International Journal of Multiphysics
Volume 19, No. 1, 2025
ISSN: 1750-9548

Analyzing the Dimensions and Components of Banking and the Role of Collateral and Collateral Management in Banking Facilities

Abolfazl Yavari[1]

1. PhD Student, Department of Finance-Financial Engineering, Kashan Branch, Islamic Azad University, Kashan, Iran.

Hossein Jabbari[*2]

2. Assistant Professor, Department of Accounting, Kashan Branch, Islamic Azad University, Kashan, Iran (Corresponding Author).

hsnjabbary@yahoo.com

Hossein Panahian[3]

3. Professor, Department of Financial Management, Kashan Branch, Islamic Azad University, Kashan, Iran.

Abstract

This study investigated the factors affecting the enforceability of collateral in legal and institutional systems and used analytical models such as meta-synthesis, interpretive structural modeling, and MICMAC to analyze the relationships between variables. In the qualitative part, the factors were extracted through meta-synthesis and evaluated with the triangular fuzzy Delphi screening technique. The statistical population included university professors, managers, and senior credit experts of the Agricultural Bank, who were selected purposefully. In the quantitative part, the relationships between the factors were analyzed with a combined method of interpretive structural modeling and MICMAC analysis in a fuzzy environment. The results showed that 15 criteria were classified into three main criteria and four levels. Among these factors, the results show that the factors of collateral validity period and the history of the collateral provider are among the most influential indicators that have direct and important effects on other collateral management criteria.

Keywords: Banking, Collateral Management, Collateral, dimensions and components.

Introduction

The banking system, as one of the most important economic sectors, is an intermediary between providers and applicants of financial resources. Due to the risk of loan default, banks use instruments such as collateral and guarantees to increase the probability of returning their financial resources. These collaterals can include real estate, cash deposits, bank guarantees, and other valuable assets that have high liquidity potential.

However, collateral management in complex economic and legal environments is always accompanied by challenges. On the one hand, banks need to receive reliable collateral to reduce credit risks, and on the other hand, implementing legal processes related to the seizure and liquidation of collateral in the event of default can cause problems. In addition, continuous changes in legal and regulatory structures make the work of banks in this area more difficult.

Previous studies have mainly examined some of the details of collateral management, but there are still significant research gaps in the interaction between collateral type, legal structure, and their impact on bank profitability. For example, studies have shown that long-term banking relationships can have a direct impact on the level of collateral required, such that some legal clients with stronger relationships are still able to obtain loans even when collateral value is low.

This study aims to analyze the complex relationships between factors affecting collateral management and explore the opportunities and challenges associated with it in order to provide better solutions for banks. The main research questions are:

.1How can effective collateral management reduce a bank's credit risk?

.2What factors in the legal and institutional systems affect the enforceability of collateral?

.3How can the relationship between different variables be analyzed?

.4How can banks improve collateral management processes using analytical models such as meta-synthesis, interpretive structural modeling, and mim-mik?

This article aims to clarify these issues and provide practical solutions for improving collateral management in the banking system.

3- Literature Review

3-1- Fundamental Theories in Risk Management and Collateral

3-1-1- Risk Management Theories in Banking

• Moral Hazard Theory

The theoretical literature proposes two general categories of theories regarding why borrowers provide collateral. The first set of theories articulates the incentive for collateral as a way for reputable borrowers to demonstrate their quality under conditions of private information. The second set of theories explains collateral as an optimal response to post-contractual problems, including moral hazard (Berger et al., 2016). Moral hazard arises when lenders, due to a lack of sufficient information, are unlikely to be able to evaluate borrowers correctly and may assume that borrowers' wealth will increase by the time the loan matures, as opposed to when the loan is applied for (Krasniqi et al., 2023).

• Adverse Selection Theory

Adverse selection theory, introduced by Stiglitz and Weiss (1981), explains the situation in which banks are unable to distinguish safe borrowers from risky borrowers. According to this theory, banks do not have sufficient information about loan customers (Stiglitz and Weiss, 1981; Krasniqi et al., 2023). This theory predicts that when the borrower's quality is observable to the lender and there is moral hazard in the transaction, the borrower is more likely to provide collateral. On the other hand, if the borrower's quality is not observable (i.e., there is hidden information and adverse selection), lenders use collateral to select borrowers based on perceived risk. This process leads to the selection of high-quality borrowers (who have sufficient collateral and are able to pay lower interest rates) (Ahlin et al., 2020).

• Information asymmetry theory

The information asymmetry theory, introduced by Akerlof (1970), refers to problems such as adverse selection and moral hazard arising from information differences between lenders and borrowers. According to this theory, borrowers usually have more information about the risks of their investments, while lenders are unaware of this information. This information asymmetry causes lenders to use collateral to reduce their risk in order to assess the creditworthiness of borrowers. Also, this situation can lead to increased credit risk and moral problems. In less

developed countries where information is sparse and reliable, it becomes more difficult for banks to assess risk, and this asymmetry has a great impact on decisions about the use and amount of collateral.

• Information economy theory

The information economy is based on a society in which information technology is developed to a certain level. Individuals with strong information can earn higher returns, while individuals with weak information pay additional costs, which can lead to market transaction inequity, increased transaction costs, and ultimately reduced market efficiency (Punyamoorthy and Sridevi, 2016).

From the borrower's perspective, he continuously improves his credit status by improving the information in his personal credit information system and by fulfilling his promises, he improves his credit conditions. This allows the borrower to obtain more favorable interest rates and opportunities in future loans. In the long run, improving the credit information system is not only beneficial to borrowers and lenders, but also contributes to the healthy development of the entire economy (Zhu et al., 2019).

• Institutional Theory

Institutionalization refers to the process by which formal organizational structures are universally recognized as necessary processes and gain legitimacy. Institutional theory is particularly applicable to risk management in terms of the homogenization of risk management practices across organizations and the impact of legal and regulatory pressures. This homogenization can lead to the use of collateral becoming a standard in risk management processes. Thus, in institutionalized systems, the use of collateral becomes a legitimate tool for reducing credit risks (Nguyen and Dang, 2023).

• Financial Intermediation Theory, Fractional Reserve Principle Theory and Credit Creation Theory

Banks as intermediaries transfer financial resources from savers to borrowers, while the fractional reserve principle theory based on keeping only a portion of deposits as cash reserves enables banks to extend loans and create new credit, ultimately leading to increased credit and liquidity in the economy (Sengupta, 2014). Financial intermediation theory has a key function in banking relationships to overcome the information asymmetry between borrowers and lenders, thus enabling the ongoing interaction of lenders to generate credit information for borrowers. Financial intermediaries exist because of their ability to reduce transaction and information costs arising from information asymmetry (Aduda and Ubundi, 2021).

• Portfolio Theory

This theory was developed by Markowitz (1952) and is considered one of the basic principles of risk management in finance. It focuses on controlling unsystematic risk to the point of eliminating it and diversifying the portfolio to manage systematic risk. According to this theory, there are four stages in portfolio construction: security evaluation, asset allocation, portfolio optimization, and performance management (Aduda and Ubundi, 2021).

Diller and Zhai (2024) showed in their study that the expansion of eligible collateral reduces the average risk of a loan. Also, Ah and Landoni (2022) found that lower-quality loans (those backed by collateral with a lower credit rating) (i.e., backed by lower interest rates) have higher margins and spreads, but despite these characteristics, they are riskier and cost less to borrowers. These studies ultimately confirm that collateral characteristics have different risk implications for different types of borrowers.

The role of collateral in credit agreements

In credit agreements, collateral is used as a tool to reduce credit risk and address the problem of information asymmetry between the lender and the borrower. Research shows that secured loan agreements are usually based on the asymmetric valuation of collateral assets, such that the borrower usually values the asset value higher than the lender (Tomura, 2016; Locke and Santos, 2019; Ioannidou et al., 2022).

One advantage of secured loans is that the lender can only foreclose on the asset if the borrower defaults. This feature reduces the costs of information screening for the lender (Kang, 2021). On the other hand, the use of collateral allows the borrower to forego the asset in the event of default, while retaining control of it until default occurs (Diller and Zhai, 2024). However, some studies have shown that higher collateral requirements may increase screening costs and cause lenders to prefer riskier borrowers (Sengupta, 2014). Research on collateral legal reforms in different countries has shown that these reforms have increased the debt capacity of borrowers and led to the democratization of credit (Kalomiris et al., 2017; Artz et al., 2020). However, weak collateral regulations can lead to misallocation of resources (Calomiris et al., 2017).

Finally, collateral characteristics, including its liquidity, have a significant impact on determining borrower risk, leading lenders to use collateral as a screening tool and reduce adverse selection (Beltram et al., 2018).

The importance of collateral pathology and risk biases in credit risk management

Traditionally, financial institutions viewed collateral management not as a strategic imperative but as a low-key operational task. This approach continued until the 2008 financial crisis, when the concept of "risk exchange" through collateral was known at least in theory, but did not play a prominent role in risk management. However, the 2008 financial crisis has fundamentally changed the way collateral and collateral management is viewed as a key tool in mitigating credit risk.

In addition to regulatory changes and new requirements, cognitive biases in credit decision-making are also a major challenge in risk management. Risk biases are systematic errors that affect the evaluation and acceptance of collateral and may lead to the acceptance of ineffective collateral or the rejection of suitable options. Some of the most common risk biases in collateral management include:

Fear of loss: Excessive avoidance of accepting risky collateral, even in situations where it has a high return.

Overoptimism: Underestimating the probability of default and overvaluing collateral assets.

Denying reality: Ignoring data that indicates the high risk of a collateral.

False confidence: Over-reliance on personal experience in accepting or rejecting securities, without careful evaluation of financial data.

Threat exaggeration: Over-focusing on worst-case scenarios and dismissing potentially viable options.

To reduce the impact of these biases, banks should optimize their decision-making processes based on analytical data, standardized assessment models, and ongoing monitoring. In addition, new regulatory frameworks such as Basel III, by setting stricter criteria for collateral eligibility, have required banks to review and refine their collateral management practices. These changes indicate that effective collateral management is no longer an option, but a legal and strategic requirement to reduce credit risks.

3-2- Collateral Management Implementation Process and Structure

3-2-1- Interaction of the Bank, Customer, and Environment in the Collateralization Process

1. Bank-Customer Interaction:

In the collateralization process, the bank and the customer must work together to provide suitable and credible collateral to secure the facility. This stage includes screening the customer and receiving the necessary documentation from the bank. By using rigorous screening and assessment methods, challenges before the collateral process can be reduced or eliminated. These interactions include a thorough assessment of the client's financial strength and creditworthiness, and compliance with bank regulations.

2. Bank-Environment Interaction:

The bank must be in harmony with the relevant legal and regulatory environment during the collateral process. This environment includes laws related to collateral ownership, asset pricing and valuation, and banking regulations. During the collateralization process, challenges related to collateral compliance with these laws may arise, which can be mitigated by developing appropriate legal procedures.

3. Challenges during the collateralization process:

Various challenges arise in the interaction with the bank at the beginning and end of the collateralization process. These challenges can arise from documentation problems or collateral not matching its actual value. These challenges can be managed by developing rigorous pricing methodologies and legal procedures.

4. Challenges during the repayment period:

When the customer is unable to repay the facility, the bank faces risks that can lead to the inability to repay the facility. These challenges can harm the bank and require periodic assessment and regular monitoring to control the risks.

5. Challenges in the process of acquisition and repricing:

If the customer does not meet its financial obligations, the bank is forced to seize the collateral. At this stage, challenges related to the repricing of the collateral arise, which must be managed with accurate pricing methodologies and periodic evaluation. Matching the pricing to the current market conditions and correctly assessing the value of the collateral is of particular importance.

6. Challenges related to the time after the collateral is acquired:

After the collateral is acquired, the bank must properly manage and maintain these collaterals to prevent their price and value from declining. These challenges are related to the way the collateral acquired by the bank is maintained and managed, which should be managed by developing appropriate legal processes and procedures.

7. Challenges in the process of selling and transferring collateral:

If the collateral is sold and converted into money, challenges arise regarding how to transfer and maintain its value. These challenges can be reduced by implementing appropriate training processes and environmental monitoring to maintain the value of the collateral.

3-2-2- Collateral Management Implementation Process (Importance and Time of Occurrence)

Collateral management is a vital process in the banking and financial industry that helps reduce credit risks and increase confidence in the repayment of facilities.

1. Identifying collateral needs; determining the amount of collateral required based on the type of facility and assessing the customer's credit risk based on the bank's internal policies and legal regulations.

2. Collateral evaluation; Determining the actual value of the collateral provided by the customer using standard valuation methods (such as market price, book value or replacement value) and updating the collateral value period according to market fluctuations.

3. Verifying the ownership of the collateral; Reviewing the ownership documents of the collateral and searching public registry systems to ensure that the collateral belongs to the customer and that there are no legal restrictions on it.

4. Registering the collateral; Legally registering the collateral in the banking system and competent authorities (such as the Land Registry).

5. Monitoring the collateral; Using intelligent monitoring systems to continuously monitor the value of the collateral and the customer's status and ability to repay the facility.

6. Collateral risk management; Using risk prediction models (such as neural networks or logistic regression) to identify and mitigate risks associated with the collateral and determining the minimum collateral value to cover the risk of depreciation.

7. Updating the collateral; Periodic assessments to update the collateral value according to market changes in order to adapt the collateral value to current market conditions.

8. Alternative collateral management; Determining the terms of alternative collateral in the event of a decrease in the value of the collateral and requesting the evaluation and registration of alternative collateral from the customer.

9. Sale of collateral in the event of non-repayment; Using fast and efficient methods for selling collateral (such as auction or direct sale) to collect receivables.

10. Reporting and analysis; Using data to improve collateral management processes by preparing periodic reports and analyzing its performance

3-2-3-Credit infrastructure and collateral assessment

Credit infrastructure is the process by which the bank assesses the creditworthiness of potential borrowers and makes decisions about granting loans. This process is of great importance, because accurate assessment and issuance of optimal loans are a prerequisite for the formation of a healthy credit portfolio.

To reduce credit risk, banks hold various assets as collateral to secure and protect their interests. While lending is based on the creditworthiness of borrowers, collateralization plays an important role as a key measure in credit risk management. The accuracy of collateral valuation has a direct impact on the level of bank loss reserves; therefore, it is essential that banks implement effective valuation standards and practices to ensure the real and documented value of collateral.

3.3- Credit Risk Management Strategies and Tools

Credit risk management is a vital process for banks and financial institutions that involves identifying, assessing, and mitigating the risks associated with granting facilities. For this purpose, various strategies and tools are used that help reduce the probability of default and improve the financial performance of banks.

One of the important strategies in risk management is to prevent the occurrence of credit risks through careful customer assessment, strong internal controls and the use of credit rating systems. In addition, transferring risk to third parties through credit insurance or derivative contracts is an effective method of reducing the impact of potential losses (Natafeh et al., 2023). Risk reduction is also carried out using mechanisms such as diversifying the credit portfolio, setting credit limits for customers and implementing efficient collateral policies. To ensure the effectiveness of these measures, continuous monitoring and control of the financial situation of customers and monitoring the macroeconomic environment are essential. In some cases, accepting part of the risk as an inevitable reality, along with the allocation of appropriate financial reserves, is considered a management strategy (Daggo and Dighi, 2015).

To implement these strategies, banks and financial institutions use various tools, including the following:

• Collateral and guarantee: Cash or non-cash assets that the borrower provides as a guarantee for loan repayment. This tool reduces losses due to default (Nazari Pourmohammad et al., 1401).

• Collateral management and swapping: In addition to receiving collateral, banks use its efficient management to increase liquidity and reduce systematic risk. Collateral swapping is a method in which banks replace riskier assets with less risky assets as collateral to improve their credit balance sheet (Smith et al., 2022).

• Late payment penalties: Imposing financial penalties on borrowers who do not pay their installments on time increases financial discipline in the banking system (Fakhrarazi et al., 2023).

• Credit rating systems: Using statistical models and machine learning to assess customer risk and optimally allocate facilities (Wang et al., 2024).

• Loan loss reserves: Banks are required to set aside a portion of their resources as reserves to cover potential losses due to borrower default (Nazari Pourmohammad et al., 1401).

• Financial derivatives: Contracts such as credit default swaps and futures contracts that are used to hedge risks related to changes in interest rates and economic fluctuations (Infante et al., 2020).

3.4- Innovations, Challenges and the Future of Collateral Management

Collateral management has undergone significant changes and developments, especially in recent years. One of the factors that has caused these changes is the increase in the frequency and value of collateral movements, which has affected not only direct users but also end users, increasing the costs of capital and financing these transactions. This has forced banks and financial institutions to use a range of techniques and tools to ensure that they have sufficient collateral in place to prevent potential losses. These techniques typically include prudential adjustments, periodic assessments, margin calls and the imposition of limits. Typically, banks require borrowers to provide collateral with a value greater than the loan amount, known as a "prudential adjustment", to protect against a possible decrease in the value of the collateral in the future.

In general, calculating write-downs is a multi-layered process that relies on analyzing the historical behavior of the collateral value, and one of the most important factors in determining the amount of write-down is the probability of the collateral value decreasing. To ensure that the value of the collateral is sufficient to cover the loan in the event of default over the life of the transaction, the value of the collateral is continuously and closely monitored. The amount of prudential adjustment is usually calculated based on metrics such as "Value at Risk" (VaR), which indicates that with a certain percentage of confidence, the loss from an investment will not exceed a certain amount.

In the future, the collateral management industry will certainly face a wave of new challenges and changes. Among the major challenges affecting collateral management today are compliance with new laws, differences in regulations between different jurisdictions, and increasing costs. Changes in regulatory frameworks and new laws have put additional pressure on collateral management processes, requiring companies to comply with these new requirements. In this regard, the effort to maintain compliance with new laws and regulations is the most significant implementation challenge in this area. Also, the differences in regulations between different jurisdictions have created challenges for asset managers.

Increasing costs, especially in the face of new regulations, have forced many companies to develop more complex systems for collateral management. Hence, the need for more effective systems for data aggregation , validation and automation of collateral-related processes are being felt more. In the future, these processes will increasingly move towards automation and digital innovations.

4- Research Method

The present study is based on the philosophy of pragmatism and uses a mixed approach (qualitative-quantitative). This philosophy emphasizes that a combination of qualitative and quantitative methods can lead to practical and practical results.

Data Collection Method and Research Strategy:

The research is a survey in terms of strategy, and the data were collected in two ways: library and field:

• In the qualitative part, the criteria effective on collateral and guarantee management were identified using reputable articles and the meta-synthesis technique.

• In the quantitative part, the data were collected through a questionnaire and interviews with experts in the banking field.

- Data Collection Tools:

• Qualitative part: The criteria effective on collateral and guarantee management were examined and identified using the meta-synthesis technique.

• Quantitative part: A Delphi-Fuzzy questionnaire was used to identify and prioritize the criteria. Interpretive Structural Modeling (ISM) and MICMAC analysis were used to examine the relationships between the criteria and their effects on each other.

- Statistical population and sampling:

The statistical population of this study consists of banking experts, including university professors, managers, and senior credit experts of Keshavarzi Bank. Sampling was carried out purposively and the experts were selected based on their expertise and experience in the field of credit risk management. In accordance with the standards for implementing multi-criteria decision-making techniques, the sample size was determined to be between 10 and 20 people.

- Data validation:

To ensure the validity of the collected data, the opinions of the research experts were used and the accuracy of the data was confirmed.

This comprehensive approach allows the identification of key criteria in collateral and guarantee management and the provision of solutions for its improvement.

Fuzzy Delphi Method

The fuzzy Delphi method is used to confirm or screen research indicators in an environment of uncertainty. The steps of this method are given below (Mousavi et al., 2015).

1- Identifying research indicators using a comprehensive review of the theoretical foundations of the research.

2- Collecting the opinions of decision-making experts: Determining the importance of each indicator based on the spectrum of Table 1.

Table 1: Fuzzy Delphi linguistic expressions and numbers (Mirspasi et al., 2016; Mousavi et al., 2015)

Triangular fuzzy numbers	Language phrases
(0،0،0.25)	Very little
(0،0.25،0.5)	Little
(0.25،0.5،0.75)	Average
(0.5،0.75،1)	A lot
(0.75،1،1)	Very much

3- Verification and screening of indicators: For each fuzzy number based on equation 1, the average of each of the fuzzy bounds is first calculated based on equations 2 to 4.

$$\tilde{\tau}_{ij} = (a_{ij}, b_{ij}, c_{ij}), \quad i = 1,2,\dots,n \quad j = 1,2,\dots,m \tag{1}$$

$$a_j = \sum \frac{a_{ij}}{n} \quad (2)$$

$$b_j = \sum \frac{b_{ij}}{n} \quad (3)$$

$$c_j = \sum \frac{c_{ij}}{n} \quad (4)$$

Then, using Equation 5, the final fuzzy numbers are converted into non-fuzzy numbers.

$$Crisp = \frac{a + b + c}{3} \quad (5)$$

In this study, the threshold value for elimination is 0.7, so that any indicator with a non-fuzzy value less than 0.7 is eliminated.

Results of the Fuzzy Delphi Method

In this section, a questionnaire containing 15 research indicators was provided to the members of the expert group, including managers and financial and credit experts of the Agricultural Bank, and they were asked to express their opinion on each criterion based on the spectrum of Table 1. Then, the Fuzzy Delphi method was implemented, the results of which are given in Table 3, which shows that all criteria are approved.

Table 3: Results of the Fuzzy Delphi

Status	Non-fuzzy average	Fuzzy average	Symbol	Substandard	Criteria	Row
Confirmation	0.750	(0.533,0.783,0.933)	C1	Real collateral (real estate and assets)	Collateral type	**1**
Confirmation	0.811	(0.617,0.867,0.95)	C2	Financial collateral (account balances and securities, etc.)		**2**
Confirmation	0.750	(0.533,0.783,0.933)	C3	Additional collateral		**3**
Confirmation	0.772	(0.567,0.817,0.933)	C4	Market value	Collateral value	**4**
Confirmation	0.828	(0.617,0.867,1)	C5	Ability to measure		**5**
Confirmation	0.717	(0.483,0.733,0.933)	C6	Ratio of collateral to loan		**6**
Confirmation	0.722	(0.5,0.75,0.917)	C7	Stability of collateral value		**7**
Confirmation	0.828	(0.633,0.883,0.967)	C8	Collateral flexibility		**8**
Confirmation	0.894	(0.717,0.967,1)	C9	Collateral validity period		**9**
Confirmation	0.828	(0.633,0.883,0.967)	C10	Pledgor's history		**10**
Confirmation	0.839	(0.633,0.883,1)	C11	Legal rights and ownership	Enforceability of collateral	**11**
Confirmation	0.833	(0.633,0.883,0.983)	C12	Ability to sell or dispose of		**12**

Confirmation	0.756	(0.533,0.783,0.95)	C13	Security and storage conditions	**13**
Confirmation	0.811	(0.617,0.867,0.95)	C14	Liquidity	**14**
Confirmation	0.817	(0.6,0.85,1)	C15	Collateral registration regulations, systems, and system	**15**

5- Discussion and Analysis

The research results show that effective collateral and guarantee management plays a key role in reducing banks' credit risk. Banks can reduce the probability of loan defaults by accurately assessing the value of collateral, continuous monitoring, and using modern risk management tools. Also, the type and quality of collateral has a direct impact on banks' profitability, as more liquid assets and more reliable collateral lead to lower funding costs and improved credit performance of banks.

In addition, the findings indicate that legal and institutional structures affect the efficiency of collateral management. Continuous changes in regulations can create challenges for banks, but the use of analytical models such as interpretive structural modeling (ISM) and MICMAC analysis helps banks identify dependencies between different variables and develop optimal strategies for collateral management.

Finally, the results show that improving the processes of recording and valuing collateral, monitoring customer credit status, and standardizing regulations can have a significant impact on increasing bank profitability and reducing financial risks.

Scientific analysis of the research results shows that effective management of collateral and guarantees is very important for reducing banks' credit risk. Scientific analysis of these results from various aspects is as follows:

1. Accurate assessment of collateral value

Correct and accurate assessment of collateral reduces the risk of loan default. This helps banks to use collateral to compensate for losses in the event of problems in repaying loans. In general, banks that have accurate valuation of collateral are better able to protect themselves from credit risks.

2. Continuous monitoring of collateral and use of new tools

Continuous monitoring of collateral and the use of new risk management tools (such as advanced algorithms and risk prediction models) enable banks to respond quickly to changes in the financial and economic situation of customers. These strategies reduce the probability of loan defaults and, as a result, reduce the bank's overall risk.

3. Type and quality of collateral and its impact on profitability

More credible and liquid collateral, in addition to reducing credit risk, reduces banks' funding costs. In fact, high-quality collateral allows banks to use financial resources more efficiently and, as a result, have better credit performance, which in turn leads to greater profitability.

4. Impact of legal and institutional structures

Changes in regulations and laws related to collateral management can create serious challenges for banks. Especially when these changes occur continuously and without sufficient information, banks may face compliance problems. However, the use of analytical models such as ISM and MICMAC can help banks identify dependencies and relationships between different variables and adopt more optimal strategies for collateral management.

5. The importance of collateral registration and valuation processes

Correct and timely registration of collateral as well as their accurate valuation, improved supervisory processes and standardization of regulations are factors that can have a great impact on reducing risks and increasing banks'

efficiency. In fact, transparent and systematic processes in this area allow banks to manage their risks more effectively.

These results clearly show that effective collateral management not only helps reduce credit risks, but can also lead to improved financial performance and profitability of banks.

Conclusion

The Interpretive Structural Model (ISM) and MICMAC analysis simultaneously show that some indicators have a greater impact based on hierarchical and complex relationships with other indicators. These findings are of particular importance for banks and financial institutions, as they can use these indicators to prioritize and determine optimal strategies for credit risk management. In particular, indicators such as collateral validity period and collateral history are recognized as key measures in reducing credit risk and improving the quality of collateral management. Accurate assessment and continuous monitoring of collateral not only reduces credit risk, but also reduces the probability of loan default. More liquid and credible collateral reduces funding costs and improves banks' credit performance.

However, the impact of legal and institutional structures can be challenging. The use of analytical models such as ISM and MICMAC helps banks identify dependencies between indicators and develop optimal strategies to improve collateral registration and valuation processes.

This research faces limitations such as available data, complex variables, unpredictable effects, dependence on specific analytical models, and the impact of factors beyond the control of banks.

References

1. Amirali Seifuddin Asl, Fatemeh Saghafi and Mohammad Mehdi Zolfagharzadeh. Extracting key indicators of research development using the Ishikawa Fuzzy Delphi method for the healthcare sector. 2016: 81 (25). 5-26.
2. Parisa Mousavi, Reza Yousefi Zenouz, Akbar Hassanpour. (2015). Identifying organizational information security risks using the Fuzzy Delphi method in the banking industry. Information Technology Management. Issue 22. 163-184.
3. Rahdari Alireza, Nasr Mostafa. Challenges of think tanks in Iran. Quarterly Scientific Research Journal of Management and Development Process. 2017; 30 (2): 23-54.
4. Mirsepasi, Dr. Naser, Toloei Ashlagi, Dr. Abbas, Memarzadeh, Dr. Gholamreza, Peidai, Dr. Mirmehrdad. (2010). Designing a human resources excellence model in Iranian government organizations using the Fuzzy Delphi technique. Management Futures, 21(No. 4(87)), 1-22.
5. Nazaripour Mohammad, Mousavi Somayeh Al-Sadat, Ghazi Askari Saba, & Nafer Zahra. (1401). Identifying and ranking credit risk management tools in the banking system using fuzzy multi-criteria decision-making methods.
6. Aduda, J., & Obondy, S. (2021). Credit risk management and efficiency of savings and credit cooperative societies: A review of literature. Journal of Applied Finance and Banking, 11(1), 99-120
7. Ahlin, C., Gulesci, S., Madestam, A., & Stryjan, M. (2020). Loan contract structure and adverse selection: Survey evidence from Uganda. Journal of Economic Behavior & Organization, 172, 180-195
8. Ajalli, M., Asgharizadeh, E., Jannatifar, H., & Abbasi, A. (2016). A fuzzy ISM approach for analyzing the implementation obstacles of electronic government in Iran. Science, Technology, Humanities and Business Management (ICSTHBM-16), 15.
9. Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. The Quarterly Journal of Economics, 84(3), 488-500
10. Aretz, K., Campello, M., & Marchica, M. T. (2020). Access to collateral and the democratization of credit: France's reform of the Napoleonic Security Code. The Journal of Finance, 75(1), 45-90
11. Auh, J. K., & Landoni, M. (2022). Loan terms and collateral: Evidence from the bilateral repo market. The Journal of Finance, 77(6), 2997-3036

12. Beltrame, F., Floreani, J., Grassetti, L., Mason, M. C., & Miani, S. (2018). Collateral, mutual guarantees and the entrepreneurial orientation of SMEs. Management Decision, 57(1), 168-192
13. Berger, A. N., Frame, W. S., & Ioannidou, V. (2016). Reexamining the empirical relationship between loan risk and collateral: The roles of collateral liquidity and types. Journal of Financial Intermediation, 26, 28-46
14. Calomiris, C. W., Larrain, M., Liberti, J., & Sturgess, J. (2017). How collateral laws shape lending and sectoral activity. Journal of Financial Economics, 123(1), 163-188
15. Charan, P., Shankar, R. and Baisya, R.K., 2008. Analysis of interactions among the variables of supply chain performance measurement system implementation. Business Process Management Journal, 14(4), pp.512-529.
16. Dieler, T., & Zhai, W. (2024). Pledgeability and bank lending technology. Journal of Corporate Finance, 102650
17. Dugguh, S. I., & Diggi, J. (2015). Risk management strategies in financial institutions in Nigeria: The experience of commercial banks. International Journal of Research, 66
18. Fachrurrazy, M., Ayyubi, HM, & Savitri, D. (2023). Penerapan Denda Keterlambatan Angsuran Pada Produk Pembiayan Syariah (Studi Kasus Pada PT. BPRS Dana Moneter Cab. Kota Palopo, Sulawesi-Selatan). Jurnal Hukum Ekonomi Syariah: AICONOMIA, 2 (2), 84-101. ,
19. Govindan, K., Palaniappan, M., Zhu, Q. and Kannan, D., 2012. Analysis of third party reverse logistics provider using interpretive structural modeling. International Journal of Production Economics, 140(1), pp.204-211.
20. Ioannidou, V., Pavanini, N., & Peng, Y. (2022). Collateral and asymmetric information in lending markets. Journal of Financial Economics, 144(1), 121-93
21. Kang, K. Y. (2021). Optimal contract for asset trades: Collateralizing or selling?. Journal of Financial Markets, 56, 100590
22. Kannan, G. and Haq, A.N., 2007. Analysis of interactions of criteria and sub-criteria for the selection of suppliers in the built-in-order supply chain environment. International Journal of Production Research, 45(17), pp. 3831-3852.
23. Krasniqi, B., Kotorri, M., & Aliu, F. (2023). Relationship banking, collateral, and the economic crisis as determinants of credit risk: an empirical investigation of SMEs. The South East European Journal of Economics and Business, 18(2), 49-62
24. Luck, S., & Santos, J. A. (2019). The valuation of collateral in bank lending. Journal of Financial and Quantitative Analysis, 1-30
25. Natufe, O. K., & Evbayiro-Osagie, E. I. (2023). Credit risk management and the financial performance of deposit money banks: some new evidence. Journal of Risk and Financial Management, 16(7), 302
26. Punniyamoorthy, M., & Sridevi, P. (2016). Identification of a standard AI based technique for credit risk analysis. Benchmarking: An International Journal, 23(5), 1381-1390.
27. Sengupta, R. (2014). Lending to uncreditworthy borrowers. Journal of Financial Intermediation, 23(1), 101-128
28. Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. The American economic review, 71(3), 393-410
29. Tomura, H. (2016). Investment Horizon and Repo in the Over-the-Counter Market. Journal of Money, Credit and Banking, 48(1), 145-164
30. Wang, Y., Jia, Y., Fan, S., & Xiao, J. (2024). Deep reinforcement learning based on balanced stratified prioritized experience replay for customer credit scoring in peer-to-peer lending. Artificial Intelligence Review, 57(4), 93
31. Zhou, Q., Yang, J. J., & Wu, W. X. (2019). Pricing vulnerable options with correlated credit risk under jump-diffusion processes when corporate liabilities are random. Acta Mathematicae Applicatae Sinica, English Series, 35(2), 305-318.