

# COMPLEX DECISION MAKING IN THE FINANCIAL SERVICES SECTOR – THE APPLICABILITY AND USAGE OF THE SYSTEM DYNAMICS METHOD

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## Abstract

Decision-making is a fundamental component of strategic and operational management; it often requires the ability to interpret and act on feedback quickly. In this article we will look at different methods employed by financial services institutions for decision making, and in particular we will explore the usage of the system dynamics method. System dynamics is a way of studying complex systems to understand their behavior and decisions outcomes.

In the article we will also seek to understand opportunities and barriers in the usage of system dynamics in preparing organizations to challenge and enrich their interpretation of a complex world. The article is based on primary research of current practices in the sector and interviews with ~35 subject matter experts.

**Keywords:** Analytical Method, Mathematical Models, Optimization, Simulation, Interpretation, Decision Making, Feedback Systems, Systemic Correlations, Managerial Methodology

**JEL Classification:** C61, G20, C81

## 1. Introduction

Strategic and operational management is an essential component in achieving the strategic objectives of the organization. Currently, the modern manager's toolkit includes a significant number of techniques and management analyses that support decision making. As methods evolve and become more refined, they increasingly generate more interest from various companies that are looking for new ways to increase service quality and customer satisfaction, reduce costs, and streamline processes.

Strategic and operational management have clear key objectives. For strategic management, the main objectives are

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determining the optimal market strategy (including target customer segments, pricing, and entering new markets), resource allocation, and increasing the adaptability of the organization; for operational management, key objectives include increasing operational efficiency, reducing waste, and increasing quality of outputs, as well as the alignment of operational processes and decisions with the organization's strategic objectives.

There are numerous methods and methodologies to support the decision-making processes. Initially, these were focused on improvement of operational processes. During late 1800s and early 1900s, much attention was focused on scientific management, which involved developing methods to analyze and solve production problems, often based on time trials (Nadia Buhuiyan, Amit Bagel – An overview of continuous process improvement, 2005). The continuous improvement methods, including statistical analysis, started to be often included in programs of national interest aimed to enhance output, with experts like Frederick Taylor, Henry Grant, and Frank and Lillian Gilbert considered to be some of the founders of modern management. The early assembly line principles developed by Henry Ford were built upon in the 1950s, when Toyota implemented the Quality Circles, aimed at efficient production systems and elimination of waste. From a strategic analysis perspective, starting with the 1960s several new methods and frameworks have been developed, either at prestigious universities, such as the SWOT analysis developed at Harvard (this framework supports the analysis of a company through the perspective of its specific Strengths, Weaknesses, Opportunities and Threats), or by management consultants, such as Porter's Five Forces (which identifies the forces which form a competitive environment), developed by Michael Porter of The Monitor Group, and the Experience curve developed by the Boston Consulting Group (this refers to the hypothesis that for any company the unit cost decreases significantly by 15-25% for each doubling of the cumulative production).

Later on in the late 1980s, the focus on operational efficiency has been furthered through extensive focus on lean manufacturing, eliminating everything that does not add value to a process, and increasing adaptability of an organization through elimination of waste.

Although initially these methods were applied especially in the production sector, recently they extended their application in the financial sector. The financial crisis of 2007-2008 resulted in an increased concern of banks to reduce their costs and maintain profitability, bringing back to the forefront the concern for efficient operational management. The largest banks in the world have successfully implemented Six Sigma methods and reengineering processes (Ayesha Khanna, "Straight-through Processing for Financial Services – The Complete Guide", 2008), achieving significant cost reductions – often, the engineering efforts are attributed an impact of hundreds of millions of US dollars. Moreover, the financial crisis demonstrated the inter-connectivity and vulnerability of the financial system resulting from this interdependence, complexity and intensity of ties between participants.

The large number of participants in financial processes and distribution of risks, as well as the interdependencies between them through complex transactions in a large number of markets and jurisdiction, result the banking sector being highly complex. Moreover, each organization is a complex system in itself, with many components and interactions which often cannot be anticipated by simply analyzing isolated factors of influence. Traditional tools methods of analysis – both in support of strategic as well as of operational management - are focused primarily on linear analyses (e.g., cause-and-effect). For example, operational process analysis is often limited to the analysis of various process steps and their failures without specifically analyzing the interaction between various process parameters.

The complex nature of organizations and the environment in which they operate bring to the fore the need for a different analysis method, with focus on fundamental understanding of all components of the organization and the environment in which it operates. Only when the systemic aspects are deeply understood one can determine what must be done to achieve long-lasting improvements.

## **2. Complex decision making in the financial services sector**

A systemic approach includes the analysis of feedback systems and is focused on finding solutions that suit the environment in which the organization operates and identifying interdependencies between different parameters and their interaction with the

environment. The ability to recognize feedback systems within an organization - although simple in concept - represents a major departure from the linear approach and gives us a different way to interpret the economic and social environment (Jay W. Forrester, Senior Lecturer at Sloan School of Management Massachusetts Institute of Technology, *System Dynamics and the Lessons of 35 Years*, 1991).

The system dynamics method is a scientific approach to studying the behavior of complex systems over time. The approach aims to understand the behavior of complex systems over relatively extended periods of time, demonstrating that even the simplest systems have a non-linear behavior. The method includes an analysis of feedback loops, using the "accumulation" and "flows" between various parameters, and provides the ability to predict possible outcomes of decisions (John D. Sterman, *Business Dynamics – Systems Thinking and Modeling for a Complex World*, 2000). A traditional analysis process, such as the linear-type approach, enables us to identify simple loops; however, as the distance between cause and effect is greater in time and space, the consequences of previous decisions become more difficult to identify, as they are directly correlated with the accumulation of experience and refining future decisions (John D. W. Morecroft, *Strategic Modelling and Business Dynamics, "A feedback systems approach"*, 2010).

Systemic dynamics is not a new approach, but its use in financial services, in the context of understanding systemic impact (e.g., risk) is limited, although recent events (such as the financial crisis) demonstrate the need to better understand how organizations are connected to the environment they operate in. According to Deming (in the "System of Profound Knowledge", 1993), only when systemic issues are deeply understood, one can determine what needs to be done to achieve lasting improvements in quality and efficiency. Organizations run by people who are guided by "profound knowledge system" are much more likely to succeed and be effective. Deming is among the most recent world-renowned experts who support the introduction of a systemic approach in answering management questions.

Surprisingly, system dynamics is studied and applied in a limited fashion. Since being developed at the Massachusetts Institute of Technology ("MIT") in Cambridge, Massachusetts by the renowned professor Jay Forrester, the method has been mostly applied to

understand public policy issues and predict possible outcomes and unintended consequences; it also has been applied to operational problems, such as production management. Currently, in the US system dynamics is included in the curricula of very few universities (however, the method continues to hold a prominent place in the curriculum at MIT).

This method has particular relevance for the financial sector. Due to the complexity of the financial system and its predominantly silo-ed approach, and due to the risks involved, a systems dynamics approach can fulfill a key role in strategic, organizational, and operational management. This topic is particularly relevant in the current context, where financial services companies that were shaken by the financial and economic crisis, are now faced with increasing pressure on costs, and at the same time with the requirements of increasingly sophisticated customers, who do not want any compromise in quality. In addition, the degree of innovation has significantly increased in recent years, propelled by numerous advances in technology. This implies the need for a higher understanding of the financial ecosystem, the role that organizations play within the ecosystem, and the growth opportunities in a new market context. System dynamics can provide significant opportunities in determining optimal positioning strategies to attract new customers.

### **3. The applicability and opportunity of using the system dynamics method**

However, the system dynamics method is not much used in the financial sector. Interestingly, the System Dynamics Society, which maintains a repository of case studies of its application across different domains, only has one existing case study, which is focused mostly on policy.

In order to explore the degree of relevance, current application, and opportunities and barriers for the usage of this method, a primary research was undertaken, including interviews and surveys with 35 international specialists with experience in the financial services sector, some of which had specific experience with the application of system dynamics.

### **4. Research methodology**

In order to obtain the perspectives of experts, research activity has included extensive data collection and analysis (interviews and

surveys conducted with experts). The objective of this research was to obtain different perspectives on the applicability and use of this method in finance and the opportunities and limitations of these methods. Specifically, this analysis had as main objective to identify the following:

- Degree of application of the system dynamics method in the financial services sector, and the degree of its maturity of its usage;
- The type of problems that this method can solve for;
- Areas where this method is most relevant, and potential beneficiaries of this method;
- Possible benefits of using this method;
- Possible limitations on the use of this method;
- Trends in the use of this method in future;
- Factors that may positively or negatively influence the applicability of this method.

Among the experts interviewed, 90.4% had experience in financial services. We included specialists with different levels of experience to provide different perspectives. Over 70% of interviewed specialists have direct experience in strategy and operations; 66% of specialists have direct experience in management. We provided an overview of system dynamics to all specialists, which included definitions of the method and key components, discussion of objectives and features, and illustrative examples.

### **5. Interview results**

Interviews with specialists in the field identified the high applicability of this method, especially as support for operational decisions. Identified key benefits of using this method included: further understanding of system behavior, identifying the necessary corrective actions, and contributing to the strategic alignment of various decision makers. In particular, specialists *anticipate significant growth in the use of system dynamics* as method of study – the vast majority (90.9%) estimating an increase in the use of this method in the financial services sector. An increased degree of adoption, according to experts, is influenced primarily by the fact that organizations are becoming increasingly complex and we need specific tools to understand them; also, the degree of adoption is also dependent on the availability of data and an increased interest in the use of new modeling methods.

A key observation was the unanimous appreciation of specialists who have used *this method* that its use has *brought the answer to the question/ problem addressed*. However, a significant subset of respondents noted that *this method has identified new areas for exploration*. This is a typical feature of management analysis methods that identify new questions and directions of exploration, without giving false confidence in achieving "absolute truth". Interestingly, of the experts interviewed, the vast majority (92%) consider that this method is beneficial and recommended its usage. The most commonly identified benefit was *the method's contribution to the strategic alignment of various decision factors enabling a deeper understanding of the system in study*.

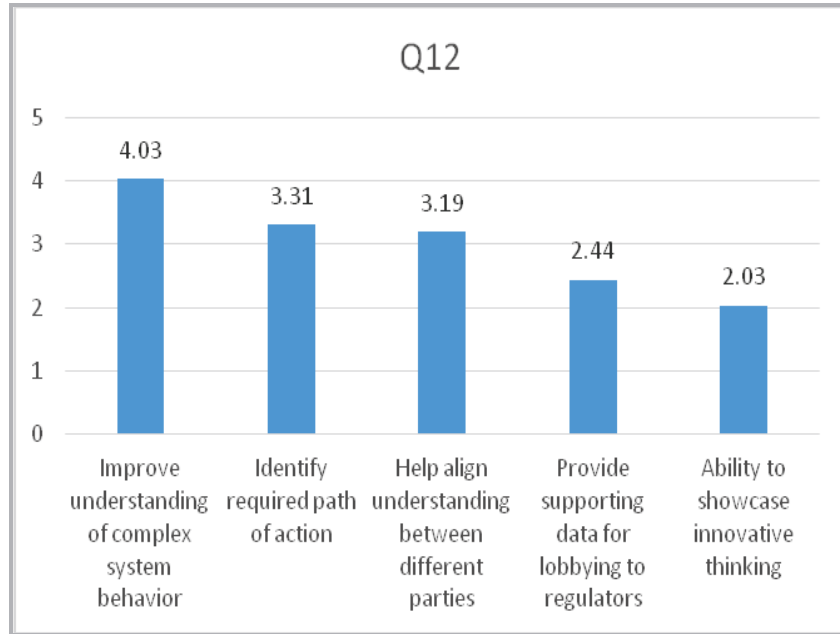
Subsequently, the experts were asked to provide insight on *decision makers that could benefit most from the usage of this analysis method*. The overwhelming response was in favor of the Chief Operating Officer – chosen by 89% of respondents as the main beneficiary of this method. This is a logical correlation with specialists' perspective that this method has significant benefits in the operations management space. The next beneficiaries identified are the regulators (identified by 60% of respondents), followed by the "Chief Executive Officer" and the "Chief Financial Officer" (both identified by 57% of respondents). Another benefit identified is the *ability to demonstrate innovative thinking*, which is becoming an increasingly important focus in the financial sector in today's environment, faced with significant competition, including competition from non-traditional players (e.g. the "fin-tech"<sup>1</sup> companies).

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<sup>1</sup> The word comes from the combination of „financial” si „technology” and refers to new companies which leverage new available technologies and apply them in the financial services sector (e.g. mobile to mobile payments with no bank accounts required)

Figure 1

Details related to the perspectives of the experts interviewed on the benefits of using the system dynamics in the financial sector

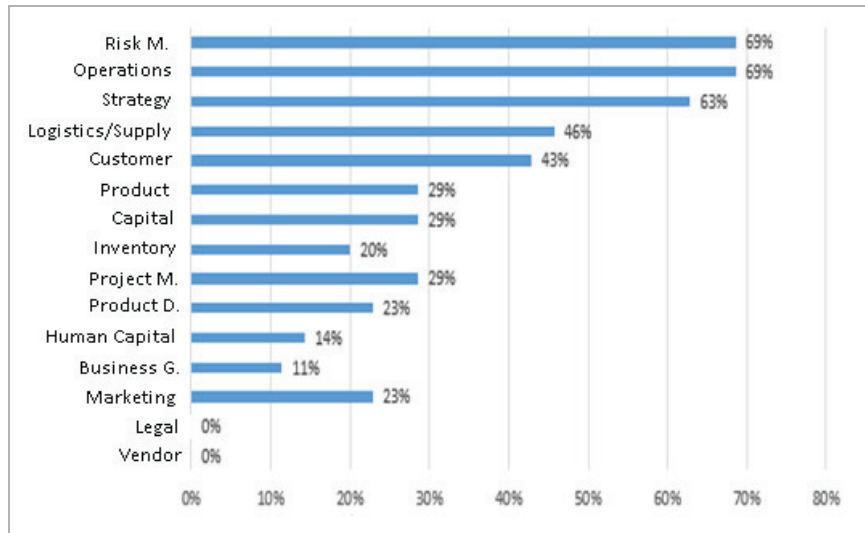


Experts were also asked what types of problems can benefit most from the application of this method. Risk management, operational and strategic issues, and consumer analysis were most selected. These selections are in line with the traditional use this method – mainly for management to identify possible future scenarios and therefore determine measures to reduce the risk in various unfavorable scenarios.



Figure 2

**Areas/Types of problems that mostly benefit from using the system dynamics method in the financial sector**



Notes: M. = Management; D. = Distribution; G. = Governance

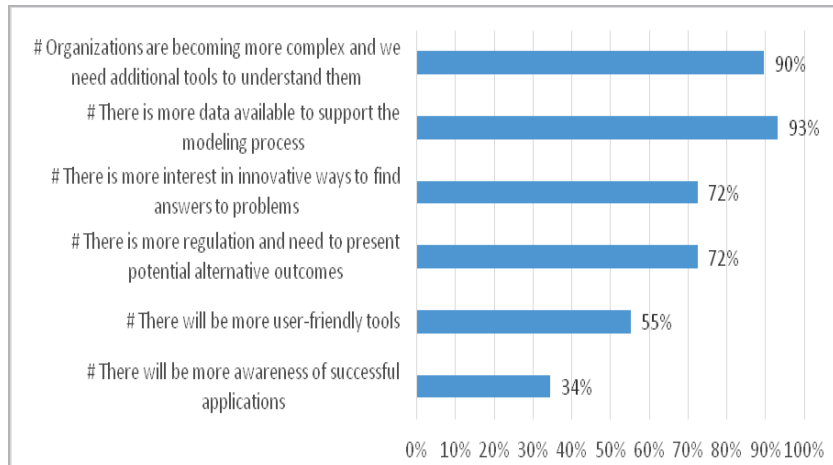
The experts were also asked to provide insight on expected evolution of applying system dynamics in the financial sector – namely, whether its utilization will increase in future. The vast majority (90.9%) expected to see an increase in its use – we next analyzed their perspectives on factors that will influence this higher degree of adoption.

Scientists have been invited to provide insights on the importance of six factors considered in our research, as well as to provide additional options on other factors of influence. One of the key factors identified was that organizations are becoming increasingly complex, and managers need new methodologies targeted to specific levels of complexity in order to understand them.

Additional factors mentioned included the fact that data availability is much higher nowadays, that there is growing interest in the marketplace in using new methods of modeling, and that there are now more innovative ways of finding answers to current problems.

Figure 3

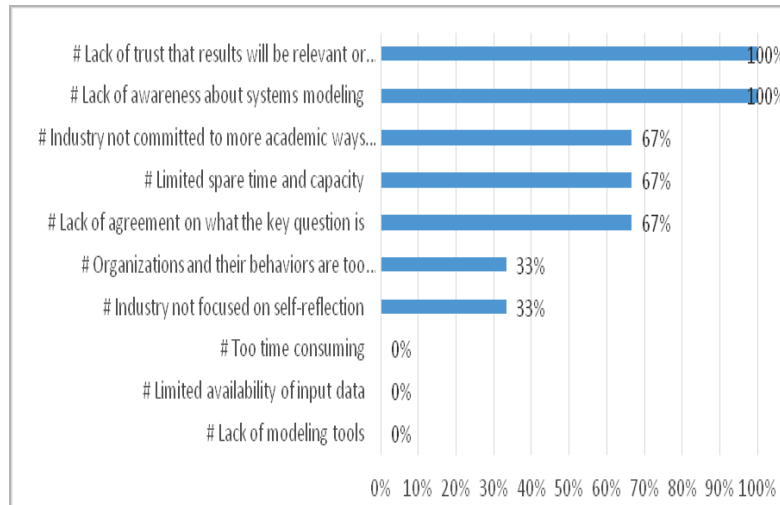
**Perspectives on factors that will influence the increased use of system dynamics method in the financial sector**



Also, the experts were asked to provide their perspective on potential barriers to increasing the adoption of this method. 100% of respondents identified lack of trust that the results obtained may be used for decision-making, and lack of information about this method as the main barriers. Very interesting is the large number of experts who believe that often, it is difficult to come to consensus on what the problem is to be solved. Indeed, this is one of the barriers often mentioned by those who are experienced in applying this methodology, often identifying a lack of common understanding of the problem as a major factor in delays in the planning phase. It is also interesting to note that none of the experts identified as barriers the lack of modeling tools or the availability of input data.

Figure 4

**Perspectives on barriers that limit will increase the use of this method in the financial sector**



**4. Conclusions**

The existing analysis and decision support methods for strategic and operational management were the foundation and starting point of this work. Building on this foundation, this research explored the opportunity of applying a new method in the financial sector through the analysis of the perspectives of 35 international specialists on the applicability of the method and the possible benefits, potential barriers and opportunities in its application in the financial sector.

In summary, system dynamics has broad application potential - both at the microeconomic and macroeconomic levels. As organizations and the environment in which they operate become more complex, increasing regulatory requirements, customer needs and expectations of shareholders to obtain increased financial performance put significant pressure on management.

The system dynamics method, focusing on the fundamental understanding of the main components of a system, provides particularly relevant instruments for the current problems of the financial system. The method also facilitates the identification of

correlations and interdependencies between the organization and the environment in which they operate, facilitating management analysis and identification of optimal decisions and trade-offs, in the context of a specific macroeconomic environment. For example, in the absence of a systemic approach, process analysis remains an isolated (Jörg Becker, Martin Kugeler si Michael Rosemann: "Process Management", 2011), linear exercise that often ignores critical systemic elements that are essential in decision making. Even a conceptual system dynamics analysis, without the development of a model, offers a new perspective on the critical factors of influence in a system. The application of the system dynamics method enables a deep understanding of the behavior of an organization and the ecosystem in which it operates.

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