# Development of a Dynamic Model of Bank Strategy in Uncertainty Using the SD Approach[1]

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## INTRODUCTION

The present study introduces a dynamic model of bank strategy in uncertain conditions using the System Dynamics (SD) approach. By examining Iran's banking system and involving Bank Saderat policymakers, future uncertainties of the system were identified and a causal diagram depicting the performance of the banking system in uncertain circumstances was constructed. A dynamic model of accumulation and flow was then developed based on bank data and simulated over a twenty-year time horizon. After validating the model, the bank's strategy and policies were extracted and analyzed under uncertainty through sensitivity analysis.

The findings revealed four strategies for effective management of bank assets and expenses, attracting financial resources, generating profits, strengthening bank management, and developing banking infrastructure. Additionally, a combined-selected strategy was identified and simulated. The simulation of the selected strategy demonstrated the best performance, which included the following key policies: 1.

Increasing investment in banking infrastructure three-fold. 2. Implementing special mechanisms for efficient collection of claims. 3. Implementing agile processes to achieve a 5% reduction in bank costs, coupled with human resource empowerment and effective monitoring of costs and expenses. 4. Enhancing the efficiency of the customer validation process four-fold. 5. Improving trust and security for depositors through the provision of financial transparency reports and effective communication with key stakeholders, resulting in a two-fold increase in trust and security levels.

By implementing these policies, the study suggests that banks can navigate uncertainties more effectively and improve their overall performance in the face of dynamic challenges.

## MATERIALS AND METHODS

In the theory of System Dynamics (SD), the relationships between variables in a complex system are modeled as interconnected feedback loops. These feedback loops create the structure of the system, which ultimately determines the system's behavior. The primary objective of SD is to assist managers in understanding and comprehending complex systems, enabling them to align system behavior with their desired goals through intervention.

The methodology of SD involves several steps: 1. Identifying and defining the problem: This initial step is crucial as it involves precisely framing and defining the problem at hand. 2. Identifying dynamic hypotheses: Once the problem is defined, modelers propose dynamic hypotheses, which serve as theories that explain the behavior of the system within the defined problem and time horizon. 3. Building the conceptual model: This step involves constructing a causal loop diagram, which visually represents the relationships between various phenomena in the system. Additionally, a flow diagram is drawn to depict the flow of variables within the model. 4. Simulating and validating the model: The constructed model is simulated to observe its behavior and test its validity. This step ensures that the model accurately captures the dynamics of the system under consideration. 5. Defining different scenarios and implementing solutions: Various scenarios can be defined and explored using the model. This helps in selecting and implementing appropriate solutions to address the problem at hand.

For data collection, the study relied on documents and reports from the Central Bank of Iran, as well as the archives of the Statistics and Accounting Department of Bank Saderat. Expert interviews were also conducted. The data spanned the period from 2011 to 2019 and was extracted from the archives of the Statistics and Accounting Department of Bank Saderat Iran.

**RESULTS AND DISCUSSION**

In this section, the dynamic modeling of the banking system under uncertainty is presented, along with the methodological steps followed in the study. The findings obtained from the dynamic model are also analyzed. Figure 1 illustrates the subsystem of the bank performance problem within the context of uncertainty and showcases the interaction between the components of the bank performance model and the uncertainties present in the banking system. This framing is based on existing research literature in the field.
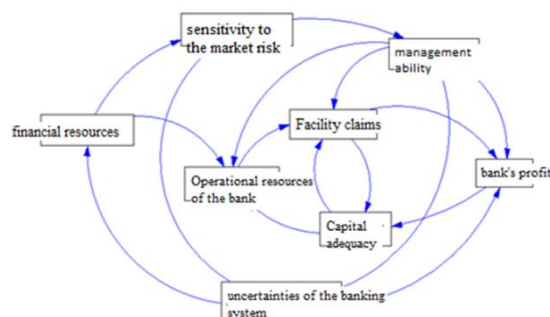


**Figure 1.** The subsystems of the bank performance model in uncertainty of the banking system and the interaction of the model components

Source: research findings

Based on the identified subsystems, both endogenous and exogenous variables were determined for each sub-system through a combination of research literature and input from banking experts. The causal diagram of the problem was then constructed, showcasing the dynamics of the bank's performance in the face of future uncertainties within the banking system.

To model the flow structures, additional variables and parameters were identified, enabling the calculation of mathematical relationships between variables. The accumulation and flow model was developed using the expertise of banking system professionals and quantitative data from Bank Saderat.

Figure 2 illustrates the modeling of the bank performance problem under uncertainty, incorporating the structure of subsystems and causal relationships. It serves as a visual representation of the complex dynamics involved in the problem at hand.
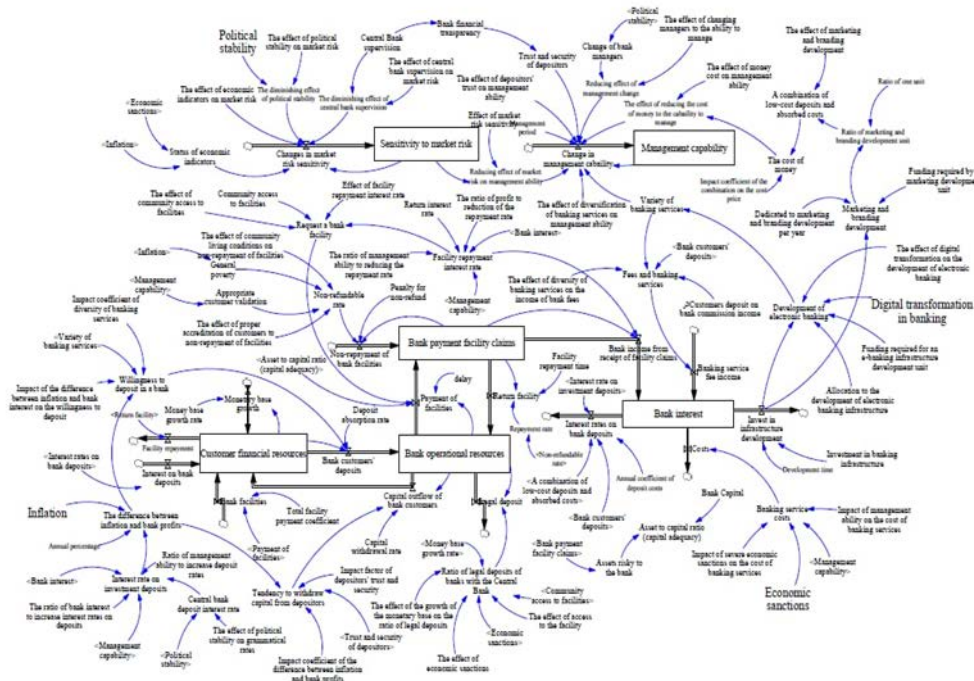
**Figure 2**. Bank performance flow in uncertainty
Source: research findings

After undergoing successful validation tests, the initial simulation of the model was conducted. Sensitivity analysis was performed on the exogenous variables using Vensim software. The results of the sensitivity analysis indicated that certain variables, such as customer validation, variety of banking services, capital outflow rate, fundraising rate, and security of depositors, had a significant impact on the model's behavior. Conversely, variables like management time and fine rate showed less sensitivity.

Considering the consensus among banking experts, various strategies to improve bank performance were evaluated. Four main strategies were identified, focusing on managing bank assets and expenses, attracting financial resources, empowering bank management, and developing banking infrastructure. Subsequently, a combination of these strategies was tested and evaluated using the model.

The selected strategy represents a comprehensive combination of multiple strategies. The specific policies associated with the selected strategy are outlined as follows:

1. Policy 1: Increase investment in banking infrastructure three-fold, with an annual allocation increase of 20% for the development of electronic banking infrastructure to align with digital transformation in banking.
2. Policy 2: Implement special mechanisms for collecting claims to reduce the non-repayment rate of facilities by 20% and improve the repayment rate.

3. Policy 3: Implement agile processes to achieve a 5% reduction in bank costs, while simultaneously empowering human resources and implementing effective monitoring and control mechanisms for bank costs and expenses.
4. Policy 4: Enhance the efficiency of the customer validation process, aiming to prevent delays in claims and improve overall customer satisfaction by achieving a four-fold increase in efficiency.
5. Policy 5: Enhance trust and security for depositors by providing financial transparency reports and establishing effective communication channels with key stakeholders.

The results of implementing the selected strategy policies, compared to the best combined strategies identified in the model, are presented in Figure 3. This visual representation provides insights into the performance outcomes achieved through the application of the selected strategy.
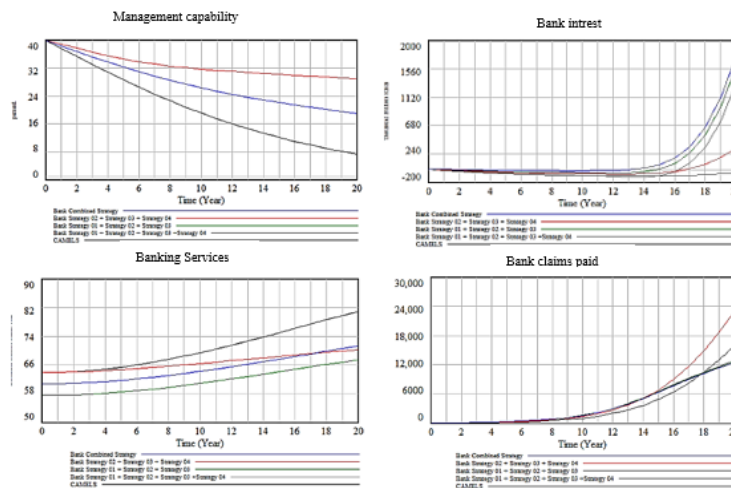


**Figure 2.** Bank's selected combined strategy compared to other combinations
Source: research findings

**CONCLUSION**

The present study has developed a dynamic model of bank strategy in uncertainty using the SD approach based on the data of Bank Saderat Iran and simulated over a twenty-year horizon. After validating the model and conducting sensitivity analysis, the bank's strategy and policies were extracted and analyzed under uncertain conditions. The findings revealed four strategies: managing bank assets and expenses, attracting financial resources and generating profits, empowering bank management, and developing banking infrastructure. Additionally, a combined-selected strategy was identified and simulated. However, in the long term, it was observed that solely implementing the strategy of managing bank assets and expenses improved the bank's performance but did not lead to its development. This could be attributed to the unchanged lack of management's ability in executing this strategy, which hindered sustained improvements.

The strategy of attracting financial resources and generating profits plays a crucial role in improving the overall system. By implementing policies aligned with this strategy, the bank increases its provision of facilities to customers, leading to a rise in the bank's claims. This strategy contributes to sustainable profitability for the bank. The implementation of empowering bank management strategies focuses on enhancing the trust and security of depositors and key stakeholders, as well as developing marketing and branding infrastructures. This results in attracting profitable customers and optimizing the combination of low-cost and revenue-generating deposits. Additionally, empowering bank managers and fostering resistance to managerial changes are key aspects. Considering the predicted political instability, empowering bank management is likely to drive the development of the bank's performance. Overall, this strategy improves the bank's overall performance. The strategy of developing electronic banking infrastructures enhances the variety of banking services and increases the user base of electronic banking services, resulting in higher profitability through increased income from banking service fees. Therefore, developing banking infrastructure is also an effective strategy for enhancing bank performance. Based on the simulation of the selected strategy, the following policies were identified as the best approach for the bank in uncertain conditions: increasing investment in banking infrastructure, creating specialized mechanisms for claims collection, implementing agile processes to manage bank costs and empowering human resources, monitoring and controlling bank costs and expenses, improving the efficiency of customer validation processes, and enhancing trust and security for depositors. Despite some limitations, this study aims to contribute to the existing knowledge on the dynamics of bank performance in uncertain environments and provides a foundation for future research in this field.

The author's suggestion in this field includes modeling the bank system by incorporating effective variables to reflect the reality as accurately as possible in the model. Additionally, the author recommends developing the model to incorporate the funds available to customers and their investment preferences in different markets, such as the stock market, gold, and foreign currency. It is also suggested to develop a model that encompasses various types of bank facilities and different sources of income, including both common and non-common incomes. Furthermore, the author recommends incorporating scenario planning and forecasting techniques to explore and analyze potential future scenarios. Finally, future studies should focus on identifying the policies of the Central Bank of Iran aimed at controlling uncertainties in the banking system and assessing their impact on the performance of Iran's banks.