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PHD THESIS

Summary

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DANA - LAURA D.E. NICULA

Title of the doctoral Thesis:

**USING BUSINESS ANALYTICS METHODS AND MODELS TO IMPROVE
COMPANIES' PERFORMANCES**

Doctoral Thesis Defense Committee:

Prof. Dr. Emilia Țițan (Chairperson)	- Bucharest University of Economic Studies
Prof. Dr. Rodica Ianole – Călin (Reviewer)	- University of Bucharest
Prof. Dr. Marian Pompiliu Cristescu (Reviewer)	- Lucian Blaga University of Sibiu
Prof. Dr. Ioana Manafi (Reviewer)	- Bucharest University of Economic Studies
Prof. Dr. Mihai Daniel Roman (Doctoral Supervisor)	- Bucharest University of Economic Studies

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INTRODUCTION

Our world is in a state of continuous evolution, where companies must adapt rapidly and efficiently to market changes, emerging technologies, and increasingly demanding customer requirements. Data-driven companies possess and acquire, through operational and transactional activities, a significant amount of information and, with it, a substantial competitive advantage. Data can be used for a variety of purposes, particularly to generate revenue growth, automate and improve organizational operational efficiency, or reduce risks. Another critical objective is to enhance customer and employee satisfaction. To achieve these results, it is necessary to employ appropriate business analysis methods and models tailored to the encountered scenarios.

This thesis aims to investigate and delve into various strategies and tools for business analysis. Game theory and decision theory models will play a significant role in the subsequent chapters, as they help us not only understand but also predict the behaviour of economic actors, thus enabling optimal decision-making and strategic decisions, ultimately optimizing company performance. Economic actors include, but are not limited to: customers, competitors, suppliers, investors, governmental institutions, and non-profit organizations. Additionally, attention will be given to the benefits and importance of digitalizing companies, utilizing data science, and integrating artificial intelligence—essential factors for companies striving to remain competitive in an increasingly dynamic environment.

The thesis is structured into five chapters. In the context of the chosen scientific domain, the introduction presents the general purpose of the thesis and the specific objectives. It also describes the research methods used and justifies the choice of the discussed topic by highlighting the utility of the adopted approach.

In the second chapter, titled "Methods and Models for Business Analysis to Enhance Organizational Performance," a literature review is conducted, focusing on the ways companies can extract value from data by applying different types of data analysis. Descriptive analysis, diagnostic analysis, predictive analysis, and prescriptive analysis are each presented in turn, emphasizing how each type contributes to understanding and optimizing organizational performance. Furthermore, the chapter discusses the data architecture necessary for implementing these types of analyses and their efficient integration within companies. Finally, a case study is included, illustrating the use of analytical methods to improve performance in the e-commerce sector, demonstrating the practical applicability of the concepts discussed in the chapter.

The third chapter presents how decision theory tools lead to optimized resource allocation, risk reduction, or improved quality of managerial decisions. In his work "Introduction to Decision Theory," Raiffa (1968) states that "decision theory deals with the problem of choosing or ranking one of the alternative courses of action, in situations where there is uncertainty about the future."

Optimizing company performance using decision theory involves the use of advanced mathematical models that guide, simplify, and improve decision-making processes within organizations under conditions of uncertainty. By applying this theory, companies can analyse and evaluate various scenarios, considering the probabilities of their occurrence, as well as the impact of each decision on organizational performance. Through the application of Fuzzy DEMATEL, I will conduct a quantitative analysis of the resource allocation options of a manufacturing company and illustrate the cause-effect relationship between the factors suggested by industry experts.

Chapter 4, "Optimizing Company Performance through Game Theory," focuses on how companies can use mathematical concepts and models to make better strategic decisions, even in real-time. Game theory provides a powerful tool for understanding and anticipating competitors' reactions, allowing companies to develop optimal pricing, production, and market entry strategies. By applying classical models for price competition (Bertrand) or quantity competition (Cournot and Stackelberg), we show how companies can make better-informed decisions and gain a competitive advantage.

In the final chapter, "The Evolution of the Insurance Market: A Global and National Perspective," the thesis addresses the complex dynamics of the insurance industry, with a focus on trends such as digitalization, climate change, and population aging. Classical economic models, such as Cournot, Bertrand, and Stackelberg, although simplifying reality, provide a solid foundation for analysing the behaviour of insurance companies and developing effective strategies. By combining economic theory with data analysis, predictive analysis, and market context knowledge, insurance companies can successfully overcome challenges and even turn them into opportunities.

Digitalization, characterized by an exponential increase in data and accelerated by the advent of artificial intelligence, is radically transforming the way we live and do business. Companies like Lemonade and Amazon, whose case studies will be presented throughout the paper, have demonstrated how technology can be used to create new business models and disrupt traditional industries. By applying economic theories and advanced analytical models, we can learn how to capitalize on these opportunities and remain competitive in the digital age.

The thesis explores in detail the market entry game, from game theory, to analyse companies' strategic decisions in relation to competition. Through the case study of Lemonade Inc., we demonstrate how this concept can be applied in practice. Lemonade has managed to revolutionize the insurance industry through the use of digital technologies. This thesis contributes both to the development of game theory and to providing practical solutions for companies looking to enter new markets or face intense competition.

The overall objective of the doctoral thesis is to present and apply advanced business analysis methods and models that contribute to optimizing company performance in an increasingly complex and digitalized business environment. This research aims to explore the applicability of game theory and decision theory in the

current competitive context, with a special focus on market dynamics and entry strategies, exemplified through the case study of Lemonade Inc. The paper seeks to provide theoretical and practical tools to support companies' strategic decisions in improving operational efficiency and achieving sustainable long-term growth.

The specific objectives aligned with the overall objective include:

1. Theoretical and applied analysis of business analysis methods: Exploring and synthesizing the main business analysis methods and models, decision theory, and optimization techniques, which will be used to enhance organizational performance.
2. Application of game theory in market entry strategy analysis: Applying and validating theoretical models from game theory, such as the market entry game, to analyse the market entry strategies of innovative companies, exemplified by the case study of Lemonade Inc.
3. Evaluation of the impact of emerging technologies on company performance: Investigating how digitalization, data science utilization, and artificial intelligence integration influence companies' decision-making processes and overall performance.
4. Study of the insurance market from a global and national perspective: Analysing the evolution of the insurance market, identifying macroeconomic and technological factors that influence this industry, and proposing strategies for insurance companies to adapt to new market conditions.
5. Optimization of strategic decisions through quantitative models: Applying and testing advanced quantitative models, such as Fuzzy DEMATEL, to facilitate strategic decision-making under uncertainty, thereby ensuring better adaptation to a dynamic business environment.

The research presented in this thesis was conducted in multiple stages. In the first stage, a systematic review of the specialized literature was conducted to establish the theoretical framework of the study. Then, four relevant case studies were selected to illustrate the practical application of the theoretical concepts. Quantitative models were developed and tested to analyse data and obtain quantifiable results for two of the four case studies. Throughout the entire process, I benefited from consultancy and feedback from professors and experts in the field.

The thesis combines elements from economics, mathematics, and computer science to provide a holistic approach to strategic analysis.

The main contributions of this research are:

1. A rigorous and comprehensive synthesis of existing theories: I combined game theory with other concepts to create a more comprehensive conceptual framework and demonstrated how these theories

can be easily applied in the real world to solve complex problems. This interdisciplinary approach offers a complex perspective on the challenges and opportunities companies face in the digital age.

2. I analysed how digital technologies, such as artificial intelligence, support new models and transform traditional business models in the insurance industry and e-commerce. My research provides insights into the challenges and opportunities these changes bring and can help companies in transition to digitalization adapt in a dynamic and competitive business environment.

By combining knowledge from economics, computer science, and management, this thesis deeply explores the impact of digital technologies on businesses. The results obtained can be applied in various sectors, contributing to the development of more efficient and adaptive business strategies. This interdisciplinarity not only enriches the content of the research but also ensures an extensive applicability of the thesis conclusions in different contexts and industries. Every day, companies face a multitude of decisions, from strategic ones, such as major investments, to operational ones, such as selecting suppliers. The quality of these decisions has a direct impact on business success, which is why it is essential to follow a well-defined process to make them.