



Applied-Research Paper

## Presenting Financial and Non-Financial Indices Model Affecting the Credit Risk on the Maskan Bank

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### ABSTRACT

Providing credit facilities to clients is considered one of the most important tasks for banks. Therefore, the current research aims to develop a model of financial and non-financial factors that influence credit risk in Maskan Bank. This study is divided into two sections: qualitative and quantitative. In the qualitative portion, the Delphi technique was employed to identify financial and non-financial variables that impact credit risk in Maskan Bank through interviews with 18 experts. In the quantitative section, the selected components of the questionnaire were initially created on a 5-point Likert scale. The questionnaire was then administered to 361 legal clients of Maskan Bank, who were part of the statistical sample in the quantitative section. The quantitative component was completed using LISREL software to model the structural equations of SEM. Based on the results of the qualitative section, three primary components (financial, market, and management) and 33 sub-components were identified as indicators of financial and non-financial factors impacting credit risk. The quantitative findings also revealed that the indicators of guarantee status in the financial component, price level in the market component, and factors such as manpower motivation and productivity, management continuity, and trade in the management component exhibited the largest factor loads.

## 1 Introduction

The banking system is one of the main pillars of every economic system. Banks and financial credit institutions play a significant role in implementing monetary policies. Therefore, their correct and principled performance can significantly contribute to the economic growth and prosperity of society [1]. Thus, a healthy and profitable system can better withstand economic shocks and play a more prominent role in the stability and consistency of the financial system. According to most experts, since many banking resources are used as credits and banks' main interests are also derived from this sector, granting credits is considered the primary use of banking resources. The scope of banking activities is such

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that various risks are focused on banking operations. The bank is also the main institution active in providing credit, which exposes its activities to credit risk. For this reason, banks should pay special attention to dynamic risk management and the design of internal risk management models. They should also establish various structures and organizations for optimal risk management in banks. Credit risk is one of the main risks that banks face. Failure to properly manage and control this risk can lead to crises and bankruptcy for the bank. Since banks are influential institutions in the economic system of any country, these crises create problems for the entire economic and social system [2].

Credit risk is based on the possibility that loans will be repaid late or not repaid at all, leading to problems in banks' cash flow and negatively impacting their liquidity and return on investment. To control and reduce credit risk, banks need to accurately identify credit applicants and distinguish between low-risk and high-risk applicants who can repay their loans on time. This requires efficient and effective credit risk management [3]. Therefore, in granting banking facilities, prevention should always take precedence over treatment. Prevention costs are always lower than treatment costs. If banks and financial institutions accurately assess applicants and credit rankings before granting facilities, and ensure accurate repayment of facilities, the cost of granting the facilities will be lower compared to when claims are deferred and need to be collected. Lack of customer accreditation, monitoring, and control leads to wasted resources. This is one of the causes of inflation, as resources are diverted instead of providing working capital for production units, resulting in increased demand and ultimately higher prices. Therefore, since banks have limited financial resources, they should strive to allocate these resources optimally to generate more profit and promote the production and service sectors of society [4]. Despite the importance of credit risk in the activities of banking and financial institutions, it seems that no coherent and organized movement has been made to create credit risk models in the country. For instance, the absence of credit risk indicators and ranking institutions is felt in the country's financial markets, and in the field of granting facilities to customers, there is currently no coherent and regular process for determining credit risk, ranking, and setting credit ceilings based on risk indicators. These determinations are currently made by experts and the credit committee.

Having an efficient risk model not only facilitates decision-making in the field of granting credit and obtaining documents but also enables the banking system, and consequently the country, to have an efficient model for allocating capital to various economic sectors. In this regard, the main purpose of this article is to provide a model to assess credit risk in Bank Maskan using the multilayer perceptron neural network prediction method. This research aligns with the research needs of Bank Maskan, and its results will be used to increase the efficiency of the credit risk coverage system in the bank. Ranking models are divided into two groups: Group 1: Parametric models: a) Linear probability model, b) Logit and Probit models, c) Audit analysis model, d) Neural networks. Group 2: Nonparametric models: a) Linear programming, b) Recursive classification trees, c) Nearest Neighbors model, d) Hierarchical analysis, e) Expert systems.

## 2 Theoretical Foundation and Literature Review

In recent years, neural network models have a special place in comparison with some classical models such as audit analysis in estimation [5]. These models can be considered as a kind of generalization of nonlinear regression models. Therefore, the use of these models by researchers to identify trends and models in the data as well as the production of knowledge from the data has extensively become pervasive. Salchenberger et al., used MLP neural networks to predict the financial health of savings and

loans. He compared this method with the Logit regression model. This study was performed on S&L data from January 1986 to December 1987 and showed the superiority of the neural network over the Logit model [6]. Other methods existing for solving issues related to classification and credit risk are the decision-making tree method and the support vector machine, which Liu et al., used optimized SVM by a genetic algorithm for credit scoring [7]. Khojasteh et al., in their article entitled "Credit rating of real bank customers with a combined approach of logistic-symbolic regression" have measured the accuracy of the combined model of logistic-symbolic regression in the classification of creditworthy and uncreditworthy customers by regression. The results of this study reveal that logistic-symbolic regression, with the classification, had about 88% of creditworthy customers and 83% uncreditworthy customers. The accuracy of predicting the combined logistic-symbolic regression model can be considered suitable in this regard [8]. The following are some of the researches in this field that are related to our research.

In the research of Akhbari & Rafiei with the title Presenting a fuzzy neural model in credit ranking of legal customers of banks, their model has considered debt ratio, activity ratio, and equity ratio to total assets as an input variable and customer default probability as the output variable. After training and testing the model based on the data of Bank Keshavarzi from the years 2001 to 2006, the presented model predicted the credit status of customers with 69.36% accuracy [9]. Dehmardeh et al. with a title about validation of bank customers using the credit scoring approach in Bank Sepah branches in Zahedan stated that the results obtained from estimation show that based on statistical indicators, logistic regression is significant in terms of coefficients and resolution power and has a high credit in the bank's credit risk management [10]. Dong with the title a logit regression model with random coefficients to create a credit scoring card Stated that experimental results showed the proposed model can improve the prediction accuracy of the logit regression model with constant coefficients without eliminating its desirable features [11]. Tabagari in research about the evaluation of reliability using logistic regression, the values of the parameters in this model are not absolute and are usually measured relatively. In this work, 16 independent variables have been considered. Important variables are age, loan debt repayment, life duration in the current place, type of job, amount of credit, and other debts [12]. In search of Razmi and Shahbazi about the comparison of different neural network models in the credit rating of the banking system and the introduction of the best model stated that the results of this study reveal that neural networks with radius axis algorithm and GMDH neural network have the highest accuracy in predicting customer credit behaviour have [13]. Based on the research of Qasemnia Arabi and Safaei, with the title about the comparison of the performance of classical models and artificial intelligence in predicting the credit status of bank customers, stated that one cannot expect statistical models with classical assumptions such as relationships of variables, to be able to properly assess customers' credit risk [14]. Rastegar & Eidygoush the research with the title about Credit risk modelling of bank customers using Cox regression model as well as survival model based on Spline method, also stated that using the Cox regression model as well as the Spline-based logistic regression survival model, the probability of credit risk over time has been predicted [15-17]. In this regard, the primary aim of this paper is to present a model of financial and non-financial factors that influence credit risk at Maskan Bank.

### 3 Methodology

A hybrid technique was adopted in this study. The hybrid research method combines quantitative and qualitative research techniques. In a project, there are two sorts of research methodologies that may be

applied efficiently Strauss and Corbin, [18]. When one of the research methodologies (quantitative or qualitative) is used, only restricted parts of a phenomena are revealed and analyzed, while other features of the phenomenon are overlooked in this situation Sarmad et al., [19]. As a result, the application of hybrid research methodologies aids in the comprehension of social and behavioral phenomena. In terms of data dependability, this research is applied in terms of purpose and descriptive-survey. In the qualitative portion, financial and non-financial factors impacting credit risk in Bank Maskan were found first through library studies, and then the validity of the components retrieved using the Delphi technique was assessed [20]. Experts from public university lecturers and managers of Maskan Bank branches made up the statistical population in this study.

Snowball sampling of 18 persons was used to produce the statistical sample. Seven of the specialists investigated were female, while 11 were male; three had master's degrees, while 15 had PhD degrees, and all but two had more than five years of experience. The qualitative model was evaluated using the structural equation technique SEM and LISREL software after describing the pattern of financial and non-financial factors impacting credit risk in the Masksn Bank. As a result, a questionnaire was created using the quality section's components and distributed to Maskan Bank's legal clients, a total of 6014 persons. Cluster sampling using Cochran's method resulted in a sample size of 361 persons. The statistical sample in the quantitative portion consisted of 42 percent women and 58 percent males, the majority of whom were between the ages of 36 and 45. In addition, the majority of them possessed at least a bachelor's degree.

## 4 Findings

In this study, the content of all gathered articles was first examined, and then 33 components were extracted in total. The Delphi approach was then used to verify the extracted components' correctness. Structural equation modeling was used after the Delphi technique to test the model using a questionnaire. The results of the qualitative and quantitative parts are reported individually in the following sections.

### 4.1 Qualitative Section

The Delphi approach was used to confirm that the discovered components are from genuine library research, to establish an agreement on the major and sub-components found, to analyze the model's validity, and to build the final model and qualitative validation of the model. The Delphi technique's steps and outcomes are listed below. The Delphi questionnaire was developed to elicit expert opinions on the extent to which they agree with the discovered components once the components connected to the qualitative element were identified. The experts were then given the Delphi questionnaire. Table 2 shows the range of responses to the questions as well as the score.

**Table 1:** The Range of Answers to the Questions and the Corresponding Score

Verbal variables	Score
Very high	5
High	4
Average	3
Low	2
Very low	1

Source: Feizi & Irandoost [21].

The survey was done in stages to ensure that experts agreed on the components. In the qualitative phase,

the discovered components were given to 18 experts in the form of a questionnaire. After that, using Excel software, the mean replies were determined. The Delphi technique is used to get the most secure group consensus of experts on a certain issue by employing questionnaires and consulting experts, who are typically consulted based on their input. This method is repeated until the mean of the numbers is steady enough. In this study, the lowest mean value of replies is 3.5. The relevant component will be eliminated if the mean replies are less than 3.5. The Delphi method's results are presented in Table (3). The discovered components were presented to the experts in the form of a 5-item Delphi questionnaire in the first Delphi stage, and the mean responses were computed. Because the mean of all submitted responses was greater than 3.5 at this point, no component was deleted. Kendall's agreement coefficient at the first stage was 0.569, indicating that the level of expert agreement is typical at this point. The Delphi questionnaire was provided to the experts again in the second stage of Delphi, and the mean and standard deviation of the answers were determined.

The mean of all components was higher than 3.5 at this point. As a result, no components were eliminated at this time. The second stage's Kendall's agreement coefficient was 0.590, indicating that expert agreement at this stage is average. The mean of all detected components was more than 3.5 in the third phase. At addition, the Kendall agreement coefficient in the third stage was 0.690, indicating that the level of expert agreement at this stage is nearly high. As a result, all indicators that advanced to the third stage of the Delphi process were assessed by qualified specialists, and these indications were authorized. According to the Delphi method's results, three major components and 33 sub-components were eventually identified, as shown in Table 2.

## 4.2 Quantitative Section

The normality of the distribution of the questionnaire data was analyzed using the Kolmogorov-Smirnov test in this section in order to choose the best approach. The probability level of test statistics in all questions is more than 5%, indicating that the hypothesis of zero normality of data distribution is accepted. Because the data is normal and the statistical sample size is over 200 persons, structural equations SEM and LISREL software are utilized for modeling.

**Table 2:** First, Second and Third round of Delphi Method

Row	Sub-components	First round		Second round		Third round	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
1	Current account status (volume of turnover in the account)	4.62	1.044	4.21	1.373	4.24	0.111
2	Bank contact history (account period)	4.46	.877	4.23	.054	4.41	0.060
3	Loan repayment history (deferred installment)	4.69	1.032	4.44	.852	4.46	0.855
4	Type of loan	3.62	1.609	4.16	1.104	4.20	0.097
5	The amount of credit	4.54	.967	4.08	1.057	4.11	0.063
6	Deposit amount	4.85	.689	3.80	1.258	3.81	0.255
7	Interest rate	4.00	1.225	4.21	1.373	4.19	0.370

**Table 2:** First, Second and Third round of Delphi Method

Row	Sub-components	First round		Second round		Third round	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
8	Warranty status	4.69	1.182	4.18	1.094	4.21	0.101
9	Company sensitivity to macroeconomics	4.08	1.115	4.14	1.021	4.16	0.022
10	The sensitivity of the company to the legal and political environment	3.69	1.109	3.95	1.304	3.99	0.309
11	Market share	4.46	1.050	3.91	1.119	3.93	0.120
12	Market Orientation	4.08	1.038	3.57	1.253	3.95	0.255
13	Variety of demand	3.69	1.251	4.19	1.075	4.19	1.075
14	Technology and innovation	4.15	1.068	4.14	1.013	4.17	0.015
15	Production flexibility	3.62	.961	4.10	1.030	4.10	1.030
16	Hybrid products	4.15	1.068	3.98	1.288	3.98	1.288
17	Price level	4.15	.899	4.69	0.514	4.69	0.514
18	Brand value	4.69	1.032	4.30	0.875	4.30	0.875
19	Dependence on customers and suppliers	3.62	.961	4.48	0.756	4.48	0.756
20	Planning and forecasting data	4.54	.967	3.83	.841	3.83	0.841
21	Timely and reliable reporting	4.38	1.387	3.72	.770	3.72	0.770
22	Certified accounting	4.85	1.068	4.05	.838	4.05	0.838
23	Behavior towards bank loans	4.69	1.251	4.28	.682	4.31	0.690
24	Behavior towards tax obligations	4.15	.899	4.41	.688	4.40	0.688
25	Behavior towards suppliers	4.08	1.038	4.59	.608	4.60	0.680
26	Behavior towards customers	4.69	1.109	4.59	.575	4.57	0.579
27	collateral	4.15	1.463	4.52	.644	4.55	0.648
28	Motivation and productivity of human resources	3.85	1.214	4.29	.747	4.29	0.747

**Table 2:** First, Second and Third round of Delphi Method

Row	Sub-components	First round		Second round		Third round	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
29	management and business continuity	4.15	1.068	4.53	.634	4.53	0.634
30	Past manager experience and performance	4.46	.877	4.60	.626	4.63	0.625
31	Commitment and skill of the management team	4.69	1.032	3.78	.912	3.80	0.901
32	Management performance	4.62	1.044	3.94	.817	3.96	0.815
33	Ethical management and orientation towards the value of the environment and the customer	4.08	1.115	3.84	.954	3.84	0.954

Source: Research Findings.

**Table 4.** Final Main and Sub-Components

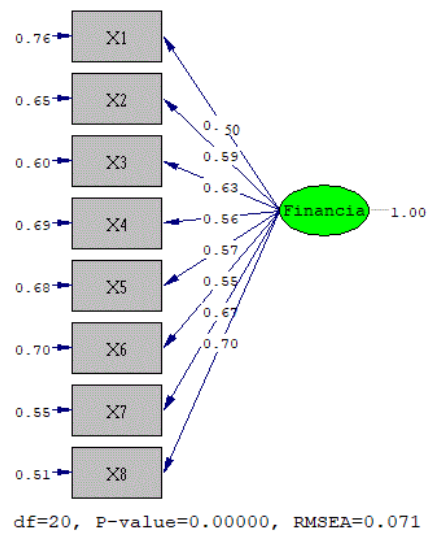
Main component	Sub-component
Financial	Current account status (volume of turnover in the account)
	Bank contact history (account period)
	Loan repayment history (deferred installment)
	Type of loan
	The amount of credit
	Deposit amount
	Interest rate
Market	Warranty status
	Company sensitivity to macroeconomics
	The sensitivity of the company to the legal and political environment
	Market share
	Market Orientation
	Variety of demand
	Technology and innovation
	Production flexibility
	Hybrid products
	Price level
	Brand value
Management	Dependence on customers and suppliers
	Planning and forecasting data
	Timely and reliable reporting
	Certified accounting
	Behavior towards bank loans
	Behavior towards tax obligations
Behavior towards suppliers	

**Table 4.** Final Main and Sub-Components

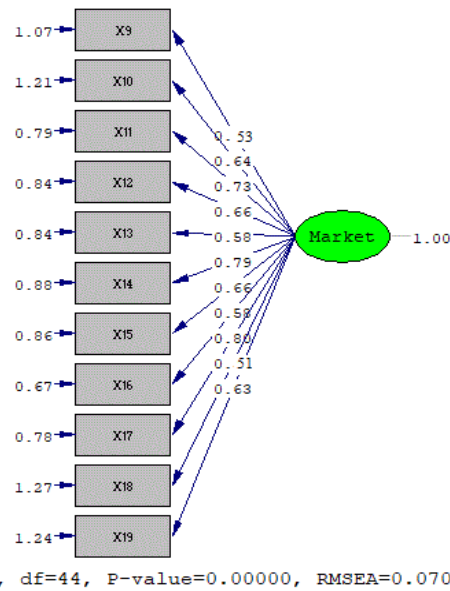
Main component	Sub-component
	Behavior towards customers collateral
	Motivation and productivity of human resources management and business continuity
	Past manager experience and performance
	Commitment and skill of the management team
	Management performance
	Ethical management and orientation towards the value of the environment and the customer

Because of the high likelihood of correlation between items, the modeling for each primary component has been done independently. The goodness of fit index is used to assess the model's validity in the following phase. GFI and AGFI, RMSEA index, Khido statistic, NFI index, and CFI are some of these indicators. The GFI, AGFI, NFI, and CFI indices are all greater than 0.9, according to the results of all three models. As a result, these signs indicate that the model is well-fitting. The RMSEA values are likewise smaller than 0.08, indicating that the model fits well. In all three models, chi-square ratio to degree of freedom is less than 3, and it is significant at the level of 5% probability, indicating that the model is well-fit. The difference between the observed and estimated variance-covariance matrices is shown by this statistic. Because the sample size has an impact on this statistic, direct interpretation is frequently avoided. The sum of all six indicators validated the model's fit, indicating that the structural model of the study is adequate in terms of fit indices and that all of the recommended components can be incorporated into the structural model of the research. After establishing the model's applicability, confirmatory factor analysis was conducted for the financial, market, and managerial components, as shown in Figures (1), (2), and (3), respectively. The findings of factor loads and associated t-statistic are shown in Table (5). Current account balances (account turnover), history of contact with the bank (account period), history of loan repayment (deferred installment), type of loan, credit amount, deposit amount, interest rate, and guarantee status are all equal to 0.50, 0.59, 0.63, 0.56, 0.57, 0.55, 0.67, and 0.70, respectively, in the financial component. The factor loads of the company's sensitivity to macro-economics, sensitivity to the legal and political environment, market share, market orientation, demand diversity, technology and innovation, production flexibility, hybrid products, price level, brand value, and dependence on customers and suppliers in the market component were 0.53, 0.64, 0.73, 0.66, 0.58, 0.79, 0.66, 0.58, 0.80, 0.51, and 0.63, respectively. In the management component, factor loads of planning and forecasting data, timely and reliable reporting, certified accounting, behavior towards bank loans, behavior towards tax obligations, behavior towards suppliers, customer behavior, collateral, manpower motivation and productivity, management and business coherence, manager's past experience and performance, management team commitment and skill, management performance and ethical management, and orientation towards environment and customer value are equal to 0.69, 0.57, 0.61, 0.62, 0.59, 0.60, 0.50, 0.59, 0.72, 0.72, 0.69, 0, 0.67, 0.59 and 0.63, respectively. All coefficients are validated since all factor loads are more than 0.3 and significant.

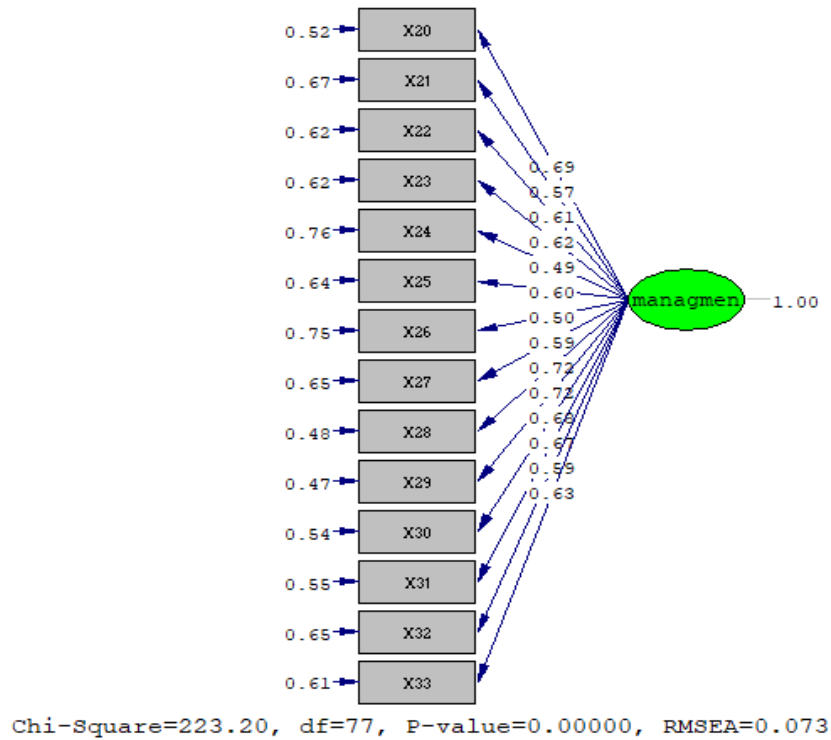




**Fig. 1:** Confirmatory Factor Analysis for the Financial Component



**Fig. 2:** Confirmatory Factor analysis for the Market Component



**Fig. 3:** Confirmatory Factor Analysis for the Management Component

**Table 5.** Factor Loads and T- Statistics of the Component

Variable	Questions	Factor load	Significant coefficients	Result
Financial	Current account status (volume of turnover in the account)	0.50	8.97	Confirmed
	Bank contact history (account period)	0.59	11.27	Confirmed
	Loan repayment history (deferred installment)	0.63	12.14	Confirmed
	Type of loan	0.56	10.47	Confirmed
	The amount of credit	0.57	10.66	Confirmed
	Deposit amount	0.55	10.36	Confirmed
	Interest rate	0.67	13.26	Confirmed
	Warranty status	0.70	13.86	Confirmed
Market	Company sensitivity to macroeconomics	0.53	7.30	Confirmed
	The sensitivity of the company to the legal and political environment	0.64	9.33	Confirmed
	Market share	0.73	12.39	Confirmed
	Market Orientation	0.66	11.12	Confirmed

**Table 5.** Factor Loads and T- Statistics of the Component

Variable	Questions	Factor load	Significant coefficients	Result
	Variety of demand	0.58	10.07	Confirmed
	Technology and innovation	0.79	12.70	Confirmed
	Production flexibility	0.66	11.05	Confirmed
	Hybrid products	0.58	11.04	Confirmed
	Price level	0.80	13.18	Confirmed
	Brand value	0.51	5.81	Confirmed
	Dependence on customers and suppliers	0.63	9.15	Confirmed
Management	Planning and forecasting data	0.69	14.38	Confirmed
	Timely and reliable reporting	0.57	11.32	Confirmed
	Certified accounting	0.61	12.30	Confirmed
	Behavior towards bank loans	0.62	11.29	Confirmed
	Behavior towards tax obligations	0.59	9.23	Confirmed
	Behavior towards suppliers	0.60	11.84	Confirmed
	Behavior towards customers	0.50	9.60	Confirmed
	collateral	0.59	11.81	Confirmed
	Motivation and productivity of human resources	0.72	15.19	Confirmed
	management and business continuity	0.72	15.20	Confirmed
	Past manager experience and performance	0.69	13.90	Confirmed
	Commitment and skill of the management team	0.67	13.89	Confirmed
	Management performance	0.59	11.60	Confirmed
Ethical management and orientation towards the value of the environment and the customer	0.63	12.54	Confirmed	

## 5 Discussion

Because one of the most essential roles of banks is to offer credit facilities, and good fulfillment of this duty leads to economic success, the country's banking system must pay special attention to this problem. One of the primary credit risk management strategies used to limit the risks in banks' lending activities is credit rating and rating of applicants for credit facilities in order to anticipate the possibility of non-repayment of loans. As a result, it is critical to develop an accurate credit rating model for the country's banking sector. As a result, the current research was carried out with the aim of developing a model of financial and non-financial factors that influence credit risk in the Maskan Bank. A hybrid technique approach was used to conduct this research (qualitative and quantitative). So, first, library research was used to identify financial and non-financial factors that impact credit risk, and then the Delphi technique

was used to test the validity of the components recovered. Structural equations were used to model the identified components.

## 6 Conclusion

Based on the findings of the study literature, three major components and 33 sub-components were identified as financial and non-financial indicators impacting credit risk in the qualitative part. The Delphi approach was used to check the authenticity of the identified components after they were identified. In this method, a questionnaire based on identified components was created and distributed to experts. To gain expert consensus on the components, the Delphi technique was used in three phases or rounds. In the quantitative section, structural equations were used to create a questionnaire based on the components found by the Delphi approach. The indicators of guarantee status in the financial component, price level in the market component, motivation and productivity of human resources, and management continuity and trade in the management component have the largest factor loads, according to the conclusions of this section. The bank is disconnected from the money after paying the loan under the usury system, and the bank wants the principal and interest of its money, regardless of the type of economic activity. As a result, there is no need to accurately evaluate the customer (and if it is done, it is better in order to facilitate exchanges and customer selection), whereas in the Islamic banking system, the bank is a partner in economic activities, and the individual's major contribution is considered a guarantee. As a result, it's critical to assess the customer's repayment capabilities while evaluating ownership-power-of-attorney sources.

The price level has decreased buying power as a result of growing inflation, which is particularly crucial for credit risk in the Maskan Bank. People's actual incomes will fall as a result of inflation, and they will be less able to repay their debts. The productivity of human resources and their motivation as a result of increased bank productivity, as well as the continuity of management and business as a result of increased revenue and profitability, all have a significant influence on credit risk. In terms of the types of factors impacting the bank's credit risks, the findings of this study are in line with those of Khojasteh et al., [8], Akhbari & Rafiei [9], and Rastegar & Eidygoush [15].

Based on the findings, it is recommended that the Maskan Bank identify the guarantee status in order to lower its credit risk, particularly during periods of inflation. In order to lower the bank's credit risk, the Maskan Bank may also boost the bank's efficiency and productivity in the internal and management spheres by raising the incentives to the labor force and in line with improving their motivation and productivity.

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