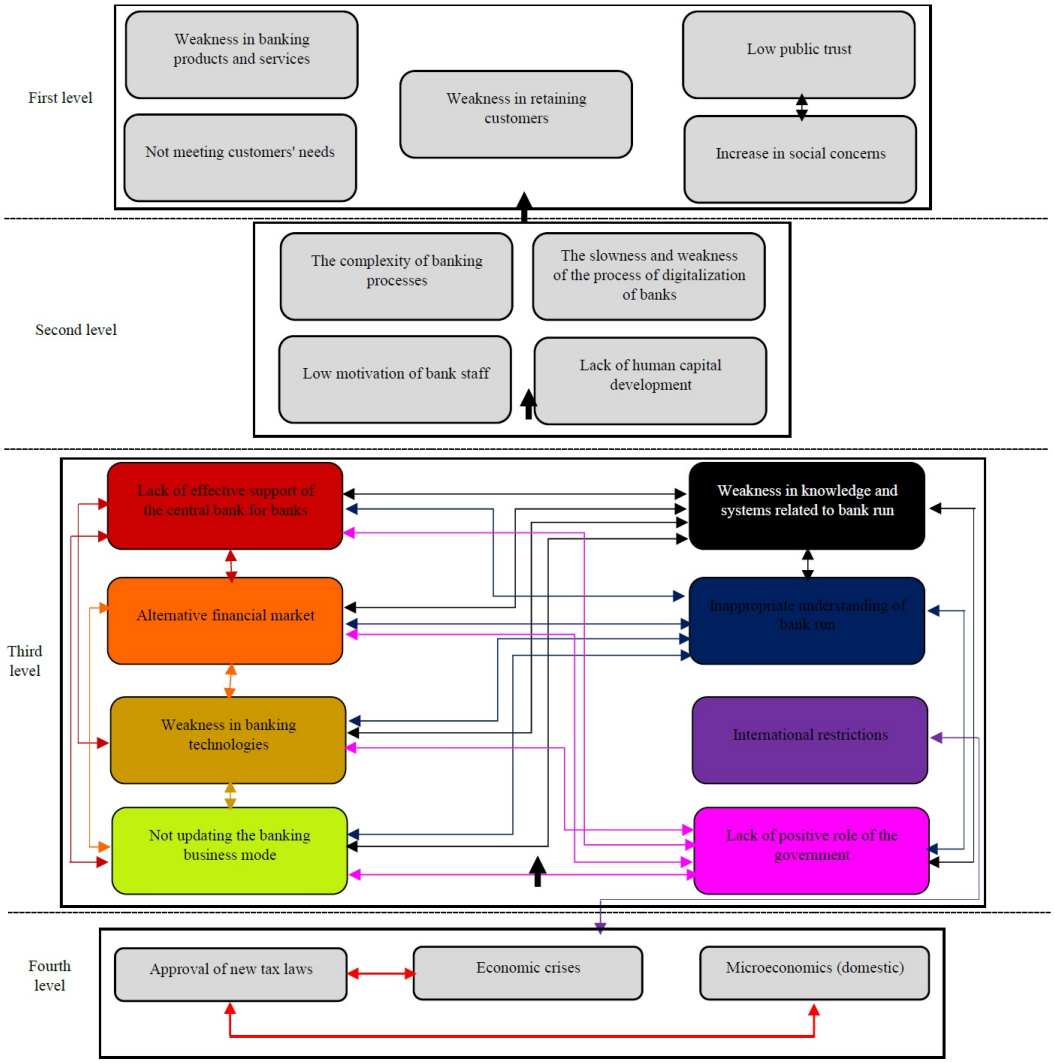

Figure 2: Schematic image of the research model

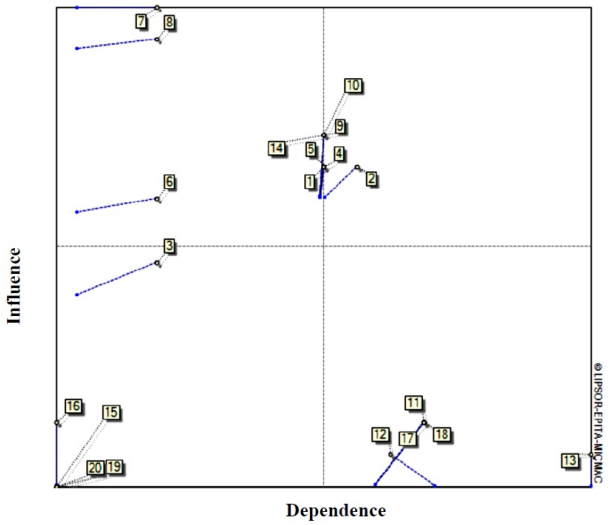

Figure 3: The output of Influence and Dependence indicators of the research model

comprehensive crisis management model as a crisis management process model, we can name the levels of the model. A comprehensive crisis management model includes 3 stages based on the time of occurrence; each stage has special features that are effective in its formation, extent, and depth.

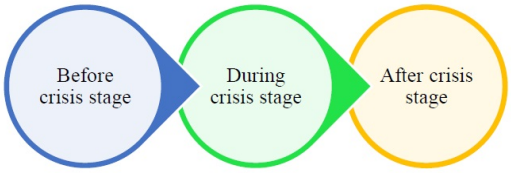

Figure 4: Comprehensive crisis management model [14]

In the comprehensive crisis management model, the action steps, such as prediction, prevention, and preparation, are performed first. Then, specialized and special operation harnessing is done. In the last stage, recovery, reconstruction, and learning take place.

The comprehensive crisis management model is one of the simple and, at the same time, prominent models in explaining the crisis process. In this way, the researchers have named the obtained model levels according to Table 2.

Table 2: Suggested names for levels of model of indicators affecting bank run management

Suggested name	**Indicators**	**Stage**
Economic and government management	Economic crises, microeconomics (domestic), approval of new tax laws	Before crisis stage
Political management and information technology	Lack of positive role of the government, lack of effective support of the central bank for banks, international restrictions, alternative financial market, not updating the banking business mode, weakness in banking technologies, weakness in knowledge and systems related to bank runs, and inappropriate understanding of bank run, the complexity of banking processes, the slowness and weakness of the process of digitalization of banks, lack of human capital development and low motivation of bank staff	During crisis stage
Customer management	Increase in social concerns, low public trust, weakness in banking products and services, not meeting customers' needs, and weakness in retaining customers.	After crisis stage

As a result, the bank-run management model in the banking industry in Iran's private commercial banks will be as follows. With proper management in these areas, bank runs can be prevented first, and in the event of a banking crisis, we can control the bank panic crisis by managing sales in three basic stages, and the subsequent systemic banking crisis will not occur.

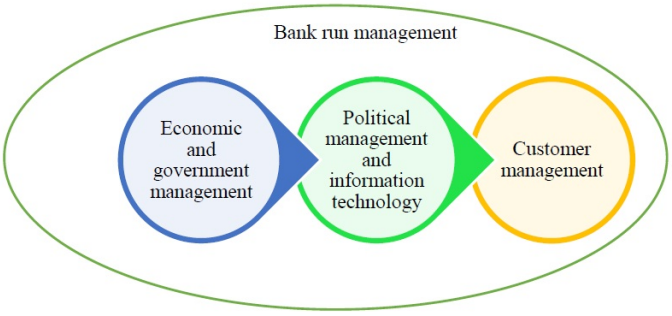

Figure 5: Bank-run management model

5 Conclusions and suggestions

In this research, by applying and presenting an Interpretive Structural Modeling (ISM), the managers of the banking industry are allowed to use a tool with the help of which they can analyze the activities of different departments of the bank in three types of banking crisis: bank run, bank Panic crisis, and systemic banking crisis should be designed and planned in three stages: before crisis stage, during crisis stage and after crisis stage.

The review of compliance showed that action had yet to be taken to test bank runs and identify indicators affecting bank runs in foreign and domestic research. This means that the banking industry of the world has not had an innovative approach in its business under the title of selling banking products and services, and the unexpected crisis of COVID-19 is one of the most influential crises of the present era, which has led to the change of this approach in all the industries of the world. It became diverse. On the other hand, Iran's banking system has been facing issues such as the nationalization of banks, imposition of mandatory policies of the government, government management, and mandated control of bank interest rates in recent decades, which has hindered the recognition of the crisis over the years and Also, after the research of the domestic researchers, it was found that Iran was involved in the systemic banking crisis like other countries, but the causes above prevent it from being made public, and these issues have been the focus of the researchers of this study as research gaps.

In this research, the researchers have considered two types of analysis of modeling of the indicators affecting bank runs in the banking industry. The first analysis, the Interpretive Structural view, is based on the extractive model of the research, which we call the basic Interpretive Structural analysis. This type of model analysis has a vertical analysis approach from whole to component. In this analysis, it is quite clear that to prevent bank runs in the banking system in Iran's private commercial banks, measures must be taken by the government, such as economic crises, domestic economic issues, and approval of new tax laws, among other things that are at the disposal of the government. Banks and people have no role; even international restrictions intensify these three indicators and vice versa. These three indicators are the most influential indicators that are the initiators of the bank run in the stage before the bank run.

When the bank run started, with the continued lack of positive role of the government and the subsequent lack of effective support of the central bank for banks, not updating the banking business mode, weakness in banking technologies, weakness in knowledge and systems related to bank run, inappropriate understanding of bank run and gaining strength of alternative financial market, banks are seriously placed in the stage of bank run. At this stage, the central bank controls and improves the bank run and selling situation. At this stage, the two arms of the central bank are the government's positive role and the implementation of internal strategic measures in the internal system of all its subordinate banks. If he cannot take effective action in this area, the internal political crisis will be one of the crises caused by the bank run.

In the case of lack of bank run management at the third level by the central bank, unfortunately, bank run with the burning flames of economic and state crises, foreign and domestic political crises, leading to an increase in the complexity of banking processes, lack of human capital development, the slowness and Weakness of the process of digitalization of banks and decrease the motivation of bank employees. At this stage of the bank run, the internal role of the banking system, including all 17 private commercial banks of Iran, is very important from the point of view of upgrading and improving the level of information technology and human resources, and if there is no planning and management at this level, we will witness a crisis. Information technology will be at the heart of bank run. At the last level of this model, we reach indicators such as weakness in banking products and services, not meeting customers' needs, weakness in retaining customers, increase in social concerns, and low public trust, which are the outputs of the research model and represent the symptoms of They are from a bank run. These indicators appear when no effective measures have been taken in the banking system's previous three levels in forecasting, preparation, and recovery. So, it can be concluded that this type of analysis proves that private commercial banks have also faced the fate of state banks in Iran's banking industry, and the government and economic and political issues related to Iran are also the cause of their banking crisis, with the difference that According to previous research, it led to a systemic banking crisis in state banks between 1990 and 2013, while in private commercial banks, it led to a bank run in 2023.

The second analysis of the researchers of this research is a reverse look at the extractive research model, which we call reverse interpretive structural analysis. This type of model analysis has a vertical analysis approach from part to whole. The approach of this type of analysis is based on the sales strategy approach. This analysis aims to prevent, curb, improve, learn, and increase accuracy in bank-run processes in Iran's banking industry. By observing each of the indicators: increase in social concerns, decrease in public trust in banks, weakness in banking products and services, not meeting customers' needs, and weakness in retaining customers, they can be sure that bank run in the banking system has happened and these are the signs or indicators of the consequences after the bank run that they have not noticed yet! This means that, unlike the previous analysis process, by knowing every indicator of this research model at every level, managers in the banking industry can plan preventive, restraining, and improving measures by increasing learning and accuracy to avoid bank panic crises. Moreover, prevents the subsequent systemic banking crisis.

In this research, we proposed an innovative method to classify banking crises in terms of their relationship with the sales cycle. Based on the results, the researchers' strategic suggestions to the banking system, especially private commercial banks, in the field of bank-run management to restore ROE: Return on Equity to the levels before the

crisis are:

1. Setting up the productivity improvement engine
    - Accelerating the digitization and reconstruction of the bank branch network
    - Systemic restructuring of employees and modification of skills on a large scale
    - Transforming technology and expanding scale according to demand
    - Monitor third-party costs through a review of supplier attributes and management
    - Moving towards minimum important and achievable functions
    - Identifying the right mix between the non-bank/remote work model and reducing the footprint of dedicated operations
2. Increasing risk management capabilities
    - Helping the customer and reducing losses
    - Review the risk of violations in the portfolio
    - Creating digital assistance capabilities for customers and prioritizing them
    - Improving the skills of frontline employees
    - Portfolio reviews: focus areas in service delivery
3. More accurate capital management

For some banks, more than these measures is needed. We suggest capital and bank integration processes as the best solution for this category of banks (as this happened in previous years for Ansar, Qavamin, Hikmat Iranian, Mehr Ekhtaz, Kotsar Credit Institutions, and Sepeh Bank). Banks should recognize the impact of bank runs on customers and businesses and, at the same time, be prepared to neutralize downward trends by taking basic measures and getting the most benefit from positive trends. Those banks that implement these measures not only guarantee their survival; Rather, they are significantly ahead of their competitors. Banks need accountability on three levels to thrive in the post-bank run era. operational power (how to perform activities), infrastructure (how to structure), and psychological aspect (the reason for their establishment). Actions suggested by researchers at each level are:

- Stabilizing the speed and flexibility that banks have achieved during the crisis.
- Making fundamental changes in the business model
- More attention to Environment, Social, and Governance (ESG) considerations and a better definition of banking goals

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