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EXPLORING THE RISKS AND BENEFITS OF USING ARTIFICIAL INTELLIGENCE IN CORPORATE FORESIGHT

Master's thesis
in Futures Studies

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Given the central role that scientific innovation and technological advancements play in driving social changes and economic developments, it is essential to understand how to leverage the benefits of innovations effectively within the context of corporate foresight.

The rapid advancements in artificial intelligence (AI) technologies have generated substantial interest in exploring how these innovations can enhance various domains of human activity.

In this regard, it is imperative for corporate foresight to capitalize on the potential benefits offered by AI while also carefully navigating the associated risks and challenges.

Through the use of 10 semi-structured interviews thematised with qualitative content analysis, this thesis explores the multifaceted implications resulting from using artificial intelligence in corporate foresight.

The results of this thesis reveal several key benefits associated with using AI in corporate foresight. Specifically, the findings indicate that AI can facilitate enhanced data integration, improve the accuracy of analyses, increase productivity, enhance data visualization, and contribute to time savings. However, the study also highlights various limitations and challenges surrounding the adoption of AI in this context, including integration and adoption barriers, algorithmic limitations, resource constraints, and data dependencies.

Furthermore, the research identifies potential risks when integrating AI into corporate foresight practices. These risks include the magnification of human cognitive biases, demographic biases, over-reliance on AI outputs, social risks, security risks, and ethical concerns. The expert interviews also suggest that the future of AI in corporate foresight may involve a spectrum of outcomes, ranging from AI serving as a human assistant to potentially replacing human decision-makers.

The results of this study indicate that the use of AI in corporate foresight projects can have both short-term and long-term impacts. The theoretical implications of this research suggest that human intervention remains crucial, not only for practical necessity but also for establishing trust in AI, ensuring its healthy evolution, and delivering more reliable solutions to real-world problems.

Key words: Corporate foresight, Artificial intelligence, Foresight.

Abstract in Persian

نام دانشجو: سمانه ابراهیم آبادی **محل تحصیل:** دانشگاه تورکو، فنلاند

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عنوان پایان نامه: بررسی خطرات و مزایای استفاده از هوش مصنوعی در آینده نگاری شرکتی

چکیده:

با توجه به نقش محوری که نوآوری علمی و پیشرفت‌های فناوری در ایجاد تغییرات اجتماعی و توسعه اقتصادی ایفا می‌کنند و کارکرد حیاتی آینده‌نگاری در تدوین برنامه‌ها و استراتژی‌های آینده‌نگر، ضروری است که بدانیم چگونه می‌توان به طور موثر از مزایای نوآوری در چارچوب آینده نگاری شرکتی استفاده کرد.

پیشرفت‌های سریع در فناوری‌های هوش مصنوعی (AI) علاقه قابل توجهی به کشف این که چگونه این نوآوری‌ها می‌توانند حوزه‌های مختلف فعالیت انسانی را بهره‌مند سازند، ایجاد کرده است. در این راستا، برای آینده‌نگاری شرکتی ضروری است که روی مزایای بالقوه ارائه‌شده توسط هوش مصنوعی سرمایه‌گذاری کند و در عین حال خطرات و چالش‌های مرتبط را نیز با دقت بررسی کند.

این پایان نامه از طریق استفاده از ۱۰ مصاحبه نیمه ساختاریافته با روش تحلیل محتوای کیفی (تحلیل مضمون)، پیامدهای چندوجهی ناشی از استفاده از هوش مصنوعی در آینده نگاری شرکتی را بررسی می‌کند.

نتایج این پایان نامه چندین مزیت کلیدی مرتبط با استفاده از هوش مصنوعی در آینده نگاری شرکتی را نشان می‌دهد. به طور خاص، یافته‌ها نشان می‌دهد که هوش مصنوعی می‌تواند یکپارچه‌سازی داده‌ها را تسهیل کند، دقت تجزیه و تحلیل‌ها را بهبود بخشد، بهره‌وری را افزایش دهد، تجسم داده‌ها را افزایش دهد و به صرفه‌جویی در زمان کمک کند. با این حال، این مطالعه همچنین محدودیت‌ها و چالش‌های مختلف پیرامون به کارگیری هوش مصنوعی در این زمینه، از جمله موانع یکپارچه‌سازی و پذیرش، محدودیت‌های الگوریتمی، محدودیت‌های منابع و وابستگی‌های داده را برجسته می‌کند.

این تحقیق، همچنین خطرات بالقوه را هنگام ادغام هوش مصنوعی در شیوه های آینده نگاری شرکتی شناسایی می‌کند. این خطرات شامل بزرگ‌نمایی سوگیری‌های شناختی انسان، سوگیری‌های جمعیتی، اتکای بیش از حد به خروجی‌های هوش مصنوعی، ریسک‌های اجتماعی، خطرات امنیتی و نگرانی‌های اخلاقی است. مصاحبه‌های کارشناسان همچنین نشان می‌دهند که آینده هوش مصنوعی در آینده‌نگاری شرکتی ممکن است شامل طیفی از نتایج باشد، از عملکرد هوش مصنوعی به عنوان دستیار انسانی تا جایگزینی بالقوه تصمیم‌گیرندگان انسانی.

نتایج این مطالعه نشان می‌دهد که استفاده از هوش مصنوعی در پروژه‌های آینده‌نگاری شرکتی می‌تواند تأثیرات کوتاه‌مدت و بلندمدت داشته باشد. یافته‌های نظری این تحقیق نشان می‌دهد که مداخله انسانی نه تنها برای ضرورت عملی، بلکه برای ایجاد اعتماد به هوش مصنوعی، تضمین تکامل سالم آن، و ارائه راه‌حل‌های قابل اعتمادتر برای مشکلات دنیای واقعی، حیاتی است.

کلمات کلیدی: آینده نگاری شرکتی، هوش مصنوعی، آینده نگاری

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1 INTRODUCTION

This section establishes the broader context for the thesis. Section 1.1 explores the current state of corporate foresight (CF) practices. Subsequently, Section 1.2 presents the research objectives and research questions that will be addressed in the study.

1.1 The current corporate foresight practices need new perspectives

Given that scientific innovation and technology serve as primary drivers of social changes and economic developments, and foresight is one of the tools for formulating forward-looking plans and strategies (Becker, 2002), it is crucial to understand how to leverage the benefits of innovations in corporate foresight. This is where the necessity of examining the advantages and disadvantages of digital innovation in foresight projects becomes more prominent than ever.

It is important to note that the role of technology in the context of Corporate Foresight is still not fully understood and lacks proper integration with its various components. (Gordon et al., 2020; Kaivo-oja and Lauraeus, 2018). More specifically, technology has predominantly been addressed in relation to corporate foresight in several ways: as a tool itself, demonstrated by the application of machine learning to enhance market forecasts (Crews, 2019; Yoon et al., 2019); as an external factor to be assessed for strategic advantages, such as through technology road mapping (Yoon et al., 2019); or as an outcome of corporate foresight activities (Mühlroth and Grottke, 2018; Sarpong and Meissner, 2018). Technology plays a crucial role in corporate foresight, and the complexity of this relationship emphasizes the importance of examining the various roles technology plays within the corporate foresight context, as well as delineating its different impacts on different aspects of corporate foresight practice and process. (Marinković et al., 2022)

The rapid emergence of novel artificial intelligence (AI) technologies has generated substantial interest in exploring how these advancements can enhance various domains of human activity, particularly work-related endeavors (Cena, 2024). It is also important for corporate foresight to benefit from this new technology, yet must also carefully navigate the associated risks. The present research undertakes an in-depth examination of the multifaceted implications stemming from the integration of AI within the realm of corporate foresight.

1.2 Research objectives and research questions

Recent research has examined the role of AI in various human activities, but a comprehensive investigation into the impact of AI on corporate foresight activities is still lacking (Gordon et al., 2020). This study aims to analyze the benefits, risks, and potential applications of current and future AI approaches in corporate foresight through semi-structured expert interviews. Additionally, the research will discuss the challenges and limitations of AI in this domain and provide experts' perspectives on emerging AI trends that could shape the future of corporate foresight. The central aim of this thesis is to investigate and provide answers to the following research questions:

Main Question:

- What are the key risks and benefits associated with integrating AI into corporate foresight practices?

Sub-questions:

- What ethical considerations arise from the utilization of AI in corporate foresight, and how do they impact decision-making processes?
- What potential biases or limitations are inherent in AI algorithms used for corporate foresight?

The thesis is structured as follows: Chapter 2 presents the conceptual framework, introducing the key concepts of corporate foresight (2.1), AI (2.2), and existing research on the intersection of AI and corporate foresight (2.3). Chapter 3 describes the research design (3.1), data collection through 10 semi-structured expert interviews, and the data analysis methods (3.2 and 3.3). The ethical considerations of the study are discussed in Section 3.4.

Chapter 4 presents the results, organized into six main themes. It begins by exploring the benefits of using AI in corporate foresight (4.1), followed by an exploration of the risks and ethics (4.2) and the limitations and challenges faced (4.3). The chapter then explores emerging AI future trends (4.4) and the role of human experts in AI-based corporate foresight (4.5), concluding with a discussion on the temporal dimension (4.6).

Chapter 5 further analyzes the results in the context of the conceptual framework. It starts by discussing the benefits of using AI in corporate foresight (5.1) and then addresses the ethical considerations that should be taken into account (5.2). The chapter also explores how corporate foresight practitioners can navigate the limitations and challenges of AI (5.3), the role of experts in AI-based corporate foresight (5.4), and the implications of future AI trends (5.5). The conclusion section (5.6) summarizes the thesis, highlights its contributions and limitations, and offers recommendations for future research.

2 THE CONCEPTUAL FRAMEWORK

The subsequent section offers a thorough conceptual analysis of the existing literature on corporate foresight and AI. The aim is to extract valuable insights regarding the potential applications of AI in enhancing corporate foresight practices.

2.1 Corporate foresight

Corporate foresight has a lineage dating back to the late 1940s (Coates et al., 2010). This organizational practice experienced a flourishing period in the 1950s, notably influenced by the "La Prospective" School led by Gaston Berger in France and the contributions of Herman Kahn from the Rand Corporation in the US in the name of the “Strategic Foresight” school (Rohrbeck et al., 2015). Subsequently, numerous companies have committed resources to establish corporate foresight units (Battistella, 2014; Becker, 2002; Daheim and Uerz, 2008; Rohrbeck and Kum, 2018). Corporate leaders began to acknowledge that business decisions should not solely rely on historical data; rather, they should incorporate a systematic assessment of potential future trends through continuous monitoring and interpretation of disruptions in the external environment (Day & Schoemaker, 2005).

In recent years, the exploration of emerging and declining trends, as well as their potential future trajectories, has become increasingly pertinent across various application domains, particularly within the realms of corporate strategy and foresight (Secco et al., 2023). The early detection of these trends allows organizations to proactively respond to evolving market, political, and societal changes and challenges promptly.

Malaska (2017, 19) defines foresight as “applied futures research carried out to provide tools for decision-making”. Expanding on this, Rohrbeck, Battistella and Huizingh (2015, 2) define foresight in a corporate setting as the process of “identifying, observing and interpreting factors that induce change, determining possible organization-specific implications, and triggering appropriate organizational responses.” Moreover, foresight can be understood as a continuous, strategic and dynamic practice that seeks to create specialized futures knowledge tailored to the distinct contexts and needs of an organization (Dufva and Ahlqvist 2015, 264-5).

2.1.1 *Commonly used methods in corporate foresight*

Voros (2003) has eloquently articulated the role and application of various foresight methodologies in his description of the foresight process. He has demonstrated the

appropriate positioning and utilization of diverse foresight approaches within the broader conceptual framework of futures studies. Figure 1 depicts the foresight process framework and methods.

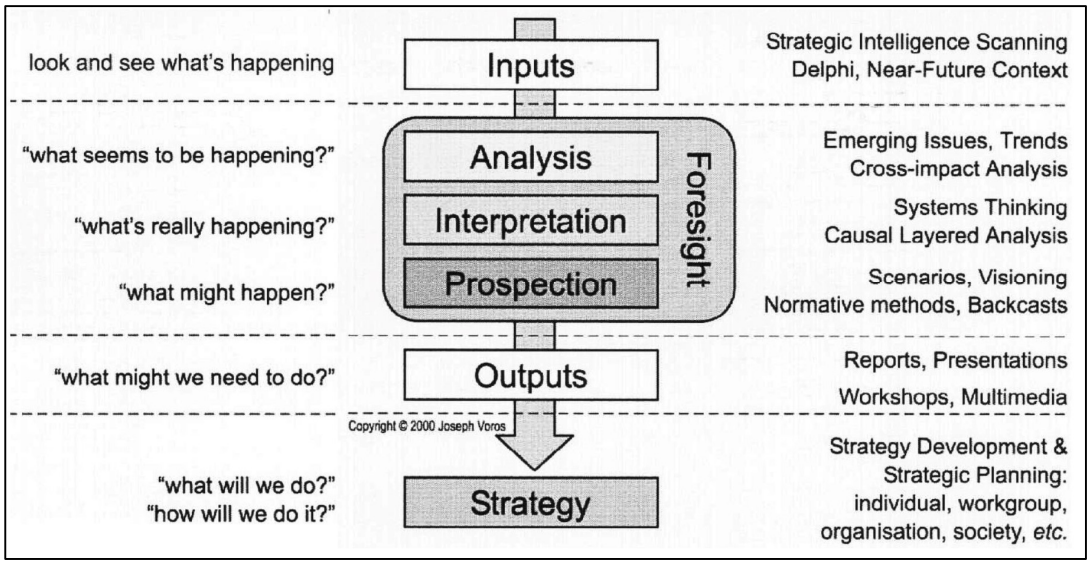

Figure 1 Foresight process framework and Methods (Voros 2003, 14-15)

The first step, "Inputs," involves collecting information about the current state and emerging phenomena in the environment that are relevant to the organization's activities and futures. The commonly used methods for this include:

Trends, megatrends, changes, and weak signals in the organization's external environment are captured on environmental scanning. The purpose is to reveal future opportunities or threats across areas like politics, economy, society, technology, ecology, and culture (PESTEC).

Weak signals are described as "an indication of a possibly emerging issue or trend" and trends characteristics and changes of the present that are believed to continue in the future while megatrends are defined as "long-term directions of change with broad societal influence" (Koivisto, Kulmala, and Gotcheva 2016).

Additionally, the process considers disruptive changes, such as low-probability future events that cannot be extrapolated from the past while having high impact, including wild cards and black swans (Voros, 2003, p. 17).

Expert panels and Delphi surveys are also utilized, where relevant experts provide ratings and justifications on the priority, probability, and desirability of the identified events and trends.

In the second step, "Analysis," the focus is on the preliminary analysis of the data gathered in the previous step to organize it into clusters, map it, and present it effectively for interpretation in order to answer the question "What seems to be happening?" The

futures wheel, futures table, trend impact analysis, and cross-impact analysis are a series of methods that can be leveraged for this analysis. (Voros, 2003, pp. 14-15).

It is in step 3 "Interpretation," where the question is posed "What is really happening?" (Voros, 2003, p. 15). It delves deeper to uncover worldviews, underlying reality, and metaphors using methods like Causal Layered Analysis (CLA), systems thinking, and Soft Systems Methodology (SSM).

During Step 4, " Prospection," the question is asked "What might happen?" (Voros, 2003, p. 15). It involves building, narrating, and visualizing alternative scenarios and images of the future. The approach involves selecting and envisioning desirable future states in rich detail so that they can be actively worked towards. This is complemented by a backcasting process, which develops the necessary paths and strategies for moving from the current state to the targeted future.

Step 5, known as Outputs, consolidates and delivers the results generated in the preceding steps in a way that supports the strategy formulation process. These outputs could manifest as foresight reports, multimedia presentations, or interactive workshop materials. (Voros, 2003, p. 15).

In the final step “Strategy” the questions are asked, "What will we do?" and "How will we do it?" (Voros, 2003, p. 16). It involves developing roadmaps, strategy and strategic goals (including technology roadmaps), and action plans.

2.2 Artificial intelligence definitions and characteristics

To delve deeper into the benefits and risks of using AI, it is first necessary to define the term of AI. AI is often used as an umbrella term encompassing various intelligent or augmented technologies, and is frequently used interchangeably with "machine learning" (Eddy, 2020). However, there is no universally accepted definition of AI.
For the purposes of this research, the definition provided by Kaplan and Haenlein (2019) will be used: AI refers to “a system’s ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation”.

In the 2020s, the focus has shifted from traditional "prediction machines" like support vector machines and deep neural networks (Agrawal, Gans, & Goldfarb, 2018) towards the rise of generative AI (GenAI). Generative artificial intelligence refers to computational techniques that can produce seemingly novel, meaningful content such as text, images, or audio from training data (Feuerriegel et al., 2024). The ability to generate new content is facilitated by the examples and correlations learned from the training data, a process known as machine learning.

In short, machine learning (ML) is the study of algorithms and statistical models that are used by computer systems to perform specific tasks without explicit instructions, depending instead upon patterns and inferences gleaned from the available data. And as a subtype of machine learning, deep learning (DL) requires less human pre-processing and incorporates a wider range of data resources, but is computationally more expensive to perform. (Eddy, 2020).

A visual representation of the relationship between AI, machine learning, and deep learning is shown in figure 2. In its most general sense, AI refers to any technology that mimics human intelligence. A deep learning is a subtype of machine learning, and each is a subtype of AI. Currently, when we discuss AI, we are referring to machine learning and deep learning.

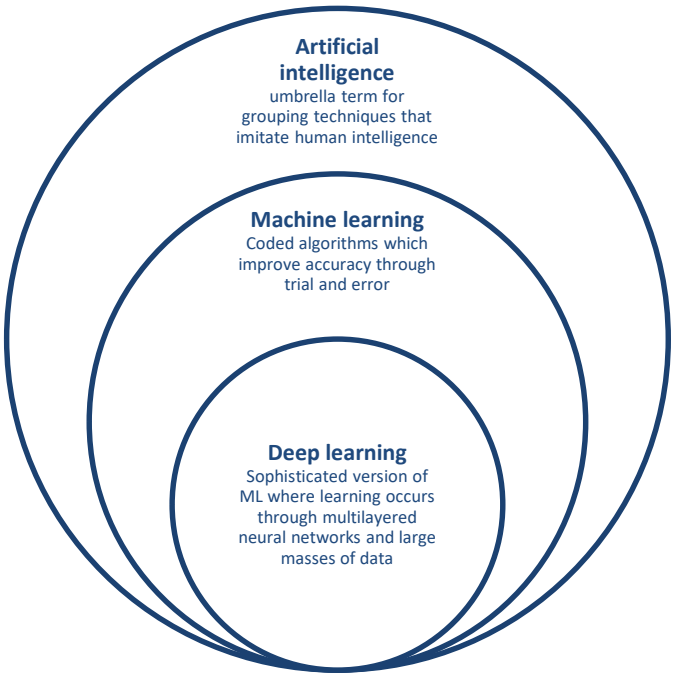

Figure 2 A Brief visualisation of AI, ML and DL layering (adapted from *A.I. Technical: machine vs. deep learning*, 2019)

AI is typically categorized into three distinct stages based on its evolutionary progression: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Superintelligence (ASI) (Kaplan & Haenlein, 2019).

ANI systems exhibit intelligence superior to humans in specific, limited domains. For instance, the AlphaGo system outperformed the human world champion in the game of Go, but cannot demonstrate the general mental capabilities of the human it defeated. The goal of the Dartmouth Summer Project was to create an AGI system, which would possess a level of general intelligence comparable to that of humans. Finally, ASI would

hypothetically exhibit intelligence exceeding human capabilities in every aspect, if such a system were to be developed. (Unal & Kilinc, 2021)

In addition to the evolutionary classification, Kaplan and Haenlein (2019) categorized current AI systems into three distinct types:

- Analytical AI "generates a cognitive representation of the world and uses learning based on past experience to inform future decisions."
- Human-inspired AI "can, in addition to cognitive elements, understand human emotions and consider them in their decision-making."
- Humanized AI "shows characteristics of all types of competencies (i.e., cognitive, emotional and social intelligence)." (Unal & Kilinc, 2021)

And from a philosophical standpoint, AI is commonly classified into two categories: Weak AI and Strong AI. The Weak AI hypothesis posits that AI systems "could act as if they were intelligent," while the Strong AI hypothesis asserts that machines demonstrating intelligence "are actually thinking (not just simulating thinking)" (Unal & Kilinc, 2021)

AI systems often rely on highly complex algorithms and criteria to make decisions, which can make it challenging for human users to comprehend and interpret the rationale behind the outputs generated by these models. (Uchida et al., 2020)

The growing prevalence of AI systems has highlighted the importance of developing models that can provide explanations for their outputs. Such explanations can give users a better understanding of how the AI system functions, educating them and supporting their future interactions with the technology. (Wohlin, 2014).

Arrieta et al. (2020) define XAI as an AI system that has the ability to provide details or explanations about its functioning in order to make it comprehensible to a given audience.

The recent success of ChatGPT has highlighted the capabilities of a particular type of AI known as large language models (LLMs). These LLMs are characterized by very large and deep neural networks that are resource-intensive to train. Prior research has referred to such models as "stochastic parrots," a term that accurately captures their ability to generate human-like responses by recombining existing information, without possessing genuine understanding or common-sense reasoning (Fayyad, 2023).

While tools like ChatGPT can effectively summarize and present information in a conversational manner, their capabilities are not entirely novel. These models excel at "parroting" well-established knowledge, but they lack the ability to provide information on the origins of their responses or to distinguish between factual information and misinformation (Bender et al., 2021). This limitation highlights the need for further development in the area of knowledge representation and reasoning to create AI systems with a deeper understanding of the information they process (Fayyad, 2023).

2.2.1 *Artificial intelligence use cases*

The concept of a "use case" originated from software development, it can be defined as a sequence of actions that generates observable value for an individual stakeholder or actor within the organization (Lelli, 2019).

Classifying AI based on its practical business applications, can provide a more meaningful understanding of its uses. Davenport and Ronanki (2018) identify three key business needs that AI can address: process automation, cognitive insight, and cognitive engagement. Of these, robotic process automation (RPA) has emerged as the most widely adopted AI solution thus far. RPA technologies excel at automating repetitive, back-office tasks such as administrative, accounting, and auditing functions. This is because RPA systems are relatively inexpensive to implement and tend to deliver more consistent returns on investment compared to other AI approaches.

However, the authors note that RPA tools are generally less sophisticated in their algorithms and are not considered truly "intelligent" systems. Their strengths lie in streamlining mundane, high-volume processes across multiple enterprise systems, rather than tackling complex cognitive challenges. (Davenport & Ronanki, 2018).

Since the launch of ChatGPT has heightened interest in generative artificial intelligence, a subfield of AI, the following will examine the practical applications of this specific AI technology.

According to a report by IDC (2024), the use cases for Generative AI (GenAI) broadly fall into three principal categories: productivity, business function, and industry-specific. Productivity use cases involve streamlining work tasks such as report summarization, job description generation, or code creation by integrating GenAI features into existing applications. Many of these use cases derive value from pre-trained models (IDC, 2024).

Business function use cases entail integrating AI models with proprietary corporate data or specific departments/functions. In these cases, data governance is crucial, necessitating integration with established enterprise platforms (IDC, 2024).

Industry-specific use cases generally require extensive customization to offer significant value to larger enterprises. The creation of these specialized vertical applications demands adapted architectural frameworks and implementation undertakings, making use of exclusive data resources. (IDC, 2024).

Furthermore, the recent report published on AIMultiple by Dilmegani (2024) provided detailed insights into more than 100 use cases for Generative AI, including applications in analytics, data, and technology, among others.

The report highlighted the following use cases for AI in Analytics:

- Conversational Analytics: Leveraging Natural Language Processing, conversational interfaces can be used to analyze business data. This enables automated analysis of voice data, reviews, and suggestions.

- E-Commerce Analytics: Specialized analytics systems designed to handle the explosion of e-commerce data. These systems can optimize the sales funnel and customer traffic to maximize profits.
- Geo-Analytics Platform: Enabling the analysis of granular satellite imagery for predictions. Businesses can leverage spatial data to capture changes in any landscape and achieve their goals.
- Image Recognition and Visual Analytics: Advanced image and video recognition systems can be used to analyze visual data, providing meaningful insights from piles of images and videos.
- Real-Time Analytics: Real-time analytics for time-sensitive decisions, allowing businesses to act promptly and maintain their key performance indicators. Machine learning can be used to explore unstructured data without disruption (Dilmegani, 2024).

Additionally, the author pointed out several key AI use cases for data management and analytics:

- Data Cleaning and Validation Platform: Automating data cleaning and validation processes to ensure high-quality data and avoid "garbage in, garbage out" issues.
- Data Integration: Combining data from multiple sources into a unified, meaningful format to enable valuable information extraction. Managing the high volume of data traffic across platforms is crucial.
- Data Management and Monitoring: Maintaining data quality for advanced analytics by automating data filtering and quality control tasks.
- Data Preparation Platform: Using ETL (extract, transform, load) tools to transform raw, low-quality data into a clean, analysis-ready format.
- Data Transformation: Adjusting unstructured data into the required formats for advanced analytics.
- Data Visualization: Developing dashboards and visual representations to convey data insights more effectively and aesthetically.
- Data Labeling: Employing human-in-the-loop systems and crowdsourcing to label data, enabling the use of supervised learning models.
- Synthetic Data: Generating artificial data to test new products, validate models, and satisfy AI needs while overcoming privacy limitations.

Dilmegani (2024) emphasized the importance of deep domain expertise and industry-specific knowledge in identifying and implementing these AI use cases to unlock the full potential of these technologies and deliver tangible business value.

2.2.2 *Artificial intelligence risks and limitations*

The rapid dissemination of AI systems has introduced significant risks, including issues around algorithmic opacity, unethical behavior, and unintended negative consequences. the emergence of racial and gender biases are other examples of these "dark side" of AI systems. (Mikalef, 2022; Laine, 2024)

The AI-powered digital infrastructure has the potential to deeply undermine the very essence of our human nature. This is because the infrastructure is not value-neutral, but rather manipulative and designed to foster addiction, all for the sole purpose of generating profit. Through the ubiquitous smartphone, which over 80% of the global population uses, the AI algorithms embedded in our apps function akin to a brain implant. These algorithms operate within our minds and cognition without our explicit consent or volition. Additionally, governments have neglected to fully grasp the long-term implications of these AI algorithms, and have consequently failed to implement adequate regulations. This regulatory gap has led to unforeseen and potentially devastating consequences for both individual human security and the broader societal landscape. (Bozesan, 2023).

In this regard, the European High-Level Expert Group's report on "Ethical Guidelines for Trustworthy AI" (2019) outlines seven high-level principles and ethical categories as the core requirements for ethical AI systems: “Human Agency and Oversight”, “Technical Robustness and Safety”, “Privacy and Data Governance”, “Transparency”, “Diversity”, “Non-Discrimination, and Fairness, Societal and Environmental Well-being” and “Accountability”.

2.3 Research on artificial intelligence and corporate foresight

Recent academic literature has highlighted the growing impact of AI technology on various aspects of human life. Scholars have described the current transformation as the "Second Machine Age" (Brynjolfsson & McAfee, 2014) or the "Age of Artificial Intelligence" (Tegmark, 2017). Regardless of the terminology used, this technological revolution is permeating all areas of human activity, including the business world, and necessitating changes to long-established concepts, habits, and traditions. (Kılınç & Ünal, 2020).

Secco et al. (2023) have introduced a novel Visual Analytics approach that combines interactive visualizations with machine learning techniques and statistical methods to identify, analyze, and forecast emerging trends from textual data. This multifaceted approach provides insights into vast data sets, enabling the prediction of the potential future course of trends based on their occurrence within textual sources. The presented visualizations facilitate the identification and forecasting of trends at macro-, monitoring, and

micro-levels, empowering decision-makers to navigate the dynamic landscape of emerging and declining trends (Secco et al., 2023).

Dewhurst and Willmott (2014) argued that as AI becomes more advanced within organizations, information will become more democratized rather than centralized. Business units and functions will not only report to top management and the CEO but will also be empowered to make better decisions through the precise insights and pattern recognition capabilities of computers. This could lead to a more self-managed organizational model, which may challenge traditional top-down decision-making.

Parry, Cohen, and Bhattacharya (2016) explored the concept of "automated leadership decision-making," where AI systems collaborate with human leaders in the decision-making process. They argued that AI could be superior to humans in forming vision, as it is free from inherent cognitive biases, beliefs, and emotions. However, they also acknowledged the potential ethical challenges, such as issues of accountability, in scenarios where the human leader has no veto power over the AI's decisions.

von Krogh (2018) also examined the issue of delegating decision-making authority to AI. Von Krogh posits that handing over decision-making authority will drive unprecedented changes in the structure and operations of organizations. The data flow may centralize around data processing algorithms and may not follow an information structure spreading among business units and human experts. Additionally, there is a potential and significant risk that AI systems may become fixated on one or more predetermined objectives, and may not require any specific incentive to drive its information-processing activities.

Barnea (2020) argues that AI possesses superior capabilities in processing large volumes of data compared to humans. Despite having significant information, humans can still make flawed strategic decisions. This AI superiority will likely catalyze a transformative shift in how decision-making is conceptualized. If organizations can analyze the "cognitive algebra" underlying their competitors' decisions, AI would be better equipped to forecast their next moves, conferring a substantial competitive edge. These AI systems also have the potential to prevent from making biased decisions. Barnea (2020) envisions a future where human-machine collaboration will be integrated into the C-suite and higher-level decision-making processes within organizations.

Farrow (2020) held a workshop to explore the future of AI, and the findings indicate that the "best-case scenario" is one where "AI takes on the jobs that humans do not want to do." Participants of the workshop foresee that AI would augment human decision-making as an advisor or an assurance service by 2038. Farrow’s scenario makes an optimistic impression that AI and humans are colleagues, not enemies. As a result, binary code may eventually supersede natural human language. Humans and AI would produce services and solutions together. The human is no longer at the core of work, and the traditional notions of employee and work are anticipated to undergo changes or require new

regulations. In the future, AI or human leaders may be responsible for guiding and managing hybrid teams composed of both humans and AI systems.

From a broader perspective, recent academic discussions often refer to the historical progression of AI as "seasons" or "booms" (Miyazaki & Sato, 2018; Haenlein & Kaplan, 2019; Shin, 2019). Yasnitsky (2020) observed that AI has undergone a cyclical evolution, where "winter gives way to spring and summer, and summer gives way to autumn and winter" (p. 16). He questioned whether the rapid advancements in AI technology represent a "revolution" or if AI is approaching a new "winter season." Yasnit-sky also offered counterarguments to the prevailing optimism in the field, cautioning that undue enthusiasm and public relations could precipitate another AI winter, given the history of AI's many ambitious but unrealized projects. (Unal & Kilinc, 2021)

State and corporate entities have significant incentives, both military and economic, to enhance the development of sophisticated AI systems. Additionally, there are competitive pressures driving them to achieve these advancements ahead of others. Without a global organization capable of imposing a permanent ban on AI development, any reluctance or attempts to actively prevent such development are expected to be limited to local and temporary measures. (Bales et al., 2024).

Deep learning (DL) models, with their more advanced algorithms and network architectures, are often required for modern AI solutions that engage in complex, non-human-like activities such as decision-making and predictive tasks (Samek et al., 2019).

Figure 4 illustrates the division of responsibilities between computer systems and human users for data analysis tasks. This figure can also serve as a preliminary indicator of a foresight project's level of (Information Technology) IT maturity and the utilization of AI tools.

At the first level, IT systems are primarily used for storing and accessing data, generating static reports, and performing basic-level analysis. Organizations at this stage are just beginning their digitalization journey and predominantly use basic IT tools like spreadsheets.

The second level of analytics involves organizations using historical data from multiple sources to formulate predictive models. The human user still plays a significant role in deriving insights and building forecasts.

At the third level, true AI technologies, such as machine learning, start to take over more of the analytical responsibilities. These advanced systems can create recommendations based on past data and perform near real-time analysis, requiring powerful computational resources and scalable data management platforms. However, humans still make the final decisions.

The fourth and highest level of maturity represents a state where sophisticated algorithms continuously learn and adapt to changes, becoming capable of making autonomous decisions that lead to action. In theory, human intervention is not necessary at this stage,

as exemplified by self-driving cars. However, in practice, robotic process automation (RPA) is more commonly adopted for simple, repetitive, rule-based activities where machine-led decision-making is limited.

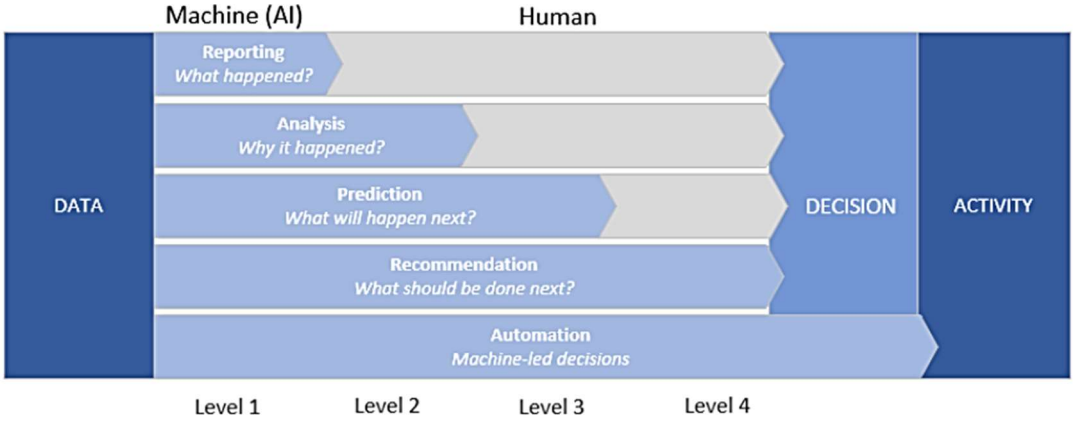

Figure 3 Analytical Capability Maturity Map (adapted from Paul, 2020)

I conducted a review focusing on corporate foresight and AI. Through this review, I identified both optimistic and pessimistic viewpoints regarding the role of AI in foresight projects. Key areas of interest explored by researchers include the delegation of decision-making to AI, ethical concerns surrounding AI, and the collaboration between humans and AI in decision-making. However, despite these efforts, I found a lack of comprehensive research examining the topic of "AI's role in corporate foresight practices" from various perspectives. Consequently, this study aims to address this gap by employing an exploratory research design to investigate the risks and benefits associated with AI's involvement in corporate foresight projects.

3 METHODOLOGY

In this chapter, the arrangement and rationale behind the research methodology are outlined. The initial part provides an overview of the research design (3.1). Following that, in Sections (3.2) and (3.3), respectively, the methods for collecting and analyzing data are discussed in detail before addressing ethical considerations (3.4).

3.1 Research design

To conduct this research, I employed a qualitative approach. This approach was considered appropriate as it allows for a comprehensive exploration of the complex factors associated with the risks and benefits of incorporating AI into Corporate Foresight practices. By employing semi-structured interviews, I aimed to capture rich, nuanced insights from experts in the field. This approach enables a comprehensive examination of the multifaceted nature of AI integration in Corporate Foresight, facilitating a deeper understanding of its implications. Additionally, qualitative research provides flexibility in data collection and analysis, allowing for the emergence of unexpected findings and the exploration of diverse perspectives on the topic (Saunders et al., 2019).

3.2 Methods of data collection

This research applied a qualitative approach to data gathering and conducted 10 interviews with experts in AI and/or foresight for data collection. As a second priority, individuals with over five years of experience and expertise in one of these areas were also considered. To identify suitable interview participants, I utilized a combination of recommendations from my academic professors, who are well-connected within the Finnish foresight research community, as well as referrals from my network of contacts developed during my prior Master's degree in Futures Studies in Iran. The data collecting period took approximately 2.5 months, from October 2023 to December 2023. The interviews followed a semi-structured format, allowing for the exploration of the topics under investigation while also permitting participants to introduce new insights to the study. Each interview was to last approximately one hour, ensuring ample time for follow-up questions.

To enhance convenience and remove travel-related barriers, interviews were conducted using Google Meet. During all interviews, video cameras remained active to simulate a face-to-face interview situation.

There were no specific geographic restrictions, and efforts were made to select participants from various locations as much as possible. This was done to enhance the trustworthiness and credibility of the research. Table 1 depicts the expertise of each interviewee and their place of residence. It is also indicated which of the interviewees have experience in using AI in corporate foresight projects. Among the interviewees, one was a woman while the rest were men.

Table 1 Interviewee's information

Interviewee	**Country of residence**	**Expert in AI**	**Expert in Foresight**	**Used AI in corporate foresight**
P1	Iran	x		
P2	Iran		x	x
P3	Iran		x	x
P4	Netherlands	x	x	x
P5	Finland		x	
P6	Finland	x	x	
P7	Italy			
P8	Finland		x	
P9	Finland			
P10	Germany	x		

The initial interview design for this thesis focused on the themes of AI, its potential advantages, and its risks in corporate foresight. The interview structure was divided to six primary questions. Supplementary questions and probes were then utilized to clarify and elaborate on themes that surfaced naturally during the interview discussions. Table 2 presents the interview structure that was implemented. Furthermore, Appendix 1 includes the original Persian versions of the interview questions.

Table 2 The interview structure

Starter Question	Could you first tell me about your work/expertise? (Field of specialization and length of professional engagement within the respective domain.)
Main Questions	In your experience, what are the key benefits that AI brings to corporate foresight projects? Can you provide examples of successful applications of AI in corporate foresight projects and the specific benefits they have yielded? What are the risks associated with the use of artificial intelligence in organizational forecasting projects, and how can these risks be mitigated? What ethical considerations should be taken into account when using AI in corporate foresight, and how can these concerns be addressed? Are there any limitations or challenges in implementing AI in corporate foresight, and how can practitioners overcome them? What are the future trends and developments in AI that are likely to impact corporate foresight projects, and how should prepare for them? What is the role of human expertise in AI-based corporate foresight* projects, and how can we establish an appropriate balance between human judgment and artificial intelligence algorithms? * In this study, AI-based corporate foresight refers to the use of artificial intelligence technologies to assist in the process of corporate foresight.

3.3 Methods of data analysis

The method chosen for analyzing the data in this research is the thematic analysis method.

Braun and Clarke (2006) outline a six-step process for conducting thorough qualitative data analysis, followed by coding and analyzing the interview data in this thesis. The steps include: 1) familiarizing oneself with the collected data, 2) assigning preliminary codes to describe the content, 3) searching for patterns or themes across the different interviews, 4) reviewing those identified themes, 5) defining and naming the themes, and 6) producing the final report (Braun & Clarke, 2006). An essential aspect of thematic analysis, as emphasized by the authors, is the focus on identifying "themes or patterns across an

(entire) data set, rather than within a data item" (Braun & Clarke, 2006). This holistic, dataset-wide approach was applied in the coding and analysis process of the primary interview data for this thesis.

The Ten expert interviews conducted for this study were all recorded on audio, with extensive notes taken both during and after each interview. The most relevant portions of the interview transcripts were then compiled into an Excel file, preparing them for thematic analysis. (step 1) (Braun & Clarke, 2006). The written data from all interviews was then assessed using Excel for qualitative research analysis. This process began with the assignment of preliminary codes (step 2) based on the findings from the literature, followed by the identification of additional patterns and themes (step 3). The initial themes were subsequently reviewed (step 4), and the newly found themes were then merged with the initial themes to form the final connections and patterns, which were then transferred to the results section for elaboration (steps 5 and 6) (Braun & Clarke, 2006).

Braun and Clarke (2006) underscore the significance of certain prior decisions that have a profound impact on the analysis of gathered data. These include the definition of a 'theme' within the context of the research, the identification of themes in the data, the level of analysis, and the epistemology of the analysis (Braun & Clarke, 2006). In the review of themes and the creation of new patterns, descriptive coding was utilized to help identify themes that went beyond the initial literature-based themes (Braun & Clarke, 2006). The analysis is conducted in an abductive manner, whereby the themes are identified based on the data and the existing theoretical framework (Braun & Clarke, 2006). The level of analysis is semantic, focusing on the surface-level meaning of what has been said rather than any latent or underlying significance. Lastly, this research adopts a relativist approach, which holds that truth is contextual and subject to the specific circumstances of the study (Braun & Clarke, 2006).

3.4 Ethical consideration

In conducting this thesis, several ethical considerations were taken into account to ensure the integrity of the research. The Finnish National Board on Research Integrity (TENK 2019, 17) states that "The researcher is always responsible for ensuring that their research is ethical. The data controller for the research is responsible for decisions regarding data protection." The research was conducted in adherence to the established ethical guidelines.

In this dissertation, potential participants were sent an email invitation detailing the reasons behind the research (accessible in Appendices 2). All interviewees willingly took part, and interview schedules were arranged according to their preferences. Prior to the interviews, a Data Protection Statement was provided to the participating experts, which

disclosed their rights as data subjects, the purposes of data collection, the type of data collected (digital recordings) and the details of data protection. The audio files kept by the researcher, and all research data will be destroyed ten years after the completion of the research.

The participants were informed about the aims and objectives of the thesis, before each interview. The experts were listened to respectfully during the conversations, and the interviews applied a discursive design. A guarantee of anonymity was also provided to the participants. The results include quotes marked by interviewee codes P1 to P10, which have been anonymized in order to minimize the possibility of identifying the company or interviewee.

No specific grant from a public, private, or non-profit organization has been obtained for this research.

4 RESULTS

This section introduces the six themes in using AI in corporate foresight that emerged from the interviews: Benefits of using AI, Risks and ethics, Limitations and challenges, AI future trends, Role of human experts in AI-based corporate foresight, and Temporal dimension. Figure 1 lists the themes and sub-themes. In the following subsections, the themes are presented in more detail.

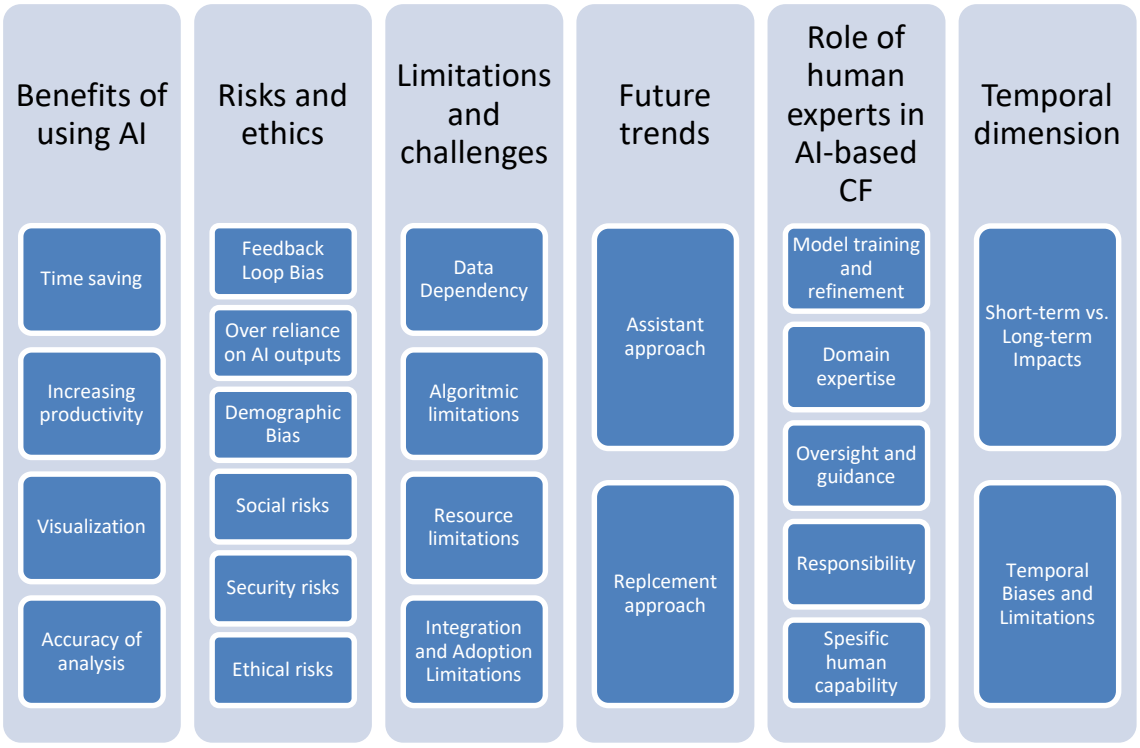

Figure 4 Result themes and sub-themes

4.1 Benefits of using AI

The benefits of using AI in corporate foresight are categorized into four sub-themes: time savings, improved productivity, visualization capabilities, and enhanced analytical precision. (see Table 3: Benefits of using AI)

Table 3: Benefits of using AI

Theme 1	**Sub-theme**	**Condensed meaning unit**	**Condensed meaning unit**
		Interpretation of the underlying meaning	**Description close to the text**
Benefits of using AI	Time saving	Data extraction	Ability to perform a quick comprehensive review of a subject on a text and provide a summary of the text or extract a report.
		Speeding Up Big Data Analytics	Ability to quickly read very long texts in different formats and perform the required analysis in a very short time, especially quantitative analysis.
	Increasing productivity	General idea generator	Quickly on new topics, giving general idea and inspiration.
		Assisting tirelessly	Not getting tired of doing repetitive processes.
	Visualization	Making tangible scenariosss	visualizing scenarios into audio and video files.
	Accuracy of analysis	Performing precise calculations	Automated, algorithmic calculations are more reliable to human-performed calculations for logical operations.
		Tracking special subject	Tracking problems in reports and recognising biases.

4.1.1 *Time saving*

Based on interviews, the most fundamental benefit of leveraging AI appears to be its capacity for efficient data extraction, text summarization, and report generation. Several of the interviewed specialists highlighted their positive experiences with these AI-powered capabilities, which enable faster and more concise synthesis of information. This streamlined approach to information processing is viewed as a key advantage that AI can bring to corporate foresight activities:

> *"For example, in the past, studying a subject like national and regional policymaking would have required a person to conduct 6 months of*

> *focused, planned study. But now, artificial intelligence can do this in a much shorter time, categorize the information, and prepare a summary." (P3)*
>
> *"Artificial intelligence has the capability to analyze large datasets and provide a concise summary of it in a short amount of time." (P10)*

Interviewee (P1) also shared this view.

4.1.2 *Increasing productivity*

AI can improve the productivity of foresight work in multiple ways. It can inspire participants in workshops through its generative abilities. It can also automate processes like report production. Additionally, by scanning a wide range of information sources, AI can quickly provide general insights, saving time and enhancing the productivity of the foresight process overall:

> *"Since it can quickly scan a vast volume of data in a non-systematic manner, artificial intelligence can assist researchers or corporate foresight consultants in gaining initial familiarity with the key concepts in a specific business domain (for example, in horizon scanning, it can relatively quickly provide general ideas about the subject)." (P8)*

AI can serve as a valuable assistant for corporate foresight by virtue of its capacity for tireless processing of repetitive tasks without loss of motivation. Furthermore, it can support foresight by leveraging its ability to analyze vast volumes of data to identify emerging trends and patterns. One oft-cited advantage of AI is its potential to generate "nonsense" data, which at first may seem unusable, but can even inspire the creation of novel, "white space" scenarios that challenge conventional thinking:

> *"Artificial intelligence can take the place of humans in data mining. It can quickly process large volumes of data without getting tired or losing motivation to search, and in this way, predict future trends." (P1)*

4.1.3 *Visualization*

Some experts argue that AI holds immense potential when it comes to visualizing future images and scenarios. By leveraging advanced machine learning algorithms, AI systems can synthesize and generate plausible representations of future states, events or outcomes. This capability is particularly valuable in applications such as scenarios:

> *"Scenarios in foresight practices often suffer from the weakness of being abstract, even if they include illustrations. With artificial intelligence, we*

can vividly visualize them through sound and imagery to make them more tangible for the audience." (P4)

4.1.4 *Accuracy of analysis*

Through the application of advanced machine learning algorithms, AI can perform complex calculations with astonishing precision and speed. Unlike human cognition, which can be susceptible to errors and biases, AI-driven computations are characterized by a degree of accuracy that often exceeds human capabilities:

> *"One of the defining characteristics of predictive artificial intelligence is its ability to perform calculations and process data with a level of accuracy and speed that often surpasses human capabilities." (P4)*

AI systems, with their capacity for pattern recognition and data analysis at scale, can serve as powerful tools for illuminating the hidden biases and imbalances that often plague established fields of study or practice. By leveraging the capabilities of AI, we can gain unprecedented access not only to the institutionalized data that has shaped the conventional wisdom of a given area, but also to the foundational assumptions that underpin it:

> *"Artificial intelligence can be leveraged to identify the core biases inherent within a given domain. At times, we observe that areas which should not receive excessive attention are being addressed in an extensive manner. If we pursue that line of inquiry, we are likely to uncover valuable insights. AI can help surface data that has become institutionalized, and more importantly, it can provide access to the underlying assumptions." (P3)*

In sum, AI can efficiently extract data, summarize text, and generate reports, while also inspiring new ideas through its generative capabilities. Additionally, AI's ability to rapidly analyze large volumes of information can uncover emerging trends and patterns that enhance the productivity and insights of the foresight process. AI's computational power also allows it to perform complex calculations with remarkable precision, far exceeding human accuracy and overcoming biases. Moreover, AI systems can serve as powerful tools for illuminating hidden biases and institutionalized assumptions within established domains, providing unprecedented access to the foundations underlying conventional wisdom. The benefits of using AI will be discussed later in Section 5.1.

4.2 Risks and ethics of using AI

The risks and ethics of using AI are categorized into six sub-themes presented in Table 4: feedback loop bias, demographic bias, over-reliance on AI outputs, social risks, security risks, and ethical risks.

Table 4: Risks and ethics of using AI

Theme 2	**Sub-theme**	**Condensed meaning unit**	**Condensed meaning unit**
		Interpretation of the underlying meaning	**Description close to the text**
Risks and Ethics of using AI	Feedback Loop Bias	Magnifying human cognitive biases	AI algorithms are heavily reliant on the quantity and quality of training data.
	Demographic Bias	Exhibiting biases against certain demographic groups	Some groups are not included in AI.
	Over reliance on AI outputs	Accepting and acting upon the AI's outputs without sufficient critical evaluation or validation.	Being overly dependent on the predictions, insights, and recommendations generated by AI.
	Social risks	Taking the place of human	Some human activities are completely replaced by AI.
	Security risks	Acting like a Black box	We do not know how some types of AI work.
	Ethical risks	Consequential risks	ethical value depends on overall impact.
		Virtu based risks	Pursuing virtuous behavior.
		Deontological risks	Action based on duty or moral rules.

4.2.1 *Feedback loop bias*

Some experts argued that AI systems can inherit and amplify the cognitive biases of their human creators. We must be cautious about the data used to train these AI models, as they are not inherently free from human biases and flaws. There is no such thing as truly "*raw*" or unbiased data - all data contains inherent biases based on how it was collected and curated:

> *"Artificial intelligence algorithms repeat all of the cognitive biases of humans. (P2, P3) We need to be careful about what data is fed into them, as they are not inherently inspired." (P2)*

> *"There is no such thing as "raw data" - data is always biased and flawed. There is a saying that "data is always already cooked"." (P4)*

One of them mentioned that at this stage, humans may still have greater self-awareness of our own cognitive biases in thinking and decision-making compared to current AI systems:

> *"We are likely still more aware of our own cognitive biases in thinking and decision-making than artificial intelligence is at this stage." (P5)*

4.2.2 *Over reliance on AI outputs*

Many experts pondered that relying too heavily on the outputs and predictions generated by AI systems can be risky:

> *"Relying too heavily on the outputs generated by AI systems - whether that's their predictions, insights, or recommended actions - can be a risky proposition." (P2)*

Interviewees (P4, P5, P7, P8, and P9) also shared this view.

Putting excessive trust in AI-derived insights or recommendations may lead to problems in the future, as the AI's knowledge is often incomplete or biased:

> *"Putting too much reliance on AI outputs may lead to problems in the future, being part of the majority of the colony of people who have used artificial intelligence but have incomplete knowledge and believe that it is correct." (P1)*

> *"You may not be aware of its features and functionality. What constitutes its default data? It might not be good in certain contexts. A person lacking sufficient expertise might not understand this problem." (P6)*

There are potential issues with extrapolating AI-generated trend lines and predictive models. When people become aware of an AI's forecasts, it can introduce new variables that change the trajectory of the predictions:

> *"What happens if you project a trend line into the future? When we know what will happen and this awareness is widely created, this adds a new variable to the current trend, which changes the path of extrapolation. The second issue is how much we can trust predictive models, because we have built them based on the hindsight of what we knew. Particularly in the*

financial sector, they often fail in interesting ways. Until the event actually happens, we cannot know what will occur." (P4)

4.2.3 *Demographic Bias*

AI algorithms often assume the default human is a white man, neglecting the diversity of perspectives and experiences across different cultures and demographics. The expert examples given highlight how AI outputs can be heavily influenced by an American-centric worldview, without accounting for the nuanced cultural and contextual differences in other regions.

This lack of cultural sensitivity and over-reliance on American-framed "*forerunner issues*" indicates a significant demographic bias in the data and assumptions underlying many AI systems. Failing to do so risks AI outputs that are misaligned with the realities faced by many non-Western, non-male users and communities:

"AI assumes human is a white man!" (P8, P9)

"AI systems are not culturally sensitive. Some of the AI outputs are very American oriented. For example, Renewable energy using in Finland is not new, it has been used for 30 years by now. If you ask AI about this context, it will suggest that you should use renewable energy! It can understand the Finnish language but cannot understand cultural context. Another example in transportation studies, I can see that it says that all problems will be solved with electric cars or maybe in the future with hydrogen cars but doesn't talk about walking or cycling which are kind of very well established in Finland if you consider specific lanes for traffic modes. If you see from east Asian mega cities perspective, it doesn't work there either because fast rail connections or subways are very strong there. Sometimes this American perspective consider as forerunner issues." (P8)

There are significant demographic biases present in many AI systems, particularly those involving large language models (LLMs). One key issue is the lack of diverse and representative data used to train these models. The expert notes that most LLMs are developed primarily using English-language data, which means they may lack the appropriate cultural knowledge and framing to properly understand and respond to non-Western, non-English contexts:

"There are groups that are not included in datasets, and the language of the data is English. For example, if we have a high-context situation, such as wanting to do something in an urban area in the south of Vietnam, there may not be a large language model that is well-suited to that region. This

> *is because most of these LLMs are created based on data in the English language. I don't mean translation, because it has been proven that if the training volume goes above a certain level or the feature size becomes larger, a model that used to speak only in English can now speak in other languages as well. So here I'm not talking about language, I mean the arguments and the essence of the content that the model needs to convey. When they are not prepared with a specific context, they usually cannot properly extrapolate, predict, or generate about that context." (P4)*

4.2.4 *Social Risks*

One of the interviewees expressed that foresight is often viewed as a "*luxury*" in companies, and there is a perception that AI can replace the work of human foresight experts. This could incentivize some decision-makers to simply defer to AI-generated outputs without the proper due diligence and critical thinking:

> *"Foresight is still considered a luxury item in companies, and with the illusion of artificial intelligence replacing foresight experts, this position can even be strengthened." (P3)*

It was also agreed upon by interviewees (P6).

Using AI could lead to a trouble where people use AI as an "*excuse to not do their jobs thoroughly*." Instead of carefully considering the appropriate questions and framing for language models, they may opt for a quicker, less thoughtful approach. Additionally, some experts mentioned that over-reliance on AI-powered writing could potentially lead to a decline in human writing skills, as people become overly dependent on the AI's ability to "*type faster than a human*":

> *I fear some people use it as an excuse to not do their jobs thoroughly, instead just producing something quickly without considering the appropriate questions for language models. If we ask in a stupid way, then the answer would be stupid. One of its strengths in the future may be that it can type faster than a human, as writing skills may decline due to digitalization." (P8)*

4.2.5 *Security risks*

Interviewees thought that the use of AI systems also raises significant concerns around biased and discriminatory outputs, lack of transparency and explainability, and privacy and data protection. If the training data used to develop an AI system is biased, the system

may exhibit biased and discriminatory behavior, leading to unfair or harmful decisions. Moreover, many modern AI systems, especially deep learning models, are "*black boxes*" whose inner workings and decision-making processes are not easily interpretable, making it difficult to understand, audit, and verify the safety and security of these systems. Additionally, AI systems that collect and process large amounts of personal data could pose significant risks to individual privacy if the data is not properly secured and protected:

> *"Except with explainable AI, all the other types of AI are black box, and we don't know how they work." (P4)*
> *"There is no analytical thinking behind AI. If you don't know how the answers formed where is the responsibility of following that advice?" (P9)*
> *"The risks of abuse, hacking, and privacy violations still exist in the use of artificial intelligence. We do not know how committed the developers are to ethics, and how accurate the data is. Whose interests will the resulting outcomes ultimately favor?" (P1)*

4.2.6 *Ethical risks*

According to the existing literature and expert insights, there are three key categories of ethical risks associated with the development and deployment of AI systems: Consequential risks, Virtu based risks and Deontological risks. In the following subsections, the risks are presented more in detail.

4.2.6.1 Consequential risks

This is a critical consideration, as the research result suggests that the traditional concepts of copyright and ownership over data may soon become "*meaningless*." This could lead to situations where the individuals or communities whose data is being leveraged to train AI models have little to no say or recourse in how their information is being utilized. Without clear mechanisms to ensure the fair and ethical use of data, there is a significant risk of consequential biases emerging in AI systems. These biases could disproportionately advantage certain groups or interests over others:

> *"We don't know who benefits from the production of the data? Also, the issue of copyright will soon become meaningless, and we need to find a solution for it." (P3)*

> *"In corporate foresight, good data is the key. If foresight practitioners get all their data from artificial intelligence, we don't know what their source is and how reliable it is." (P9)*

4.2.6.2 Virtu based risks

A number of experts highlighted the critical issue of virtue-based risks that must be addressed in the context of AI-driven corporate foresight. It was emphasized that key ethical principles such as nonmaleficence, fairness, transparency, and trustworthiness should be of the utmost importance. Of particular importance is the need for meaningful transparency into the inner workings of AI systems. They stressed that understanding the process by which an AI generates its outputs, the reasoning behind its recommendations, and the data sources and weightings it relies upon is essential:

> *"Non-maleficence, fairness, transparency, and trustworthiness - all these ethical principles should be considered in the context of AI in corporate foresight. If I take up certain things, transparency is quite important. Having meaningful transparency into the process and the thought process of the AI means: how is the process of generating the output, why did it reach this recommendation, how did it synthesize the information, from which data source, and how it assigned different weights to different pieces of information." (P5)*

4.2.6.3 Deontological risks

The central concern in deontological risks linked to AI usage is the ambiguity regarding intellectual property rights and the sources of knowledge and content that AI systems employ to produce their outputs:

> *"Intellectual property is important. Artificial intelligence receives a blend of everything to respond to you in the form of sentences. We don't know how the thought process goes from the producer to the." (P3)*

Furthermore, numerous experts caution that people "*rely too heavily on artificial intelligence without understanding its workings*." This highlights the danger of treating AI systems as authoritative or reliable when their internal mechanisms are not transparent:

> *"People too much rely on artificial intelligence without knowing how it works. Artificial intelligence is like a parrot - in large language models, it just puts words together, and we make sense it, give it meaning, and sometimes even say it's hallucinating. But if we look at it from the perspective*

of artificial intelligence, both are produced using the same method, and both are valid." (P4)

4.2.7 *Solutions to risks and ethical issues of using AI:*

Many experts thought that critical awareness and futures-oriented expertise are essential to countering the skewed perspectives that can arise when powerful corporate interests drive technological change. The more futures literacy increases in society, the more resistant the public will become to these biased, profit-driven visions of the future:

"Capitalists who profit from the expansion of certain things like the metaverse and NFTs cause the reality of the issues to be obscured and covered in dust, and virtual world applications greatly assist them. If this happens for things like games, it's not a big problem, but corporate foresight practitioners need to be very conscious about these narratives. Some who profit from the expansion and advancement of artificial intelligence may tell unrealistic stories, but those who have studied futures studies should be immune to this "virus". I also believe that the more futures literacy increases in society, the more the society becomes immune." (P3)

The time has come for concrete legal policymaking to govern the ethical implementation of AI:

"There are many academic movements regarding ethical risks, such as responsible AI, value-sensitive design, and justice-oriented design. Each of them has proposed several models, but in my opinion, legal policy needs to be developed for this issue. Companies should be bound to those policies, otherwise, the body of these ethical considerations is too large but not authoritative and inclusive enough, and it cannot be followed until it is crystal clear." (P4)

Additionally, to address the concentration of AI power among tech giants, the most effective strategies are providing free education and promoting decentralization:

"It seems that artificial intelligence will lean towards capitalist policy frameworks, although there are independent organizations as well, but most users will gravitate towards tech giants. The only solution to overcome this is free education and decentralization." (P1)

In summary, AI systems can inherit and amplify the biases of their human creators, as there is no such thing as truly "unbiased" data, and overreliance on AI-generated insights and forecasts can be risky, as the outputs may be incomplete or skewed by these underlying biases.

Many AI systems, especially large language models, are developed primarily using data from Western, English-speaking contexts, which can result in a lack of cultural sensitivity and an American-centric worldview, leading to misalignment with the realities faced by diverse user groups and communities. Furthermore, the lack of transparency in many modern AI systems, whose decision-making processes are not easily interpretable, raises significant ethical concerns, as it makes it difficult to understand, audit, and verify the safety and security of these systems. Finally, the collection and processing of large amounts of personal data by AI systems pose significant risks to individual privacy if the data is not properly secured and protected.

According to expert interviews, there are a number of key solutions to address the risks and ethical concerns associated with using AI. Increasing futures literacy across society will make the public more resistant to biased, profit-driven visions of the future. Additionally, concrete legal policymaking is needed to govern the ethical implementation of AI and, decentralized approaches to AI development and deployment can help curb the dominance of a few large tech companies, ensuring more diverse perspectives and accountability.

In Section 5.2, the risks and ethical implications of the use of AI, as well as its solutions will be discussed.

4.3 Limitations and challenges

Regarding limitations and challenges of using AI in corporate foresight, four sub-themes are presented in Table 5: data dependency, algorithmic limitations, resource limitations and integration and adoption limitations.

Table 5: Limitations and challenges

Theme 3	**Sub-theme**	**Condensed meaning unit**	**Condensed meaning unit**
		Interpretation of the underlying meaning	**Description close to the text**
Limitations and challenges	Data Dependency	Absence of transparency around the data source.	Some context and innovation is missing.
	Algoritmic limitations	lack of common-sense reasoning	Challenges with understanding Causal Reasoning.
		Inability to transfer learning across domains	Most AI models cannot easily transfer knowledge gained in one domain to excel in another unrelated domain.
		Lack of Explainability	Cannot easily explain their decision-making process.
		Inability to grasp meaningful connections	Failure to perceive meaningful connections and systemic levels.
	Resource limitations	Requirement for Large Datasets	Require massive labeled datasets for training, which can be costly and difficult to obtain.
		Narrow specialization	Lacking the general intelligence and flexibility of the human mind.
	Integration and adoption limitations	Cumbersome regulations	Excessive rules for users and developers will limit its expansion.

4.3.1 *Data Dependency*

Experts highlighted several significant limitations of AI concerning the dependency of AI systems on data. Beyond the data quality concerns, experts pointed to political

decisions that restrict certain communities from accessing or using AI technologies as another significant limitation. Additionally, there is still a stigma or "shame" associated with admitting when a task was performed by AI rather than humans, which further hampers the adoption and utilization of these technologies. Furthermore, the constraint on the creative and innovative potential of AI is seen as a significant shortcoming:

> *"The main question is where the data comes from. If the algorithm is good, but the data is incomplete or not correct, it will not give a good result, so there are organizations ahead that have better and more data. Also, choosing a service provider organization will be a great challenge." (P1)*
> *Not everyone is familiar with the literature on the use of artificial intelligence (AI). Additionally, political decisions that restrict some communities' use of AI are another limitation. Beyond that, the shame of admitting that a task was done by artificial intelligence restricts the data. We need to get past this stage so that the outputs of artificial intelligence can also be acceptable. Using it is not necessarily taboo. (P3)*
> *The responses of artificial intelligence are not creative, because the knowledge of artificial intelligence comes from previous knowledge and is not new. (P3)*

Expert (P9) was agreed on this view as well.

4.3.2 *Algorithmic limitations*

According to the experts interviewed, one of the key limitations of current AI systems is their inability to propose complex, multidimensional solutions that are required in many real-world business scenarios. Additionally, another limitation is the "black box" nature of many AI algorithms, where the internal workings and decision-making processes are opaque and not readily explainable. Another significant constraint is the inherent "time freeze" of AI systems, which can only access and process data up to a specific cutoff date. This temporal limitation can hamper the real-time responsiveness and relevance of AI-generated insights:

> *It cannot propose complex and multidimensional solutions that are actually needed in business. (P3)*
> *The connection between values, meanings, subjective meaning, and contextual meaning, as well as social complexity, are limitations that current AI systems cannot overcome. (P7)*
> *"Except with explainable AI, all the other types of AI are black box, and we don't know how they work." (P4)*

> *"One of the limitations that artificial intelligence has is time freeze. It has access to information only up to a specific date. Beyond the fact that not all companies have access to all the data that is available on Google, you cannot have the same data that you see on the internet in your AI system on the same day. It usually takes from a few days to a few months for their system to ingest and be ready to use that data. Artificial intelligence also has a learning model like humans, which takes time to learn before we can ask questions of it." (P10)*

4.3.3 *Resource limitations*

The experts expressed several resource-related limitations surrounding the effective implementation of AI systems. One key constraint they identified is the shortage of individuals who possess the necessary expertise in both AI development and foresight/futures studies:

> *"One of the limitations is lack of trained person in both so we should make a team of AI expert and foresight expert to solve this challenge. multidisciplinary team might work in this regard. for example, hospitals hire engineers for machinery fixing." (P8)*

Furthermore, the successful deployment of advanced AI capabilities may be limited to organizations with the financial resources and willingness to invest in these high-end solutions. The "company's willingness or capability for investment" can be a significant barrier to unlocking the full potential of AI:

> *"The most powerful software's are behind the paywall and the company's willingness or capability for investment is the matter." (P8)*

4.3.4 *Integration and adoption limitations*

One significant issue the experts identified regarding the integration and adoption of is the difficulty of LLM models in making connections and comparisons between concepts or domains that are not obviously related. This poses a challenge for applications that require cross-domain understanding and analysis.

Additionally, LLMs do not excel at grappling with systemic-level complexities. While these models may initially provide responses that appear well-structured, the output can lack the coherence and contextual understanding necessary to make sense of intricate, multi-faceted problems:

> *These large language models are not good at comparing issues which are not obviously connected. If the language is different (for example you have something in two domains that you want to compare, and the language is completely different) LLMs cannot make the connections and understand the similarities and differences between two domains. It also does not understand systemic levels very well. If you ask for a breakdown, it might get something that looks nice at first hand, but then you start thinking deeper, it is a list that is produced and does not make any sense. (P8)*

In sum, the experts expressed several key limitations and challenges surrounding the use of AI in corporate foresight. A fundamental constraint is the dependency of AI systems on data. The inherent "time freeze" of AI systems, which can only access and process data up to a specific cutoff date, also hampers the real-time responsiveness and relevance of AI-generated insights.

Another significant limitation is the inability of current AI systems to propose complex, multidimensional solutions required in many real-world business scenarios. LLMs do not excel at grappling with systemic-level complexities, and their output can lack the coherence and contextual understanding necessary to make sense of intricate, multi-faceted problems. Additionally, the "black box" nature of many AI algorithms, where the internal workings and decision-making processes are opaque, further constrains their transparency and explainability.

Experts also pointed to resource-related limitations, such as the shortage of individuals possessing expertise in both AI development and foresight/futures studies. The successful deployment of advanced AI capabilities may also be limited to organizations with the financial resources and willingness to invest in these technologies.

Furthermore, experts identified issues regarding the integration and adoption of large language models (LLMs), which can struggle to make connections and comparisons between concepts or domains that are not obviously related. This poses a challenge for applications that require cross-domain understanding and analysis. Section 5.3 will address the limitations and challenges of using AI in corporate foresight.

4.4 AI future trends

The trends mentioned in the interview can be divided into two main categories: the Assistant Approach and the replacement approach.

In the first category, Assistant Approach, trends indicate that AI will make significant advancements in the future, in terms of improving human-like capabilities. This includes the ability to establish better verbal communication, as well as the capacity to perceive and convey senses like smell, sound, and touch. Ultimately, this could make AI a viable

option for producing visual scenarios. Additionally, AI can generate accurate statistical reports from meetings and interviews:

> *"We will have a speech recognition model that works with a robot and can have different types of environmental awareness. It can understand dimensions of the space and move there and understand emotional state from reading face of people in the meeting room and can have big data analysis." (P9)*
>
> *"AI will be specialized in futures studies, taking on the role of futurists. AI would help in all phases of foresight work, maybe after 10 years we can consider it as a similar tool to grammar check in Microsoft Word. AI can make graphs out of report text to improve communication. Visualization AI tools will develop significantly and can generate visual scenarios. AI is also developing to be more speech-oriented and intuitive, like a conversational partner rather than just a source of relevant information." (P8)*
>
> *"AI visuality development could support corporate foresight practices-feel of all senses through variable sensors." (P7)*

The Replacement Approach is the second category, where some interviewees believed that AI will soon entirely replace certain professions, including foresight experts. Their perspective was that the use of AI will become widespread, where individuals or organizations can customize specific types of AI based on their needs. In this approach, corporate foresight experts would only contribute to product development, and companies could order specialized AI packages with unique capabilities to use for their future planning needs:

> *"Meta history says there is an overall global trend where the world is becoming more complex every day. So, if we accept this view, we are prisoners for an intelligence greater than ourselves, and this is a trend that ultimately either ends the age of humanity or produces another species that we don't know is biological, silicon-based, or a combination of the two!*
>
> *Elon Musk says general AI should not be created, but I believe it will be built eventually. It's just a matter of time! In this process, artificial intelligence will soon replace humans and do the work of futurists.*
>
> *Artificial intelligence, with the help of blockchain, can influence people's opinions and form a harmonized democracy for decision-making. We usually select one or more capable individuals to make decisions, and the opinions of others are not considered." (P2)*
>
> *"We will have trained corporate foresight models that can do 100% knowledge work of corporate foresight. Artificial intelligence is disruptive technology, not eliminative- we should think more peaceful about it." (P4)*

Future trends of AI will be discussed in Section 5.4.

4.5 Role of human experts in AI-based corporate foresight

Identifies sub-themes in the role of human expert in AI-based corporate foresight categorized into Model training and refinement, Domain expertise, responsibility, and specific human capability shown in Table 6.

Table 6: Role of human experts in AI-based corporate foresight

Theme 5	**Sub-theme**	**Condensed meaning unit**	**Condensed meaning unit**
		Interpretation of the underlying meaning	**Description close to the text**
Role of human experts in AI-based corporate foresight	Model training and refinement	Helping in enhancing the accuracy, reliability, and robustness of the AI systems.	Training and refinement of AI models by annotating data, validating model outputs, and providing feedback to improve the system's performance over time.
	Domain expertise	Providing the deep domain knowledge and contextual understanding	Human expertise helps in framing the right problems, identifying relevant data sources, and interpreting the outputs generated by AI systems.
	Responsibility	Establishing clear lines of accountability and effective oversight mechanisms to monitor the use of AI	This supports trust, accountability, and responsible use of AI technologies.
	Spesific human capability	Creativity and innovation	Humans possess the ability to generate novel, imaginative ideas, and solutions.
		Managing complexity	Humans have a deep understanding of the world and the ability to reason about complex, contextual information and also flexibility and broad problem-solving.
		Sensory perception	Human senses provide with a multifaceted, integrated understanding of the world.
		Movement and mobility	Humans perform a vast array of complex movements with ease and adaptability.
		Cognitive abilities	It reflects an individual's curiosity, desire to understand, and attempt to gain new knowledge or clarification.

4.5.1 *Model training and refinement*

According to one of the expert interviewees, the role of human experts is critical in the model training and refinement process when using AI for corporate foresight. While AI can excel at knowledge-based tasks, human foresight experts are essential for identifying and addressing the limitations or flaws in the AI models:

> *"Artificial intelligence performs very well in knowledge-based work, and it is possible that it will soon outperform humans in all fields, including foresight. However, this does not mean that this expertise will be lost, because there will always be a need for a group of people who need to correct the flaws, and this is not a computer science job, but rather the job of a foresight expert." (P4)*

4.5.2 *Domain expertise*

While AI can excel at processing vast amounts of data and generating insights, human foresight experts play a vital role in providing the deep domain knowledge and contextual understanding necessary to ensure the relevance and reliability of the AI-generated outputs. The experts' ability to fine-tune the AI models, moderate the content, and critically evaluate the AI's findings is essential for translating the AI-derived insights into meaningful and actionable foresight:

> *"One of the tasks of the corporate foresight practitioner will be to work with the AI models, content moderation, fine-tuning, and also read the outputs and determine whether the answers are relevant or not." (P4)*

Expert (P8) was agreed on this view as well.

> *"Despite the advancements in artificial intelligence, contextual meaning in knowledge, the human judgment and definition of the boundaries between different options and solutions remains a crucial role for experts in corporate foresight." (P7)*

4.5.3 *Responsibility*

The human experts' role in testing the transparency of AI systems, validating the models, and taking responsibility for the AI-derived insights is crucial for ensuring the ethical and responsible use of AI within the corporate foresight project:

"Inhouse transparency testing for the developers also for the customers before purchasing is a human responsibility." (P9)
"In the use of artificial intelligence in corporate foresight, the role of human expertise emerges in the realm of control. Likewise, where there is a need for accountability and responsibility, to answer the reasons behind the models and so on, an expert is required to examine, validate, and be present everywhere to say, 'I am responsible'." (P4)
"It seems that artificial intelligence can be like a co-pilot - it increases the speed of task completion, but the guidance is still with the human." (P10)

4.5.4 *Specific human capability*

The experts emphasized that while AI can excel at processing and analyzing vast amounts of data, the ability to envision the future and generate novel, innovative ideas remains a uniquely human task:

"Envisioning the future is a human task. We shape the world, but artificial intelligence collages data and puts it together." (P2)
"It does not produce new ideas. Man is the author." (P1, P3)

This suggests that even as AI systems become increasingly sophisticated in their ability to uncover patterns and generate insights from data, the creative and innovative thinking required for corporate foresight remains a domain where human experts are irreplaceable.

Additionally, the experts' views highlight that the human capacity to navigate complex, ambiguous, and rapidly changing environments is a key advantage over AI. It shows that the ability to reason about complex and contextual information, as well as the flexibility and broad problem-solving skills of human experts, are essential when dealing with the intricate and multifaceted challenges of corporate foresight:

"Humans are still needed to manage the complexities of the human world." (P1)
"In some decision-making process AI is very good but in complicated and critical ones we need humans for example firm level strategy." (P5)

The expert interviewees thought that the depth and complexity of human perceptive and cognitive capabilities and the ability to integrate multifaceted information from the world around them; It is specific to humans and artificial intelligence does not yet have such a capability. As one interviewee explained:

> *"AI is much more capable of doing pattern matching within a certain frame of reference but in matching outside of specific frame human is better for example if you are a two-year-old child, you can immediately distinguish a cat from a dog, but AI needs millions of cats and dogs' images and supervision and everything to distinguish. Also, Human sensory system is more complicated than AI, when we need that kind of decision making, we need humans." (p5)*

Another interesting aspect that was raised was that: Adaptability and versatility of human movement and mobility is remarkable, which AI systems have yet to fully replicate. While robots may excel in specific, structured environments, human experts possess the unparalleled capacity to navigate diverse physical spaces and effortlessly manipulate a wide range of objects:

> *"And even the best robots cannot move like humans do. We are still very capable of navigating through vastly different physical environments. We also remain highly capable of manipulating a wide variety of objects." (P5)*

As a final point, asking questions is another unique human cognitive trait that AI systems are still unable to replicate. While AI may excel at processing and analyzing data to provide answers, it is the human experts, driven by their curiosity, desire to understand, and quest for new knowledge, who can identify the right questions to ask in the first place:

> *"AI is not good at asking questions, it might be better at answering. It cannot generate surprising questions that the futurists might not think of themselves." (P8)*

Expert (P2) was agreed on this view as well.

In brief, Human foresight experts play a critical role in the model training and refinement process when using AI for corporate foresight. Furthermore, their deep domain knowledge and contextual understanding are vital for ensuring the relevance and reliability of the AI-generated outputs. Additionally, their role in testing the transparency of AI systems, validating the models, and taking responsibility for the AI-derived insights is crucial for ensuring the ethical and responsible use of AI within corporate foresight projects.

Experts emphasized that the creative and innovative thinking as well as the flexibility and broad problem-solving skills of human experts, required for corporate foresight remains a domain where human experts are irreplaceable. Moreover, the depth and complexity of human perceptive and cognitive capabilities, the adaptability and versatility of human movement and mobility, and the unique human ability to ask the right questions are all key advantages that human experts possess over current AI systems. In Section 5.5, role of human experts in AI-based corporate foresight will be discussed.

4.6 Temporal dimension

Short-term vs. long-term impacts, and temporal biases and limitations are two categories under the temporal dimension theme that is presented in Table 7.

Table 7: Temporal dimension

Theme 6	**Sub-theme**	**Condensed meaning unit** **Interpretation of the underlying meaning**	**Condensed meaning unit** **Description close to the text**
Temporal dimension	Short-term vs. Long-term Impacts	Benefits and risks of using AI for corporate foresight	Immediate Efficiency Gains and Rapid Response vs. Challenges in Interpretability and Overreliance on AI Predictions.
		Adaptability and Responsiveness to rapidly changing market conditions and emerging trends.	Ability to detect and respond to short-term disruptions versus long-term shifts.
	Temporal Biases and Limitations	Potential temporal biases or limitations that AI-driven foresight may introduce.	Over-reliance on historical data or difficulties in predicting radical, discontinuous change.
		Technological obsolescence due to rapidly evolving AI	The specific tools and techniques used for corporate foresight may become obsolete over time, requiring foresight practitioners to continuously adapt and invest in the latest AI capabilities.

4.6.1 *Short-term vs. Long-term Impacts*

Some experts caution against putting "*too much reliance on AI outputs,"* warning that this could lead to "*problems in the future*" due to incomplete knowledge and overconfidence in AI's infallibility. They further elaborate on the risk of AI causing people to "*turn off parts of our brains*" and lose the ability to thoughtfully analyze questions and challenge answers. For example, AI may surpass human writing skills, implying a potential decline in human writing abilities. On the positive side, they note that once general AI is

achieved, it may enable "*complete and good models for predicting the future*" - a capability that could dramatically accelerate and enhance foresight and futures studies:

> *"Putting too much reliance on AI outputs may lead to problems in the future, being part of the majority of the colony of people who have used artificial intelligence but have incomplete knowledge and believe that it is correct." (P1)*
>
> *"The fear I have is that the use of artificial intelligence will become like Google. We used to study and ask people, we accepted that some questions have no answers, or their answers are very difficult, but after Google, this mindset changed. I'm afraid that we won't think about our questions and won't nurture our questions. We turn off parts of our brains, like using a calculator and contact lists. We don't focus on our questions, we don't concentrate on the question until it matures, we just go and ask quickly. Secondly, we think that the wise god-like human has given an answer, and it is certainly correct and knows more than everyone else, and this makes us not doubt it. So gradually, in the long run, it takes away our ability to ask questions, analyze them, and search, while the civilized human asked questions and progressed." (P2)*
>
> *"One of its strengths in the future may be that it can type faster than a human, as writing skills may decline due to digitalization." (P8)*

The use of AI in corporate foresight projects can have short-term and long-term effects that require a nuanced approach. If the development of AI is controlled by the interests of an organization that is pursuing its own immediate gains, it can have destructive effects in the future. Conversely, if it is guided by the new concepts of green-blue companies, it could have good effects for society and the planet in the future:

> *"One point is that the very concept of a "corporate" is unstable. The evolution of future organizations is also important. If an organization whose sole purpose is to make money dominates artificial intelligence, it can be very destructive. But if our view of the company changes, and we have a green-blue organization, then artificial intelligence can cause people to gain the right overall perspective and better regulate their relationships with others. An organization that collaborates to do what everyone wants. If it can use artificial intelligence to collect the desired future image of individuals and present a society from that image where everyone has the right role and everyone is working towards the growth and goodness of others and society, it could become a film that shows our future. But it must be ethical, and no one should be able to manipulate it. If such work is done, it will be a great help for humanity." (P2)*

4.6.2 *Temporal Biases and Limitations*

One expert highlights a key limitation of AI-powered predictive models, particularly regarding complex, dynamic systems like financial markets. This reflects a temporal bias inherent in many AI models, which excel at identifying and extrapolating patterns from historical data, but struggle to account for sudden, unanticipated changes that disrupt those patterns. In rapidly evolving, nonlinear environments prone to radical shifts, the static, backward-looking nature of AI predictive capabilities can prove inadequate. Lacking access to the "correct data," which may be inherently challenging to acquire in complex, discontinuous scenarios, AI outputs will have limited capability in predicting dramatic, nonlinear shifts:

> *"In this regard, I recalled an example from my university days. I had a friend who was working on predictive models for the stock market (we have a set of algorithms in artificial intelligence that can predict what events are going to happen). After a year, my friend changed the subject, and the reason was that the factors affecting the Iranian stock market are too many and cannot be measured. Artificial intelligence needs the right data. If you cannot provide it with the correct data, you cannot have the right output." (P10)*

One expert hint at the profound impact that the emergence of true general AGI could have on the practice of future forecasting and foresight. He argues that the technological foundation of foresight activities is continuously changing, with advancements in AI swiftly outpacing and making former tools and methodologies outdated. For foresight practitioners to remain impactful, they will need to continuously invest in and adapt to the latest AI advancements:

> *"We still do not have general artificial intelligence, and it is unclear when we will have it. But once we reach that point, it is possible that certain individuals will be able to provide us with complete and good models for predicting the future. If such a thing were to happen, the story of humanity would change, and it would not just be corporate foresight practitioners who need to take action - it would directly impact the future of this planet. It is better that we are not just passive consumers." (P3)*

There will be a discussion of the temporal dimension in section 5.6.

5 DISCUSSION

In this chapter, the thesis analyzes the results, and its purpose is to provide an overview of how the use of AI affects corporate foresight.
The following sections discuss and critique the six themes that emerged from the interviews and try to find best answers for research questions: Benefits of using AI, Risks and ethics, Limitations and challenges, future trends, Role of human experts in AI-based corporate foresight, and Temporal dimension.

5.1 Benefits of using AI:

As author mentioned earlier in section 2.3, Secco et al. (2023), introduced a visual approach for displaying trends that integrate statistical methods and AI techniques. The findings of the current research are thus aligned with the previous scholarly contributions in this domain.

Moreover, these findings are consistent with the previous studies conducted by Secco et al. (2023), which acknowledge the potential for incorporating additional data sources, such as patent information, to further strengthen the proposed methodology. These supplementary data sources may offer insights into more mature technological developments. Furthermore, they suggest that the integration of explainable AI approaches could be leveraged to evaluate the decision-making processes of hybrid predictive models, thereby enhancing their transparency and interpretability.

Furthermore, based on Dilmegani (2024) and interview results, the use of AI in corporate foresight offers several key benefits. The answer to the research question is: First, AI facilitates data integration by combining information from multiple sources into a unified, meaningful format, enabling valuable insights to be extracted from the high volume of data. Second, AI can automate data filtering and quality control tasks, improving data management and monitoring to ensure the integrity and reliability of data for advanced analytics. Additionally, AI-powered data visualization tools can develop dashboards and visual representations to convey data insights more effectively and aesthetically, aiding in scenario-making and visualization. Finally, AI can transform unstructured data into the required formats for advanced analytics, unlocking the potential of diverse data sources to inform corporate foresight.

5.2 Risks and ethics

The results of this study show that the use of AI systems in corporate foresight carries significant risks and ethical concerns. Although AI still has a significant advantage over humans in a number of areas, it remains limited. Firstly, AI systems can inherit and amplify the biases of their human creators, as there is no such thing as truly "unbiased" data. The analogy of AI as a "parrot" that "just puts words together" further underscores this deontological concern. If AI is merely recombining existing information in an automated way, rather than engaging in genuine reasoning, then it's out-puts may lack the moral grounding required for truly ethical decision-making. This can lead to the outputs of AI-generated insights and forecasts being incomplete or skewed by these underlying biases, posing a risk of relying on such outputs.

Furthermore, many AI systems, particularly large language models, are developed primarily using data from Western, English-speaking contexts. This can result in a lack of cultural sensitivity and an American-centric worldview, leading to a misalignment with the realities faced by diverse user groups and communities. Additionally, the lack of transparency in the decision-making processes of many modern AI systems raises significant ethical concerns, as it makes it difficult to understand and verify the security of these systems.

Moreover, the collection and processing of large amounts of personal data by AI systems pose substantial risks to individual privacy if the data is not properly secured and protected. In addition to providing an answer to the research question regarding the risks of using AI, these findings are in accordance with previous studies that have addressed the ethical implications of using AI.

To address these risks and ethical concerns, expert interviews have identified a number of key solutions. Increasing future literacy across society will make the public more resistant to biased, profit-driven visions of the future. Furthermore, based on the findings of this research, concrete legal policymaking is needed to govern the ethical implementation of AI, and decentralized approaches to AI development and deployment can help curb the dominance of a few large tech companies, ensuring more diverse perspectives and accountability.

Any attempt to actively prevent AI development will likely be limited to local and temporary measures since there is no global organization capable of imposing a permanent ban on its development.

Regulations ought to be established by governments and regional or global unions. The AI100 (Littman et al., 2022) report corroborates this view, indicating that as AI-human interaction intensifies, more legal and ethical issues arise. Torresen (2018) highlighted the significance of legal frameworks concerning AI accountability and ethical matters. Furthermore, Jiang et al. (2021) drew attention to the current AI regulations'

deficiencies in standards and safety. Addressing the consequential risks and biases inherent in AI data production and usage must be a top priority for AI developers, policymakers, and ethicists as these technologies continue to advance and become more pervasive in our society.

The overall message is that we cannot blindly trust AI to be unbiased or objective - the systems reflect the limitations and flaws of their human origins and development processes.

5.3 Limitations and challenges

In response to one of the research questions, the expert interviews and prior literature highlight key limitations and challenges in using AI for corporate foresight. A fundamental constraint is the dependency of AI systems on data, as their "time freeze" limits real-time responsiveness. Another limitation is the inability of current AI, especially large language models, to grapple with the complexities and multidimensional solutions required in real-world business scenarios. The "black box" nature of many AI algorithms also constrains their transparency and explainability. Experts noted resource-related limitations, such as a shortage of individuals with expertise in both AI and foresight. The successful deployment of advanced AI may be limited to well-resourced organizations. Furthermore, experts identified issues with the integration and adoption of language models, which can struggle to make connections across disparate domains.

As mentioned in the literature review, securing the appropriate data corpus to train a Large Language Model (LLM) presents a formidable challenge. It involves meticulously filtering out toxic language and ensuring a balanced and diverse dataset—a task that requires continuous refinement. (Fayyad and Fayyad, 2023)

Ferràs-Hernández (2018) presents a bold and somewhat alarming vision of the future. The author suggests that the emergence of a "future digital CEO" and "self-driven companies" is within the realm of possibility. Such a development could signal the obsolescence of management science. However, he also notes that humans' greatest asset is their intuition in strategic management, which is linked to "creative thinking and art." Currently, while intelligent machines excel at identifying patterns and answering questions more effectively than humans, they lack the ability to pose questions.

Overall, the expert interviews and literature align in identifying these key limitations surrounding the use of AI in corporate foresight.

5.4 Future trends

The literature and expert opinions have raised concerns about the potential for excessive enthusiasm and public relations around AI projects to trigger another "AI winter"(Yesnitsky, 2020). Given the history of ambitious but ultimately unrealized AI projects, there is a question of whether the cycle identified by Yesnitsky (2020) is likely to recur, and if so, how the timeline of such cycles can be estimated. On the contrary, Bostrom (2014, p. 74) argues that a rapid increase in optimization power is imminent. This surge will stem from growing investments in resources like capital and hu-man researchers. As AI systems acquire more capabilities, they will also contribute to enhancing optimization power. The current literature identifies three primary scholarly research perspectives: 1) the enhancement perspective, which views AI as supplementary assistance to existing leadership functions; 2) the replacement perspective, which predicts AI will supplant both followers and leaders, leading to robot leadership and management; and 3) the skeptical perspective, which considers AI to be an "oversold idea," suggesting that the potential and impact of AI in the modern world are overstated, and AI robots will never fully replace human leaders. (Titareva, 2021) Similarly, the results of the expert interviews also stated that the future of AI can have two scenarios: either it will remain as a human assistant or it will replace them. In this way, the idea of "oversold" and the idea of "enhancement" can be categorized under "assistant," and the future that sees AI replacing humans can be placed in the other category.

Regarding the idea of humans being replaced by AI, a thought-provoking theory has been proposed. It seems that if a specific event does not disrupt its course, this idea has the potential to be realized and could determine the future of humanity in an unprecedented way. The Singularity Hypothesis suggests a period of swift, iterative improvements in AI capabilities once they contribute to their own research. This hypothesis implies a catastrophic risk, as an "intelligence explosion" from such progress could create highly advanced artificial systems that may pose a danger to humanity if they do not align with human interests. Chalmers (2010) presents the argument for the Singularity Hypothesis: the rise of AI is inevitable in the near future, with subsequent versions of AI (termed AI+ and AI++) emerging shortly thereafter. Chalmers (2010) categorizes AI as human-level AI, AI+ as surpassing the intelligence of most humans, and AI++ as far exceeding human intelligence. He supports the initial premise by arguing that if evolution could yield human-level intelligence, then theoretically, humans could replicate this artificially. The recent rapid advancements in AI during the "deep learning revolution" lend further credibility to this premise. (Bales et al., 2024).

Chalmers (2010) identifies two main categories of obstacles that could hinder the emergence of super intelligent AI through a singularity-type recursive process. The first category, situational defeaters, encompasses natural or manmade disasters, resource

constraints, and other factors that could disrupt the recursive enhancement process. The second category, motivational defeaters, involves a lack of willingness among humans or AI systems to begin or continue the recursive improvement, as well as deliberate efforts to halt or disrupt this process (Bales et al., 2024).

According to the results of this study, the first discussion point raises the question of how much we can rely on predictive models of AI. These models are inherently limited by being based on the hindsight of our current knowledge. Similarly, financial predictions often fall short because until an event actually occurs, there is inherent uncertainty about the outcome.

The second discussion point focuses on trend lines and the awareness of future events. When we know what will happen and this awareness is widespread, it introduces a new variable that can alter the path of the projected trend. This suggests that simple extrapolation of current trends may not be sufficient, as the awareness of future events can change the trajectory in unexpected ways.

5.5 Role of human experts in AI-based corporate foresight

As mentioned in the literature review, Fayyad and Fayyad (2023) highlight the importance of human involvement in the loop for optimal outcomes. They argue that human intervention is crucial not only for necessity but also for establishing trust in AI, ensuring its healthy evolution, and delivering more reliable solutions to real-world problems.

Spitz (2020) lends support to the notion that "as AI continues to develop, machines could become increasingly legitimate in autonomously making strategic decisions, where today humans have the edge" (p. 5). Spitz (2020) argues that a general level of intelligence is not a prerequisite for AI to surpass humans in specific strategic management domains. Given the exponential evolution of AI, including advancements in the field of artificial emotional intelligence, Spitz (2020) suggests that humans must become "agile, antifragile and anticipator (AAA)" to maintain their superiority in decision-making processes. Failure to do so may result in a shift from the traditional C-suite to an "A-suite" where AI systems assume a more prominent role in strategic decision-making (Spitz, 2020).

Foresight practitioners are required to make judgments, draw inferences through logical reasoning, and take rational actions. However, the question arises whether an AI-powered foresight practitioner should also possess emotional states, such as hate, love, anger, ambition, hope, or desire. If not, how effective would the actions of an emotionally isolated entity be within a human population? Emotional states can have an "asymmetric" impact even in today's human-centric business world, and it cannot be asserted that they have a solely positive or negative effect on project performance. For instance, in the

decision-making process, some emotions may enhance performance, while in other conditions, the outcome could be detrimental (Unal & Kilinc, 2021).

Given the asymmetric nature of emotional impact, further questions arise: Can we successfully transfer the "beneficial" emotions to AI or eliminate the "harmful" ones? Would it be better for AIs to make purely rational decisions isolated from emotions? Or should AI think and act in a "human-like" manner? Additionally, how can we ensure that AI is consciously aware, despite exhibiting intelligent behaviors? The state of consciousness is a multidisciplinary challenge and the "last enigma of humankind," closely related to the mind-body problem in philosophy (Unal & Kilinc, 2021).

This finding is consistent with the previous studies, while AI has demonstrated victories in specific domains, this does not necessarily imply that AI is completely superior to humans. The current AI systems are operating at a "narrow AI" level, lacking the broad, general capabilities possessed by humans. These narrow AI systems that have achieved victory in particular tasks do not possess the capability to cause a revolutionary transformation in social systems or a paradigm shift, which would require the development of AGI (Unal & Kilinc, 2021).

It appears that foresight practitioners will need to combine robust futures-thinking skills with increasingly sophisticated analytical tools to effectively manage their projects.

5.6 Temporal dimension

The results of this study show that the use of AI in corporate foresight projects can have both short-term and long-term impacts, and a nuanced approach is required to address these temporal dimensions.

The results of this study show that some experts caution against putting too much reliance on AI outputs, warning that this could lead to problems in the future due to incomplete knowledge and over-confidence in AI's infallibility. Furthermore, they elaborate on the risk of AI causing people to turn off parts of their brains and lose the ability to think critically and challenge answers.

Alternatively, as mentioned in the literature review, in contrast to the claims made in Section 5.3, Unal & Kilinc (2021) argue that AI has not yet achieved the capability to solve the NP problem. Therefore, they contend that AI will not be able to replace human intelligence in the near future:

The challenging issues in the field are "non-deterministic polynomial time" (NP) problems and "NP-complete" problems. These complex problems remain unsolved even after extensive processing by a Turing Machine (i.e., a computer). Researchers are tasked with overcoming these obstacles. Without such breakthroughs, discussing or forecasting the future of AI, capable of exhibiting complete human-like intelligence, is futile. Currently,

the Turing Machine cannot solve these complex problems and does not match the human brain's capabilities. The computer scientist's "toolbox" is not yet ready for an AGI revolution. Therefore, it is considered premature to expect AI to perform actions specific to humans and assume all human-centric tasks. Predictions for the feasibility of such advancements range from 50 to 150 years. (Unal & Kilinc, 2021)

Alternatively, Farrow (2020) believed that by 2038, the use of AI as an advisory or assurance service to augment leader decision-making would become a standard best practice in corporate leadership.

According to the research results, if the development of AI is controlled by the interests of an organization that is pursuing its own immediate gains, it can have destructive effects in the future. Conversely, if it is guided by the new concepts of green-blue companies, it could have good effects on society and the planet in the future.

The results of this study show that the technological foundation of foresight activities is continuously changing, with advancements in AI swiftly outpacing and making former tools and methodologies outdated. Investing in and adapting to the latest AI advancements will be essential for foresight practitioners to remain effective. This suggests that a dynamic, forward-looking approach is necessary when incorporating AI into corporate foresight practices.

6 CONCLUSION

The integration of explainable AI approaches can enhance the transparency and interpretability of hybrid predictive models, providing valuable insights into their decision-making processes. Additionally, AI offers several key benefits for corporate foresight. It facilitates data integration, automates data filtering and quality control, enhances data visualization, and transforms unstructured data into the required formats for advanced analytics.

However, the research also highlights the risks and ethical considerations surrounding AI. While academic movements have proposed ethical models, legal policies are now needed to make these considerations authoritative and inclusive for companies to follow. Regulations should be established by governments and regional or global unions to address the ethical and legal issues that arise from increasing AI-human interaction.

Furthermore, the research identifies key limitations and challenges in using AI for corporate foresight. These include the dependency on data, the inability of current AI to grapple with the complexities of real-world business scenarios, the "black box" nature of many AI algorithms, and resource-related limitations. The successful deployment of advanced AI may be limited to well-resourced organizations, and issues with the integration and adoption of language models can constrain their effectiveness.

The future trends in AI highlight both the potential for a rapid increase in optimization power and the concerns about the possibility of another "AI winter" due to excessive enthusiasm and unrealized expectations. The literature and expert opinions present three primary perspectives: the enhancement, replacement, and skeptical perspectives. These suggest that the future of AI may involve it remaining as a human assistant or potentially replacing humans in some roles.

The role of human experts in AI-based corporate foresight remains crucial. Human intervention is necessary not only for establishing trust in AI but also for ensuring its healthy evolution and delivering more reliable real-world solutions. While AI has demonstrated superiority in specific domains, it does not necessarily imply complete superiority over humans. Current AI systems operate at a "narrow" level, lacking the broad, general capabilities of the human mind. These narrow AI systems, despite their victories in particular tasks, do not possess the ability to drive revolutionary transformations or paradigm shifts, which would require the development of AGI.

The asymmetric impact of emotions on decision-making raises important questions. Can we successfully harness the "beneficial" emotions in AI while eliminating the "harmful" ones? Should AIs make purely rational decisions devoid of emotions, or should they emulate human-like emotional cognition? Additionally, the challenge of ensuring conscious awareness in AI, despite its intelligent behaviors, remains a complex, multidisciplinary problem.

While some researchers argue that AI cannot solve NP problems and replace human intelligence in the near future, others foresee AI becoming a standard advisory or assurance service for corporate leadership by 2038.

The primary objective of this study was to identify interesting patterns and themes that could have practical applications as well as linkages to previous research. Nonetheless, it is important to recognize the active role the researcher plays in detecting such patterns and themes when conducting qualitative research. The researcher's personal theoretical perspectives, values, and prior experiences inevitably shape the qualitative research process. As a result, the reliability of this thesis should be evaluated based on the transparency of the research and analysis procedures, as well as the clarity in the implementation of the chosen methodological approach (Braun & Clarke, 2006).

Several potential limitations can be identified within the current study. As Braun and Clarke (2006) note, qualitative research and thematic analysis, in particular, are inherently subject to certain constraints. While thematic analysis offers flexibility in research design and the ability to examine broader conceptual patterns within large datasets, it is susceptible to researcher bias due to the highly subjective nature of the analysis, which relies heavily on the researcher's judgment. To mitigate this limitation, the researchers report that they engaged in careful reflection on the choices made throughout the research process and followed established step-by-step research guides for the research design and coding phases (Braun & Clarke, 2006).

Another potential limitation of the study lies in the selection of interview participants. Most interviewees were either experts in the field of AI or foresight, rather than being required to have expertise in both domains. This may have resulted in a restricted range of experiences and perspectives being captured in the interview data, as the participants' knowledge and understanding were not necessarily integrated across the two relevant fields of study.

The present study opens up several promising avenues for future research on the role of AI in enhancing temporal horizons within corporate foresight. One potential area of investigation is how AI can be leveraged to expand the temporal reach of organizational planning and decision-making. Researchers could explore how AI-powered tools and techniques can enable companies to anticipate and prepare for future scenarios more effectively, extending the temporal scope of their foresight capabilities.

Another fruitful direction for future research lies in the realm of dynamic forecasting and scenario planning. Scholars could investigate how AI can contribute to more agile, real-time forecasting and scenario development, allowing organizations to continuously update their foresight models in response to changing conditions.

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APPENDIXES

Appendix 1. The original interview question in Persian

پرسش ابتدایی	ممکن است ابتدا در مورد کار/ تخصص خود به من بگویید؟ (رشته تخصص و طول مدت فعالیت حرفه‌ای در حوزه مربوط به آینده نگاری شرکتی یا هوش مصنوعی)
پرسشهای پژوهش	طبق تجربه شما، مزایای کلیدی هوش مصنوعی برای پروژه‌های آینده نگاری شرکتی چیست؟ آیا می‌توانید نمونه‌هایی از کاربردهای موفق هوش مصنوعی در پروژه‌های آینده‌نگاری شرکتی و مزایای خاصی که به‌دست آورده‌اند ارائه دهید؟ خطرات مرتبط با استفاده از هوش مصنوعی در پروژه‌های آینده نگاری شرکتی چیست و چگونه می توان این خطرات را کاهش داد؟ چه ملاحظات اخلاقی باید در هنگام استفاده از هوش مصنوعی در آینده‌نگاری شرکتی در نظر گرفته شود و چگونه می‌توان به این نگرانی‌ها پرداخت؟ آیا محدودیت‌ها یا چالش‌هایی در پیاده‌سازی هوش مصنوعی در آینده‌نگاری شرکتی وجود دارد، و چگونه متخصصان می‌توانند بر آن‌ها غلبه کنند؟ روندها و پیشرفت‌های آینده در هوش مصنوعی که احتمالاً بر پروژه‌های آینده‌نگاری شرکتی تأثیر می‌گذارد، چیست و چگونه باید برای آنها آماده شویم؟ نقش تخصص انسانی در پروژه‌های آینده نگاری شرکتی مبتنی بر هوش مصنوعی* چیست و چگونه می‌توانیم تعادل مناسبی بین قضاوت انسان و الگوریتم‌های هوش مصنوعی برقرار کنیم؟ * در این پژوهش، آینده‌نگاری شرکتی مبتنی بر هوش مصنوعی به استفاده از فناوری‌های هوش مصنوعی برای کمک به فرآیند آینده‌نگاری اشاره دارد.

Appendix 2. The Original Interview Invitation

Dear...

I trust this message finds you well. My name is Samaneh, and I am currently pursuing my thesis titled "Exploring the risks and benefits of using Artificial Intelligence in Corporate Foresight " in the FFRC department, Turku, Finland.

I reach out to you for insights related to my thesis. I am genuinely eager to benefit from your experience and gain valuable perspectives that could enhance the quality of my work.

Considering the demands on your schedule, I assure you that our discussion will be brief and focused, lasting no more than one hour. Your willingness to contribute to my research is greatly appreciated.

I would be honored to conduct the interview at a time convenient for you, either in person or through a virtual platform.

Thank you for considering my request. Your time and guidance are invaluable to me. Please let me know your availability, and we can arrange a time that suits you best.

Looking forward to the opportunity to learn from your expertise.

Best regards,
Samaneh Ebrahimabadi
Finland Futures Research Centre, University of Turku
[email]