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Administration



## **Master's Thesis:**

Strategic Management and Organizational Sustainability  
(Competitive Intelligence and Managerial Implications)

## **Students' name:**

Fatima Ashumova, Zahid Ahmadov

## **Supervisor:**

Julia Trabskaya

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We have written this master's thesis independently. All perspectives from other authors, literary sources, and data obtained from various sources that were incorporated into this paper have been appropriately cited.

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# Abstract

Organizations today face the challenge of effectively integrating advanced Data Analytics (DA) and Data Science (DS) tools into their Competitive Intelligence (CI) frameworks to enhance strategic decision-making.

With the increasing complexity of global markets and rapid technological advancements, traditional CI practices are insufficient. There is a pressing need for a systematic application of these technologies to improve operational efficiency and strategic expectancy.

This research proposes a structured framework that enables organizations to harness data analytics and data science for supporting their CI processes, thereby improving strategic agility and competitive standing.

The framework explains the mechanisms through which data analytics and data science can be effectively utilized in CI, addressing the gaps in current integration techniques and underutilization of available data.

The practical applicability and usefulness of the integrated framework are demonstrated through the GOMS model (Goals, Operators, Methods, and Selection rules), providing a methodological basis for assessing usability and optimizing user interactions.

By offering theoretical, practical, and methodological contributions, this thesis advances the field of CI, equipping organizations with the capability to navigate and excel in dynamic market environments. The research validates the framework's effectiveness in enhancing CI practices, thus confirming its real-world applicability and benefits.

# 1 Introduction

In this era of rapid digital transformation, organizations face unique challenges and opportunities due to the unprecedented speed of change. Companies around the globe are constantly striving to outperform their competitors and gain a competitive edge. Competitive intelligence is vital for businesses looking to succeed in unpredictable market environments. Competitive intelligence encompasses the systematic planning, collection, analysis, dissemination, and utilization of information regarding the market landscape, which includes competitors, customers, and other external elements that impact an organization's strategic decisions in the present and future ((Prescott & Gibbons, 2006); (Fleisher & Bensoussan, 2007)).

Data analytics and data science advancements have entirely transformed the competitive intelligence landscape. These tools help organizations gain valuable insights from large datasets, enhancing decision-making processes and strategic planning. By leveraging cutting-edge analytics and machine learning techniques, businesses can preserve a competitive edge by staying up-to-date on market trends and proactively identifying potential opportunities and risks (Davenport, 2014). Despite notable progress, there remains a need for further research into the specific functions and approaches of data analytics and data science within competitive intelligence. There is a significant need for a better grasp and more organized utilization of these technologies in CI processes.

This study is motivated by the critical need to address this knowledge gap. This research offers organizations a well-organized framework to improve their strategic agility and competitive position. It will explain how data analytics and data science can be effectively employed in competitive intelligence. The importance of conducting such research is resulted by the increasing complexities of global markets and the rapid advancements in technology. It is becoming increasingly clear that traditional CI practices alone are insufficient. It is now crucial to incorporate advanced analytical tools to make informed decisions.

## **Scope:**

This research aims to explain data analytics and data science use in organizations' CI processes. This study examines the organizational context where CI capabilities are already in place, aiming to enhance these capabilities through the use of technological tools. The research aims to investigate the application of data analytics and data science in all stages of the CI cycle, encompassing planning, collection, analysis, and dissemination. This integration has the potential to improve decision-making and strategic planning processes significantly.

This research has certain limitations as it assumes that organizations already have some competitive intelligence processes in place. It does not provide guidance on setting up these capabilities from scratch. It can only utilize data analytics and data science tools within these pre-established frameworks. Furthermore, the study emphasizes the significance of using these tools to derive practical insights from data rather than just focusing on the technical advancement of the tools. This focus guarantees a practical, experiential approach ideal for CI professionals seeking to maximize the advantages of current data technologies to enhance their organizations. While the findings of this study may have important implications, it's worth mentioning that the primary data collection was limited to European markets. This limitation arises from the widespread use of data analytics, data science, and competitive intelligence practices in these regions, providing an ideal environment for empirical research. Furthermore, there is a strong emphasis on industries that heavily depend on technology. These industries

are known for their fast-paced nature and intense competition, which is why they see the most significant advantages of implementing enhanced CI practices.

The study participants are professionals actively involved in the CI processes within their organizations. These roles include positions such as Data Analysts, Business Intelligence Analysts, Risk Analysis Department Leads, and Finance Data Management Team Leads who utilize or oversee the utilization of data analytics and data science tools. There is a limitation in the research regarding the coverage of data analysis and data Science tools. This research aims to investigate the practical applications of commonly used data analytics and data science tools. These tools include Regression Analysis, explanatory or prescriptive analysis, predictive modelling, and more. This coverage does not include branded or highly specialized tools like Deep Neural Networks, Augmented Reality, and others that are not widely accessible or used across different industries.

The research aims to provide detailed and practical insights within its specific focus by setting clear boundaries. The goal is to tackle the obstacles and possibilities of combining data analytics and data science in competitive intelligence. This focused approach aims to produce specific, applicable outcomes that can directly help organizations within the defined parameters, ensuring the study's practical significance and influence.

### **Research Problem:**

In today's rapidly changing business environment, staying ahead of the competition means seamlessly incorporating technological tools with strategic business functions like CI. Data analytics and data science can significantly improve operational efficiency and strategic management when applied to the CI process. Despite the potential benefits, the integration of these tools into CI has not been deeply explored and is not commonly used in real-world situation.

Since the 1970s, businesses have been working to improve their intelligence capabilities to better understand market dynamics and competitor strategies. In the past, CI has heavily relied on manually gathered data and basic analytical methods, resulting in delayed and less accurate insights (Kahaner, 1997). Over the past few years, the market has become more complex and there has been a considerable increase in the volume of data. As a result, there is a growing need for advanced analytical tools that rely on insights obtained from data. The development of digitalization has created numerous opportunities for data generation, leading to an important increase in the scope and complexity of competitive intelligence. (McGonagle & Vella, 2012).

Despite the obvious need for advanced analytics in CI, there is a clear lack of comprehensive integration of these technologies. Many experts and industry professionals believe that the lack of integration between data analytics, data science, and CI processes can lead to a disorganized and less effective CI function. Many existing methodologies do not fully utilize the potential of advanced data analytics and data science tools, which can lead to a disadvantage in industries that are highly competitive. (Fleisher & Bensoussan, 2007)

This research aims to address the lack of a standardized framework for incorporating data analytics and data science tools into different stages of CI processes. By incorporating these tools, organizations can improve their strategic agility and gain a competitive edge through data-driven insights. By addressing these gaps, the research will provide valuable insights into how organizations can successfully adapt to and stay ahead of changes in the competitive landscape, ultimately strengthening their competitive advantage.

## **Research Questions:**

The correct structuring of research questions is a fundamental component in any research. It guides the research focus, informs methodology, and helps articulate the purpose of the study. In this research, the questions are developed to explore the use of data analytics and data science tools into competitive intelligence processes within organizations. These questions originate from the identified gaps in current practice and theory as discussed in the following sections of this thesis.

The primary research question asks: **RQ:** *How to use Data Analytics and Data Science tools to support the Competitive Intelligence Process in the organizations with Competitive Intelligence Capability?* This research aims to find a correct structure for integrating Data Analytics and Data Science tools into the Competitive Intelligence process in organizations with existing Competitive Intelligence capabilities. The focus will be on identifying effective practices, understanding their impact on strategic and operational outcomes, and presenting a organized model for their application.

To address this main question comprehensively, the study breaks down into several sub-questions that focus on specific aspects of the integration process. First, we consider **SRQ1:** *What is Competitive Intelligence Capability?* Aiming to explain the definition of Competitive Intelligence and what it means as a capability in the current business environments followed by the steps involved in the competitive intelligence process as they are currently implemented in several organizations: **SRQ2:** *What are the steps of the Competitive Intelligence Process?* This helps to understand the standard practices and to identify potential areas for development through technological solutions.

Following the exploration of competitive intelligence steps, the study then explores into the foundations of the technological tools utilized in this process. **SRQ3:** *What is Data Analytics and Data Science?* This question aims to clarify the scope and capabilities of data analytics and data science within CI context as they relate to extracting actionable insights from datasets and originating predictive models and advanced analytics that can enhance competitive intelligence.

Next, the research examines the specific tools employed within these fields to understand their direct implementation in competitive intelligence. **SRQ4:** *Which Data Analytics and Data Science tools are used to support the Competitive Intelligence Capability?* This question investigates the current tools in use and evaluate their effectiveness in supporting CI operations within organizations.

Further, to understand the integration of these tools into the CI process, the study asks: **SRQ5:** *How are Data Analytics and Data Science tools integrated into each step of the Competitive Intelligence Process?* This question aims to answer how data analytics and data science tools can be specifically used to enhance each phase of the CI process, from data collection to analysis and reporting by providing deeper insights and forecasts that can influence strategic decision-making.

Finally, the study aims to answer the practical applicability and usefulness of the integrated data analytics and data science tools within the competitive intelligence framework. This leads us to **SRQ6**: *What is the usability of the proposed framework?* To answer this, we will employ the Analytical Modeling methodology, specifically applying the GOMS model (Goals, Operators, Methods, and Selection rules) to simulate user interactions with the proposed framework. This method is crucial for proactively identifying how users will interact with the system and where they might face usability issues before the framework is implemented. The data collection for this question will involve a detailed theoretical analysis of the tasks that users are expected to perform using the framework. By modeling these tasks, the study aims to predict user behavior, identify potential challenges, and explore how user interactions can be optimized to increase efficiency and simplify the user experience. This proactive approach in refining the workflow and interface design offers a feasible method to assess usability, allowing for adjustments in the developmental stage without extensive experimental user testing.

These questions aim to construct a complete understanding of how data-driven technologies can be systematically implemented to improve competitive intelligence practices, accordingly, ensuring that organizations not only keep pace with but also strategically outsmart their competition in rapidly evolving markets.

#### **Novelty of the research:**

This thesis makes a significant contribution to the field of competitive intelligence by incorporating data analytics and data science into CI processes. This integration enhances both the theoretical understanding and practical applications in this area. This research makes significant contributions to strategic management practices within technology-intensive industries. It enhances these practices in multiple ways, including theoretical, methodological, and practical dimensions.

The theoretical contributions involve the creation of a comprehensive framework that effortlessly integrates data analytics and data science tools into the competitive intelligence processes. This framework enhances the theoretical foundations of CI by incorporating dependable and scientifically validated methodologies. In addition, this study offers a thorough analysis and definition of competitive intelligence capabilities and processes, improving our understanding of CI's operational definitions and scopes.

This research provides practical insights on data analytics and data science tools that can greatly improve CI processes, enabling organizations to quickly implement them. Applying the GOMS model to assess the usability of the proposed framework provides valuable insights on successfully implementing and utilizing these advanced tools for organizations. The methodological contributions offer practical insights into the application of theoretical data capabilities in real-world competitive intelligence. Additionally, it provides valuable guidance on effectively implementing and utilizing these advanced tools within organizations, allowing for the practical application of data integration in CI.

This research has significant implications for the strategic management field. It can help improve competitive intelligence processes and enhance competitive strategies, making them more efficient and effective. Organizations that have developed advanced CI capabilities are



able to swiftly and precisely anticipate market changes, resulting in improved strategic decision-making and a more powerful competitive position.

The following sections of the thesis will explore each of these contributions, providing a comprehensive analysis of their implications and practical uses. This overview gives a clear understanding of the study's contributions and sets the stage for the detailed analysis that will be presented in later chapters.

### **Structure Overview:**

To summarize, the remaining parts of the thesis are organized as follows: Chapter 2 presents an overview of the current body of literature and theoretical frameworks that contribute to the incorporation of data analytics and data science into competitive intelligence. This text provides a thorough analysis of the development of technology and how they have influenced contemporary competitive intelligence methods.

Chapter 3 defines the research methodology, data gathering, and analysis procedures. The content showcases detailed interview findings to show the actual implementation of data analytics and data science in improving competitive intelligence within organizations.

Chapter 4 defines the use of Data Analytics and Data Science into Competitive Intelligence processes. The chapter shows the practical applications of DA and DS in improving CI within organizations. These applications were gathered from interviews, providing real-world examples of how these advanced analytical tools can transform CI processes.

Chapter 5 focuses on the verification of the theoretical and empirical methodologies employed in the investigation. The process involves the use of analytical modeling to simulate and verify the functionality and usefulness of the proposed competitive intelligence framework.

Chapter 6 explores the solutions to the research inquiries presented in the introductory chapters, providing detailed explanations on how the incorporation of data analytics and data science facilitates the competitive intelligence process and improves organizational capacities. Additionally, it evaluates these findings in relation to previous research in order to provide a contextual understanding of the study's contributions.

Chapter 7 serves as the final section of the thesis, where the findings are summarized and the theoretical and practical contributions of the work are discussed. Additionally, this study offers suggestions for future research and encourages further contemplation on the wider consequences of incorporating sophisticated analytical tools into competitive intelligence procedures. This chapter seeks to summarize the knowledge acquired from the research and propose directions for future work in the topic.

**Keywords:** *Competitive Intelligence, Data Analysis, Data Science, Decision-making, Strategic Management*

**Research classification code (CERCS):** *S190 - Management of enterprises.*

## 2 Literature Review

In this chapter, the study provides a review on the existing literature and theoretical frameworks that inform the integration of data analytics and data science into competitive intelligence. It critically reviews the evolution of technologies and their impact on modern competitive intelligence practices. It also presents information about modern day implementations by providing in-depth interviews of the organizations with CI capability.

### 2.1. Review of Existing Related Work

Before we describe the specifics of Competitive Intelligence, it's important to acknowledge the existing body of work in this field. The body of literature on Competitive Intelligence is extensive and varied, encompassing a variety of investigations and theories that have significantly contributed to our present comprehension of this field. These studies have examined many facets of Competitive Intelligence, encompassing its concept, development, range, and implementation across diverse industries. Furthermore, they have emphasized the significance of data analytics and data science in enhancing Competitive Intelligence procedures.

This section provides a concise overview of these research, which will be examined in further detail in the following parts to get a more thorough understanding of Competitive Intelligence. Furthermore, it recognizes the need for this research, which seeks to address the absence of a standardized framework for effectively incorporating data analytics and data science technologies into various stages of Competitive Intelligence processes.

#### **Competitive Intelligence: Definition, Evolution and Scope:**

Competitive intelligence is the ability to gather and utilize knowledge on elements that affect an organization's competitive advantage. Organizations analyze collected data and information to develop effective and efficient corporate strategies. Collecting data and information is a more demanding task compared to performing a simple online search. Competitive Intelligence is a dynamic and adaptable discipline within strategic management that aims to improve an organization's market position by acquiring a comprehensive comprehension of its competitive environment. This area involves the systematic gathering, analysis, and application of data related to competitors, market conditions, legislative changes, and technology advancements.

Academics and professionals hold divergent perspectives regarding the precise meaning of CI. (Fleisher & Bensoussan, 2007) describe it as a method for making informed decisions by understanding the external business environment, especially in relation to managing risks and planning strategically. Meanwhile, as stated by (Wright et al., 2002), competitive intelligence encompasses not just the act of investigating competitors, but also the ability to anticipate market trends and take proactive measures to address them. The definitions highlight CI's dual focus on both reactive competitions monitoring and proactive strategic forecasting.

The process of competitive intelligence involves systematically gathering, analyzing, and

disseminating information on competitors and market conditions to support strategic decision-making. A successful competitive intelligence plan entails the identification of crucial sources of information, encompassing both public and private channels, such as press releases, sales statistics, and customer feedback. In addition, it encompasses a wide array of scientific topics, surpassing conventional commercial matters (Cekuls, 2023). An significant aspect in educational institutions is the comprehension of organizational and individual information demands, as it directly impacts the data collection behaviors within universities (Oraee, 2022). Moreover, Competitive Intelligence has a substantial influence on strategic marketing decisions in various industries, including the healthcare sector. Certain research specifically concentrates on the integration of CI in specific disciplines. For example, CI is regarded as a crucial step towards establishing a learning health system by efficiently integrating and sharing information (Farley & Freyn, 2022)

(Alnoukari & Hanano, 2017) provide a definition of Competitive Intelligence as an analytical procedure that involves gathering, choosing, and analyzing information about competitors' talents, achievements, and market position in order to formulate a competitive strategy for enterprises. (Cavallo et al., 2020) defines Competitive Intelligence as the strong combination of knowledge from various sources within the business environment, in conjunction with other functional areas and disciplines. This synthesis of information aims to provide a comprehensive understanding of a market's present condition and its potential future state. The ultimate result of integrating intelligence efforts is the production of crucial judgments that have a significant impact on and provide support for the suggestions needed to drive and attain a competitive edge for a business. Organizations require robust systems and procedures to collect and evaluate substantial volumes of accurate, pertinent, and up-to-date information on rivals and markets (Saayman et al., 2008) In this particular scenario, the utilization of CI proves to be advantageous. CI encompasses several perspectives, but its core concept involves collecting fragmented data, analyzing it, and deriving insights to enhance comprehension of an organization's competitive environment and facilitate well-informed strategic choices. The objective of competitive intelligence is to predict market trends and drive innovation through the use of strategic information (Foley & Guillemette, 2017). Hence, Competitive Intelligence provides greater value for firms as it surpasses the effectiveness of company development, market research, and strategic planning (Tahmasebifard, 2018)

Competitive Intelligence emerged from Porter's Competitive Strategy, which emphasizes the importance of watching competitors and understanding a company's relationship with its environment. In the late 1990s, media such as The Wall Street Journal started to support the concept of intelligence, based on the practices of U.S. intelligence. Jan Herring enhanced the field of competitive intelligence by establishing the CI cycle, which breaks down the process into distinct steps: planning, gathering, analysis, and dissemination. The expansion of CI has given rise to a new branch called Competitive Technical Intelligence (CTI). CTI goes beyond the usual scope of CI by not only focusing on competitors, but also assisting organizations in understanding customer needs, technology possibilities, and the competitive environment. The integration of artificial intelligence (AI) and big data in recent years has significantly increased the value of CTI. This combination enables the acquisition of insights that were before

unreachable (Paap, 2020). Based on the literature, the evaluation of CI can be categorized into the stages outlined in the Table 1.

**Table 1: History and evaluation of Competitive Intelligence**

Stage	Period	Key Characteristics	Defining Events	Primary Focus
Competitive Intelligence Gathering	60s and 70s	CI activities are mostly located in Library or Marketing departments. The primary skill was the capability to find information. A large amount of data was collected, but static analyses were rarely applied.	Publication of Michael Porter's "Competitive Strategy" in 1980.	Basic information gathering and storage.
Industry and Competitor Analysis	1980 to 1987	CI personnel were mostly in Planning or Marketing departments. Emphasis on quantitative analyses, but with a weak connection between CI and decision-making processes.	Founding of the Society of Competitive Intelligence Professionals (SCIP).	In-depth industry and competitor analysis. Development of analytical skills and building a business case for CI.
Competitive Intelligence for Strategic Decision Making	1987 to 2000	Transition towards using CI more strategically for decision-making.	Establishment of the Competitive Intelligence Review.	Integrating CI with strategic planning and decision-making processes.
Competitive Intelligence as a Core Capability	Early 2000s	Maturing of CI as a recognized discipline in business. Emphasis on evidence-based approaches using business intelligence, market research, data analytics, and KPIs. Focus on understanding market shifts in real-time.	Expansion of CI's scope to include customer needs and technology, coupled with AI and big data innovations.	Focusing on holistic insights including customer needs, technological options, and the competitive environment. Strategic use of AI and big data for in-depth analysis and actionable insights. Applying strategic and tactical initiatives based on data-driven insights.

Technology Integration and Adoption	Mid-2000s to Present	Rise of Competitive Technical Intelligence (CTI). Significant influence of technology, especially AI and SaaS tools, on CI practices. Increased efficiency in CI processes and broader adoption across various sized enterprises.	Expansion of CI's scope to include customer needs and technology, coupled with AI and big data innovations.	Leveraging AI technologies and external partnerships for sophisticated CI practices and human intelligence integration
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After conducting a comprehensive examination of current relevant research, the fundamental components of the Competitive Intelligence process can be categorized into the following steps:

**Planning:** This phase include the activities of identifying requirements and setting objectives. During this phase, the company must define and establish precise intelligence requirements that are tailored to its operations. During the planning phase, the company determines its precise requirements for intelligence. This stage is crucial for aligning CI actions with strategic objectives and ensuring that the obtained intelligence is both pertinent and actionable. (Tyson, 2002) argues that effective planning in competitive intelligence requires a deep understanding of organizational goals and the competitive landscape.

**Collecting:** This stage entails gathering data from primary and secondary sources. Primary sourcing refers to the method of gathering information directly from stakeholders, customers, suppliers, and competitors through interviews, surveys, or direct observation. Referring to secondary sources is the practice of utilizing published materials such as industry reports, news items, academic publications, and online databases. It is crucial to analyze ethical considerations at this point. It involves ensuring that the data collection process adheres to legal and ethical standards. The ethical issues in this phase are crucial for maintaining the integrity of CI activities (Herring, 1999).

**Analyzing:** This step involves transforming the data collected in the previous step into practical and useful intelligence (Saayman et al., 2008). The analysis stage of competitive intelligence necessitates the utilization of creativity, intuition, and insight. Pattern identification, trend analysis, deductive and inductive reasoning are essential for transforming information into actionable intelligence, which serves as the basis for strategic decision-making ((Cavallo et al., 2020); (Bose, 2008); (Saayman et al., 2008)). In this stage, (Bose, 2008) identified many analytical methods such as SWOT analysis, Porter's Five Competitive Forces, environmental analysis, and PEST analysis. Additionally, analysis tools such as data/text mining, statistical approaches, and visualization-based tools were utilized.

**Dissemination:** The dissemination phase in CI is vital for ensuring that the insights and findings produced from the CI process are effectively provided to the right stakeholders within a business. The results of the competitive intelligence process must be efficiently

communicated to individuals who have the authority and responsibility to make suitable decisions and conduct necessary actions in response to the discoveries. Intelligence communication can occur through several means such as ad hoc reports, alerts, e-mails, presentations, news briefs, competitor files, and special notes (Wright, 2007). Through the utilization of reports, dashboards, or strategy meetings, the process of effective distribution ensures that the insights provided are practical and that stakeholders receive them promptly (Juhari & Stephens, 2006)

### **Data Science and Analytics in Competitive Intelligence:**

Data science and data analytics have changed the way things are done by using data in a planned way to find insights that can be put into action and help make strategic decisions in the context of competitive intelligence. These fields offer firms effective methods to thoroughly examine large quantities of data, enabling a comprehensive comprehension of market dynamics, rival actions, and customer preferences. This, in turn, improves strategic planning and decision-making processes. Data analytics and data science in competitive intelligence encompass a range of methodologies, each making unique contributions to strategic intelligence. Descriptive analytics involves evaluating historical data to get insights into past market circumstances and competitor behavior. This stage facilitates the creation of a comprehensive overview of the competitive environment by utilizing tools like data visualization and business intelligence software to efficiently summarize and show intricate data sets (Fleisher & Bensoussan, 2007). Both disciplines utilize statistical models and machine learning algorithms to predict future trends and prospective rival actions, going beyond just analyzing past events. The ability to forecast future events allows competitive intelligence to shift from a reactive to a proactive role, empowering organizations to foresee changes and proactively position themselves for upcoming market developments ((Sharda et al., 2014); (Cavallo et al., 2020)).

Prescriptive analytics, the most sophisticated iteration of analytics, beyond mere prediction of future results by additionally providing recommendations for ideal tactics to attain desired objectives. It employs sophisticated algorithms and simulations to offer precise recommendations that can directly impact decision-making processes, ultimately improving the strategic choices firms take in competitive situations (Davenport, 2014),

The technological developments in big data and machine learning have greatly enhanced the capabilities of data analytics and data science in competitive intelligence. CI experts can effectively adapt to market developments by utilizing real-time processing and analysis of big datasets. In addition, the introduction of cloud computing has made strong analytics tools more accessible to a wider range of businesses. This enables organizations of different sizes to employ advanced CI strategies without requiring expensive infrastructure (Schroeck et al., 2012). The successful incorporation of these fields in CI requires a comprehensive procedure that encompasses the entire process, starting with gathering and refining data to employing sophisticated analytical modeling techniques. approaches such as deep learning, clustering, and natural language processing are used to analyze and utilize enormous datasets that standard approaches are not able to handle well (Foley & Guillemette, 2017). Decision-makers are

equipped with knowledge to comprehend and influence their competitive landscape through actionable insights obtained from data science and data analytics. For instance, analyzing the sentiment of social media data can offer immediate insights into how a brand is perceived and help firms make prompt and well-informed strategic changes, hence enhancing their competitive strategies (Ranjan & Foropon, 2020).

Although there are benefits, incorporating these fields into CI poses difficulties, such as the requirement for high-quality data, strong analytical abilities, and the capacity to smoothly integrate intricate insights into strategic choices without overwhelming stakeholders (Freyn & Hoffman, 2023). The integration of AI and machine learning inside CI is anticipated to grow as breakthroughs in these technologies progress. It is expected that next tools will improve the accuracy of predictions and provide better assistance for decision-making. As a result, data science and data analytics will become essential parts of strategic intelligence frameworks (Paap, 2020). The use of data analytics and data science into competitive intelligence has fundamentally revolutionized the approach that firms take towards their competitive strategies. By facilitating comprehensive analyses, anticipatory insights, and practical recommendations, these fields help organizations not only to comprehend their competitive landscape thoroughly but also to actively shape it. As technology progresses, the significance of data analytics and data science in competitive intelligence is set to grow. This will consistently increase innovation in competitive tactics and emphasize the necessity of a data-driven strategy in modern business operations.

### **Integrative Models and Approaches:**

Integrative models and methodologies in competitive intelligence combine several fields, including data science and data analytics, to provide a comprehensive comprehension of the competitive landscape. These models employ diverse approaches from several disciplines to enhance the precision, comprehensiveness, and practicality of obtained intelligence. Consequently, this aids in making more intricate strategic choices.

Integrative models at the theoretical level combine concepts from business intelligence, information science, and strategic management. The hybrid SWOT-PESTEL framework is a commonly utilized paradigm that combines the internal analysis of SWOT with the outward environmental scanning of PESTEL. This dual strategy guarantees that firms not only recognize their internal strengths and limitations, but also comprehend the broader market dynamics in operation (Cavallo et al., 2020).

Efficiency is a crucial element in the implementation of integrative methods in the field of competitive intelligence. Currently, these approaches heavily depend on data-driven procedures, which involve the integration of quantitative data analysis with qualitative insights. Machine learning algorithms can forecast market trends by evaluating past data. However, human analysts are essential in delivering the essential context required to comprehend these trends. The integration of artificial and human intelligence improves the strategic planning process and increases adaptation in changing market conditions (Freyn & Hoffman, 2023)

Contemporary CI techniques emphasize the significance of collaboration within frameworks that integrate inputs from several corporate departments, including marketing, finance, and operations. Employing cross-functional teams is crucial for integrating diverse data sources and viewpoints, facilitating the creation of complete competitive intelligence that influences all aspects of business strategy. Collaborative platforms and enterprise social networks are essential for facilitating seamless communication and exchange of data among stakeholders (Jorge et al., 2021).

The incorporation of many technologies, such as cloud computing, big data analytics, and AI, is essential in these models. The cloud offers versatile resources for storing and processing extensive datasets, while big data analytics facilitate the extraction of intricate insights. Furthermore, AI has the capability to automate and enhance decision-making processes. These technologies allow firms to perform sophisticated competitive analysis that was previously impractical (Paap, 2020).

Integrative models offer advantages as well as difficulties. A difficulty arises in effectively managing a variety of data sources, which can be intricate. Having the ability to understand and combine different analytical results is also important. Furthermore, it is imperative to give utmost importance to the protection and confidentiality of data, especially when combining internal and external data sources.

Technological improvements and changes in the business sector will affect the development of integrative models in CI in the future. Organizations who are able to effectively integrate and adapt these models will have a strategic advantage in anticipating and tackling competitive threats.

### **Critical Review of Literature:**

The literature on competitive intelligence extensively discusses its importance in strategic management, however, there is a clear gap when it comes to the systematic integration of data analytics and data science within CI processes. This review provides a thorough evaluation of the existing body of knowledge, carefully examining both the strengths and limitations of current research. It also identifies specific areas that this thesis addresses through its innovative framework.

In the past, CI has primarily concentrated on gathering and analyzing data to predict market trends and competitor actions. Although this approach has given us a good starting point, it heavily depends on manual data collection and analysis methods. However, these methods are no longer sufficient to handle the vast amount and speed of data generated in today's digital economy. Studies conducted by (Prescott & Gibbons, 2006) (Fleisher & Bensoussan, 2007) have played a crucial role in establishing the initial methodologies of CI. However, these studies provide limited direction on how to effectively utilize advanced analytical technologies.



Over the past few decades, there has been a move towards implementing CI practices that are more driven by technology. Important studies conducted by (Schroeck et al., 2012) and (Davenport, 2014) have illustrated the potential impact of data analytics and machine learning on improving strategic decision-making. These works, while not recent, have played a crucial role in paving the way for further research that explores the intricate ways in which DA and DS can be smoothly incorporated into CI cycles, spanning from planning to action.

In addition, the literature highlights the potential of DA and DS in revolutionizing CI. However, it frequently fails to provide empirical evidence regarding the real-world obstacles and organizational consequences of integrating these technologies. This thesis addresses an important gap by presenting a theoretical framework and illustrating its practical application through case studies in different organizational settings. The text provides a comprehensive analysis of how DA and DS tools are utilized in CI, including a thorough examination of the factors that facilitate their implementation and the challenges that are faced along the way. The critical review also highlights a need for more comprehensive models that can bridge the gap between data science capabilities and competitive intelligence outputs. Although there have been some attempts to integrate different approaches, these attempts often fall short in fully addressing the entire process or considering the specific analytics tools that can be used at each stage of the CI process. This thesis makes a valuable contribution to the existing literature by creating and validating a model that effectively integrates and maximizes the utilization of data analytics and data science throughout all stages of CI. The model ensures that the insights derived from data are not only useful but also aligned with strategic objectives, enabling actionable decision-making.

In addition, this review emphasizes the importance of conducting more research on the scalability of data-driven CI frameworks in various industry sectors and geographical contexts. Many of the current studies primarily concentrate on specific sectors like technology or finance, which naturally have more abundant data. This thesis expands the use of its framework to non-traditional sectors, thereby increasing the knowledge of the flexibility and usefulness of data-driven CI.

Overall, the literature offers a strong foundation for comprehending the development of CI and the growing significance of DA and DS. However, a more in-depth examination is needed to understand how these technologies can be effectively integrated into CI processes. This thesis addresses the need for a comprehensive framework that can bridge theoretical gaps and offer practical guidance to organizations looking to utilize advanced analytics in their competitive intelligence practices.

## 2.2. Theoretical Frameworks in Competitive Intelligence

This subsection provides an overview of the theoretical frameworks that encompass the field of competitive intelligence. It explores how these foundational theories have influenced CI practices and adapted to changes in technology and market dynamics.

Several theoretical frameworks have greatly influenced the field of competitive intelligence. These frameworks have been instrumental in shaping its initial conceptualization and guiding its evolution into a sophisticated strategic tool that is indispensable for business planning. Michael Porter's Competitive Forces Model, introduced in "Competitive Strategy" (1980), continues to be widely regarded as one of the most influential frameworks. This model offers a thorough examination of the competitive landscape, evaluating the power dynamics among competitors, potential new players, suppliers, customers, and alternative products. Strategic analysis is crucial for CI as it provides a methodical approach to assessing the risks and opportunities within an industry (Porter, 1980). In addition to Porter's model, SWOT Analysis is an essential tool in strategic planning for competitive intelligence. SWOT Analysis was initially created to assess a company's internal strengths and weaknesses in relation to external opportunities and threats. It helps CI professionals identify strategic opportunities and prepare for potential threats. Through a comprehensive analysis, organizations can develop strategies that capitalize on their strengths and address potential risks from the external environment (Humphrey, A. (2005), n.d.)

Another framework that may be of interest is the PESTEL Analysis. This framework improves the environmental analysis component of competitive intelligence by methodically evaluating the Political, Economic, Social, Technological, Environmental, and Legal factors that may affect business operations. This analysis is particularly valuable in global CI applications, as it is essential to comprehend broad macro-environmental factors in order to navigate diverse and often unpredictable global markets (Zita & Wilson, 1997)

The CI theory also encompasses the Resource-Based View (RBV), which emphasizes the significance of a company's internal capabilities and resources in achieving a competitive advantage. This viewpoint, as explored in Barney's influential publication from 1991, emphasizes the importance of utilizing distinct organizational resources in the process of strategic decision-making.

The Knowledge-Based View (KBV) highlights the significance of knowledge as a vital asset for organizations. The importance of knowledge management and information sharing in improving competitiveness is highlighted, especially in industries that rely on technological innovation (Grant, 1996).

In addition, Game Theory provides CI professionals with a distinct perspective to analyze competitive behavior. Game Theory is an important tool for accurately predicting the actions of competitors and devising highly effective counter-strategies. Theoretical approaches are essential in competitive intelligence, particularly in industries with intense competition. Having insight into the actions of competitors can provide companies with a significant advantage, as noted by (Neumann & Morgenstern, 1944). In the end, the Evolutionary Theory offers valuable insights into the ever-changing nature of business environments. It suggests that business processes and competitive contexts are always evolving, occasionally in unexpected ways. This theory emphasizes the importance of CI practices being flexible and proactive, able to adapt to current conditions and anticipate future developments (Nelson & Winter, 2002).

These various theoretical frameworks improve the application of CI by providing a detailed understanding of the external competitive environment and internal organizational strengths. With the rapid advancement of technology, data analytics and artificial intelligence are being used in increasingly sophisticated ways. This allows CI professionals to perform more thorough and forward-thinking analyses. Continuous adjustment and improvement of strategies is crucial for CI practitioners to remain competitive in rapidly changing markets.

## 2.3. Review of existing technology

In this subsection, the study provides an overview of the current technological landscape in the context of competitive intelligence. It explores the various tools and methodologies employed in the industry, highlighting their impact and effectiveness. The survey of existing technologies is divided into two parts: the first part focuses on the general application of technology in competitive intelligence, while the second part describes specific examples of technology use in related works. This structure allows for a detailed understanding of the topic, from broad trends to detailed case studies.

### **Existing technology in related works:**

Traditional competitive intelligence methodologies have been revolutionized into dynamic, technology-driven processes through the combination of data analytics, data science, and competitive intelligence. The development of CI from manual data collection to complex, automated procedures are a clear example of this transition, highlighting the enormous influence of technology breakthroughs. Data analytics and data science are increasingly used to improve modern CI procedures by offering deeper market insights and supporting proactive business strategy.

Using real-time data monitoring tools is one of the major advances in CI. These solutions enable businesses to instantly monitor changes in the market since they are coupled with CI software and powerful analytics. Businesses may quickly adjust their plans to take advantage of opportunities and reduce risks as they present themselves because to this skill (He et al., 2015). The growing use of predictive analytics to forecast future market trends and competitor moves is another noteworthy development. To improve its promotional plans and market response, a large retail corporation, for example, used predictive analytics to examine competition activity and previous sales data (M. Olszak, 2014).

To find patterns and changes in huge data sets, machine learning methods are widely employed in CI. For example, IT organizations use these algorithms to evaluate rival developments and identify new trends by analyzing data from various sources, such as social media. Another technique that has been widely used in CI is Natural Language Processing (NLP). To learn more about how customers feel and perceive a product or brand, it is used to analyze social media postings, reviews, and other unstructured data. This aids businesses in comprehending their brand image and implementing the required strategy adjustments (Sun et al., 2022)

Professionals in CI have recently provided input that emphasizes the trend toward data-driven CI. More than 75% of CI practitioners, according to a thorough survey, currently use data analytics in their work. The results highlight how crucial AI and machine learning are to improving CI systems' capacity for prediction. In-depth discussions with CI specialists in the technology industry highlighted the increasing dependence on artificial intelligence to expedite data gathering and processing, freeing up time for strategic decision-making.(Sadeghi R. et al., 2024)

In conclusion, strategic management techniques have been greatly impacted by the synergy between data analytics/data science and competitive intelligence. Through the utilization of real-time monitoring, predictive analytics, machine learning, and natural language processing, enterprises may acquire a wealth of information and anticipate and respond to forthcoming market trends.

### **Existing Technology according to Interview Reports:**

*Company A- Interview report:* The analyzed company (Company A) is a neobank headquartered in Germany which operates in the European Market. This digital banking platform offers mobile banking solutions such as a free basic current account, a debit MasterCard, overdraft protection, investment products, and premium accounts. Company A has more than 8 million customers and processes over 100bn EUR in transactions a year. The company has been chosen for research because of the large and diverse customer base and strong competitiveness of the external environment the company operates in. The market is also known for the easy customer acquisition but challenging customer retention characteristics. This factor about the market makes the keeping competitive advantage vital for the company.

The interviewed personnel hold the position of Data Analyst within the team that evaluates the performance of implemented changes to digital products of the company. CI functionality resides in the Product, Marketing departments. DA/DS techniques such as A/B testing, predictive modeling and machine learning are used by the company during the analysis stage of the data to make the data driven decisions about the potential feature implementations, forecasting market changes and learning the customer behavior. Customer Profiles are created based on available data to know their customer better and categorize them. Competitor profiles are created based on intelligence collected about them.

Examples of using DA/DS tools for strategic decision making could be the Public Relations team's utilization of data analytics on customer data and the formation of customer profiles prior to the execution of a major policy shift. For instance, a company might leverage customer data to perform detailed data analytics and create customer profiles. This process could help identify the potential impact of their decisions and ensure they do not disproportionately affect minority or vulnerable groups. By doing so, the company can prevent potential backlash and safeguard its reputation.

Company A collects the data from the sources like customer feedback, social networks, AI chatbot history for understanding the customer behavior. The Data Engineering team of the company creates a system that collects, manages and converts raw data into structured actionable data. Structured Query Language (SQL) within DataGrip IDE is one of the main IT tools used by analysts to extract the data and create subsets for analysis from the data pools created by Data Engineers. Python programming language is used by the data science team to implement the machine learning techniques such as language processing, classification, predictive modeling (particularly Jupyter Notebook for this purpose) in the analysis step of the data that is extracted in the previous step. Other software tools like Metabase, Looker Studio or PowerBI are used for visualization of the insights and reporting purposes.

In conclusion, according to interviewee, Company A is very familiar with the CI practices. Data-Driven decision making is implemented not only for operational but also for strategic purposes. Outputs which can be categorized as competitor profile reports, customer profile reports, financial reports, industry trend reports, market forecast reports, operational reports (A/B testing results for product features, change analysis) are mainly shared with the chief level management. CI capability of the company with the help of DA/DS tools is key for Company A to gain fast domination in the market.

Company B - Interview Report: Our second company is Company B, a governmental institution in Estonia. This organization issues digital identity which gives global entrepreneurs remote access to the world's most digital country. It allows you to securely authenticate yourself online and sign documents using the most secure and efficient electronic signatures. Plus, the ability to start a company 100% online from anywhere. This company has been chosen for research to add diversity to our sample as a governmental institution. Including companies from different institutions makes our research more useful.

We interviewed a Business Intelligence Analyst of Company B. Company B gave insights about the organization's CI practices, DA/DS and how these affects strategic decision-making. Company B mainly operates entrepreneurs from abroad who want to start businesses in Estonia. Key departments that work largely on duties related to competitive intelligence are Business Development, Product, and Marketing Departments. The main customers are foreign business owners who want to operate in Estonia. The company operates within the global market. The competitors are other countries' government institutions. It is believed that Company B is holding a specific competitive advantage as Estonia is well-known for digitalization of the bureaucratic process. External information sources include publicly available data, industry reports, and market trends.

Company B uses data collection techniques to illustrate the capabilities of CI. A variety of sources, like surveys and aggregate data from the Police Board and Estonian Statistics Offices, are used to collect data. Company B also uses outsourcing the data collection process. Regular surveys are conducted, and ad hoc surveys address specific research questions.

Regarding DA/DS tools, the Business Intelligence Analyst team uses R language to extract meaningful patterns, correlations, and insights from the collected data. Reports with descriptive data are useful for understanding consumer behavior, industry trends, and company success. The interviewee mentioned utilizing Facebook Prophet, a R and Python-based forecasting process. R studio is also used for the dissemination stage of the CI which includes visual reports. Facebook Prophet considers non-linear patterns, seasonal variations, and holiday effects while analyzing time series data. It provides automated forecasts that data scientists and analysts can adjust. The program uses Facebook Prophet to improve its forecasting abilities and learn about upcoming trends. The interviewee also mentioned that usage of the forecasting tools is not a usual practice in their analytical stage. The usual practice is using explanatory statistics.

DA/DS and CI are integrated, enhancing the overall intelligence-gathering process. CI outputs play a critical role in strategic decision-making. The Business Intelligence Analyst team considers that CI contributes to informed choices within the organization. By analyzing data, the program identifies growth opportunities, potential risks, and areas for improvement.

CI helps the Company B gain a competitive edge by:

- Understanding market trends.
- Identifying gaps in their services and addressing customer needs proactively.
- Anticipating regulatory changes and adapting swiftly.

In conclusion, according to interviewee CI capability of the company backed by DA/DS tools are used for both tactical and strategic purposes. The output reports which can be categorized as market trends reports, competitor country performances, performance reports of the company (with monthly and yearly periods) are shared with both operational and top management using the channels like Slack and Confluence.

### *Company C - Interview Reports*

Company C belongs to the financial sector, more specifically in the capital market industry and was established by the state-owned oil and gas company in Azerbaijan. This company aims to manage the cash flow between sub-instances and also for investment management. It also seeks to provide a platform for all investors, including Azerbaijani citizens, to benefit from state-owned oil and gas company's revenues. Company C competes both domestically and internationally. This company has been chosen for research to add diversity to our sample as it mainly operates in a B2B context.

The position of the interviewee is the Finance Data Management Team Lead at Company C. Research Development, Investment, and Sales are the main departments that reside in CI functionality. Considering the nature of the investment domain, CI is essential to the process of creating long-term strategic decisions.

The interviewee mentioned using CI capabilities in vendor prioritization, competitor analysis, customer analysis, and industry trends analysis. CI gives Company C a competitive edge by allowing it to stay up to date with advancements and trends in the industry.

Company C has an organized methodology for its CI process. First, by defining specific goals based on stakeholder requirements and accessible data sources, they do plan for the data collection step. Company C should get accounting reports from its internal sources (sub-instances) with the purpose of generic cash flow management. As previous practice, Data Team members were collecting the data in different formats from each sub-instance. However now, the procedure is simplified and centralized, and the labor is decreased by automating data collecting using a web application. This portal with validated fields, creates a standardized format for each sub-instance to upload their reports. It means predefined report templates are available in this app, and sub-instances' representatives can upload the data that is required from them. This centralization eliminates the additional effort that was required from the Data Management Team previously for aggregation of data in structured databases. Aggregated data managed and extracted with SQL, analyzed by Python where modeling tools also applied to get financial insights. The insights are later disseminated as visualized data by using mainly Microsoft Excel and PowerBI software.

Company C uses financial media channels such as Bloomberg as external data sources to get real time market insights. A specific Microsoft Excel third party Add-in used by the company to download the data from these sources. The insights are collected with this method are used for strategic and long-term purposes

Company C gives a six out of ten rating to its competitive intelligence efficacy. During the interview the company representative distinguished themselves from competitors by highlighting their CI procedures and analytical techniques. It's crucial to understand that CI is not the only element positively influencing their performance. Optimizing the efficacy, efficiency, and cost-effectiveness of internal operations and processes is another important way to provide the business a competitive edge. Company C's structured approach to CI shows its importance in informing strategic decisions and maintaining competitiveness in the dynamic capital market industry.

*Company D - Interview Reports:* Our fourth interviewer was the Risk Analyst Department Lead at Company D. Currently, Company D is the largest financial institution in Azerbaijan. Company D serves more than 5 million individuals and more than 22,000 legal entities. At the same time, this bank closely participates in a number of state-owned social projects and implements a number of development programs of the real sector. Company D is mainly served to local clients. This company has been chosen for research to add diversity to our sample as belonging to the traditional banking sector.

The main departments which are involved in the CI process are Credit Risk Analysis, Modelling, Marketing and Customer Experience. Company D has an extensive Know Your Customer (KYC) capability of understanding customer needs. They are relying on the customer experience data mainly generated from the mobile applications and web page of the company such as account activity, customer transactions and walkaways. Company D also queries the data from the Credit Bureaus of the government to gain the insight about customers' credit history. Generated data from these sources are used to estimate the default probability, creditworthiness and income estimations of the customers. In this process SQL with PL/SQL IDE used for data extraction, and above listed estimations are made with the help of regression, machine learning tools applied by Python programming language. Tableau is used as main software to disseminate the findings periodically with the higher management. Additionally, Microsoft Excel is used for reporting purposes for ad-hoc analysis requests. Ad hoc reports are produced as needed and provide in-depth analysis of particular subjects or issues, making root-cause analysis for well-informed decision-making.

In addition to internal data sources, Marketing Department of Company D actively monitors external factors such as social media trends, industry reports, and competitor activities. However, integration of DA/DS tools and software usage is not the regular practice of this department.

In summary, according to interviewee, Company D is mainly using the integration of DA/DS with CI capability for the customer-oriented processes rather than for competitor or market analysis, decision making is implemented not only for operational but also for strategic purposes.

## 2.4. Summary of the Literature Review

In this chapter, we explained into the world of Competitive Intelligence, Data Analytics, and Data Science. We began by exploring the existing literature on CI, tracing its evolution, understanding its scope, and recognizing its significance in today's data-driven world. The literature review highlighted the importance of DA and DS in enhancing CI processes, thereby providing a detailed assessment on the subject.

The chapter further illustrated the theoretical frameworks that are foundations for CI. These frameworks serve as the core for understanding and implementing CI in different organizational contexts. The discussion also described the transformative impact of modern technologies on CI, emphasizing how they have revolutionized the way we gather, analyze, and interpret competitive data.

Chapter 2 also addressed the sub research questions (**SRQ1**, **SRQ2**, **SRQ3**, **SRQ4**) by providing a detailed analysis of the literature and theoretical frameworks. **SRQ1** (*What is Competitive Intelligence Capability?*) and **SRQ2** (*What are the steps of the Competitive Intelligence Process?*) were answered through the detailed review of CI literature and its evolution, while **SRQ3** (*What is Data Analytics and Data Science?*) was addressed by discussing the role of DA and DS in enhancing CI. Lastly, **SRQ4** (*Which Data Analytics and Data Science tools are used to support the Competitive Intelligence Capability?*) was answered by examining the impact of modern technologies on CI. This chapter, therefore, not only provided a deep understanding of CI, DA, and DS but also answered the sub research questions, paving the way for further exploration in the subsequent chapters.

In conclusion, Chapter 2 provided a thorough background and literature review on CI, DA, and DS. It highlighted the importance of integrating DA and DS into CI processes and discussed the theoretical frameworks that guide CI. The chapter also examined the influence of modern technologies on CI, setting the stage for the subsequent chapters that describes the practical applications and implications of these concepts. This detailed research serves as a solid foundation for understanding the synergies between CI, DA, and DS, and their collective potential to drive competitive advantage.



## 3 Methodology and Data

Chapter 3 of this research investigates the details of integrating DA and DS into CI processes. This chapter is structured into two main sections: The Research Method and Data Analysis and Findings.

In the Research Method section, we described the data collection techniques, participant selection, and data analysis methods used in the study. This section also outlines the ethical considerations and strategies employed to ensure the reliability and accuracy of the study findings.

In the Data Analysis and Findings section we presented the in-case findings from four different companies, each with its unique approach to integrating DA and DS into their CI processes. This section provides a thorough analysis of each company's CI process, by highlighting the strengths, areas for improvement, and the strategic implications of their DA and DS integration.

### 3.1. Research Method

This study explores the incorporation of Data Analytics and Data Science into Competitive Intelligence processes through the use of a qualitative research methodology. The qualitative approach is highly effective in delving into complicated phenomena within specific contexts, particularly when the boundaries between the phenomenon and context are not easily understood. This approach allows for a thorough examination of how technological tools can be effectively incorporated into existing competitive intelligence frameworks. It is in line with the exploratory nature of the research questions discussed earlier. The qualitative methodology provides a deeper understanding of the subject matter by allowing the researcher to explore the complexities of the integration process, the challenges encountered, and the strategies used to overcome them.

The data collection in this study is carried out using semi-structured interviews, which is a well-established qualitative data collection technique. This technique is well-suited for gathering in-depth information about individuals' experiences, attitudes, and perspectives on the use of DA and DS in CI processes. The interviews are designed to be flexible, allowing for in-depth exploration of complex issues while staying on track with the research framework. This approach also enables the researcher to adjust the interview process according to the participants' responses, facilitating a more thorough investigation of the subject.

A purposive sampling approach is used to choose a diverse group of professionals, including Data Analysts, Data Management Team Leads, Business Intelligence Analysts, and Risk Management Team Leads. These professionals have valuable experience and expertise in CI and strategic management within their organizations. Participants are carefully selected from a wide range of industries to ensure a rich and varied collection of perspectives. In order to ensure comparable findings, companies from both non-EU and EU countries are intentionally selected. This varied selection offers a valuable collection of information, presenting different viewpoints on how DA and DS can be incorporated into CI processes.

We analyze the collected interview data using thematic analysis, which is a method for identifying, analyzing, and reporting patterns within the data. Thematic analysis is well-suited for examining the scope and depth of qualitative information, making it easier to interpret diverse data sets in relation to the research questions. It requires an iterative process of coding

data in phases to produce significant trends that reflect the integrated use of DA and DS in CI. The data analysis process is broken down into three stages:

**Initial Coding:** Transcripts from interviews are first examined for common ideas or language used by participants that pertain to the integration of analytics and intelligence processes. In this stage, the data is carefully examined, and the researcher fully immerses themselves in it to gain a comprehensive understanding of the content.

**Focused Coding:** Codes identified in the initial phase are then grouped into potential themes, with a specific focus on the integration of DA and DS tools into CI practices. In this stage, the researcher takes a more focused approach, seeking out patterns and connections among the codes.

**Theme Development and Revision:** Themes are reviewed and refined to ensure they precisely represent the dataset and are coherent, distinctive, and relevant to the research objectives. In this stage, the researcher carefully evaluates the themes, assessing how well they align with the data and research questions.

Participants are provided with information about the research's purpose, the voluntary nature of their participation, their right to withdraw at any time, and the confidentiality of the data collected. All participants are required to provide informed consent before the interviews take place. The data is carefully anonymized and stored securely to ensure the privacy of participants and adhere to relevant data protection regulations. Ethical considerations go beyond just collecting data. Researchers are dedicated to ensuring the confidentiality of participants during the analysis and reporting stages. In order to guarantee the reliability and accuracy of the study findings, a number of strategies are put into place:

**Triangulation:** This method involves gathering evidence from various data sources and using different methodologies to ensure the reliability of findings. Triangulation adds to the trustworthiness of the findings and offers a more comprehensive grasp of the phenomena being studied.

**Member Checking:** Participants receive a summary of their interview findings to confirm the researcher's interpretation. This process ensures that the researcher's interpretations align with the participants' intended meanings, which enhances the credibility of the findings.

## 3.2. Data Analysis and findings

### **In case Findings:**

*Company A:* Company A has been effectively utilizing CI in combination with DA/DS tools for strategic decision-making. The company's primary focus is on policy shifts and customer profiling, which aligns with the research objectives of understanding the role of CI in strategic management and organizational sustainability.

The in-case findings show that Company A has a strong CI process in place. The company collects data from various sources, including market trends, customer behavior, and competitor actions. This data is then analyzed using advanced DA/DS tools to extract meaningful insights. These insights play a crucial role in shaping the company's strategic decisions, such as entering new markets, developing new products, or adjusting pricing strategies.

The evaluation of the CI process at Company A indicates that the company is effectively using DA/DS for strategic planning. The integration of DA/DS in the CI process has enhanced the company's ability to make data-driven decisions, thereby contributing to its long-term sustainability. However, it's also worth noting that the company uses these tools for operational purposes, such as improving customer service and optimizing internal processes.

Although Company A has a well-organized CI process, further DA/DS techniques can be employed to improve the effectiveness of the process such as Sentiment Analysis. Company A could gather and analyze data on customer sentiment from social media and other online platforms. This could provide insights into customer perceptions of the company and its products, which could inform strategic decisions related to marketing and product development.

In conclusion, Company A serves as a good example of how the integration of CI, DA, and DS can contribute to strategic management and organizational sustainability. The company's success in the competitive neobank market can be largely attributed to its effective use of these tools in strategic decision-making.

*Company B:* Company B has been effectively utilizing CI integrated with DA/DS tools for strategic decision-making. The in-case findings reveal that Company B has a robust CI process in place. Company B primarily uses descriptive analysis, which focuses on explaining what has happened or what is happening. While this is useful for understanding the current situation, it may not provide enough insights for future strategic planning. The company could benefit from incorporating more prescriptive and predictive analysis, which focus on suggesting actions for future scenarios and predicting future outcomes, respectively.

The company collects data from various sources, including external environment trends, e-resident's behavior, and competitor countries actions. This data is then analyzed using DA tools rather than DS tools. These insights are used for informative purposes to understand Estonia's place in the world's e-residency statistics. While Company B collects and analyzes data, the application of these insights appears to be more tactical than strategic. The company could improve by using the insights gained from CI and apply more DS tools to get strategic insights, such as for reaching more entrepreneurs, product development, or policy changes.

The evaluation of the CI process at Company B indicates that the company is effectively using DA for strategic planning. The integration of DA in the CI process has enhanced the company's ability to understand the current external environment and performance ability, thereby contributing to its long-term sustainability. However, the current approach seems to be more reactive than proactive. Relying on descriptive analysis might lead to missed opportunities for innovation and growth. Shifting towards a more proactive strategy, informed by prescriptive and predictive analytics, could help the company anticipate market changes and stay ahead of the competition.

*Company C:* Company C has also been effectively utilizing CI integrated with DA/DS tools for strategic decision-making. Company C uses Competitive Intelligence in vendor prioritization, competitor analysis, customer analysis, and industry trends analysis. CI gives Company C a competitive edge by allowing it to stay up to date with advancements and trends in the industry.

While the company relies on a variety of sources for internal operational purposes, the diversity of sources for the external environment is limited to mainly one source about the global environment which is crucial considering the nature of the investment sector. This makes the CI capability of the Company C more operational oriented rather than strategic oriented.

In conclusion, Company C has effectively utilized CI integrated with DA/DS tools for operational decision-making. However, the company's reliance on a limited number of sources for external data has resulted in a more operationally oriented CI capability. This could potentially limit the company's ability to make fully informed strategic decisions that consider a broader range of external factors. Therefore, to maximize the benefits of CI and DA/DS integration, Company C should strive to diversify its external data sources and align its CI activities with both operational and strategic goals.

*Company D:* Company D has been effectively utilizing CI integrated with DA/DS tools for strategic decision-making. The in-case findings reveal that Company D has a robust CI process in place. Company D primarily uses descriptive analysis, which focuses on explaining what has happened or what is happening. This is particularly evident in their extensive Know Your Customer (KYC) capability, where they analyze customer experience data and credit history to estimate default probability, creditworthiness, and income estimations of the customers. While this is useful for understanding the current situation, it may not provide enough insights for future strategic planning. The company could benefit from incorporating more prescriptive and predictive analysis, which focus on suggesting actions for future scenarios and predicting future outcomes, respectively. This could enhance their customer-oriented processes and provide more strategic insights for decision making.

Company D collects data from various sources, including customer transactions, account activity, and government's Credit Bureaus. This data is then analyzed using DA tools such as SQL with PL/SQL IDE and Python programming language. These insights are used for informative purposes to understand the customers' creditworthiness and income estimations. While Company D collects and analyzes data, the application of these insights appears to be more customer-oriented than competitor or market-oriented.

The evaluation of the CI process at Company D indicates that the company is effectively using DA for strategic planning. The integration of DA in the CI process has enhanced the company's ability to understand the current external environment and performance ability, thereby contributing to its long-term sustainability. However, the current approach seems to be more reactive than proactive. Relying on descriptive analysis might lead to missed opportunities for innovation and growth. Shifting towards a more proactive strategy, informed by prescriptive and predictive analytics, could help the company anticipate market changes and stay ahead of the competition.

In summary, Company D has a strong focus on customer-oriented processes and uses various tools and technologies to support their decision-making processes. However, there is room for improvement in terms of integrating DA/DS tools in other departments and using the insights gained for more strategic purposes.

### **Overview:**

This study thoroughly analyzed the incorporation of Data Analytics and Data Science into Competitive Intelligence processes in technology-intensive industries. The primary data,

gathered from semi-structured interviews and case studies, offered valuable insights into the practical and long-term applications of CI enhanced by DA and DS. In line with the theoretical framework presented in the thesis, the incorporation of advanced analytics tools has greatly improved the predictive abilities of CI systems. All participating organizations demonstrated a clear shift from traditional CI approaches to more advanced, data-driven strategies. These tools allowed companies to better predict market trends and competitor actions, making it easier to plan ahead strategically.

The findings showed a significant enhancement in the integration and utilization of data for strategic decision-making. Companies that successfully integrated data analysis and data science into their CI processes experienced a more efficient decision-making process. This resulted in faster and more accurate insights, allowing for quicker responses to market changes. The integration of DA and DS tools has resulted in a more effective alignment of CI activities with the strategic goals of organizations, giving them a competitive advantage in the market. This alignment proved to be highly effective in enhancing the organizations' ability to take advantage of market opportunities and proactively manage risks.

The findings from this study emphasize the importance of incorporating technology into contemporary CI practices. It is crucial for organizations to not only embrace advanced DA and DS tools, but also to consistently customize and adjust these tools to align with their ever-changing strategic requirements. The study also highlights the importance of having a structured framework that organizations can use to effectively incorporate these technologies into their CI processes.

Considering the available information, the research highlights how CI has developed as a field, particularly with the incorporation of technology as mentioned earlier in the thesis. The practical examples and data from this study enhance the proposed framework for integrating DA and DS in CI, offering a stronger structure for future research and application. This research provides evidence for the significant impact of incorporating data analysis and data science into CI processes, as predicted in the thesis. The empirical evidence supports the proposed integrative framework, demonstrating its relevance and usefulness in improving strategic decision-making in competitive environments. Future studies could investigate the long-term strategic outcomes of these integrations and continue to improve the integration frameworks in line with emerging technological trends.

**Table 2. Comparison of in-case findings**

Company name	Industry	Location/Operating Market	Organization & Structure of CI practices	Purpose of CI	Software Usage	DA/DS usage
Company A	Fintech	Germany/Europe	Decentralized CI functionality that is customer, market and competitor oriented.	Operational & Strategic	<b>Collection/Extraction:</b> Data Build Tool (DBT), DataGrip-SQL <b>Analysis:</b> Python, Jupyter, Notebook, NumPy, Pandas <b>Dissemination:</b> Metabase, Looker Studio, PowerBI	- A/B testing, Descriptive Analytics - Prescriptive Analytics - Predictive Modeling - Machine Learning - Data Visualization
Company B	Digital residence	Estonia/Global	Centralized CI functionality, mainly supported by descriptive analysis.	Operational & Strategic (Mainly operational)	<b>Collection/ Extraction:</b> R language <b>Analysis:</b> Facebook Prophet, R language, Python <b>Dissemination:</b> R, Slack, Confluence	- Questionnaires - Correlation Analysis - Descriptive Analysis - Forecasting timeline series - Data Visualization
Company C	Capital-market industry	Azerbaijan/Global	CI functionality mainly relies on internal data. External environment scanning outsourced.	Operational & Strategic (Mainly operational)	<b>Collection/ Extraction:</b> Web application, SQL <b>Analysis:</b> Python <b>Dissemination:</b> PowerBI, Excel	- Data Validation - Descriptive Analytics - Trend Analysis - Data Visualization
Company D	Finance industry	Azerbaijan/Azerbaijan	Customer oriented CI process.	Operational & Strategic (Mainly operational)	<b>Collection/ Extraction:</b> Web Page, Mobile Application, PL/SQL IDE <b>Analysis:</b> Python <b>Dissemination:</b> Tableau, Microsoft Excel	- Regression - Machine Learning - Data Visualization - Probability Estimation - Descriptive - Predictive

## 4 Result and Analysis

### 4.1. Theoretical results

This thesis significantly advances the field of Competitive Intelligence by incorporating and enhancing theoretical frameworks related to Data Analytics and Data Science. The research fundamentally challenges traditional CI models by showcasing the power of advanced DA and DS tools in improving predictive capabilities within CI processes. The study builds upon existing theoretical models by integrating advanced analytics and machine learning technologies, resulting in a more agile and adaptable approach to competitive intelligence. This research presents a unique theoretical framework that effectively combines DA and DS throughout the entire CI cycle, encompassing planning, collection, analysis, and dissemination. This framework not only supports existing theories on competitive strategy and intelligence but also enhances them by incorporating technological sophistication into traditional processes. This resource addresses a significant need in literature by offering a systematic approach to improve the practical value of CI, effectively translating theoretical ideas into actionable intelligence strategies.

This work builds on well-established theories of competitive strategy, such as Porter's Competitive Forces and the Resource-Based View. It aims to align the improved competitive intelligence capabilities with the strategic objectives of the organization. By demonstrating the power of automated and real-time data analysis, it challenges the traditional dependence on manual data processes and highlights how this can greatly enhance the speed and precision of competitive assessments. This thesis addresses a significant gap in the CI literature by emphasizing the importance of utilizing DA and DS tools in the CI process. By doing so, it improves the efficiency and effectiveness of intelligence operations.

The research employed a methodological approach that included qualitative interviews. This approach ensured a thorough analysis of how data analytics and data science can be smoothly integrated into competitive intelligence processes. This approach allowed for a comprehensive understanding of the operational and strategic effects of incorporating technology in CI. It was supported by both empirical data and theoretical analysis, providing a thorough perspective. The methodology serves as the foundation for the theoretical results and is further supported by its practical application in various organizational contexts.

The research findings have important implications for both academic and practical applications. From an academic standpoint, this perspective brings a new and valuable angle to the discussion on incorporating technology into strategic intelligence frameworks. Practically, it provides CI professionals and organizations with a proven method to improve their competitive positioning and strategic decision-making abilities. This thesis introduces a framework that has the potential to shape future developments in the field of data science and analytics in strategic contexts, opening up new avenues for research.

The theoretical results that are achieved, supported by empirical evidence collected from industry case studies and expert interviews, demonstrating their relevance and impact. These validations demonstrate that incorporating DA and DS into CI processes not only improves analytical capabilities, but also enhances the agility and effectiveness of strategic management.

This research makes significant progress in combining DA and DS in CI. However, it also recognizes certain limitations, such as the reliance on data quality and the requirement for

ongoing updates and maintenance of technological tools to stay up to date with market changes. The theoretical framework, although thorough, needs continuous assessment and adjustment to stay relevant in the face of evolving technologies and market conditions. This subsection of the thesis emphasizes the theoretical contributions and their connection to existing theories and literature. It is supported by methodological rigor and empirical validation. This comprehensive approach guarantees that the contributions are not only innovative but also practical, paving the way for future research and improvements in the field of Competitive Intelligence.

## 4.2. Practical results

This research has made a valuable result to the practical application of competitive intelligence by incorporating data analytics and data science into CI processes in technology-intensive industries. This study has practical implications that are diverse, showcasing the improved capabilities and operational enhancements made possible by this integration. The integration of DA and DS tools has transformed decision-making processes within organizations, offering precise and timely insights into competitive dynamics and market opportunities. This has allowed organizations to respond more quickly to market changes, anticipate competitor actions, and strategically position themselves in favorable ways. For example, the application of predictive analytics has enabled companies to predict market trends ahead of time, giving them a competitive edge in various situations.

The research has provided a systematic method for incorporating advanced analytics into every step of the CI cycle, including planning, collection, analysis, and dissemination. This seamless integration enhances the overall CI cycle, improving its efficiency and effectiveness. Companies have seen significant improvements in gathering and processing information, resulting in better relevance and precision of intelligence. This has led to optimized resource allocation and strategic planning.

This study has made a significant practical contribution by developing a comprehensive framework that can guide the integration of DA and DS tools into existing CI processes. This framework provides a roadmap for organizations seeking to improve their CI capabilities using technology. This resource offers comprehensive guidance on how to seamlessly integrate data science techniques into competitive intelligence tasks, covering methodologies, tools, and strategies in great detail.

This thesis showcases the practical advantages of incorporating advanced analytical tools into CI practices through interviews. These interviews showcase both successful implementations and the challenges faced, offering valuable insights for professionals in the field. As an illustration, a case study on a prominent technology company demonstrates how they leveraged machine learning algorithms to enhance their grasp of customer behavior patterns, resulting in improved competitive strategies.

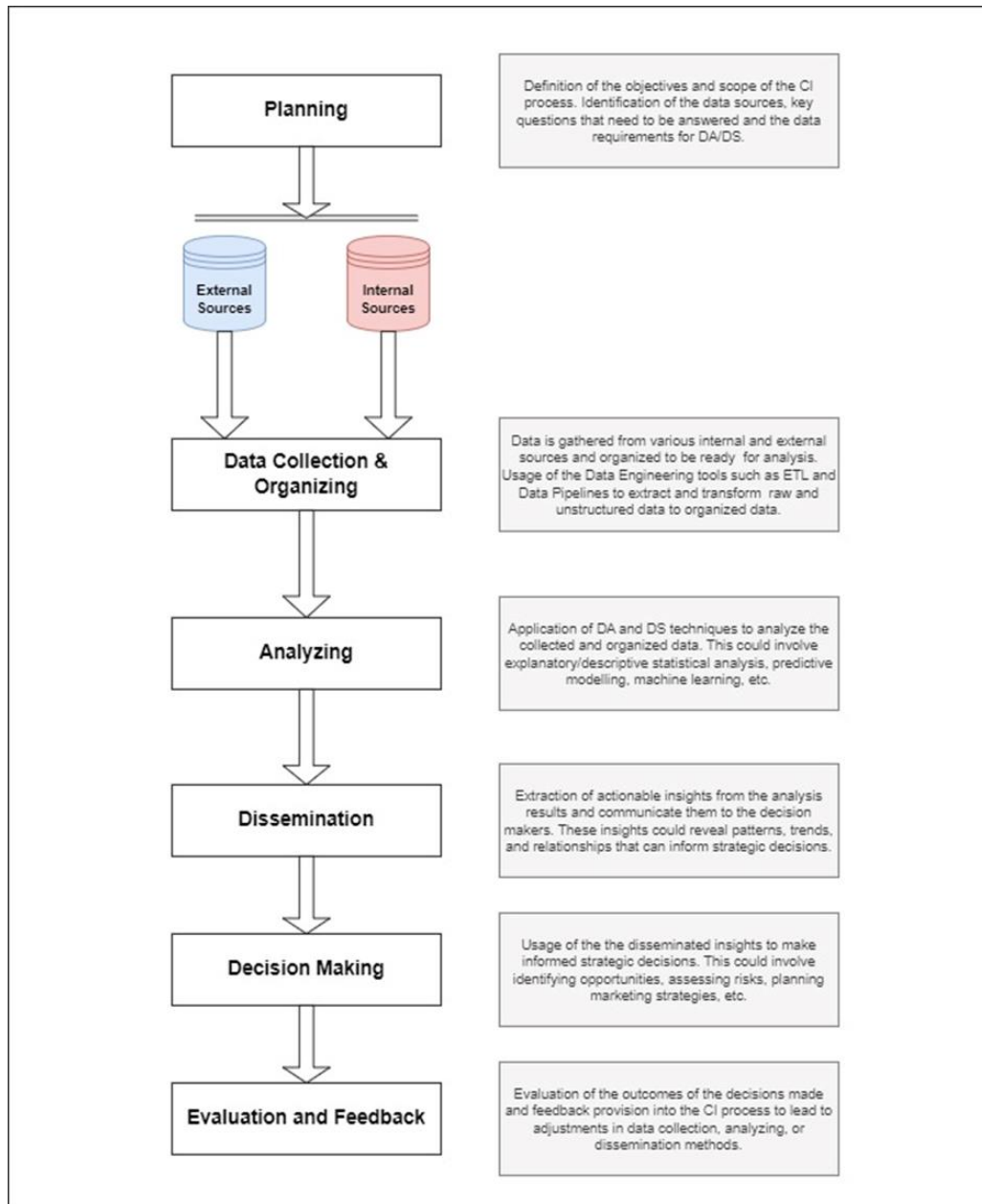
This research has provided CI professionals with the necessary knowledge and tools to harness the potential of big data and advanced analytics. The training modules and practical guidelines created for this study assist CI practitioners in comprehending and applying advanced analytical techniques, thereby enhancing the overall proficiency in the field.

In summary, this thesis makes practical contributions by connecting theoretical knowledge to real-world application, greatly improving organizations' strategic intelligence capabilities.



These advancements allow businesses to gain a deeper understanding of their competitive landscape and take proactive steps to shape it in their favor. This research is a crucial foundation for future investigations into the merging of competitive intelligence, data analytics, and data science. It holds the potential for exciting advancements and enhancements in strategic management practices.

For this purpose, we recommend using the following framework that encompasses every stage of the CI process and seamlessly incorporates DA/DS tools. The framework starts with **Planning**, where the goals and scope of the CI process are determined. It also involves identifying the key questions that need to be answered and the data requirements for DA/DS. After that, we move on to **Collection and Organizing**, where we gather data from different internal and external sources through techniques like web scraping and API calls. During this stage, data engineering tools like ETL (Extract, Transform, Load) and Data Pipelines are used to extract and transform raw and unstructured data into organized data. Next comes the **Analyzing** phase, where various techniques such as data analysis and data science are used to analyze the collected data. This may include tasks like statistical analysis, predictive modeling, and machine learning. The fourth step involves **Dissemination**, where the analysis results are transformed into actionable insights and shared with the appropriate stakeholders. These insights can provide valuable information for making strategic decisions by uncovering patterns, trends, and relationships. The fifth step involves **Decision Making**, where the insights are utilized to make well-informed strategic decisions. This could include identifying opportunities, evaluating risks, developing marketing strategies, and so on. The last step, **Evaluation and Feedback**, involves evaluating the outcomes of the decisions made and providing feedback into the CI process. There may be a need to make changes to how data is collected, analyzed, or shared. This framework offers a holistic approach to incorporating CI with DA/DS, improving the strategic decision-making process.



*Diagram1: Framework for use of Data Analytics and Data Science in CI process*

### 4.3. Summary of the results and analysis

In this chapter, we described the integration of Data Analytics and Data Science into Competitive Intelligence processes. The chapter illustrated the practical applications of DA and DS in enhancing CI within organizations. These applications were drawn from in-depth case studies, providing real-world examples of how these advanced analytical tools can transform CI processes.

Chapter 4 also addressed the sub research question **SRQ5** (*How can Data Analytics and Data Science be integrated into Competitive Intelligence processes?*) by developing a theoretical framework for this integration. This framework serves as a guide for technology-intensive industries looking to leverage DA and DS to enhance their CI capabilities.

In conclusion, Chapter 4 provided a comprehensive exploration of the integration of DA and DS into CI processes. It highlighted the importance of this integration in enhancing CI capabilities and discussed the practical implications of the research findings. The chapter also developed a theoretical framework for this integration, setting the stage for the subsequent chapters that describes the practical applications and implications of these concepts. This chapter serves as a solid foundation for understanding the connection between CI, DA, and DS, and their potential to drive competitive advantage.

## 5 Validation

This chapter divided to Theoretical, Empirical Validation and Analytical Modelling subsections, collectively aiming to demonstrate the reliability and applicability of the research conducted in the thesis.

### 5.1. Theoretical Validation

This subsection will connect the study's methodologies and findings to established theories and frameworks in competitive intelligence and data analytics. Our research is firmly grounded in the theoretical frameworks of competitive intelligence, with a strong emphasis on the systematic collection and analysis of information to inform strategic decision-making. Our approach incorporates data analytics and data science to enhance existing frameworks, allowing for more advanced predictive and prescriptive analytics.

Our research methodology and framework are built upon well-established theories such as Porter's Five Forces and the Resource-Based View (RBV). These theories emphasize the significance of comprehending both the external competitive forces and internal capabilities. Our research shows how the use of data analysis and decision support can greatly improve the competitive intelligence process. By utilizing these tools, companies can stay ahead of the game by predicting future trends and making the most of their internal resources.

Our findings demonstrate how data analytics and data science can be applied in competitive intelligence practices, making a unique contribution to the field. This integration fills a void in traditional CI practices, which often struggle to handle and analyze large amounts of unstructured data in a timely and efficient manner.

Through the effective utilization of cutting-edge analytical tools in the CI cycle, our study not only provides support, but also enhances the theoretical concepts of agility and responsiveness in business strategy contexts. The practical application of these advanced tools demonstrates a shift in theoretical application, transitioning from static to dynamic, real-time strategic management.

### 5.2. Empirical Validation

Empirical Validation is about showing the reliability and applicability of the research methods and findings through data and real-world application. This section will examine the research methods employed and analyze how the data aligns with the research hypotheses and objectives.

We carefully selected our empirical research methods to gain a thorough understanding of how DA and DS are integrated into competitive intelligence processes. Conducting semi-structured interviews with various companies provided a comprehensive understanding of the practical applications and strategic implications.

**1. Data Collection and Analysis:** The data collected from different technology-intensive industries through semi-structured interviews has provided a valuable dataset for analysis. Thematic analysis of this data uncovered recurring patterns, including improved predictive capabilities and enhanced decision-making processes, which are in line with our research goals.

**2. Verification Through industry practices:** The thesis includes several case studies that showcase how the theoretical framework can be applied in real-world situations. These examples showcase how organizations have effectively incorporated data analysis and data science into their competitive intelligence processes, resulting in noticeable advantages such as increased agility in the market and enhanced strategic planning.

**3. Cross-Verification:** The empirical findings were thoroughly examined alongside existing literature and theoretical frameworks to ensure the credibility and strength of the conclusions drawn from the data. This cross-verification validates that the integration of DA and DS not only improves CI processes but also aligns with the latest theoretical advancements in the field.

The practical implications of our findings are supported by their alignment with industry trends and feedback from CI professionals. These implications demonstrate that organizations that embrace this integrated approach can anticipate substantial enhancements in their strategic intelligence capabilities.

### 5.3. Analytical Modeling (GOMS)

Our research used the GOMS model to validate the functionality and usability of the proposed competitive intelligence framework. The GOMS model is important for predicting user interactions, optimizing system design, and proactively identifying potential usability issues. By following this systematic approach, we are able to improve our framework by considering theoretical predictions of user behavior and operational effectiveness.

#### **Components of the GOMS Model:**

**Goals** are well-defined objectives provide clear guidance for utilizing the framework. These include: identifying emerging market trends to stay ahead in the industry, analyzing competitor strategies to understand market dynamics, generating actionable strategic insights through advanced data analytics, enhancing decision-making processes with real-time data, optimizing resource allocation to maximize efficiency and minimize waste. Every goal is aligned with the strategic needs of organizations seeking success in dynamic market conditions, ensuring that our framework is useful in real-world challenges.

**Operators:** encompass a range of actions that users can perform within the system, including data analysis, predictive modeling, and sentiment analysis. Every operator is carefully crafted to make specific tasks easier to accomplish within the framework. They are designed to be user-friendly and minimize mental effort, allowing users to work more efficiently.

**Methods:** We provide comprehensive instructions for completing tasks. As an illustration, to accomplish "Goal 1," users could utilize machine learning algorithms for trend analysis, and then apply NLP techniques to assess market sentiment. The method section offers a clear and easy-to-follow guide, allowing users to navigate through the process without needing extensive training beforehand.

**Selection Rules:** These guidelines assist users in selecting the most optimal method for their specific scenarios, considering factors such as data urgency or complexity. For example, if making decisions quickly is important, the model may suggest using real-time data streaming methods instead of batch processing methods.

The effectiveness of the GOMS Model in validating the framework is outlined by the following points:

***Predictive Capability:*** The GOMS model enables us to simulate and forecast user interactions within the framework before it is fully implemented. This predictive analysis is essential for identifying potential usability bottlenecks and areas where users may encounter confusion or delay.

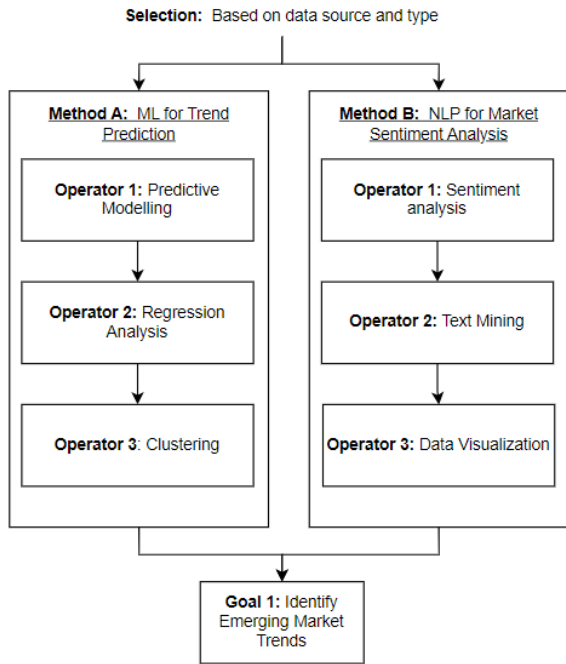
***Optimization Opportunities:*** By mapping out each step of user interaction, the GOMS model provides insights into optimizing the workflow and interface. This results in a smoother user experience, making it easier for users to learn and increasing the rate at which they adopt the product.

***Theoretical and Practical Alignment:*** The model ensures that the framework is grounded in both theoretical and practical usability. By ensuring that every component of the GOMS model is in line with user needs and business goals, we can confirm that our framework is both scientifically sound and practically viable.

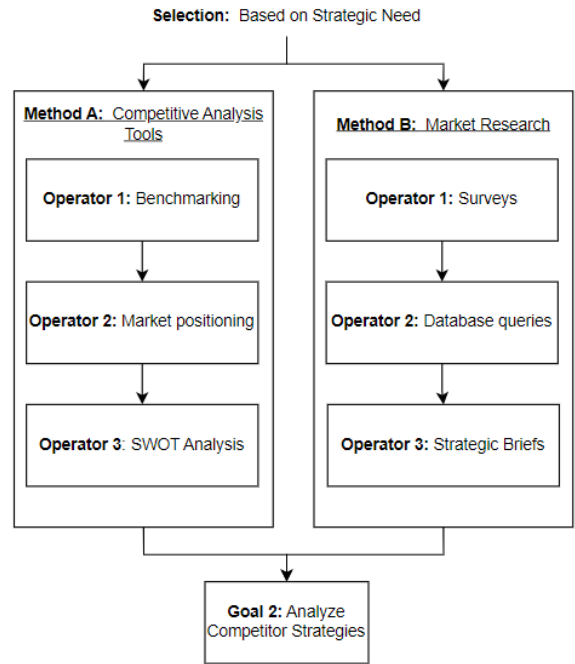
***Feedback Incorporation:*** The GOMS model facilitates early detection of issues, allowing for the integration of user feedback into the development process. This iterative approach guarantees that the final product is carefully adjusted to meet the expectations and requirements of its end-users.

The GOMS model is used to validate our competitive intelligence framework, which is based on a detailed analysis of usability and functional effectiveness. This model demonstrates the framework's effectiveness in both theoretical and practical environments, making it a trustworthy tool for organizations looking to improve their competitive intelligence capabilities. With this improved validation process, we show our dedication to providing a framework that is scientifically validated and optimized for users, ensuring it can meet the challenges of today's competitive environments.

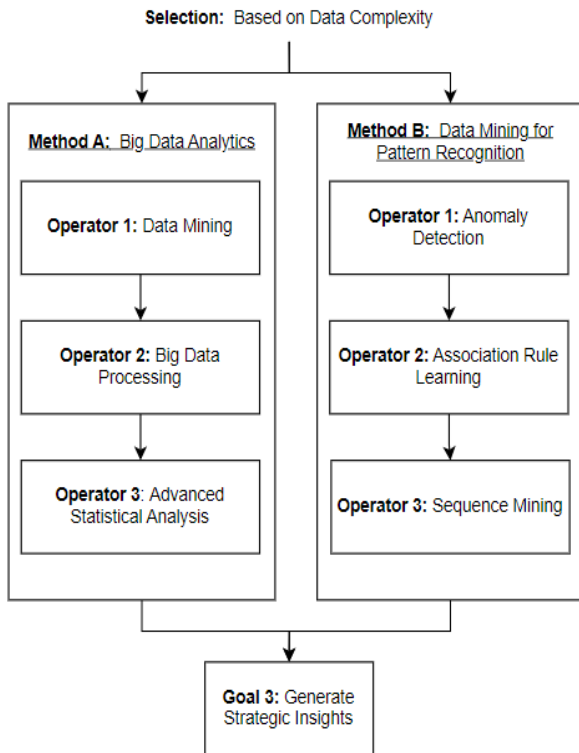
**Initial Situation:** Need for timely strategic insights to align with market dynamics



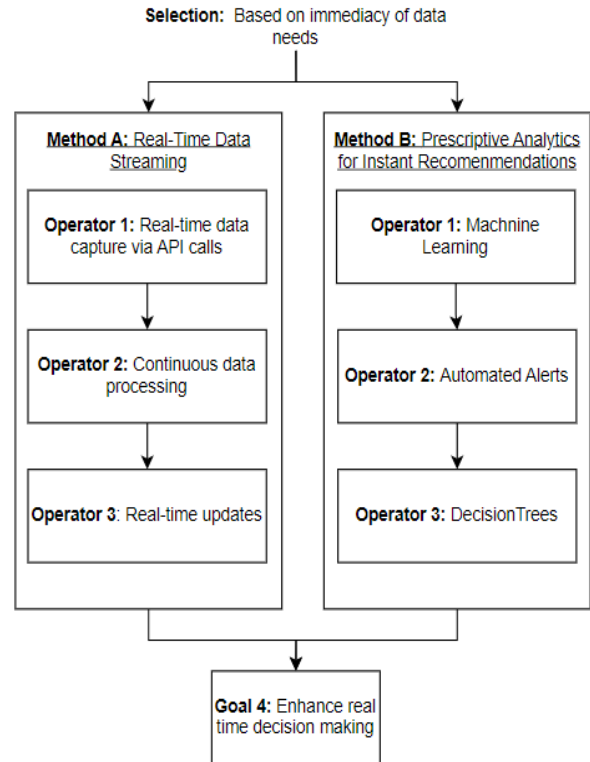
**Initial Situation:** New Competitor initiatives



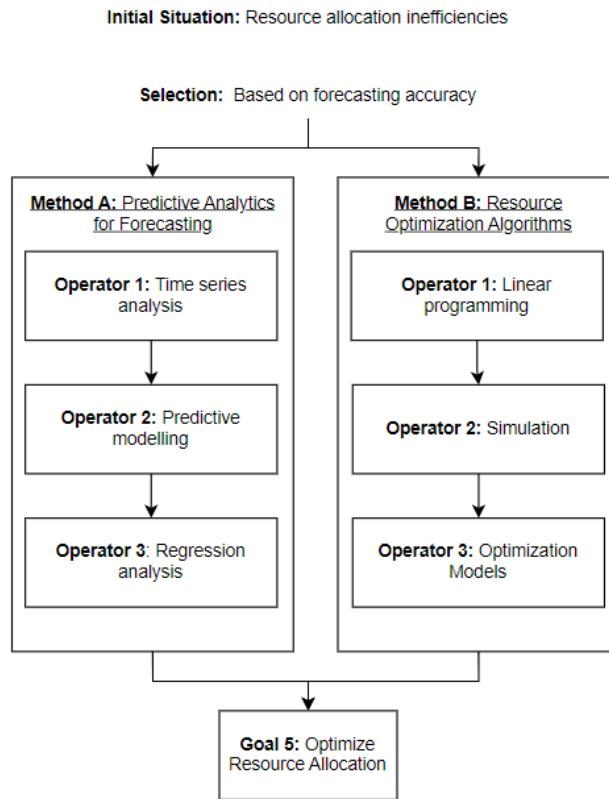
**Initial Situation:** Massive Internal and External Data



**Initial Situation:** Decision-making needs to be faster to react to market and operational changes.



**Diagram: GOMS Model for Goal 1-4**



**Diagram: GOMS Model for Goal 5**

## 5.4. Summary of Validation

The validation chapter of the thesis is detailed research of the theoretical and empirical validity of the research conducted. Theoretical validation describes, where the methodologies and findings of the study are linked to established theories and frameworks in competitive intelligence and data analytics. This demonstrates how the research is grounded in academic knowledge. Following this, the chapter describes empirical validation. This section showcases the reliability and applicability of the research methods and findings through data and real-world application. It confirms the consistency of the findings with industry trends and feedback from competitive intelligence professionals. The chapter then applies the GOMS Model for in a section on analytical modeling. This model is used to validate the functionality and usability of the proposed competitive intelligence framework. This is a practical application of the theoretical constructs discussed earlier and provides a concrete example of the framework in action. Finally, the chapter addresses **SRQ6** (*What is the usability of the proposed framework?*) by confirming the usability of the proposed framework. This is demonstrated by various case studies within the thesis, which provide real-world examples of the framework's application. The GOMS model is employed to predict and enhance user interactions with the framework, providing a clear answer to **SRQ6**.



In conclusion, Chapter 5 ensures that the contributions made in the thesis are both theoretically sensible and practically feasible. It provides a strong tool for organizations aiming to enhance their competitive intelligence capabilities and serves as a basis for future explorations into the convergence of competitive intelligence, data analytics, and data science. This chapter is a demonstration to the accurate validation process that the research has undergone, answering **SRQ6** and setting the stage for the remaining chapters of the thesis.

## 6 Discussion

### 6.1. Answers to Research Questions

This section provides a detailed explanation of how the proposed framework, which combines Data Analytics and Data Science tools with Competitive Intelligence processes, effectively improves organizational capabilities. It also addresses the specific research questions that were established at the Introduction chapter

**Research Question:** *How to use Data Analytics and Data Science tools to support the Competitive Intelligence Process in the organizations with Competitive Intelligence Capability?*

In Chapter 2 (Literature Review), we described the capabilities of Data Analytics and Data Science tools in enhancing the Competitive Intelligence process. These tools have proven to be incredibly valuable for organizations, greatly improving their ability to collect, analyze, and interpret competitive intelligence. They have the ability to automate data collection, enable advanced analysis, and offer visualizations that assist in decision-making. Integrating Data Analytics and Data Science tools into the CI process, as mentioned in previous chapters, can greatly improve the CI process. These tools are able to automate the collection of large volumes of data, which is essential for staying up-to-date with the competitive landscape. In addition, employing advanced analytical techniques provides a greater understanding of market trends and competitor strategies, which ultimately improves the predictive abilities of competitive intelligence. Visualizations and other outputs from these tools can effectively communicate complex information, enabling more informed strategic decisions. The study highlights the significance of integrating modern technological tools into CI practices to stay ahead in today's fast-paced market environment. This approach has the potential to greatly improve organizations' ability to collect, analyze, and interpret competitive intelligence.

**Research Sub-question (SRQ)1:** *What is Competitive Intelligence Capability?*

The Competitive Intelligence Capability, as mentioned earlier in the Literature Review Chapter, encompasses an organization's ability to collect, analyze, and share information about its competitors, changing market trends, and various external factors that may impact its competitive advantage.

This capability is more than just a static skill; it is a dynamic and systematic process that requires following a sequence of steps. It begins with careful strategic planning, followed by detailed data collection. The collected data is carefully analyzed and then shared to provide valuable intelligence. This process provides the organization with the necessary insights to navigate the competitive landscape effectively.

**SRQ2:** *What are the steps of the Competitive Intelligence Process?*

The Competitive Intelligence Process, mentioned in literature review, is a thorough procedure that consists of four essential steps. The initial stage involves planning and direction, where the objectives and goals of the competitive intelligence activities are established. This process includes identifying the main intelligence subjects, establishing the intelligence team, and determining the necessary resources. This step is crucial as it establishes the course for the

entire process and guarantees that the intelligence activities are in line with the strategic goals of the organization.

After the planning and direction phase, the next step involves collecting data. This requires collecting information from a variety of sources, including those within and outside the organization. Possible sources of information could be market reports, financial statements, customer feedback, social media, and other relevant sources. It is crucial that the collected data is relevant, reliable, and timely to ensure its usefulness in the subsequent stages of the process.

The analysis of the collected data is an essential step in the Competitive Intelligence Process. This requires analyzing the data to uncover valuable insights. Several analytical tools and techniques have been traditionally employed in this stage, such as SWOT analysis, PESTEL analysis, Porter's Five Forces analysis, and others. Our goal is to gain a deep understanding of the competitive landscape, recognize emerging trends and patterns, and reveal potential opportunities and threats.

The final step in the process is the dissemination of the intelligence to the relevant stakeholders and getting their feedback. This could include presenting the findings in reports, dashboards, or briefings. The feedback received is then utilized to improve the intelligence process, enhancing its effectiveness and efficiency in the future.

Overall, the Competitive Intelligence Process is a methodical and organized way of collecting, evaluating, and sharing data about the competitive landscape. Every step in the process is crucial and contributes significantly to the overall success of the competitive intelligence activities.

### **SRQ3:** *What are Data Analytics and Data Science?*

Data Analytics and Data Science, as explained in chapter 2, encompass a broad aspect of scientific methods, processes, algorithms, and systems. Their main goal is to gather valuable knowledge and insights from both structured and unstructured data.

Data Analytics is a field that specializes in examining data sets to extract insights and make informed conclusions. It utilizes a range of methods, such as data mining and descriptive statistics, to assist organizations in making well-informed business decisions. This process entails examining, cleaning, converting, and analyzing data to uncover valuable insights, propose findings, and facilitate decision-making.

However, Data Science encompasses a wide range of disciplines, including statistics, mathematics, computer science, and domain expertise, to derive valuable insights from data. It utilizes cutting-edge analytics technologies, such as machine learning and predictive modeling, to analyze and interpret intricate data sets. Data scientists utilize this analysis to discover patterns, trends, and insights that can inform strategic business decisions.

Both Data Analytics and Data Science utilize statistical techniques to analyze data sets and make informed conclusions. On one hand, Data Analytics is primarily centered around examining past data to address specific inquiries or resolve issues. On the other hand, Data Science is primarily focused on utilizing data to comprehend intricate behaviors, patterns, and predictions for the future.

Finally, Data Analytics and Data Science are interdisciplinary areas that are important in assisting organizations in making informed decisions based on data. They utilize a range of scientific methods, processes, algorithms, and systems to extract, analyze, and interpret data, offering valuable insights that can inform strategic decision-making. Every field has its own distinct way of collecting and analyzing data, even though they are all connected.

**SRQ4:** *Which Data Analytics and Data Science tools are used to support the Competitive Intelligence Capability?*

In Chapter 3, the study talked about how different DA and DS tools can be used to improve CI. Data collection is the first step in the process. To do this, tools like web scraping apps are used to get relevant information. Machine learning techniques and statistical methods, which are part of the tools for data analysis, are then used to look at this data. Data visualization tools like Tableau and Power BI are used to show and share the findings that come from the research. Predictive modeling is also used to guess what market trends and tactics competitors will use. These advanced analytics tools are an important part of the CI process because they make operations more efficient and give companies an edge in the market. This chapter stresses how important it is to use these tools in every step of the CI process.

**SRQ5:** *How are Data Analytics and Data Science tools integrated into each step of the Competitive Intelligence Process?*

In Chapter 4, the integration of Data Analytics and Data Science tools into the Competitive Intelligence process is described in a systematic manner. When the CI process is being planned, DA/DS tools are used to set the process's goals, scope, and data needs. During the collection and organizing process, tools like web scraping and API calls are used to get the data. ETL and Data Pipelines are then used to organize the data. In this step, methods like statistical analysis, predictive modeling, and machine learning are used on the data that has been collected. In the dissemination phase, actionable ideas are gleaned from the research and shared with stakeholders. In the decision-making phase, these insights are then used to make smart choices, like finding chances and analyzing risks. Finally, results are looked at in the review and feedback step, and suggestions are made to make the CI process better. Our study's suggested strategy makes sure that using DA/DS in CI to improve strategic decision-making is done in a planned way.

**SRQ6:** *What is the usability of the proposed framework?*

Chapter 5 is about how the suggested strategy for combining Data Science and Data Analytics into Competitive Intelligence processes can be used. The GOMS model (Goals, Operators, Methods, and Selection rules) was used in the study to make sure the system worked and could be used. It proves that the system is easy to use and makes the CI process much better. The GOMS model predicts how users will interact with the system, improves system design, and finds possible usage problems. This makes sure that the framework is not only scientifically sound but also useful in real life. Case studies show that it can be used, showing that it works in the real world and has the potential to improve CI processes.

## 6.2. Limitations

This section's goal is to recognize the natural limitations and difficulties that came up during the study. The goal of this review is to be clear about the research's scope and dependability by focusing on a critical analysis of the methods and theoretical approaches that were used. By being aware of these limits, we can get a more complete picture of the study's results and how they can be used in competitive intelligence that is improved by data science and analytics.

The research encountered various methodological constraints, such as difficulties in participant selection and the qualitative nature of data collection techniques. The semi-structured interviews gave us a lot of information, but they may also have shown the subjects' personal opinions. The purposeful sampling method works well for this study framework, but the results can't be used in other situations or businesses that weren't included in the sample.

To achieve the goals of integrating data science and data analytics into competitive intelligence processes, the theoretical frameworks utilized were selected. But sticking to well-known models like Porter's Five Forces and the Resource-Based View might have made it harder to look into other academic views that might have given us new ideas about how to strategically use technological tools.

Interviews with workers in technology-heavy industries were the only way that data was gathered. This may not fully reflect other industries where competitive intelligence methods might be different. Furthermore, figuring out what qualitative data means is always a matter of opinion, which could change the results of the analysis.

These limitations may affect the validity and reliability of the study's conclusions. For instance, the methodological limitations could affect the scope of application of the study's recommendations, limiting their efficacy to similar contexts. Because of the theoretical limits, it might not be possible to try out new or multidisciplinary methods that could give us better information about how to use analytics in competitive intelligence.

Even with these limitations, the study makes a big contribution to the field by giving an organized way to combine data science and analytics into competitive intelligence processes, backed up by real-world examples from businesses that use a lot of technology. These additions show that advanced analytics has the ability to change the way competitive intelligence is collected and used, giving businesses strategic benefits in markets that are changing quickly.

## 6.3. Related Work Comparison

The aim of this section is to provide a background for the current study by placing it within the established academic conversation on competitive intelligence, with a specific emphasis on the incorporation of data analytics and data science. This analysis will clarify the extent to which the study agrees with, differs from, or expands upon the findings and techniques of earlier studies, highlighting the unique contributions of the current work.

Notable and recent studies that are relevant to this research examined the significance of predictive analytics in competitive intelligence; (Freyn & Hoffman, 2023), who analyzed the consequences of prescriptive analytics in CI; and (Paap, 2020) who investigated the transformative impact of artificial intelligence (AI) and big data on CI emphasized the transition towards proactive strategy planning enabled by predictive analytics, employing statistical models to predict market trends. (Freyn & Hoffman, 2023) further investigated the

potential of prescriptive analytics in guiding strategic actions through simulations, revealing a notable deficiency in incorporating these analytics into real-time decision-making processes. (Paap, 2020) explored the comprehensive incorporation of AI, highlighting a comprehensive perspective on market dynamics that goes beyond conventional competitor-centric intelligence.

This study utilizes a qualitative approach by conducting semi-structured interviews to investigate the operational integration of data analytics and data science inside Competitive Intelligence processes. This perspective has received less attention in the previous studies. This methodology enables a more profound comprehension of the strategic consequences of incorporating technology, offering subtle insights that are sometimes disregarded in research methods focused on description or exploration. While (Freyn & Hoffman, 2023) emphasized the theoretical capacity of prescriptive analytics, this study presents tangible instances of these analytics in operation, providing empirical proof of its utilization in real-time corporate settings.

This study applies a novel combination of the Resource-Based View and Porter's Competitive Forces model to examine how the strategic use of Data Analytics and Data Science might improve Competitive Intelligence skills, building upon existing theoretical frameworks used in previous research. This theoretical integration offers a fresh perspective for assessing the strategic consequences of technology breakthroughs in CI.

Although previous studies have thoroughly explored the potential of data analytics and data science to improve competitive intelligence, they have not adequately examined how these technologies may be practically integrated into the operational CI processes of businesses. This research aims to fill the existing vacuum in the literature by providing a detailed account of how these technologies are actually put into reality. This will help bridge the divide between their theoretical promise and their real-world implementation.

This research goes beyond the current models by including Data Analytics and Data Science throughout all stages of the competitive intelligence cycle, rather than treating them as separate elements. The paradigm provided integrates sophisticated analytics into the strategic intelligence frameworks of enterprises, and is supported by actual data from case studies and expert interviews. This contribution not only improves the theoretical comprehension but also offers a practical manual for firms aiming to utilize advanced analytics in their competitive intelligence activities.

Although the above works provide important contributions to our understanding of the potential of data analytics and data science in competitive intelligence, they frequently fail to thoroughly examine the integration of these technologies at an operational level. This work aims to fill this gap by conducting a thorough investigation of the practical and theoretical aspects of DA and DS. It offers a critical analysis that connects the theoretical possibilities with real-world implementation.

This study confirms and expands upon the results of earlier research when comparing it to comparable studies. It not only shows the ability of DA and DS to revolutionize CI, but also provides a practical and methodical approach to integrating these technologies. By engaging in this practice, it adds to both the theoretical discussion and practical implementations in competitive intelligence. It supports a dynamic and technologically integrated approach that is crucial for enterprises to sustain a competitive advantage in dynamically changing markets.

## 7 Conclusion

Research has shown how important data science and data analytics are to improving competitive intelligence procedures inside companies. CI methods have been much enhanced by technological developments, but the integration and real-world use of these tools still present difficulties. Through improved understanding of market trends and rival tactics, DA/DS integration, according to the research, facilitates strategic decision-making. Effective application of DA/DS technologies has also been demonstrated to increase operational efficiency, allowing businesses to react quickly to changes in the market and keep a competitive advantage.

### 7.1. Contributions Overview

Research has shown how important data science and data analytics are to improving competitive intelligence procedures inside companies. CI methods have been much enhanced by technological developments, but the integration and real-world use of these tools still present difficulties. Through improved understanding of market trends and competitor strategies, DA/DS integration, according to the research, facilitates strategic decision-making. Effective application of DA/DS technologies has also been demonstrated to increase operational efficiency, allowing businesses to react quickly to changes in the market and keep a competitive advantage. The main conclusions of the study are summarized in this paper, which also offers a succinct assessment of how data science and analytics affect competitive intelligence.

### 7.2. Recommendations for future research

In order to strengthen the conclusions, future research might broaden the methodological scope by using a mixed-methods approach and merging qualitative and quantitative data. New understanding of the strategic integration of technical tools may be provided by integrating developing ideas in data science and analytics into the theoretical frameworks. Research might be expanded to cover more sectors and international marketplaces, therefore increasing the usefulness and application of competitive intelligence methods. Finally, future research could find it interesting to look at how new technologies like artificial intelligence affect the development of competitive intelligence processes. These suggestions are meant to direct next studies and further the body of information in the subject of competitive intelligence.

### 7.3. Final Thoughts

The purpose of this study has been achieved by showing how Data Science and Data Analytics technologies may assist Competitive Intelligence procedures in companies with established CI capabilities. The results of this work have important implications for practice as well as theory. They advance our knowledge of the function of DA and DS in CI and provide useful guidance to companies looking to use these tools for competitive advantage. This work has limitations even if it has made significant contributions. These restrictions give chances for next studies to expand on these findings and investigate the junction of DA, DS, and CI in more detail.

This work emphasizes, to sum up, the revolutionary possibilities of DA and DS in the field of CI. It asks us to reconsider conventional CI procedures and creates new opportunities for digital era strategic decision-making. The journey of exploring these complex connections has been

both difficult and fulfilling, and it is my hope that this work will inspire further investigation into this fascinating area of study.



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## 9 Resümee

Tänapäeval on organisatsioonide üheks väljakutseks andmeanalüütika ja andmeteaduse vahendite integreerimine konkurentsiluure raamistikesse, et tõhustada strateegiliste otsuste tegemist.

Ülemaailmsete turgude suureneva keerukuse ja tehnoloogia kiire arengu tulemusel on traditsioonilised konkurentsiluurepraktikad ebapiisavad. On tungiv vajadus nende tehnoloogiate süstemaatilise rakendamise järele, et parandada tegevustõhusust ja strateegilist ulatust.

See uurimus pakub välja struktureeritud raamistiku, mis võimaldab organisatsioonidel rakendada andmeanalüütikat ja andmeteadust oma konkurentsiluure protsesside toetamiseks, parandades seeläbi *strategic agility*'t ja konkurentsivõimet.

Raamistikus selgitatakse mehhanisme, mille abil saab andmeanalüütikat ja andmeteadust konkurentsiluures tõhusalt kasutada, kõrvaldades lüngad praegustes integratsioonitehnikates ja olemasolevate andmete alakasutamises.

Pakkudes teoreetilisi, praktilisi ja metodoloogilisi panuseid, edendab see uurimus konkurentsiluure valdkonda, varustades organisatsioone võimega dünaamilistes turukeskkondades navigeerida ja silma paista. Uurimistöö kinnitab raamistiku tõhusust konkurentsiluure tavade tõhustamisel, kinnitades seega selle rakendatavust ja kasu.

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