CATÓLICA LISBON
BUSINESS & ECONOMICS

AI Adoption in Early-Stage Tech Startups: An Exploratory Study

Katharina Hagemann

Dissertation written under the supervision of
professor Filipa Lancastre.

Dissertation submitted in partial fulfilment of requirements for the MSc in Management with specialization on Impact, Entrepreneurship, and Strategy program, at the Universidade Católica Portuguesa, 01.06.2023.

Abstract

Title of Thesis: AI Adoption in Early-Stage Tech Startups: An Exploratory Study
Author: Katharina Hagemann

This study provides a comprehensive exploration of the challenges and opportunities inherent in the adoption of Artificial Intelligence (AI) in early-stage tech startups. Through in-depth qualitative interviews with 16 startup founders, the research offers both a theoretical exploration and a practical perspective on the dynamics of AI integration in this unique business environment. The study reveals, that while AI adoption can yield significant benefits such as increased productivity, enhanced decision-making, and heightened innovation, it also presents considerable hurdles including high costs, time requirements, the necessity of a skilled workforce, and extensive understanding of the technology. A critical finding of this study is the importance of robust data management and the necessity of a comprehensive alignment of business objectives and technological deployment for the effective deployment of AI. Furthermore, it introduces an adapted business model incorporating AI as a central force in new venture creation, which has the potential to proactively guide strategic decision-making and enable successful AI adoption in startups. These insights contribute to both the theoretical understanding of AI in early-stage tech startups and provide a foundation for practical application in this rapidly evolving field. Future research directions and limitations, such as the need for more practical guidance and investigation into the financial implications of early-stage AI adoption, are also outlined. This research serves as a significant step in recognizing and navigating the transformative potential of AI within the tech startup landscape.

Keywords: *Artificial Intelligence; Startup; Digital Entrepreneurship; AI adoption; Qualitative Methods*

Abstracto

Título da tese: AI Adoption in Early-Stage Tech Startups: An Exploratory Study
Autor: Katharina Hagemann

Este estudo oferece uma extensa investigação das complexidades e perspectivas associadas à incorporação da Inteligência Artificial em empresas de tecnologia em fase inicial. Aproveitando os conhecimentos adquiridos em entrevistas qualitativas com 16 fundadores de empresas em fase de arranque, a investigação fornece uma sondagem teórica e um ponto de vista aplicado sobre os meandros da assimilação da IA neste meio empresarial distinto. Descobre que, embora a adopção da IA possa trazer benefícios substanciais, como uma maior eficiência, uma melhor tomada de decisões e uma inovação ampliada, também implica desafios notáveis, como custos elevados, restrições de tempo, a necessidade de pessoal competente e um conhecimento profundo da própria tecnologia. Uma descoberta crucial desta investigação é a importância de uma gestão de dados robusta e uma estratégia de negócios de IA abrangente para a implementação bem sucedida de IA. Além disso, a investigação apresenta um modelo de negócio reformulado que coloca a IA no centro da criação de novas empresas, influenciando potencialmente a tomada de decisões estratégicas e alterando a cultura organizacional. Estas conclusões enriquecem a compreensão teórica da IA em *startups* tecnológicas e lançam as bases para uma implementação pragmática neste contexto, que se encontra em rápido desenvolvimento. De um modo geral, esta investigação constitui um passo importante no sentido de reconhecer e orientar o potencial transformador da IA no domínio das empresas em fase de arranque.

Palavras-chave: *Inteligência Artificial; Startup; Empreendedorismo Digital; Adopção de IA; Métodos Qualitativos*

Acknowledgements

Hereby, I will take the opportunity to say thank you to my Mama and Papa. Thank you for supporting me always, holding my back in every wild decision I make, or idea I have. I am beyond grateful for you and my siblings Antonia and Clemens - your unconditional love and support lift me up.

Thank you to Filipa Lancastre, for being such a dedicated supervisor. She had the necessary patience to work with me and put me back on track while my mind was wondering. Also, she was pushing me to go further, and I hope she will do continue to do so. Her smart and structured way of working and thinking, while being kind and motivating, has deeply inspired me.

Philipp, you know - I am so grateful for your constant love and support. Thank you, Olivia, Mona, and Jonas, for being my rocks, my constant companions and for making life joyful every single day. A heartful appreciation for all my insane friends here in Lisbon. I love this city, but it would not be close to what it is without you.

Finally, thank you University Católica. Life wasn't always easy here, but I have learned a lot and I am happy to have made the special experience of organising the TEDx Católica Lisbon event 2022 together with Anna Maria.

Thank you, Tinki, you made it! Cheers Lisbon, you keep me!

Table of Contents

I. Table of Figures

II. Table of Tables

III. List of Abbreviations

AI	Artificial Intelligence
ML	Machine Learning
DE	Deep Learning
DE	Digital Entrepreneurship
BM	Business Model
HR	Human Resources
RQ	Research Question
GPT	General Purpose Technology
US	United States of America

1 Introduction

The advent of digital technology has resulted in holistic transformations across all sectors of society, with Artificial Intelligence (AI) playing a pivotal role. Researchers believe that AI may be the force with the strongest potential for disrupting the business world (Borges et al., 2021; Brynjolfsson & Mcafee, 2017a; Davenport, 2018). AI's impact on entrepreneurship, particularly within the startup ecosystem, is an area of interest that needs comprehensive exploration. This research focuses on exploring the various effects of AI adoption within the startup ecosystem, being a significant element of the overarching digital transformation (Borges et al., 2021; Obschonka & Audretsch, 2020), aiming to expand theoretical understanding in this scarcely investigated area, while providing practical guidance for entrepreneurs.

The implementation of AI into startups has triggered a new wave of innovation that breaks down traditional industry boundaries and accelerates the creation, scaling, and development of new businesses (Kraus et al., 2018; Winecoff & Watkins, 2022). From tech giants to emerging startups, AI has become an indispensable catalyst for business innovation and strategic restructuring (Cockburn et al., 2018; Obschonka & Audretsch, 2020). The adoption of AI is not only changing the nature of uncertainty inherent in entrepreneurial ventures, but also shaping its processes and outcomes. Big data, resource scarcity and the need for rapid decision-making are making AI technologies increasingly indispensable for businesses today (Chalmers et al., 2021; Shams, 2018; Sreenivasan & Suresh, 2022). Yet there is a critical gap in the literature regarding the role of AI in shaping business strategies, pointing to the need for a more robust theoretical and empirical understanding of AI's potential to create internal and external business value (Davenport, 2018).

Despite the potential benefits of productivity, increased innovation, speed, and accuracy (Chalmers et al., 2021; Obschonka & Audretsch, 2020; Wright & Schultz, 2018; Young, 2022), the rise of AI also introduces significant challenges. Given the accessibility of AI, competition within the startup ecosystem is increasing, requiring companies to continuously innovate to maintain their competitive advantage (Choudhury et al., 2020; Giuggioli & Pellegrini, 2022). At the same time, the use of AI brings new complexities. Startups have to deal with issues such as data privacy and security and the need for skilled personnel to manage and interpret AI systems (Wright & Schultz, 2018). The increasing dependence on AI also raises concerns about transparency and the ethical implications of AI-driven decisions (Borges et al.,

2021; Kraus et al., 2018; Sreenivasan & Suresh, 2022). The transformative potential of AI in the startup ecosystem is undeniable, but the unique challenges of adopting AI and the mechanisms employed by startups to leverage these challenges into opportunities remain underexplored (Borges et al., 2021; Chalmers et al., 2021; Di Bernardo et al., 2021; Sreenivasan & Suresh, 2022). This lack of comprehensive understanding represents a significant gap in current research, particularly considering the rapidly evolving AI landscape and its profound impact on early-stage tech startups (Borges et al., 2021; Nambisan et al., 2019). Research on the impact of AI on startups has often been limited to specific disciplines (Lakshmi & Corbett, 2020), with little attention to the concrete challenges and prospects that entrepreneurs overall face when founding an AI startup. Therefore, an all-encompassing perspective that connects multiple disciplines is crucial to fully grasp the nuances of integrating AI into startups. Furthermore, an understanding of the interorganisational dynamics that these companies face is essential for the formulation of effective strategic AI practices (Winecoff & Watkins, 2022).

Given the lack of research on the intersection of AI and entrepreneurship (Obschonka & Audretsch, 2020) this exploratory, qualitative study aspires to fill this gap by answering the following RQs:

1. What challenges do early-stage tech startups face when adopting AI, and how do they overcome them?
2. How do early-stage tech startups use the introduction of AI technology to create new opportunities and competitive advantages?

In this regard, the purpose of this research is to perform a comprehensive investigation of the impact of challenges and opportunities on AI on early-stage startups, to contribute to the literature on entrepreneurship, and to provide valuable insights for founders in this rapidly evolving digital economy.

Answering the RQs requires a clear and logical structure. Thus, this research is organised into six major chapters, each providing a sequential and interconnected insight into the topic of AI in early-stage tech startups.

The introduction aimed to explain the significance and relevance of AI's impact in startups and state the research purpose. This is followed by **Chapter 2** - *Literature Review*, which provides a critical understanding and theoretical foundation of the topic and enables the reader to situate the relevancy and outcomes of this examination.

Chapter 3 - *Methods,* elucidates the methodological underpinnings of the study. It explains the reasons for selecting a qualitative research approach and outlines the procedures for data collection and analysis.

Thereafter, **Chapter 4** - *Findings*, presents the results derived from the data analysis by presenting an extensive table, offering a data-driven understanding of the RQs, as well as a short textual elaboration on the findings.

This leads into **Chapter 5** - *Discussion*, where the findings are interpreted in the context of the existing literature to answer the research question and highlight the theoretical contributions. Moreover, a framework is presented to support allocating the findings and deriving practical implications. The chapter also addresses the limitations of the study and suggests avenues for future research.

Finally, **Chapter 6** – *Conclusion,* provides a summative reflection on the study's key insights, their implications, and the contribution of the research to the wider academic discourse on AI in early-stage tech startups.

2 Literature Review

The literature presented refers to cited papers from well-ranked literature reviews that were found using the search engines *Google Scholar*, *Semantic Scholar*, and *Springer Link*, and introducing keywords such as 'Digital Entrepreneurship', 'Artificial Intelligence', 'Startups'. Emphasis was placed on the publications that already linked the topics of AI and Entrepreneurship. Considering the scarce amount of research on AI adoption in startups, no restriction was made on the geographical location of the mentioned studies.

2.1 Artificial Intelligence

In 1956, John McCarthy coined the term Artificial Intelligence, defining AI as the science and engineering of creating intelligent machines (McCarthy, 1959). The author was referring to the findings of the *Turing Test*, an experiment that was conducted by Alan Turing eight years before, with the intention to investigate the question 'can machines think?' (Shapiro, 1992; Turing, 1950). Turing examined computer intelligence, claiming that "[w]hat we want is a machine that can learn from experience" (Turing, 1950, p. 123). The *Turing Test* measures the ability of a machine to perform intelligent behaviour that is indistinguishable from that of a human. The test involves a human investigator having a conversation in natural language with another human and a machine. If the investigator is unable to distinguish between the human and machine responses, the machine has passed the *Turing Test*. In other words, it is a way to test whether a machine can mimic human intelligence and behaviour (Borges et al., 2021; Shapiro, 1992). Ever since, AI is known as a technology that allows machines to act intelligently by using large amounts of data and learning from it with the help of human-programmed algorithms (Russell & Norvig, 2010; Taddy, 2018).

AI is a key force driving the fourth industrial revolution. The technology is affecting everything by merging physical, digital, and biological worlds, and in particular transforming business, industry, and even the way we live and act as humans (Chalmers et al., 2021; Schwab, 2017). This industrial revolution, characterised by new technologies and cyber-physical systems and driven by innovation, is fundamentally different from previous ones, in that it involves much faster transformation (Dikshit et al., 2021; Schwab, 2017). The rapid expansion of AI, as part of this transformation, carries both great potential and considerable risks (Schwab, 2017; Taddy, 2018). On the one hand, modern technology, such as AI, is enabling the interconnection of millions of people and improving the efficiency of various systems

significantly. Among others, notable advances include speech recognition (Hinton et al., 2012), increased accuracy in the medical industry (Hosny et al., 2018; Young, 2022), and the development of self-driving vehicles (Farabet et al., 2012).

Moreover, recent studies suggest that human-created AI technologies and Machine Learning (ML) are already outperforming human intelligence in analysing complex problems. These advancements have shown great potential in areas such as long-term forecasting, data analysis, and strategy formulation, surpassing human expertise at an exponential rate (Campbell et al., 2002; Kurzweil, 2022; Sætra, 2020; Schwab, 2017). As a result, AI technologies may eventually be able to replace human labor in these areas.

This progressive technology has evolved into a highly investigated research field in which has been predominantly examined from two different perspectives (e.g. Borges et al., 2021; Nilsson, 2009; Russell & Norvig, 2010): The human-centered approaches (Bellman, 1978; Haugeland, 1989; Kurzweil, 1990) and the rationalist approaches (Charniak & McDermott, 1985; Schalkoff, 1990; Winston, 1970). First, the human-centered approach includes observations and hypotheses about human behavior. Bellman (1978) describes this approach as "[the automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning." (1978, p. 1978). Second, the rationalist approach considers a synthesis of mathematics and engineering. Scholars within this perspective focus on the study of mental faculties through the use of computational models (Borges et al., 2021; Charniak & McDermott, 1985).

This thesis explores the impact of AI and ML on digital entrepreneurship (DE) and will build on the common definition of AI provided by Kaplan & Haenlein (2019), who define AI as "the ability of a system to correctly interpret external data, learn from that data, and use those insights to achieve specific goals and tasks through flexible adaptation" (Haenlein & Kaplan, 2019, p. 5). In their much-cited work, the authors have summarised several articles that present a variety of perspectives on AI provided by world-leading experts and specialists in the AI field, which confers credibility and validity to their definition. Further, since AI systems have no pre-programmed instructions, these technologies are able to "take in human-level knowledge (e.g., through machine reading and computer vision) and use that information to automate and speed up tasks that were previously performed only by humans" (Taddy, 2018, p. 62).

Although the field of AI has been widely researched, the utilisation, applications, and capabilities of the technology have not yet been fully explored. The following chapter explains the underlying technological aspects.

2.1.1 Technological Background

In the following section, the underlying technology of AI is briefly explained to create a general understanding of the function of the technology and to frame the results of this study in the appropriate context. The technical background is incredibly large and complex. In this dissertation, the focus will be on only necessary terms for the management context. Technology of AI processes is characterised by the ability to structure large amounts of data into thematic patterns by using algorithms written out of simple "if-then" conditions (Taddy, 2018; Wilson & Daugherty, 2018). How accurately an AI works depends on the set of conditions that are provided by a human (Wilson & Daugherty, 2018). The umbrella term AI can be classified as narrow or strong. Narrow AI, which is the most prevalent form of AI, refers to technology designed and trained for a specific task or set of tasks. Such technology can perform the specific tasks it was designed for with high accuracy and efficiency. However, narrow AI lacks the general intelligence and adaptability of a human. Examples of narrow AI are language translation or image recognition in smart products, such as Siri, Netflix recommendation system, or self-driving cars (Dahlqvist & Pivén, 2020; Wilson & Daugherty, 2018). In contrast, strong AI aims to replicate human-level intelligence and cognitive abilities, including rational thinking and problem-solving possibilities. These AI systems can perform any task that a human can do and can adapt to new situations and tasks with human-like intelligence (Russell & Norvig, 2010). However, creating a strong AI system is still a long-term goal of AI research and development, and such a system has not yet been achieved (Taddy, 2018; Wilson & Daugherty, 2018).

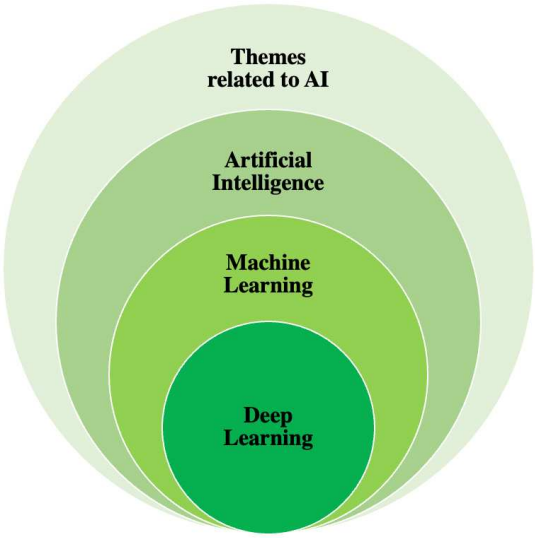

Figure 1 – Relationship between AI, ML, and DL. Source: Own Illustration.

Further, presented in *Figure 1*, the field of AI can be separated in three main areas, namely "Artificial Intelligence", ''Machine Learning", and ''Deep Learning" (Borges et al., 2021; Chalmers et al., 2021; Dahlqvist & Pivén, 2020). While being deeply intercorrelated, there are significant differences in how these systems operate and how tools or combinations of tools are used to provide machines with intelligence (Taddy, 2018). In this thesis the terms will be used interchangeably and summarised under the umbrella term AI technology, because

the differences are on the technical side which is less relevant for the exploration of the organisational environment and managerial implications of startups studied in this thesis.

ML is a subset of AI that deals with the development of algorithms that can learn from data without being explicitly programmed by a human (Brynjolfsson & Mcafee, 2017a; Murphy, 2012). The ability to generate models automatically enables ML algorithms to better analyse large volumes of data in order to identify patterns and relationships and use this information to make bias-free predictions or decisions (Borges et al., 2021; Goodfellow et al., 2016; Murphy, 2012; Taddy, 2018).

Deep Learning (DL) is a subfield of ML that focuses on the development of neural networks. It is composed by a set of algorithms designed to mimic the structure and function of the human brain (LeCun et al., 2015). Deep neural networks may consist of multiple layers, allowing these layers to learn complex features and relationships in data. They are commonly trained with very large datasets and require significant processing resources. DL has been successfully used in a variety of applications, including natural language processing, computer vision, and autonomous driving (Goodfellow et al., 2016; LeCun et al., 2015).

AI technologies belong to the category of General Purpose Technologies (GPT). GPTs differ from other technologies in their broad applicability and transformative impact across multiple industries and sectors (Brynjolfsson & Mcafee, 2017a). Unlike narrow technologies that rather serve limited purposes, GPTs have the potential to revolutionise various fields, thus build a foundation for innovation and drive significant economic and societal changes (Brynjolfsson & Mcafee, 2017a). AI technologies are characterised by a profound and broad impact on multiple industries and sectors of the economy and are often associated with waves of innovation and growth, as they spur the development of new products, services, and industries (Brynjolfsson & Mcafee, 2017a). The next section outlines AI's disruptive influence on business operations.

2.1.2 Business Applications

AI is rapidly transforming the way companies do business by enabling them to automate tasks, enhance decision-making, and improve operational efficiency (Di Bernardo et al., 2021; Wilson & Daugherty, 2018; Winecoff & Watkins, 2022). The previously described AI technologies are increasingly adopted by organisations of all sizes and industries to drive innovation and gain a competitive edge (Borges et al., 2021; Wang et al., 2022; Wilson & Daugherty, 2018). Indeed, a study carried out by Accenture prognosed that AI will be a main

driver to gain and secure the competitive advantage of companies and moreover, that AI has the potential to double annual economic growth rates by the year 2035 (Daugherty & Purdy, 2016).

The use of AI in business operations dates back to the 1980s, when companies implemented the technology to adopt computer vision systems, robots, as well as software and hardware for these applications (Russell & Norvig, 2010). In recent years, there has been a strong boost in the development and implementation of AI in organisations (Alsheibani et al., 2019; Borges et al., 2021), which can be attributed to three key factors: The availability of big data, the advances of algorithms that enable better analysis and decision making, and significant improvements in computer hardware (Brynjolfsson & Mcafee, 2017a).

One major benefit of AI in companies is the ability to automate repetitive and routine tasks (Winecoff & Watkins, 2022). For example, AI-powered chatbots are automating customer service, allowing employees to rather focus on effective customer communications (Chung et al., 2020). Similarly, AI-powered software can automate data entry, processing, and analysis, supporting companies in their decision-making processes (Di Bernardo et al., 2021; Wilson & Daugherty, 2018). These beneficial capabilities of AI, particularly speed, scalability, and quantitative potential, can greatly augment the abilities of human workers, which result in high-quality outcomes that are both more efficient and effective (Bessen et al., 2018; Winecoff & Watkins, 2022). Conversely, this superior work of AI raises reasonable fears by many researchers, that AI will eventually replace human labor across the economy (Borges et al., 2021; Boyd & Crawford, 2012; Frey & Osborne, 2017; Nosek et al., 2015; Obschonka & Audretsch, 2020; Wilson & Daugherty, 2018; Winecoff & Watkins, 2022; Wright & Schultz, 2018). A study by Grace et. al (2018) predicts with a probability of 50%, that AI will outperform all human tasks in the next 45 years and in 120 years every job will be fully automated (Grace et al., 2018). Similar Frey and Osborne (2017) forecast that nearly half of the jobs in the United States will be threatened by automation in the next ten years. This disrupting effect on the labor market is coming along with ethical challenges, such as issues of privacy protection, and the accessibility of big data, pressuring businesses to define ethical standards and transparency (Boyd & Crawford, 2012; Nosek et al., 2015; Obschonka & Audretsch, 2020; Wright & Schultz, 2018). According to Andrews (2017), the development of a well-designed, holistic AI strategy is considered one of the most important determinants for the successful implementation of the technology, as the use of AI has many potentials, but can also bring some significant drawbacks (Andrews, 2017; Wright & Schultz, 2018).

2.2 Entrepreneurship

In this study the focus will be on entrepreneurs and their startups since this is a less explored business context in the research field of AI adoption (Barot, 2015). Moreover, entrepreneurship holds a pivotal stake in modern economy, being responsible for pioneering initiatives and startups that enable sustainable economic development (Ferreira et al., 2015; Obschonka & Audretsch, 2020).

To provide a context for this research, it is necessary to understand the well-studied field of entrepreneurship (Bull & Willard, 1993; Drucker, 1986; Gartner, 1985). While Bull and Willard (1993) claim that entrepreneurship research fails to find a meaningful definition of its term, Drucker (1986) states, that entrepreneurship is an invention that gives existing resources a new potential to create wealth. According to Gartner (1985) the process of new venture creation requires four components: (1) the individual(s), who drive the process as entrepreneurs, (2) the organisation created, (3) the ongoing process, and (4) the environment in which the process takes place and in which the individual(s) and the organisation operate. These four essential elements represent the process of new venture creation and, by extension, entrepreneurship (Gartner, 1985).

The terms 'entrepreneur' and 'founder' are used interchangeably hereafter, as the latter is commonly used and refers to the act of founding an organisation. Entrepreneurs are characterised as both the catalysts of new ideas and the leaders who put those ideas into practice (Baumol, 1968). According to Schumpeter (1965), entrepreneurs use organisational or technological innovations to exploit market opportunities. Thus, entrepreneurs discover and create numerous business opportunities, because their explicit intention of overcoming the complexity of the prevailing business environments results in the development of products and services that meet the current market demand (Ferreira et al., 2015; Gartner, 1985; Schumpeter, 1965). Researchers argue that in addition to creating startups, entrepreneurs also perform a vital role in the revitalisation of existing businesses by contributing innovations and creating new products and services (Ferreira et al., 2015; Zhang & Van Burg, 2020). The benefits of entrepreneurship, demonstrated for example in easier adaptation and agile response to unpredictable or new market changes, have transformed startups into the leaders in the development and adoption of digital technologies such as AI, ML and DL (Agrawal et al., 2017; Iansiti & Lakhani, 2020). This development also brought up a new stream of research in the entrepreneurial field which is the summarised as Digital Entrepreneurship (DE). DE represents a subset of traditional entrepreneurship, as it involves entrepreneurial activities that occur within a digital environment (Antonizzi & Smuts, 2020). DE expands the scope of traditional

entrepreneurship by leveraging the technological dimension to identify, launch, and scale ventures in the digital space (Giones & Brem, 2017; Shen et al., 2018).

2.2.1 Digital Entrepreneurship

DE focuses on the integration of digital technologies and strategies into the entrepreneurial process (Elia et al., 2020; Nambisan, 2017). While physical elements play a central role in traditional businesses, in DE these physical components are transformed and digitised, making DE a subcategory of its own within the broader field of entrepreneurship (Hull et al., 2007; Le Dinh et al., 2018). Nambisan (2017) highlights the importance of studying DE as a distinct research area of entrepreneurship, because digital progress increasingly challenges and reshapes the traditional startup ecosystem. Understanding the profound impact and transformative potential of digital technologies in entrepreneurial practice is necessary to create valid theories, concepts, and constructs (Nambisan, 2017).

The previous decade's incredible development of digital technologies across AI and digital infrastructures, has enhanced the fundamental shift in the startup and innovation industry towards DE (Nambisan et al., 2019; Obschonka & Audretsch, 2020). The demand for rapid and disruptive change of established BM's (BM) has left large companies barely able to keep up, giving startups a central role in implementing and harnessing the potential of these innovations (Elia et al., 2020; Kraus et al., 2018; Nambisan et al., 2019). In a study, Steininger (2019) explored the impact of digital technologies on organisational innovation and found that they are manifold, as they can serve as facilitators, mediators or outcomes of entrepreneurial activities or the entire BM. Another study on innovation is the knowledge-spillover-based strategic entrepreneurship theory (Cetindamar et al., 2020; Ferreira et al., 2017; Kraus et al., 2018). The theory highlights the central role of entrepreneurs in the shift towards a digitised business environment. Knowledge spillovers are specifically useful in the entrepreneurial setting because these spillovers provide entrepreneurs with access to valuable knowledge and resources that entrepreneurs may not have access to otherwise, enabling young founders to identify new opportunities and develop innovative solutions to problems (Ferreira et al., 2017). Moreover, entrepreneurs can strategically leverage knowledge spillovers to gain a competitive advantage in the marketplace and improve their chances of success when starting a new business (Caldera et al., 2019).

The increasing number of digital startups has stimulated a wave of research on this topic, partly because DE represents a new field of research and partly because it is a vital pillar

for digital economic (Shen et al., 2018). Hull et al. (2007) studied the difference of launching a traditional business versus launching a digital venture. According to these scholars, DE can be categorised into *mild*, *moderate*, and *extreme* versions that reflect the degree of digitalisation within the BM, in which *extreme* refers to a fully digitised enterprise. Overall, digital entrepreneurs can broadly benefit from the opportunities that technology offers by leveraging significant advantages in speed, reliability, consistency, extensibility, and cost savings (Sreenivasan & Suresh, 2022). DE fosters open innovation networks and communities that are in a position to create value and benefits that go beyond those of a single company or a single market transaction (Chesbrough et al., 2014; Möller & Rajala, 2007). In contrast, with regard to intelligent ML and the adoption of AI, research "has not shown a clear link between [extremely high] intelligence and entrepreneurship" (Obschonka & Audretsch, 2020, p. 6). However, entrepreneurship requires a combination of analytical, creative and practical aspects of intelligence to be successful and generate a competitive advantage (Attaran & Deb, 2018; Obschonka & Audretsch, 2020). This multi-layered correlation between competitive advantage and DE is addressed in the next chapter.

2.2.2 Competitive Advantage in Digital Entrepreneurship

Michael Porter is one leading researcher in the field of strategic management by extensively investigating competitiveness in the business world (Porter, 1980). Porter (1980) defines competitive advantage as the unique, firm-specific advantage a company has over its competitors by offering better, cheaper, and more valuable services (Porter, 1980).

Porter (1980) proposes that a company can strategically outperform its competitors by selecting a primary strategy and coordinating all business operations to align with that chosen strategy (Porter, 1980). Firms have the option to adopt *Cost Leadership*, *Differentiation*, and *Focus* as their central strategy. Comprehending these strategic options can guide digital entrepreneurs in grasping the concept of competitive advantage and its underlying principles, as these strategies continue to play a crucial role in achieving business success (Ismail et al., 2017; Jones & Tilley, 2003; Porter, 1980).

A startup has to act strategically smart and focused to exceed its competition and increase customer perceptions of value and quality, for example by strategically leveraging knowledge spillovers (Attaran & Deb, 2018; Ferreira et al., 2017). Another important element in achieving a competitive advantage is brand loyalty, which results from customers' preference for unique products or services (Awamleh & Bustami, 2022). The ability to create and maintain

strategic competitive advantage varies with the business environment, and it is crucial for startups to deploy their resources effectively to achieve it (Awamleh & Bustami, 2022). Joseph Schumpeter (1934) argued that entrepreneurs, often in the form of startups, can also disrupt markets through innovation, creating a form of competition known as *creative destruction* (Schumpeter, 1934). This can create a first-mover advantage that is enabling innovative startups to dominate new markets ahead of others. However, the relentless innovation cycle means that this advantage can only be temporary as new innovators arise (Schumpeter, 1934). Similarly, Richard D'Aveni (2010) introduced the concept of *hypercompetition* into the extensive research around competitive advantage. This concept describes the highly dynamic state of intense competition in which advantages quickly fade and market stability is constantly disrupted due to rapid and aggressive strategic actions by competitors (D'Aveni, 2010). *Hypercompetition* arises from rapid market changes and permanent innovation, which lead to temporary rather than sustainable competitive advantages (D'Aveni, 2010).

Bessen et al. (2018) identified multiple factors that could make it challenging for startups to compete with technologies, such as high data amounts, hardware and software access, and data privacy issues. However, the study shows that these factors are not necessarily entry barriers for startups in many markets, although they might hamper market entry. According to Barney (1991) achieving superior performance compared to direct competitors is a competitive advantage and to achieve this in a sustainable manner, a company must possess resources and capabilities that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Having rare and inimitable resources seems to be increasingly challenging in the field of DE, since intelligent technologies, such as AI and ML, are able to replicate complex, process-dependent operations almost immediately (Awamleh & Bustami, 2022; Bessen et al., 2018). Therefore, it is essential for digital entrepreneurs to constantly assess evolving opportunities to maintain their competitive advantage as they innovate and generate economic value for customers while reducing operational costs (Phangestu et al., 2020).

At the same time, digital entrepreneur's must be careful not to focus only on new technological innovations, but also on the needs of their customers and how to accurately position themselves in the market (Nambisan et al., 2019). Following the significant changes caused by the numerous technological advances and increasing competitive pressures in the DE landscape, entrepreneurs, investors and strategists are increasingly striving to leverage AI as a means to discover new valuable sources of business and develop innovative strategies (Jakšič & Marinč, 2018). Lee et al. (2019) note that the successful utilisation of AI has the potential to change the global competitive landscape through transformative BM's and processes (Lee et

al., 2019). Similarly, a study by Accenture predicts that AI will be a major factor in gaining and sustaining competitive advantage for companies, in addition to having the potential to double annual economic growth rates by 2035 (Daugherty & Purdy, 2016).

Waltzmann (2020) found that tech startups will need "large numbers of highly trained engineers", to preserve competitive edge in AI development and application (Waltzman et al., 2020, p. 23). Ultimately, having a competitive advantage is significant for startups as it leads to business survival and sustainability (Zaridis, 2009).

2.2.3 Artificial Intelligence in Digital Entrepreneurship

Research on the intersection of digital entrepreneurship and AI is still quite limited., Literature conducted so far is mainly based on anecdotal case studies (Di Bernardo et al., 2021; Marr, 2019; Pfau & Rimpp, 2021), within the healthcare industry startups (Garbuio & Lin, 2019; Iliashenko et al., 2019; Young, 2022) or the financial startup environment (Almansour, 2023; Ashta & Herrmann, 2021; Jakšič & Marinč, 2018). However, the majority of these studies point out that AI technologies can be an effective, useful, and a powerful engine for innovative new ventures (Di Bernardo et al., 2021). Since AI is no longer a futuristic innovation and has become more easily accessible, digital entrepreneurs can leverage AI in many ways to unlock entirely novel business opportunities (Giuggioli & Pellegrini, 2022; Obschonka & Audretsch, 2020; Winecoff & Watkins, 2022). Thereby, research highlights a strong potential of AI in favor of startups (Agrawal et al., 2017; Ferreira et al., 2017; Iansiti & Lakhani, 2020). Entrepreneurs have the ability to experiment as a micro-level mechanism to develop, expand, and diffuse new technologies and innovations both in the marketplace and through technical experimentation (Lindholm-Dahlstrand et al., 2019; Quan & Sanderson, 2018). Hence, Lindholm-Dahlstrand et al. (2019) consider experimentation as a key function of entrepreneurship that contributes to the accumulation of knowledge in specific technologies and business areas. Also the previous introduced *knowledge-spillover-based* theory emphasises the special role that entrepreneurship holds when it comes to the adoption of new technologies in the economy (Ferreira et al., 2017). The adoption of AI is leading to the biggest entrepreneurial opportunity in history, as AI not only boosts the performance of AI-driven startups, but also puts emerging ventures in an inspiring position for traditional companies to incorporate AI-based solutions into their BM's (Iansiti & Lakhani, 2020).

The tech startup environment is heterogeneous in form, function, and purpose. Accordingly, Chalmers et al. (2021) found three different ways in which AI can be used by

entrepreneurs to improve information search and idea production. The first approach involves using AI to search for technical solutions across complex combinatorial problem spaces, particularly for science and technology-focused startups. (LeCun et al., 2015). The second approach utilises social sentiment analysis and natural language processing to analyse social media and other online content to identify customer needs. AI-augmented approaches have the scope to identify needs or market failures at significant scale and can offer new insights that drive business development. (Davidsson et al., 2020). The third approach involves using AI systems to test assumptions with a high level of confidence, using existing data assets to predict how customers react to a feature or pricing change. (Chalmers et al., 2021)

The availability of AI technologies at relatively affordable costs has had an exponential impact on the development of entrepreneurship and is causing a rapidly growing market for AI-driven ventures (Di Bernardo et al., 2021; Giuggioli & Pellegrini, 2022). In 2022, investments in AI startups reached a record high of $65 billion globally, increasing from $26.6 billion in 2019 (*The generative AI Landscape: Top Startups, Venture Capital Firms, and More*, 2023). These investments are driving innovative disruption in new industries and creating new opportunities due to the increasing importance of AI to the value proposition of startups (*The generative AI Landscape: Top Startups, Venture Capital Firms, and More*, 2023). While it is likely that AI is currently a hype, supported by the finding that new ventures defining themselves as AI startups, secure between 15% to 50% more funding than technology-based new ventures (Olson, 2019), there are also reliable research studies showing that AI startups promise significant benefits in terms of increased speed, reliability, productivity, scalability, and cost savings (Agrawal et al., 2017; Bessen et al., 2018; Cetindamar et al., 2020; Di Bernardo et al., 2021; Sreenivasan & Suresh, 2022; Winecoff & Watkins, 2022). However, these performance indicators attributed to AI implementation in startups, can also lead to significant stress for founders. A study found that the expectations placed on new AI technologies are unrealistically high and therefore put a lot of pressure on entrepreneurs, especially when external stakeholders lack technological knowledge (Winecoff & Watkins, 2022). Furthermore, scalability is a crucial feature of viable BM's in tech startups (Thiel et al., 2017). Scalability can be considered innate, since the technology of AI-based processes is built on vast amounts of data and therefore naturally entails high scalability, which is reinforcing the statement that AI has a disruptive effect on both startups and their products or services (Bock et al., 2020; Thiel et al., 2017). This is also supported by Di Bernardo et al. (2021), arguing that the performance-enhancing effect of AI is unleashed through innovation and new BM's.

Moreover, the organisational structures and processes of startups are affected by AI adoption. Entrepreneurs benefit from using AI techniques to improve their decision-making systems, which is increasing the effectiveness and efficiency of their decisions, ultimately accelerating their operational performance (Kraus et al., 2018). For example, Frey and Osborne (2017) forecast that nearly half of the jobs in the United States of America (US) will be threatened by automation in the next ten years. However, if that prediction would be accurate, significant job loss could be associated with the advent of AI. However, a study from Bessen et al. (2018) on startups found the opposite. Startups' commercial AI applications focus on enhancing human abilities rather than substituting them (Wilson & Daugherty, 2018). While rather repetitive jobs, such as services, office work and manual tasks are declining, the demand for employees in the areas of management, professional staff, and distribution and marketing is increasing (Bessen et al., 2018; Wilson & Daugherty, 2018).

Indeed, startups face institutional and inter-organisational pressures when it comes to AI integration (Sreenivasan & Suresh, 2022; Winecoff & Watkins, 2022). Hence, there is a major demand to holistically explore the potentials and challenges of strategic AI adoption in tech startups which is executed in this research.

3 Methods

This section presents the qualitative, exploratory methodology used in this study, with an emphasis on expert interviews. The aim of this research is to gain insights into the challenges and opportunities of AI adoption, that founders of early-stage tech startups face and understand how they can leverage potentials to overcome the challenges. Therefore, the applied methodology is designed to enable an in-depth exploration of the founder's knowledge and expertise. Further, the methods used to select, recruit and conduct interviews with these experts, as well as the analytical approach used to analyse the resulting data, are described extensively.

3.1 Choosing qualitative research

Qualitative Research

The selection of an empirical method depends on the research objective (Saunders et al., 2016). This typically involves choosing between quantitative, qualitative, or a mixed-method approach (Saunders et al., 2016). For this study, a qualitative research approach was employed for its emphasis on understanding human behaviour and experience through non-numerical data analysis (Saunders et al., 2016; Yin, 2009). Silverman (2015) describes qualitative research as having "a unique ability to focus on how people construct their behaviour in naturally occurring situations" (2015, p. 40), as opposed to just testing isolated hypotheses (Meuser & Nagel, 2009; Saunders et al., 2016). Qualitative research is usually employed to explore complex phenomena like social and cultural issues, individual experiences, and subjective perceptions (Flick, 2014). Unlike quantitative research that produces generalisable statistical outcomes, qualitative research delivers detailed, in-depth insights into the research subject (Gläser & Laudel, 2010; Kaiser, 2014; Meuser & Nagel, 1991). Thus, to maximise the potential of organisational studies in describing, explaining, and predicting, the identification of relevant concepts for theory building and construct development is crucial (Gioia et al., 2013). Acknowledging this importance of concept identification, this study notes that there is scant literature specifically addressing the interface between AI adoption in startups, a gap that is partly due to the rapid advances in AI technology. This research scarcity has led to a predominance of subjective perspectives. Thus, the qualitative research approach used here aims to describe, interpret, and understand relationships among existing concepts, and to develop classifications for deeper insight generation (Flick, 2014; Kaiser, 2014). With an exploratory nature, this study seeks to offer new insights into the impacts of AI adoption on

early-stage tech startups, and how founders can harness AI's potential while addressing its associated challenges (Saunders et al., 2016).

Expert Interviews

In this study, data was collected through conducting expert interviews with a sample of 16 experts. According to Meuser and Nagel (2009), expert interviews involve conducting a qualitative interview based on a thematic guide, which focuses on the knowledge of an expert's specific topic area. Criteria for identifying experts, the definition of expert knowledge, and considerations for recognising good or bad experts are controversially debated in academia (Gläser & Laudel, 2010). Nevertheless, expert interviews are recognised as primary data collection method in qualitative social research.

In general, qualitative interviews are a data collection method that focuses on the relevance of exploring interviewees' experiences and perspectives in order to gain a deeper understanding of social reality (Flick, 2014; Gläser & Laudel, 2010). Expert interviews enable researchers to access in-depth and precise data on complex phenomena, such as the marginalized groups' experiences or industry perspectives, as these individual perceptions significantly shape social practices within various fields of action (Meuser & Nagel, 2002). In this study, there is a need for a broader understanding of the founder's perception that goes beyond technical data and sheds light on the implicit dimension of their knowledge and decisions. Discovering the 'insider knowledge' of the individual experiences of the entrepreneurs was crucial to understand how they are handling the challenges and potentials that AI adoption is bringing along (Doeringer, 2020; Flick, 2014).

Semi-structured Interviews

The expert interviews are conducted following a semi-structured interview guide. The semi-structured approach allows the researcher to understand the how and the what of this exploratory approach and thus is congruent with the RQ (Saunders et al., 2016). Although there is a set of predefined questions, the semi-structured interview allows for the interviewer and interviewee to deepen a specific topic with further questions that they find worth pursuing (Gioia et al., 2013; Kaiser, 2014). The interview protocol is a list of questions which has been created based on the literature review and the objective of answering the RQ. Collecting primary data through semi-structured interviews has the benefits of being comparable but also very specific and insightful due to the flexibility to go in depth with newly raised aspects that give the interviewees the chance to explain or build on responses (Gioia et al., 2013; Saunders

et al., 2016). Thus, even the small sized sample of this study can provide valuable data to understand the AI-influenced startup industry (Kaiser, 2014).

On the opposite side, semi-structured interviews also include disadvantages. One critique is that the generated findings have a low level of reliability and generalisability (Diekmann, 2002; Jackson et al., 2015; Saunders et al., 2016). Exploratory studies, however, do not focus on creating precisely repeatable research, they rather aim to capture real-world phenomena at a specific time and location (Diekmann, 2002).

3.2 Data collection process

Sampling Strategy

The sample was selected using a non-probability sampling technique. This sampling technique is based on subjective judgments of the researcher and not on random selection (Wolf et al., 2016). The less stringent method is characterised by a simple and quick way of collecting data. Hence, it is suitable and often used in exploratory research (Baker et al., 2013). Within non-probability sampling methods, different variations exist (Wolf et al., 2016). In this dissertation, the methods of convenience sampling and snowball sampling were applied. Convenience sampling is characterised by the availability of and accessibility to the participants. Given the relatively restricted timeline for this study, the researcher's fertile network was used to find suitable experts who are available to be an interview partner. Although this method does not represent the entire population, it is commonly used in the context of non-probability sampling (Baker et al., 2013; Saunders et al., 2016). The initial sample was expanded by using the snowball method. In this method, the interviewed individuals were asked for recommendations of other potential participants suitable for the study.

To find the expertise required to answer the RQ, all selected experts had to fulfil the following three criteria: (1) they should be the founder or co-founder of a digital startup; (2) they should work in a startup with AI as part of their BM; and (3) they should work at a startup that had not had a Series A[1] funding. The first criterion was chosen because, in early-stage startups, the founders and co-founders are the potentially the only decision-makers involved in all decisions. Therefore, they can provide very deep insights into the decision-making processes, which is the goal of explorative expert interviews. Secondly, inherent from the RQ, the startups must be AI-focused. To explore the business environment and strategic

[1] Series A funding is an early-stage investment round in which a company receives its first significant funding from external investors in exchange for a percentage of equity ownership.

entrepreneurial implications, the focus was on startups that have integrated AI into their BM. Finally, the purpose of the last criterion is to improve comparability and to explore a very dynamic phase of the startups. In this early stage, agility and openness allow fast decision-making and rapid integration of new developments, such as AI technologies. In general, all criteria are chosen to contribute towards closing the research gap and answering the RQs.

Identification of Experts

The identification of the experts fulfilling the above-mentioned criteria is not easy, due the scarce information about early-stage startups, neither about their existence, nor about their BM. Hence, a tech startup accelerator program was the source of the contacts through a tight connection, that was making introductions to valuable contacts. From an initial list of 17 startups, four did not meet all three criteria and three founders where not available for an interview. After each of the ten interviews conducted, the interviewees were asked if they knew other founders that they could refer, fitting my sample criteria. Seven new recommendations were collected, of which three gave a positive answer for an interview. In addition, the personal network was explored, leveraging connections from former employers and educational institutions. Through this method, three additional interview partners were found. These 16 stimulating interviews have covered many areas of RQ. While some parts of the interview were indicating theoretical saturation through repetitive and very alike statements, other interview topics could have benefited from further interviews and information (Saunders et al., 2016). However, this was not done due to the time limitations.

ID	Job Position of Expert	Age of startup	No. of employees
S1	Co-Founder	1 year	4
S2	Co-Founder	1,5 years	2
S3	Founder	2,25 years	16
S4	Founder	2 years	12
S5	Founder & CTO	1,2 years	9
S6	Co-Founder & CEO	3,25 years	8
S7	Co-Founder	3,5 years	22
S8	Founder	6 months	2
S9	Co-Founder & Advisor	8 months	3
S10	Co-Founder & CTO	3,25 years	8
S11	Founder	2,5 years	12
S12	Co-Founder & CEO	9 months	6
S13	Co-Founder & Managing Director	1 year	4
S14	Founder	2 years	10
S15	Founder & Managing Director	1,75 years	5
S16	Founder	4 months	1

Table 1 – Overview of Experts.
Source: Own illustration; data provided by founders.

Interview Protocol and Process

After specifying the research topic of the thesis and selecting the appropriate methodological approach, the interview guide for the expert interviews was created. As outlined before, the interviews followed the semi-structured approach. The question guide was created to answer the RQ in the best way possible. The interviews followed the guide presented in *Table 2*, covering all areas of the research objectives of the study. In addition, some parts of the guide were adapted and refined as the research progressed, since some questions had very similar answers and other questions were not specific enough. During the interviews, an additional question was asked about the perception of AI as a trend. This was triggered by repeated mentions of the term in early interviews. The interview guide structure is systematic and topic-oriented and follows the principle "from the general to the specific" (Helfferich, 2009, p. 565).

Category	Topics
General Information	• Information about the startup • Information about experts' position
Product & AI	• Definition of AI • How is AI integrated
Value generation	• Success assessment for startups • The role of AI in value generation
Potentials of AI	• Opportunity creation • Effects on stakeholder communication & funding • Productivity enhancement
Challenges of AI	• Immaturity of the technology • Ethical issues • Demand of resources and skills
Closing & Outlook	• Future influence of AI on startups • Learnings and suggestions for future founders

Table 2 – Interview Guide.
Source: Own illustration.

3.3 Data analysis process

To create a robust foundation for the data analysis, all interviews were recorded, and the audio was transcribed with the software *Descript* and *Amberscript*. Due to the complex and multi-faceted nature of the data, stemming from varying perspectives and opinions on AI adoption and its effect, Gioia's method for qualitative content analysis was deemed appropriate for analysing the data (Gioia et al., 2013). This approach provides a framework that facilitates deeper insights into the various aspects discussed in the interviews, enabling an in-depth exploration of the topics and their complexities (Magnani & Gioia, 2023). The method has proven effectiveness in generating theory that is firmly rooted in empirical data and grounded in real-world observations and experiences, which is especially suitable, among other areas, for

entrepreneurship research (Magnani & Gioia, 2023). The systematic and structured method for analysing the textual data involves the iterative development of a category system. The reduction of categories and the development of themes and dimensions facilitate a deeper understanding of the research topic and the creation of grounded theory (Gioia et al., 2013). By faithfully adhering to the startup founder's ideas and concepts and iteratively coding, the method enabled to capture the richness and nuances of the data. Thereby, the data structure not only helps organise the data, but also increases the rigour and transparency of the research (Gioia et al., 2013). Moreover, the systematic and rigorous framework of Gioia and colleagues provides a method for conducting inductive research that allows researchers to follow the lead of experts and explore new concepts (Gioia et al., 2013). The use of the inductive approach in this study was made due to the exploratory nature of the RQs and the desire to remain open to unexpected findings, not originally anticipated. Overall, the Gioia method allowed for a comprehensive analysis of the qualitative data and contributed to the understanding of opportunities and challenges of AI adoption in tech startups in a meaningful and theoretically sound way (Gioia et al., 2013). Next, the individual steps of the data analysis are explained.

First, after conducting the semi-structured interviews, those are transcribed to form the textual data base for the subsequent analysis. In the second step, the transcripts get screened to identify a wide range of expert's terms, codes, and categories, capturing the diverse perspectives of the early-stage startup founders, building *1st order categories*. The collection process was executed in an overwhelming excel spreadsheet. Here, first overall clusters, such as *Potentials*, *Challenges*, *Industry change*, *Competitive Advantage*, and *Data*, were found and further subdivided and specified during the screening of all interview transcripts. Commonalities, duplications, and differences were identified to group than create abstract *2nd order themes*, that synthesise the direct quotes of the *1st order categories* into theoretical themes. Hereby, the focus was to explore new topics and concepts related to AI in startups, by contrasting some ideas and putting together related quotes, and considering their relevance and potential theoretical contribution to the RQs. The *2nd order themes* (APPENDIX A) that initially evolved where reduced by constantly shifting between the data, themes, concepts, and the overall research topic, to ensure grounding and alignment. In the final step the *2nd order themes*, these were distilled even further to build *Aggregated dimensions*. *Table 3* represents the analysing process visually and serves to provide the reader with the ability to comprehend the origin of the synthesised findings contained in the data.

4 Findings

The following table displays the results that emerged from the data analysis using the Gioia method. In the left columns, direct quotes from the interviews are presented as part of the 1st order analysis. These quotes, linked by their content, lead to the 2nd order themes presented in the middle column. Those themes are grouped together and form the final aggregated dimensions which are the main theoretical findings of this research.

Managing high costs and time intensity: Critical obstacles for AI adoption in startups

The process of adopting AI in startups is a complex challenge characterised by two main obstacles: high costs and time intensity. For instance, one interviewee (S12) acknowledged the potential of AI but pointed out the substantial effort required for its integration. The financial burden associated with integrating AI can be a key barrier, as one founder (S1) expressed: "(…) building our core technology, drained our financials". These costs, combined with the pressure of the startup's cash burn rate, tend to exceed the limited resources startups typically have available. In addition to monetary concerns, the integration process itself is often time-consuming and requires a significant commitment of HR and operational focus. On the contrary, startups have an advantage over larger companies because of their agility. As one founder (S4) explained, "Tech startups are usually just the first to adopt new technologies. It's much easier for them to integrate new technologies.". Startups can make decisions and changes faster, accelerating the adoption process of AI technologies.

This suggests, that if startups manage to overcome the challenges of high costs and time intensity, their flexibility and adaptability can be unique opportunities in AI adoption.

Addressing security, ethics and acceptance issues: a requirement to realise the full potential of AI in startups

With the increasing prevalence of AI adoption in startups, critical questions related to safety, ethics and societal acceptance arise. The interviewees represent a variety of perspectives regarding the impact of AI on data security. While some founders seem to downplay these concerns (S14), others are aware of the risks coming along (S2). However, an interesting and surprising finding is that the trust in technology is decreasing with the advent of AI. Some founders expressed their reservations, for instance S3 claimed "[d]on't share sensitive data with AI, everything you feed in to get information out of will be used to train the algorithm and to

1st order analysis	2nd order themes	Aggregated Dimension
"We could implement it much more, in so many more ways and operational settings, but we haven't done it yet, because of implementation effort." (S12)	**AI adoption comes with high implementation efforts**	Managing high costs and time intensity: Critical obstacles for AI adoption in startups
"It's a whole new process, so the challenge was the transformation process." (S10)		
"As a [startup], we need to research it. We need to understand exactly how we are going to use it, how we're going to implement it (…)." (S10)		
"The challenge is, that the people that do AI, like data scientists or AI engineers, these specialists are super expensive." (S5)	**High costs for AI implementation challenge startups**	
"We are a small startup, (…) we're trying to figure out how to use [AI] in a way that's not too expensive." (S14)		
"(…) as a startup, we have to be fast in deciding and implementing because everyday costs us a lot of money (…). It is a constant battle with our cash burn rate." (S6)		
" (…) building our core technology, drained our financials (…)." (S1)		
"And [AI implementation] also something that takes time." (S14)	**AI integration is very time consuming for startups**	
"Time for startups is very rare and even if you want to increase and develop a working process with AI, it still has a time effort to implement it." (S6)		
"The second aspect is that building an AI solution takes time. It's not fast. It takes time." (S3)		
"That means it can suck up a lot of energy from the founders and take that time away from spending that with customers." (S4)		
"(…) tech startups are usually just the first to adopt new technologies. It's much easier for them to integrate new technologies." (S4)	**It's easier for startups do adopt AI than for other companies due to the former`s agility**	
"(...) because we're a startup, we're two, it's only me, a technical person." (S2)		
"Startups are flexible and can change their workflows fast and use this to do things big companies can't do." (S9)		
"Usually, startups are, compared to the traditional companies, smaller and more agile. (…) If we wanna try something, (...) we're trying it. And big enterprises and big companies are moving a bit slower. It's harder to make decisions." (S12)		
"So obviously we have all the security measures in place, but it's not like a huge worry what would happen if. (…) I'm not aware of any major concerns in our company." (S14)	**Mixed opinions regarding security concerns emerge with AI**	Addressing security, ethics and acceptance issues: a requirement to realise the full potential of AI in startups
"Not everyone in the world is accepting AI so in our case, as an education company, AI is a very sensitive topic (…)." (S6)		
"Security companies, financial companies, they probably have much future risk. " (S2)		
"Actually, right now in our world today, we have to prove ourselves more than before. Before you just show up and that's it. (…) Now we have trust issues, which makes human, spending so much time convincing people because now people don't want to trust you." (S4)	**AI has decreased humans trust in technology**	
"People will maybe stop validating data provided from AI so now we can easily be manipulated by AI (…)." (S7)		
"Don't share sensitive data with AI, everything you feed in to get information out of will be used to train the algorithm and to further learn, so others can access it afterwards." (S3)		
"(…) AI can be a tool for exploitation." (S8)	**Founders have ethical concerns about the usage of AI**	
"You need to have a panel of 10 people reviewing the results. And these people need to be from minorities, different ethnicities, women, men and not just one guy like me. Measuring it. And that's how you can make it unbiased." (S1)		
"(…) AI can act unethically simply because it has learned to be discriminatory based on our data." (S7)		
"Yes, there are data privacy regulations, but (…) I just feel that this is something that should also be looked at." (S1)	**AI needs legal regulations**	
"I think there should be a government intervention in regulating all of this stuff, because I think everyone is now gearing towards adapting to AI and there's not much of regulation surrounding that." (S3)		

"Similar to how they control corporations. Corporations can avoid exploiting people (…) AI can be a tool for exploitation." (S8)		
"It is really the trend in the market right now." (S1)	**Startups are adopting AI because they need to ride the hype-wave**	Appropriate AI application: Navigating between market trends and business goals
"I don't think the technology is hyped. But the urgency to integrate it, the urgency to leverage it, the urgency to use it – that is hyped." (S6)		
"We're just going to assume that we use AI to solve the problems. (…) So right now, we're taking advantage of the hype as well." (S4)		
"All our services might be hyped." (S5)		
"(…) don't go into the hype. Think, if it's really useful and if it's really needed and [don't adopt AI] just because it's hyped." (S14)		
"And you need to block yourself from the noise. You need to constantly figure out the noise from the important. And because it's so easy and because it's so cool and because it's hyped, it can be noisy." (S8)	**Startups need to stay focused on their goals and just adopt AI as it fits such goals**	
"(…) building an AI solution can be a black hole. That means it can suck up a lot of energy from the founders and take that time away from spending that with customers." (S4)		
"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases, and so on, (…), and the AI solutions can take you off focus." (S14)		
"Not negative. I don't think there's something negative in it, but it does bring a lot of distraction that isn't necessarily good." (S10)		
"[AI] diverges us from our focus (…)." (S12)		
"Companies need to know to stay focused on their vision and target market (…). If they get disturbed from this, it can hurt the business." (S2)		
"You need not only quantity of data, which is easy to get, you need quality of data, and that is the hard part to get." (S5)	**High data quality and quantity are key components for successful AI implementation**	Data management in AI: Fostering data quality, access and continuous improvement for trust and performance
"(…) AI is all about the data that you feed to the AI systems, and the more intelligent your data is, the better the AI." (S15)		
"(…) as you feed more to that algorithm, that AI will become smarter, which will then add more value to your service (…)." (S4)		
"So it's about the quantity of data, but also the quality of data." (S1)		
"For some companies it was super hard to access data or type of service or infrastructure that has AI." (S5)	**Lack in data access is a challenge in AI adoption**	
"So, the challenge that we have as a company is to have the right data (…)" (S11)		
"It is never fully trained. Right now, we can do something with it, but we can be much better. We can be unbiased and much more." (S1)	**Continuous optimization and training with new data is vital for high-performance AI**	
"Data is not static, so that's why you have a process of making it learn somehow." (S16)		
"And for us to make sense of [the data], we have to re-engineer and harmonize and at the same time, optimize [the data] (…), which then enables us to deliver better output for our clients." (S4)		
"One thing that's emerging with that exposure that I had with AI and ML today, is really the accuracy of the prediction based on the data that we are feeding the algorithm." (S3)	**Accuracy is necessary to build trust in AI**	
"Like our accuracy in predicting employee resignation is currently at 88% (…) that is insane." (S4)		
"What makes [a customer] trust more or less in your solution, depends on how accurate your results are." (S13)		
"Challenges are always, how accurate the AI works and how much human input it requires." (S8)		
"I did not understand [AI]. I was afraid of something that I didn't know. I never built something with AI (…) I wasn't able to visualize what it takes and how it worked." (S1)	**Founders should have a good understanding about the AI technology**	Human-AI synergy: The demand for knowledge, skills and collaborative interaction
"But for us, with my Co-Founder, who has a PhD in ML, we were able to develop something that we have validated in the market (…)." (S4)		
"But if you have at least a high-level understanding of how these things work, it'll be easy for you to jump on board and at the same time deliver understanding for how things work and deliver more than what is expected from your product." (S8)		
"I should have invested on data science people. Because I've utilized different skillsets in building our core technology which drained our financials (…)." (S3)		
"There's a lot of know-how behind [the technology] you need to understand (…)." (S10)		

"If my employees are highly skilled, they're gonna be able to do more. They're gonna be able to deliver more, which will then equate to delivering more to our clients and hopefully transform that into more revenue that will make my investors happy." (S11)	**AI implementation requires highly qualified and skilled workforce**	
"So now as a CEO, my challenge is to have the right people, that make things happen and get my product done." (S12)		
"I would believe finding the balance between a fact&feeling driven decision related to the acceptance of customers is something which humans can do better, but not faster. It may take longer for a human, but it has more depth (…)." (S6)	**A combination of AI and human work is needed**	
"[Employees] are going to be replaced by this type of technologies. But at the same time, many jobs are going to be created around this technology, because it's a different way to process this new data that you didn't have access before." (S12)		
"AI is super important for not replacing the human, but to make the human better. So, we can use this new technology to help us do our jobs in a better way. Of course, there are some processes that are going to be replaced. But processes, not humans." (S8)		
"(…) I am very confident to say that AI will never replace a human, because AI has no capability of identifying the good and bad."(S2)		
"I can tell you right now, probably all founders are using AI to get their jobs done easier." (S16)	**AI is increasing startups productivity and performance by making them work significantly faster**	Leveraging AI as productivity catalyst: Increasing pace, efficiency, and performance
"[AI] gives you the ability (…) to multitask and do many things and scale (…)." (S16)		
"Productivity in generating leads has increased 22% month to month." (S4)		
"So in my cases, I create a month of work in just one or two weeks. So, I believe that is a great impact." (S2)		
"[AI] saves a lot of time" (S14)		
"It can help in just everyday life of every team. Increasing productivity in general. All over." (S8)		
"(…) my development team is using an AI co-pilot and it decreased their development time around 40 - 50%. That's a lot." (S1)		
"As a founder, it helped me to prioritize things better." (S2)		
"(…) see how it answers [your companies] needs, either from the work environment, the everyday aspects of it, marketing, design development, scheduling (…)." (S11)	**AI is a multifaceted tool that helps startups to enhance their efficiency**	
"So, where we use it as a company are on two things. On my end to automate commercial processes and on my team's end to automate certain technical processes." (S5)		
"AI generated customer surveys with AI supported target group matching will help to decide better and faster." (S7)		
"As a product manager AI is helping me in researching the market, researching users, and creating user stories." (S15)		
"(…) I think it's a great tool that every company should try to figure out how to integrate and see how it answers their needs (…)." (S11)	**Founders advice to leverage AI for business optimisation possibilities**	
"Now it's on your end to pay the cards right and see how you could adapt it to your technology or your workflows as a founder." (S10)		
"We are now looking at the future five steps ahead. So always think five steps ahead and look for an opportunity in the technology." (S1)		
"So, AI is a critical component for innovation." (S12)	**AI stimulates innovation within startups internally**	Utilising AI as a competitive advantage: Driving innovation, improving value creation and enhancing customer-focused strategies
"Discover new things about your solution." (S2)		
"(…) identifying what are the features what are the specific data sets that we wanna look at to create new products." (S5)		
"Because right now we're in an early stage and they see innovation on our end." (S8)		
"The market and the solutions are evolving fast and new solutions lead to new possibilities (…)." (11)	**New business opportunities evolve through AI driven market change**	
"In the future, the job of a nurse might be paid better than that of a doctor." (S7)		
"It might be that the startup market changes from tech to something else, to a more product driven and investment heavy sector." (S9)		
"Offering a new set of products will be possible, as it can be offered in a scaled and cheap way with AI (…)." (S5)		
"With AI we (…) deliver value to customers faster and more reliable." (S1)	**AI as a driving force for increasing customer satisfaction**	
"We are using [AI] to create, like, real value for our users, not just for the sake of using it." (S11)		
"(…) if your business is applying these core technologies, you will be able to deliver more than what [your customer's] are expecting from you." (S15)		

"(…) I think as an AI startup, we all need to care about balancing the value added to the [clients] and the cost they pay." (S5)		
"(…) applying AI (…) will [enable] us to deliver more value to our clients." (10)		
"Delivering value is more important than the AI itself. " (S4)	**Startups need to focus on delivering value and not developing technology**	
"Making sure they are not building AI just for the sake of AI, but rather delivering value. Like it can be AI, but it can be something else behind it. Just deliver value!" (S11)		
"Like the goal is to deliver value, not actually to develop technology." (S15)		
"AI is not going to solve the problem. Before thinking about how to use AI, think about why and what are you trying to solve (…)." (S3)		
"(…) the tech startup scene is going to have more competitors (…), and [AI] is not going to be a competitive advantage." (S8)	**Implementing AI is not sufficient for securing a strong competitive advantage**	Steering through the AI-driven competitive landscape: The critical impact of strategic adaptation on the survival of startups
"AI is not going to be like the main differentiator for your company. Because it's going to be accessible for others. So, you're going to be more precise on the way you're creating the solution for your customers." (S5)		
"I mean by that AI alone cannot be your competitive advantage." (S16)		
"It used to be a competitive advantage if you used [AI]; it was a differentiator. But that's not the case anymore." (S7)		
"I don't know if it is necessary to implement [AI] immediately but (…) one has to keep up with the competition and new ways of working. (...) The competition is tough out there. We always have to adjust and rethink our strategy: Are we still relevant (…)?" (S6)	**Intensified market competition and survival challenges for startups due to AI**	
"And for startups. Many startups are going to die. Many startups are going to die with these new infrastructures." (S9)		
"Yes, it's getting more competitive, and suddenly your competition is not only other startups, but also AI. (…). I'm a bit scared." (S12)		
"And in one year this startup is not gonna have a business anymore. It will be replaced by AI." (S9)		
"It hurts (…) the survival rate of startups because you're gonna get replaced by AI." (S9)		
"So the market is going to be more fragmented, the market is going to be more competitive." (S5)		
"I believe that we're entering the fourth industrial revolution, which is the AI revolution. So, what we're going to start seeing is companies commoditizing AI." (S9)	**AI as a catalyst for the rapid transformation of the business industry and the imperative need for adaptation**	
"And on the other hand, if you don't adapt, you're going to stay behind." (S11)		
"AI is becoming more and more widespread and also more and more powerful." (S7)		
"Because, okay, we can be one step ahead of them, but (…) in a month or in two months, they will get aligned with that as well." (S12)		
"So, there's a lot of startups popping up." (S2)		
"Because if you don't adapt to these new AI technologies that are coming right now, you're going to be in problems because other companies, your competition might adapt quicker as you, and they will take advantage of that." (S13)		
"It's a little bit stressful seeing that everything's moving so fast and you wanna catch up and you don't wanna be left behind. (…). It's like a try or die." (S8)		

Table 3 – Data Analysis.
Source: Own illustration; based on the qualitative content method of Gioia (2013)

further learn, so others can access it afterwards.". Furthermore, founders raise the awareness on the ethical dimension of the business, articulating that AI can be a tool for exploitation (S8) and discrimination (S1). Finally, there was a consensus regarding the need for legal regulations to guide AI usage and implementation exemplified by one founder (S3) who suggests that: "there should be a government intervention in regulating all of this stuff, because I think everyone is now gearing towards adapting to AI and there's not much of regulation surrounding that."

This finding implies that there is a need for comprehensive legal guidelines that pressure startups to be very distinct and transparent on their ethical communication. This will foster trust and acceptance among users, thereby reducing the risks associated with AI adoption.

Appropriate AI application: Navigating between market trends and business goals

The strategic application of AI in startups was a vital topic in all interviews. Due to the growing global recognition of AI's transformative potential and its influence in reshaping the competitive landscape, founders are increasingly adopting AI, not only for technological progress, but as a strategic tool to ride the *hype wave*. The urgent motivation to adopt AI is reflected by the statement of S6: "I don't think the technology is hyped. However, the urgency to integrate it, the urgency to leverage it, the urgency to use it – that is hyped.". This hype needs to be cautiously balanced with a clear focus on the primary business goals. While AI can offer great opportunities for growth and competitive advantage, alignment on strategic direction is essential to prevent founders from getting distracted by chasing AI trends: "(…) don't go into the hype. Think, if it's useful and if it's really needed and [don't adopt AI] just because it's hyped." (S14).

Therefore, the strategic use of AI in startups requires a balance between capitalising market trends and focusing on core business objectives ensuring that the application of AI supports the startups vision and unique value proposition.

Data management in AI: Fostering data quality, access and continuous improvement for trust and performance

AI technologies is based on data: "(…) AI is all about the data that you feed to the AI systems, and the more intelligent your data is, the better the AI." (S15). It was found to be a challenge for the startups to balance all parts of their data management, consisting of data quantity, quality, access, and continuous improvement. The founders stated that AI algorithms can only provide reliable and accurate insights if they have a robust data set that is characterised by quantity and quality. However, limited access to such data remains a challenge for some

founders. They need innovative solutions to overcome this hurdle. It is important to constantly train and optimise the algorithm. One founder mentioned: ”It is never fully trained. Right now, we can do something with it, but we can be much better. We can be unbiased and much more.” (S1). As a result, startups have to invest in a process of constant refinement and adaptation, despite limited resources. Moreover, the accuracy of AI systems is vital to create trust among customers, which can be achieved by the factors mentioned above: “What makes [a customer] trust more or less in your solution, depends on how accurate your results are.” (S13). Therefore, startups need to priorities accurate and reliable AI outcomes to foster stakeholder trust and gain credibility in the market.

In conclusion, investing in the implementation of AI needs to be strategically supported by extensive data management, which is a pivotal factor in ensuring performance and fostering trust in the technology.

Human-AI synergy: The demand for knowledge, skills, and collaborative interaction

This dimension is highlighting the necessity of foundational knowledge among founders and a highly skilled workforce in order to successfully utilise AI in a startup. Especially in the context of small startups the comprehensive understanding of the founders is crucial to not only facilitate strategic decision-making but also enhance their communication with their development team. “But if you have at least a high-level understanding of how these things work, it'll be easy for you to jump on board.”, was stated by S8. Additionally, the success of AI integration depends on the competence of the employees, since the technology requires constant development and maintenance, as highlighted in the previous dimension. This stresses the growing demand for advanced technical skills and adaptability in the workforce: “So now as a CEO, my challenge is to have the right people, that make things happen and get my product done.” (S12). Another interesting finding, mentioned in almost all interviews, was that despite the transformative potential of AI technologies, human supervision, creativity, and emotional skills remain essential. AI is not a threat, but a powerful tool that can complement and enhance human capabilities. Hence, a collaborative work environment that creates a human-AI synergy should be fostered.

AI adoption demands an extensive understanding of its technology by the founders, a highly skilled workforce and an integrative approach where AI and human efforts work together to unfold its full potential and drive business success.

Leveraging AI as productivity catalyst in startups: Increasing pace, efficiency, and performance

The utilisation of AI in startups is boosting speed and efficiency and thus increasing the overall productivity in startups. The significant impact is emphasised by S16: "I can tell you right now, probably all founders are using AI to get their jobs done easier.". Startups are leveraging AI in multiple ways, such as automating commercial and technical processes (S5), market research, creating user reports (S15) and better decision-making through customer surveys (S7). Founders recognised and communicated the opportunities of AI adoption for productivity and business optimisation and recommended to evaluate its potential for new BM's: "Now it's on your end to play the cards right and see how you could adapt it to your technology or your workflows as a founder." (S10).

The increasing importance of AI reflects the paradigm shift in startup culture, which increasingly values technology-driven and innovative tools for enhanced productivity and success.

Utilising AI as a competitive advantage: Driving innovation, improving value creation and enhancing customer-focused strategies

AI is stimulating internal innovation in startups by facilitating new perspectives to identify new development-areas for current solutions or even create new products. The impact of AI extends further, towards changing entire market dynamics, which is bringing up new business opportunities. These opportunities arise from the ability to automate processes, predict outcomes, and streamline operations, resulting in the transformation of the competitive landscape. However, this market change can also break up structures that are not always favorable for the tech startup industry, as founder S9 mentioned: "It might be that the startup market changes from tech to something else, to a more product driven and investment heavy sector.". Regarding customer satisfaction, AI technology can contribute to effective enhancements. AI-enabled processes deliver more reliable and faster outcomes (S1) that are scalable and cheap (S5) and thus increase the value perceived by customers. S15 underlines one important topic discussed in every interview, that the main objective should be "to deliver value, not actually to develop technology.".

Therefore, while AI offers a wide range of potential benefits for startups, the focus should exceptionally be linked to deliver meaningful, tangible value to customers. As appropriately summarised by S4: "Delivering value is more important than the AI itself."

Steering through the AI-driven competitive landscape: The critical impact of strategic adaptation on the survival of startups

The strategic adaptation to the increasingly AI-driven competitive landscape is found to play a critical role, especially for startups. The interviews revealed that simply implementing AI will not be sufficient for creating a robust competitive advantage. Quite the opposite was reflected, for instance by (S8), stressing that "[AI] is not going to be a competitive advantage.". Instead of relying on AI as a main differentiator, entrepreneurs should focus even more on their core business and strong customer value, as mentioned repeatedly. Moreover, AI is driving market competition and thus making startups face new survival challenges. The founders report that the democratisation and accessibility of AI technologies, not least through the presence of *OpenAI*, make it more difficult to balance the importance of adopting AI with the necessity to be focused on the customer value creation, in order to stay leveled with the competition. The worries of the startups are significant, as clearly illustrated by the statement from S12, stating that "suddenly your competition is not only other startups, but also AI. (…). I'm a bit scared.". Additionally, AI is evoking a transformative market shift, putting further pressure on all market participants. One interviewee spoke of the upcoming "fourth industrial revolution" and described AI as a phenomenon that companies are increasingly turning into a commodity (S9). While this also creates space for new startups, the speed of diffusion and the power of AI requires constant adaptation of business leaders, because otherwise they could become redundant. Founder S13 stated, that if you are not adopting to new technologies "your competition might adapt quicker as you, and they will take advantage of that."

In conclusion, the market is facing a hyper competition landscape that gains speed and rigour through an increasing presence of AI. Thus, the dynamic interplay between AI adoption and strategic adaptation forms a critical axis that startups need to overcome to secure their survival within the industry.

5 Discussion

This study aimed to understand the challenges and opportunities of AI adoption in early-stage tech startups. The findings largely confirm the claims in extant literate extending them to the specific context of this research, while presenting new insights to theory and important implications for practitioners.

First, this study confirms existing theory and extends these ideas to the context of early-stage startups regarding the benefits, challenges, and the need for a collaborative work environment in AI adoption. The established potential **benefits** of using AI, such as increased productivity and enhanced pace (Di Bernardo et al., 2021; Obschonka & Audretsch, 2020; Winecoff & Watkins, 2022), improved of decision-making (Bellman, 1978; Borges et al., 2021; Kraus et al., 2018; Taddy, 2018), and elevated innovation (Brynjolfsson & Mcafee, 2017b; Ferreira et al., 2017; Lindholm-Dahlstrand et al., 2019) were also found in the context of early-stage tech startups. Despite the many benefits that AI adoption is providing for startups, this study also found significant **challenges**, such as high costs and time consumption, as well as the demand for a highly skilled workforce and extensive comprehension of the technology. These challenges reflect what has already been found in previous studies (e.g. Ferreira et al., 2017; Gartner, 1985; Nambisan, 2017; Obschonka & Audretsch, 2020). Addressing security, ethics and acceptance issues were identified as essential to realise the full potential of AI, which confirms the findings of Borges et al. (2021) and Boyd & Crawford (2012). Additionally, this study found that in the early-stage tech startup context there is a **need for a collaborative work environment** of AI and the human workforce, which supports the more general claims from Wilson and Daugherty (2018). The interviewed founders in this study predict the creation of new job profiles and a beneficial collaboration of the technology and employees, which is necessary to effectively utilise the power of AI technology. However, some operative and repetitive jobs will be replaced, which is matching the predictions of Grace et. al (2018) and Frey and Osborne (2017), that at least half of the human workforce will be replaced by AI.

Second, this research found new insights about AI adoption in the context of early-stage tech startups that may present new contributions to theory with important managerial implication. To the best of the researcher's knowledge, the **importance of data management** in AI startups is not yet found in the context of startups and AI in previous research. This effect is potentially more salient in the context of early-stage startups because such companies are more resource constrained. Founders should note the importance of data management,

indispensable for the successful implementation of AI and not inherently trivial. The implementation decision should take data quality, quantity, and accessibility into account. The development of a **holistic business strategy** was proven to be crucial for successful AI adoption in startups. This aligns with former research of Andrews (2017) who highlights a well-designed AI strategy as the most important factor for its successful implementation. Entrepreneurs must overcome two challenges simultaneously. On the one hand, they often have to manage limited resources effectively, on the other hand, they have to fully focus on their strategic problem-solving (Porter, 1980). This double burden can potentially hamper startups business success, especially if compared to larger companies that usually have less resource constraints (Elia et al., 2020; Kraus et al., 2018; Nambisan et al., 2019). On the other hand, early-stage companies can leverage agility as major advantage, enabling them to quickly adapt to market shifts and new technologies. These results confirm the research findings of Agrawal et al. (2017) and Iansiti & Lakhani (2020), who see startups as pioneers in the adoption of AI. Besides, AI can also negatively impact necessary business focus because the hype-wave of AI technology can be distracting. Although Borges et al. (2021) have already employed the term 'hype' in their description of market changes due to AI adoption, the finding of focus loss through AI distraction is an additional contribution to the current research on AI in startups.

The shift in the competitive landscape induced by AI creates new challenges in sustaining competitive advantage. This result is contradicting the study Accenture, for example, which prognosed AI as main driver of securing competitive advantage and potential to double annual economic growth rates by the year 2035 (Daugherty & Purdy, 2016). The progressive industry shift demands seeing AI as more than just another external force in the business world. For founders who want to successfully establish their startups in the market, it is necessary to revise existing concepts. Therefore, the development of a modified strategic concept is intended to assist in practical strategy creation. In the adaptation of Gartner's model for new business creation, AI is introduced as a fifth central force that affects all components: the environment, process, organisation, and individual(s) (Gartner, 1985).

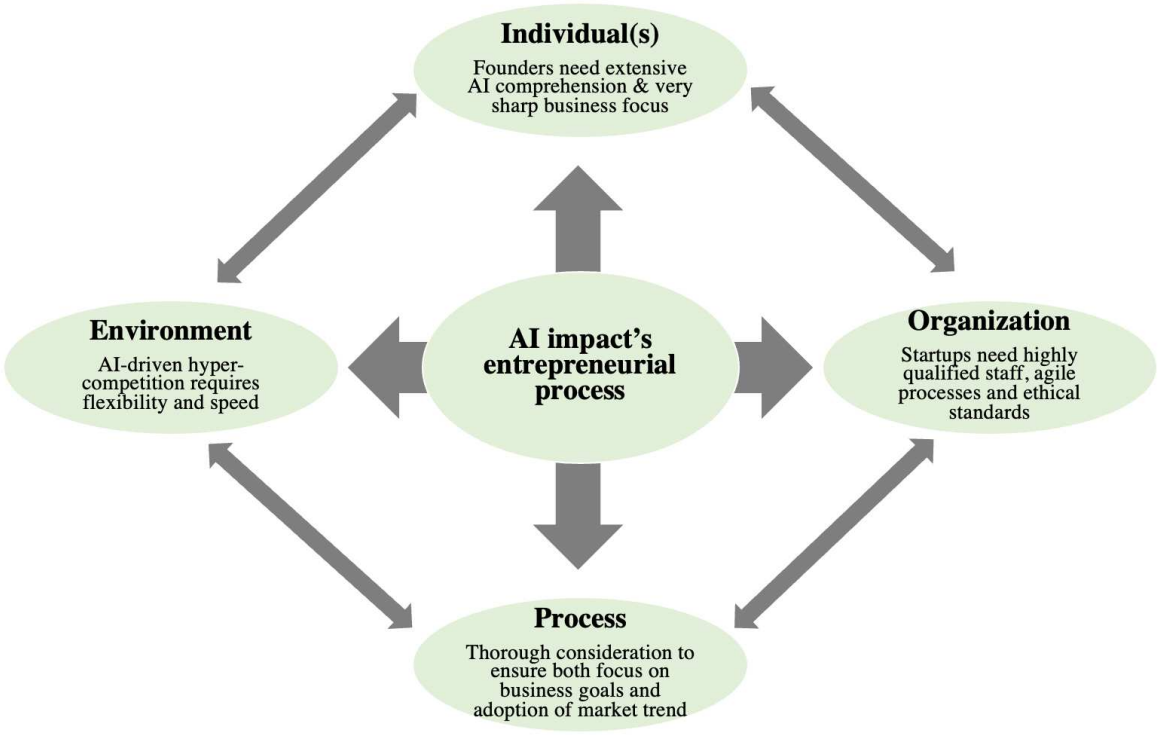

Figure 2 – AI-impacted entrepreneurial process
Source: Own illustration; based on Gartner's framework for new venture creation (1985, S. 698).

This adapted model illustrates the impact of AI at all levels of the entrepreneurial process. While the primary process of business creation, that involves the four initial, interconnected components, remains relatively unchanged, AI influences all these activities. In that light, this study proposes an approach that requires the integration of AI into each component and interrelationship. This allows for proactive engagement with any potential transformations. Translating this into practical applications, it becomes clear that the disruptive and continual shifts in the tech industry necessitate recognition and consideration of of AI's impact across every dimension. Regarding managerial implications, the proposed framework can assist in anticipating emerging challenges in AI adoption and enable conscientiously consideration in the strategic decision-making and organisational culture reshaping. Furthermore, demonstrating the link between AI and business strategy can help executives embrace these technologies with a greater awareness of the opportunities and benefits that AI can create for their business.

Overall, the results of this study are meaningful in both a theoretical and management context. Through this study, founders get an overview about the main impacts, positive and negative, of AI adoption that they need to pay attention when commoditising AI. Moreover, the

framework can help them to identify critical areas in the process of AI adoption and eventually enable them to react appropriately at an early stage.

5.1 Limitations

While providing valuable theoretical insights, it is important to recognise the limitations of this study to evaluate the findings cautiously. This study consists of a sample of 16 startup founders, representing some heterogeneity in the tech startup field. Despite the efforts spent in providing a large and diverse perspective, the author acknowledges that the time available to conduct the analysis limited the exploration of some topics. Additionally, with only two female founders included in the sample, this selection bias might be limiting the range of experiences and perspectives obtained during the data collection process. Although the sample size of this study was designed to only include early-stage AI startups from the technology sector, the wide range of technology startups, varying in terms of sectors, development stages, geographic location, and size, poses a challenge for the coverage of the extensive experience in this study. Recognising the potential subjectivity inherent in qualitative research, careful attention was paid to ensure methodological rigour throughout the analysis process to ensure the validity of the findings.

The insightful results offer limited hands-on guidance for managers. While they point to the challenge of managing the interplay between strategic AI adoption and simultaneously staying focused on the core business goals, they fall short on providing actionable recommendations for the practical process. Also, given the rapid development of AI and its capabilities, these insights require constant review and reassessment to adapt to changing conditions in the market landscape.

5.2 Future Research

Due to space and time constraints, certain parts of the interviews could not be thoroughly investigated. While there was consensus among the founders on most issues, differences emerged that require further investigation. For instance, the perception of AI as innovation-driver was not affirmed by all founders: “AI harms innovation” (S13). Another topic that needs deeper exploration is the entire field of stakeholder relationship management, which includes aspects such as customer acceptance and perceptions, employee opinions and concerns, and the impact of AI on securing investment support. These topics were touched upon, but the results (APPENDIX A) were not sufficient to achieve theoretical saturation.

As already mentioned in the limitations, some of the findings lack the practical guidance and concrete strategic suggestions. Hence, an avenue for further research lies in the creation of a framework that is considering AI as a new market player and thus puts the individual players into new relations, indicating how to handle AI as a constantly evolving force. A valuable baseline for further research is also provided by the adapted model of the *AI-impacted entrepreneurial process* provided in this thesis discussion. Additionally, it would greatly contribute to entrepreneurship research, to study strategic tools that could mitigate founder's tough challenges of financial constraints. Considering startups constant battle with their cash burn rate (S6), it would be beneficial to conduct a quantitative analysis of the financial impact of early-stage AI adoption. Such a study could provide insights into the cost-risk ratio and enable founders to reduce potential risks while quantifying the performance improvement from AI implementation.

6 Conclusion

This study sheds light on the complexity and potential of using AI in early-stage tech startups, drawing on previous literature as well as providing new insights. Key challenges include the high cost and time involved, the need for skilled personnel and extensive knowledge of AI, and pressing concerns about security, ethics, and acceptance. However, significant opportunities such as increased productivity, improved decision-making and innovation potential were also identified, and the need of synergetic AI-human workforce was emphasised. The study contributes to theory by providing new insights, such as the importance of robust data management and a holistic AI business strategy, which can be particularly challenging for startups with limited resources. Additionally, it proposes a revised business framework that incorporates AI as a critical force in new venture creation to support successful strategy formulation, decision-making, and culture transformation in the rapidly evolving AI and technology landscape. Future research should aim to provide more practical guidance, deepen the role of stakeholder relationship management within startups and further explore the strategic implications of early-stage AI adoption.

References

Agrawal, A., Gans, J., & Goldfarb, A. (2017). What to Expect From Artificial Intelligence. *MIT Sloan Management Review*, *Magazine Spring 2017 Issue*. https://hbsp.harvard.edu/product/SMR598-PDF-ENG

Almansour, M. (2023). Artificial intelligence and resource optimization: A study of Fintech start-ups. *Resources Policy*, *80*, 103250. https://doi.org/10.1016/j.resourpol.2022.103250

Alsheibani, S. A., Cheung, D. Y., & Messom, D. C. (2019). *Factors Inhibiting the Adoption of Artificial Intelligence at organizational-level: A Preliminary Investigation*.

Andrews, W. (2017). *Applying Artificial Intelligence to Drive Business Transformation: A Gartner Trend Insight Report*. Gartner. https://www.gartner.com/en/documents/3792874

Antonizzi, J., & Smuts, H. (2020). The Characteristics of Digital Entrepreneurship and Digital Transformation: A Systematic Literature Review. In M. Hattingh, M. Matthee, H. Smuts, I. Pappas, Y. K. Dwivedi, & M. Mäntymäki (Eds.), *Responsible Design, Implementation and Use of Information and Communication Technology* (pp. 239–251). Springer International Publishing. https://doi.org/10.1007/978-3-030-44999-5_20

Ashta, A., & Herrmann, H. (2021). Artificial intelligence and fintech: An overview of opportunities and risks for banking, investments, and microfinance. *Strategic Change*, *30*(3), 211–222. https://doi.org/10.1002/jsc.2404

Attaran, M., & Deb, P. (2018). Machine learning: The new "big thing" for competitive advantage. *International Journal of Knowledge Engineering and Data Mining*, *5*(4), 277–305. https://doi.org/10.1504/IJKEDM.2018.095523

Awamleh, F. T., & Bustami, A. N. (2022). Examine the Mediating Role of the Information Technology Capabilities on the Relationship Between Artificial Intelligence and Competitive Advantage During the COVID-19 Pandemic. *SAGE Open*, *12*(3), 21582440221119480. https://doi.org/10.1177/21582440221119478

Baker, R., Brick, J. M., Bates, N. A., Battaglia, M., Couper, M. P., Dever, J. A., Gile, K. J., & Tourangeau, R. (2013). Summary Report of the AAPOR Task Force on Non-probability Sampling. *Journal of Survey Statistics and Methodology*, *1*(2), 90–143. https://doi.org/10.1093/jssam/smt008

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Baumol, W. J. (1968). Entrepreneurship in Economic Theory. *The American Economic Review*, *58*(2), 64–71. https://www.jstor.org/stable/1831798

Bellman, R. (1978). *An Introduction to Artificial Intelligence: Can Computers Think?* Boyd & Fraser Publishing Company.

Bessen, J. E., Impink, S. M., Reichensperger, L., & Seamans, R. (2018). *The Business of AI Startups* (SSRN Scholarly Paper No. 3293275). https://doi.org/10.2139/ssrn.3293275

Bock, D. E., Wolter, J. S., & Ferrell, O. C. (2020). Artificial intelligence: Disrupting what we know about services. *Journal of Services Marketing*, *34*(3), 317–334. https://doi.org/10.1108/JSM-01-2019-0047

Borges, A. F. S., Laurindo, F. J. B., Spínola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management*, *57*, 102225. https://doi.org/10.1016/j.ijinfomgt.2020.102225

Boyd, D., & Crawford, K. (2012). Critical Questions for Big Data. *Information, Communication & Society*, *15*(5), 662–679. https://doi.org/10.1080/1369118X.2012.678878

Brynjolfsson, E., & Mcafee, A. (2017a). Artificial Intelligence, for real. *Harvard Business Review*, *The Big Idea*. hbr.org

Brynjolfsson, E., & Mcafee, A. (2017b). ARTIFICIAL INTELLIGENCE, FOR REAL. *ARTIFICIAL INTELLIGENCE*.

Bull, I., & Willard, G. E. (1993). Towards a theory of entrepreneurship. *Journal of Business Venturing*, *8*(3), 183–195. https://doi.org/10.1016/0883-9026(93)90026-2

Caldera, H. T. S., Desha, C., & Dawes, L. (2019). Evaluating the enablers and barriers for successful implementation of sustainable business practice in 'lean' SMEs. *Journal of Cleaner Production*, *218*, 575–590. https://doi.org/10.1016/j.jclepro.2019.01.239

Campbell, M., Hoane, A. J., & Hsu, F. (2002). Deep Blue. *Artificial Intelligence*, *134*(1), 57–83. https://doi.org/10.1016/S0004-3702(01)00129-1

Cetindamar, D., Lammers, T., & Zhang, Y. (2020). Exploring the knowledge spillovers of a technology in an entrepreneurial ecosystem—The case of artificial intelligence in Sydney. *Thunderbird International Business Review*, *62*(5), 457–474. https://doi.org/10.1002/tie.22158

Chalmers, D., MacKenzie, N. G., & Carter, S. (2021). Artificial Intelligence and Entrepreneurship: Implications for Venture Creation in the Fourth Industrial Revolution. *Entrepreneurship Theory and Practice*, *45*(5), 1028–1053. https://doi.org/10.1177/1042258720934581

Charniak, E., & McDermott, D. (1985). *Introduction to Artificial*. *Intelligence*(Addison Wesley, Reading, MA, 1984).

Chesbrough, H., Vanhaverbeke, W., & West, J. (2014). *New Frontiers in Open Innovation*. OUP Oxford.

Choudhury, P., Starr, E., & Agarwal, R. (2020). Machine learning and human capital complementarities: Experimental evidence on bias mitigation. *Strategic Management Journal*, *41*(8), 1381–1411. https://doi.org/10.1002/smj.3152

Chung, M., Ko, E., Joung, H., & Kim, S. J. (2020). Chatbot e-service and customer satisfaction regarding luxury brands. *Journal of Business Research*, *117*, 587–595. https://doi.org/10.1016/j.jbusres.2018.10.004

Cockburn, I. M., Henderson, R., & Stern, S. (2018). The Impact of Artificial Intelligence on Innovation: An Exploratory Analysis. In *The Economics of Artificial Intelligence: An Agenda* (pp. 115–146). University of Chicago Press. https://www.nber.org/books-and-chapters/economics-artificial-intelligence-agenda/impact-artificial-intelligence-innovation-exploratory-analysis

Dahlqvist, J., & Pivén, O. (2020). *A Race to the Top in the Era of Artificial Intelligence*.

Daugherty, P., & Purdy, M. (2016). *Why Artificial Intelligence is the Future of Growth*. (p. 27). Accenture.

D'Aveni, R. A. (2010). *Hypercompetition*. Simon and Schuster.

Davenport, T. H. (2018). *The AI Advantage: How to Put the Artificial Intelligence Revolution to Work*. MIT Press.

Davidsson, P., Recker, J., & von Briel, F. (2020). External Enablement of New Venture Creation: A Framework. *Academy of Management Perspectives*, *34*(3), 311–332. https://doi.org/10.5465/amp.2017.0163

Di Bernardo, I., Tregua, M., Fabio, G., & Andrea, R. (2021). AI as a boost for startups companies: Evidence from Italy. *University of South Florida (USF) M3 Publishing*, *5*(2021). https://www.doi.org/10.5038/9781955833035

Diekmann, A. (2002). Soziologie und empirische Sozialforschung—Von den siebziger Jahren bis heute. In *Von Generation zu Generation* (Vol. 8, pp. 43–50).

Dikshit, A., Pradhan, B., & Alamri, A. M. (2021). Pathways and challenges of the application of artificial intelligence to geohazards modelling. *Gondwana Research*, *100*, 290–301. https://doi.org/10.1016/j.gr.2020.08.007

Doeringer, S. (2020). 'The problem-centred expert interview'. Combining qualitative interviewing approaches for investigating implicit expert knowledge. *International Journal of Social Research Methodology*, *24*. https://doi.org/10.1080/13645579.2020.1766777

Drucker, P. F. (1986). Review of Innovation and Entrepreneurship: Practice and Principles. *Public Productivity Review*, *10*(1), 105–109. https://doi.org/10.2307/3380320

Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technological Forecasting and Social Change*, *150*, 119791. https://doi.org/10.1016/j.techfore.2019.119791

Farabet, C., Couprie, C., Najman, L., & LeCun, Y. (2012). *Scene Parsing with Multiscale Feature Learning, Purity Trees, and Optimal Covers* (arXiv:1202.2160). arXiv. https://doi.org/10.48550/arXiv.1202.2160

Ferreira, J. J., Ferreira, F., Fernandes, C., Jalali, M., Raposo, M., & Marques, C. (2015). What Do We [Not] Know about Technology Entrepreneurship Research? *International Entrepreneurship and Management Journal*, *24*, 1–21. https://doi.org/10.1007/s11365-015-0359-2

Ferreira, J. J., Ratten, V., & Dana, L.-P. (2017). Knowledge spillover-based strategic entrepreneurship. *International Entrepreneurship and Management Journal*, *13*(1), 161–167. https://doi.org/10.1007/s11365-016-0415-6

Flick, U. (2014). *The SAGE Handbook of Qualitative Data Analysis*. SAGE Publications, Inc. https://doi.org/10.4135/9781446282243

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, *114*, 254–280. https://doi.org/10.1016/j.techfore.2016.08.019

Garbuio, M., & Lin, N. (2019). Artificial Intelligence as a Growth Engine for Health Care Startups: Emerging Business Models. *California Management Review*, *61*(2), 59–83. https://doi.org/10.1177/0008125618811931

Gartner, W. B. (1985). A Conceptual Framework for Describing the Phenomenon of New Venture Creation. *Academy of Management Review*, *10*(4), 696–706. https://doi.org/10.5465/amr.1985.4279094

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Giones, F., & Brem, A. (2017). *Digital Technology Entrepreneurship: A Definition and Research Agenda* (SSRN Scholarly Paper No. 2984542). https://papers.ssrn.com/abstract=2984542

Giuggioli, G., & Pellegrini, M. M. (2022). Artificial intelligence as an enabler for entrepreneurs: A systematic literature review and an agenda for future research. *International Journal of Entrepreneurial Behavior & Research*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IJEBR-05-2021-0426

Gläser, J., & Laudel, G. (2010). *Experteninterviews und Qualitative Inhaltsanalyse*. VS Verlag.

Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.

Grace, K., Salvatier, J., Dafoe, A., Zhang, B., & Evans, O. (2018). Viewpoint: When Will AI Exceed Human Performance? Evidence from AI Experts. *Journal of Artificial Intelligence Research*, *62*, 729–754. https://doi.org/10.1613/jair.1.11222

Haenlein, M., & Kaplan, A. (2019). A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. *California Management Review*, *61*(4), 5–14. https://doi.org/10.1177/0008125619864925

Haugeland, J. (1989). *Artificial Intelligence: The Very Idea*. MIT Press.

Helfferich, C. (2009). Interviewplanung und Intervieworganisation. In C. Helfferich (Ed.), *Die Qualität qualitativer Daten: Manual für die Durchführung qualitativer Interviews* (pp. 167–193). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-91858-7_6

Hinton, G., Deng, L., Yu, D., Dahl, G. E., Mohamed, A., Jaitly, N., Senior, A., Vanhoucke, V., Nguyen, P., Sainath, T. N., & Kingsbury, B. (2012). Deep Neural Networks for Acoustic Modeling in Speech Recognition: The Shared Views of Four Research Groups. *IEEE Signal Processing Magazine*, *29*(6), 82–97. https://doi.org/10.1109/MSP.2012.2205597

Hosny, A., Parmar, C., Quackenbush, J., Schwartz, L. H., & Aerts, H. J. W. L. (2018). Artificial intelligence in radiology. *Nature Reviews Cancer*, *18*(8), Article 8. https://doi.org/10.1038/s41568-018-0016-5

Hull, C. E., Hung, Y.-T. C., Hair, N., Perotti, V., & Richard DeMartino. (2007). Taking advantage of digital opportunities: A typology of digital entrepreneurship. *International Journal of Networking and Virtual Organisations*, *4*(3), 290–303. https://doi.org/10.1504/IJNVO.2007.015166

Iansiti, M., & Lakhani, K. R. (2020, January 1). Competing in the Age of AI. *Harvard Business Review*. https://hbr.org/2020/01/competing-in-the-age-of-ai

Iliashenko, O., Bikkulova, Z., & Dubgorn, A. (2019). Opportunities and challenges of artificial intelligence in healthcare. *E3S Web of Conferences*, *110*, 02028. https://doi.org/10.1051/e3sconf/201911002028

Ismail, M. H., Khater, M., & Zaki, M. (2017). Digital Business Transformation and Strategy: What Do We Know So Far. *Cambridge Service Alliance*, *10*(1), 1–35.

Jackson, P. R., Thorpe, R., & Easterby-Smith, M. (2015). *Management and Business Research*. SAGE Publications Ltd. https://www.torrossa.com/en/resources/an/5018207

Jakšič, M., & Marinč, M. (2018). Relationship banking and information technology: The role of artificial intelligence and FinTech. *SpringerLink*, *Risk Management*(21), 1–18. https://link.springer.com/article/10.1057/s41283-018-0039-y

Jones, O., & Tilley, F. (2003). *Competitive Advantage in SMEs: Towards a Conceptual Framework*.

Kaiser, R. (2014). *Qualitative Experteninterviews: Konzeptionelle Grundlagen und praktische Durchführung* (2014th ed.). Springer VS.

Kraus, S., Palmer, C., Kailer, N., Kallinger, F. L., & Spitzer, J. (2018). Digital entrepreneurship: A research agenda on new business models for the twenty-first century. *International Journal of Entrepreneurial Behavior & Research*, *25*(2), 353–375. https://doi.org/10.1108/IJEBR-06-2018-0425

Kurzweil, R. (1990). The Age of Intelligent Machines. *MIT Press*, *580*. https://calculemus.org/lect/si/dlalomzy/mchron.htm

Kurzweil, R. (2022). Superintelligence and Singularity. In *Machine Learning and the City* (pp. 579–601). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119815075.ch48

Lakshmi, V., & Corbett, J. (2020). How Artificial Intelligence Improves Agricultural Productivity and Sustainability: A Global Thematic Analysis. *Hawaii International Conference on System Sciences 2020 (HICSS-53)*. https://aisel.aisnet.org/hicss-53/os/ai_and_sustainability/3

Le Dinh, T., Vu, M. C., & Ayayi, A. (2018). Towards a Living Lab for Promoting the Digital Entrepreneurship Process. *International Journal of Entrepreneurship*, *22*(1), 1–17. https://www.proquest.com/docview/2046108774/abstract/3E302447EFE84008PQ/1

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature*, *521*(7553), Article 7553. https://doi.org/10.1038/nature14539

Lee, J., Suh, T., Roy, D., & Baucus, M. (2019). Emerging Technology and Business Model Innovation: The Case of Artificial Intelligence. *Journal of Open Innovation: Technology, Market, and Complexity*, *5*(3), 44. https://doi.org/10.3390/joitmc5030044

Lindholm-Dahlstrand, Å., Andersson, M., & Carlsson, B. (2019). Entrepreneurial experimentation: A key function in systems of innovation. *Small Business Economics*, *53*(3), 591–610. https://doi.org/10.1007/s11187-018-0072-y

Magnani, G., & Gioia, D. (2023). Using the Gioia Methodology in international business and entrepreneurship research. *International Business Review*, *32*(2), 102097. https://doi.org/10.1016/j.ibusrev.2022.102097

Marr, B. (2019). *Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems*. John Wiley & Sons.

McCarthy, J. (1959). *Programs with common sense*. (pp. 300–307).

Meuser, M., & Nagel, U. (1991). ExpertInneninterviews—Vielfach erprobt, wenig bedacht. In D. Garz & K. Kraimer (Eds.), *Qualitativ-empirische Sozialforschung: Konzepte, Methoden, Analysen* (pp. 441–471). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-97024-4_14

Meuser, M., & Nagel, U. (2002). ExpertInneninterviews—Vielfach erprobt, wenig bedacht. In A. Bogner, B. Littig, & W. Menz (Eds.), *Das Experteninterview* (pp. 71–93). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-93270-9_3

Meuser, M., & Nagel, U. (2009). The Expert Interview and Changes in Knowledge Production. In A. Bogner, B. Littig, & W. Menz (Eds.), *Interviewing Experts* (pp. 17–42). Palgrave Macmillan UK. https://doi.org/10.1057/9780230244276_2

Möller, K., & Rajala, A. (2007). Rise of strategic nets—New modes of value creation. *Industrial Marketing Management*, *36*(7), 895–908. https://doi.org/10.1016/j.indmarman.2007.05.016

Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective*. MIT Press.

Nambisan, S. (2017). Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship. *Entrepreneurship Theory and Practice*, *41*(6), 1029–1055. https://doi.org/10.1111/etap.12254

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy*, *48*(8), 103773. https://doi.org/10.1016/j.respol.2019.03.018

Nilsson, N. J. (2009). *The Quest for Artificial Intelligence* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511819346

Nosek, B. A., Alter, G., Banks, G. C., Borsboom, D., Bowman, S. D., Breckler, S. J., Buck, S., Chambers, C. D., Chin, G., Christensen, G., Contestabile, M., Dafoe, A., Eich, E., Freese, J., Glennerster, R., Goroff, D., Green, D. P., Hesse, B., Humphreys, M., … Yarkoni, T. (2015). Promoting an open research culture. *Science*, *348*(6242), 1422–1425. https://doi.org/10.1126/science.aab2374

Obschonka, M., & Audretsch, D. B. (2020). Artificial intelligence and big data in entrepreneurship: A new era has begun. *Small Business Economics*, *55*(3), 529–539. https://ideas.repec.org//a/kap/sbusec/v55y2020i3d10.1007_s11187-019-00202-4.html

Olson, P. (2019). *Nearly Half Of All 'AI Startups' Are Cashing In On Hype*. Forbes. https://www.forbes.com/sites/parmyolson/2019/03/04/nearly-half-of-all-ai-startups-are-cashing-in-on-hype/

Pfau, W., & Rimpp, P. (2021). *AI-Enhanced Business Models for Digital Entrepreneurship | SpringerLink* (Digital Entrepreneurship). https://link.springer.com/chapter/10.1007/978-3-030-53914-6_7

Phangestu, J., Kountur, R., & Prameswari, D. A. (2020). The Moderating Effect of Entrepreneurial Leadership and Competitive Advantage on the Relationship Bbetween Business Model Innovation and Startup Performance. *Journal of Business & Retail Management Research*, *14*(03). https://doi.org/10.24052/JBRMR/V14IS03/ART-06

Porter, M. E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press. https://www.hbs.edu/faculty/Pages/item.aspx?num=195

Quan, X. I., & Sanderson, J. (2018). Understanding the Artificial Intelligence Business Ecosystem. *IEEE Engineering Management Review*, *46*(4), 22–25. https://doi.org/10.1109/EMR.2018.2882430

Rowley, J. (2012). Conducting research interviews. *Management Research Review*, *35*(3/4), 260–271. https://doi.org/10.1108/01409171211210154

Russell, S. J., & Norvig, P. (2010). *Artificial intelligence: A modern approach*. (3rd Edition). Nova Jersey, EUA: PrenticeHall.

Sætra, H. S. (2020). A shallow defence of a technocracy of artificial intelligence: Examining the political harms of algorithmic governance in the domain of government. *Technology in Society*, *62*, 101283. https://doi.org/10.1016/j.techsoc.2020.101283

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7. ed). Pearson.

Schalkoff, R. J. (1990). Artificial intelligence engine. *McGraw-Hill, Inc*. https://scholar.google.com/scholar_lookup?title=Artificial%20intelligence%20engine&author=R.J.%20Schalkoff&publication_year=1990

Schumpeter, J. A. (1934). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Harvard University Press.

Schumpeter, J. A. (1965). Economic Theory and Entrepreneurial History. In *Explorations in Enterprise* (pp. 45–64). Harvard University Press. https://doi.org/10.4159/harvard.9780674594470.c5

Schwab, K. (2017). *The Fourth Industrial Revolution*. World Economic Forum. https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab/

Shams, R. (2018). Developing Machine Learning Products Better and Faster at Startups. *IEEE Engineering Management Review*, *46*(3), 36–39. https://doi.org/10.1109/EMR.2018.2870669

Shapiro, S. C. (1992). The Turing Test and the economist. *ACM SIGART Bulletin*, *3*(4), 10–11. https://doi.org/10.1145/141420.141423

Shen, K. N., Lindsay, V., & Xu, Y. (Calvin). (2018). Digital entrepreneurship. *Information Systems Journal*, *28*(6), 1125–1128. https://doi.org/10.1111/isj.12219

Silverman, D. (2015). *Interpreting Qualitative Data*. SAGE.

Sreenivasan, A., & Suresh, M. (2022). *Adoption of Artificial Intelligence (AI) in Start-ups*.

Taddy, M. (2018). *The Technological Elements of Artificial Intelligence* (Working Paper No. 24301). National Bureau of Economic Research. https://doi.org/10.3386/w24301

Thiel, P., Masters, B., & Aneet. (2017). Zero to One: Note on Start Ups, or How to Build the Future. *Gyan Management Journal*, *11*(1), Article 1. https://acspublisher.com/journals/index.php/gmj/article/view/543

Turing, A. M. (1950). *COMPUTING MACHINERY AND INTELLIGENCE*. *Computing Machinery and Intelligence*(49), 433–460.

Waltzman, R., Ablon, L., Curriden, C., Hartnett, G. S., Holliday, M. A., Ma, L., Nichiporuk, B., Scobell, A., & Tarraf, D. C. (2020). *Maintaining the Competitive Advantage in Artificial Intelligence and Machine Learning*. RAND Corporation. https://www.rand.org/pubs/research_reports/RRA200-1.html

Wang, X., Lin, X., & Shao, B. (2022). How does artificial intelligence create business agility? Evidence from chatbots. *International Journal of Information Management*, *66*, 102535. https://doi.org/10.1016/j.ijinfomgt.2022.102535

Wilson, H. J., & Daugherty, P. R. (2018, July 1). Collaborative Intelligence: Humans and AI Are Joining Forces. *Harvard Business Review*. https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces

Winecoff, A. A., & Watkins, E. A. (2022). Artificial Concepts of Artificial Intelligence: Institutional Compliance and Resistance in AI Startups. *Proceedings of the 2022 AAAI/ACM Conference on AI, Ethics, and Society*, 788–799. https://doi.org/10.1145/3514094.3534138

Winston, P. H. (1970). *Learning Structural Descriptions from Examples*. https://dspace.mit.edu/handle/1721.1/6884

Wolf, C., Joye, D., Smith, T. W., & Fu, Y. (2016). *The SAGE Handbook of Survey Methodology*. SAGE Publications, Inc.

Wright, S. A., & Schultz, A. E. (2018). The rising tide of artificial intelligence and business automation: Developing an ethical framework. *Business Horizons*, *61*(6), 823–832. https://doi.org/10.1016/j.bushor.2018.07.001

Yin, R. K. (2009). *Case Study Research: Design and Methods*. SAGE.

Young, A. S. (2022). AI in healthcare startups and special challenges | Elsevier Enhanced Reader. *Elsevier B.V., Intelligence-Based Medicin*(6). https://doi.org/10.1016/j.ibmed.2022.100050

Zaridis, A. (2009). Competitive Advantage and its Sources in an Evolving Market. *AIP Conference Proceedings*, *1148*, 917–921. https://doi.org/10.1063/1.3225468

Zhang, S. X., & Van Burg, E. (2020). Advancing entrepreneurship as a design science: Developing additional design principles for effectuation. *Small Business Economics*, *55*(3), 607–626. https://doi.org/10.1007/s11187-019-00217-x

APPENDIX

APPENDIX A - Findings table extended version

1st order analysis	2nd order analysis	Aggregated Dimension
"We could implement it much more, in so many more ways and operational settings, but we haven't done it yet, because of implementation effort." (S12)	**AI adoption comes with high implementation efforts**	Managing high costs and time intensity: Critical obstacles for AI adoption in startups
"It's a whole new process, so the challenge was the transformation process." (S10)		
"We are an enterprise solution and what I've seen from enterprise solution is the friction in getting it implemented (…) we have improved our implementation at least 40%." (S3)		
"[AI implementation] also takes time. As a company, we need to research it. We need to understand exactly how we are going to use it, how we're going to implement it (…)." (S10)		
"So, it's critical experience that the people that say they know AI, they actually can prove they know, because it's ML, it's data science (...) it's a more complex process." (S5)		
"The challenge is, that the people that do AI, like data scientists or AI engineers, these specialists are super expensive." (S5)	**High costs for AI implementation challenge startups**	
"We are a small startup, (…) we're trying to figure out how to use [AI] in a way that's not too expensive." (S14)		
"(…) as a startup, where we have to be fast in deciding and implementing because everyday costs us a lot of money, thinking about employee salaries for example or other fixed costs, that we need. It is a constant battle with our cash burn rate." (S6)		
" (…) building our core technology, which drained our financials (…) I'm trying to save money, because data scientists are so expensive at the end of the day." (S12)		
"And [AI implementation] also something that takes time." (S14)	**AI adoption is very time consuming for startups**	
"(…) even if you want to increase and develop a working process with AI, it still has a time effort to implement it." (S6)		
"Time for startups is very rare and even if you want to increase and develop a working process with AI, it still has a time effort to implement it." (S6)		
"The second aspect is that building an AI solution takes time. It's not fast. It takes time." (S3)		
"That means it can suck up a lot of energy from the founders and take that time away from spending that with customers." (S4)		
"[Evaluate if] the implementation effort and time of AI smaller than the outcome in the end. [Can] the startup effort putting in this time effort in its' current state?" (S5)		
"[Evaluate if] the implementation effort and time of AI is smaller than the outcome [of AI technology] in the end. [Can] the startup effort putting in this time effort in its' current state?" (S5)	**It's easier for startups do adopt AI than for other**	

"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases, (…) and the AI solutions can take you off focus." (S14)	**companies due to the former`s agility**	
"I think that for startups specifically, not much has changed why a startup will be successful. (...) You really need to know something about your customer, and you need to create a solution for that customer in a way that nobody else is able to create." (S13)		
"How much time will it take to implement AI (…) does this amount make sense (…) in our current situation as a startup, where we have to be fast in deciding and implementing, because everyday costs us a lot of money, (...). It is a constant battle with our cash burn rate." (S6)		
"(…) tech startups are usually just the first to adopt new technologies. It's much easier for them to integrate new technologies." (S4)		
"(...) because we're a startup, we're two, it's only me, a technical person." (S2)		
"Startups are flexible and can change their workflows fast and use this to do things big companies can't do." (S9)		
"Usually, startups are, compared to the traditional companies, smaller and more agile. (…) If we wanna try something, (...) we're trying it. And big enterprises and big companies are moving a bit slower. It's harder to make decisions." (S12)		
"I had the fortune to work in and understand how an AI company works. But if I didn't have that experience before, it would be harder for me to understand if I really need to use AI or if I should apply AI to my company." (S5)	**(There are clear reasons for adopting AI)**	
"(…) AI is critical for the new companies that are going to embrace and adapt it. Because, if you don't adapt to these new AI technologies (…) you're going to be in problems (…)" (S13)		
"Two years ago, Google published a paper. The paper that changed our world. It's called *Attention is Volume*. Attention is all you need. That's the foundation for building our transformer models." (S3)		
"We are using it to create, like, real value for our users, not just for the sake of using it." (S11)		
"[Evaluate if] the implementation effort and time of AI is smaller than the outcome in the end. [Can] the startup effort putting in this time effort in its' current state?" (S5)	**There is a logical decision process for adopting AI**	
"Would require so much effort, if we're gonna do it manually. So the idea of integrating AI and jumping into AI happened." (S13)		
"First, I was the skeptic one. I (…) thought building an algorithm as a decision tree would be better. But we went with AI instead." (S1)		
"(...) get the insight on how hard it is and (...) work with somebody that understands this topic. You need to know, if you want to do that process in your company, you need to be somebody that can handle it." (S8)		
"We could implement it much more, in so many more ways and operational settings, but we haven't done it yet, because of implementation effort." (S12)	**(AI adoption comes with high implementation efforts)**	
"It's a whole new process, so the challenge was the transformation process." (S10)		

"We are an enterprise solution and what I've seen from enterprise solution is the friction in getting it implemented (…) we have improved our implementation at least 40%." (S3)		
"[AI implementation] also takes time. As a company, we need to research it. We need to understand exactly how we are going to use it, how we're going to implement it, (…)." (S10)		
"So it's critical experience that the people that say they know AI, they actually can prove they know, because it's ML, it's data science (...) it's a more complex process." (S5)		
"(…) even if you want to increase and develop a working process with AI, it still has a time effort to implement it." (S6)		
"It's a black box, so you can't know why it's saying and why it's working in that way, it's not like in the code where you have first this, then that." (S1)	**Complex technological procedures of AI implementation**	
"So we're using the three different components on our end. We're using different models for ML. From speech recognition to sentiment analysis, we're using Generative AI to add more value in the training on our models." (S5)		
"Technically speaking, this translates into optimizing on false positives, false negatives. The rate of acceptance of recommendations (...), feedback scores from customers, all of those metrics is how we track our adoption. So, those metrics impact adoption. If those metrics are good and closer to customer expectations, then the adoption is very good." (S3)		
"They believe that if your business is applying these core technologies, you will be able to deliver more (…). Because AI systems, as they grow old, they become smarter. They learn more." (S15)		
"But they built something from two different technologies, combined that together and made something different, which is special." (S12)		
"I think that startups can use AI as a competitive advantage over large companies." (S3)	**Advantages of startups in adopting AI over large companies**	
"So [AI] works better for startups." (S10)		
"Startups are flexible and can change their workflows fast and use this to do things big companies can't do." (S9)		
"Startups can be a lot faster than traditional companies or large corporations. Speed matters the most! We can validate faster and better and find product-market fit easier and faster." (S8)		
"Usually, startups are, compared to the traditional companies, smaller and more agile. (…) If we wanna try something, we're trying it." (S8)		
"(…) big enterprises and big companies are moving a bit slower. It's harder to make decisions." (S12)		
"So obviously we have all the security measures in place, but it's not like a huge worry what would happen if. (…) I'm not aware of any major concerns in our company." (S14)	**Mixed opinions regarding security concerns emerge with AI**	Addressing security, ethics and acceptance issues: a requirement to realise the full potential of AI in startups
"Not everyone in the world is accepting AI so in our case, as an education company, AI is a very sensitive topic (…)." (S6)		
"Security companies, financial companies, they probably have much future risk. " (S2)		
"(…) the ability [of the technology] is going beyond what you have trained the AI." (S5)		

"I trust AI, but I didn't trust building this solution with it. I'm not sure if it was going to work. But it's a risk that we took and it made sense to take the risk." (S5)	**AI has decreased human trust in technology**	
"Actually, right now in our world today, we have to prove ourselves more than before. Before you just show up and that's it. (…) Now we have trust issues, which makes human, spending so much time convincing people because now people don't want to trust you." (S4)		
"People will maybe stop validating data provided from AI so now we can easily be manipulated by AI (…)." (S4)		
"Don't share sensitive data with AI, everything you feed in to get information out of it will be used to train the algorithm and to further learn, so others can access it afterwards." (S3)		
"(…) AI is a very spicy topic for the educational sector." (S6)	**Founders have ethical concerns about the usage of AI**	
"(…) strong ethical standard internally are needed." (S13)		
"(…) AI can be a tool for exploitation." (S8)		
"(...) because for us we have our own ethical standard, at least for our organization. Like we pretty much define what's ethical and non-ethical, what is negotiable and non-negotiable within our organization. And everyone is fully onboarded on that. "		
"People will maybe stop validating data provided from AI so it can be manipulated in an easy way by AI, there is different quality of different AI tools, and it is hard to see the difference." (S4)		
"You need to have a panel of 10 people reviewing the results. And these people need to be like from minorities different ethnicities, women, men and not just one guy like me. Measuring it. And that's how you can make it unbiased." (S1)		
"(…) AI can act unethically simply because it has learned to be discriminatory based on our data." (S7)		
"And the usage of AI is not defined in detail by law yet, so one has to find his way to use it in some areas where governmental authorities might not want you to use it in your use case as a startup." (S10)	**AI needs legal regulations**	
"Yes, there are data privacy regulations, but (…) I just feel that this is something that should also be looked at." (S1)		
"(…) But there's a law that will ask us to do some reviewing of our algorithm and there's some legal work that must be done." (S3)		
"Regulations from authorities (…) are needed." (S9))		
"I think there should be a government intervention in regulating all of this stuff, because I think everyone is now gearing towards adapting to AI and there's not much of regulation surrounding that." (S14)		
"Similar to how they control corporations. Corporations can avoid exploiting people (…) AI can be a tool for exploitation." (S8)		
"Our accuracy in predicting employee resignation is currently at 88%, (...), and we're only analyzing office tools, employee databases and productivity tools that they're using. Imagine if we can incorporate social media, Tinder, bumble, all of these things where you have interaction, imagine if we have access to those personal data our prediction will be much, much better. " (S4)	**AI gives access to in-depth company data**	

"So, when we deploy our AI in the companies, we are learning about [the employees] and we are keeping it secure." (S3)		
"That means there is a bridge that you need to build between the AI and the company. This bridge works on company specific information and company specific data." (S16)		
"And that gives you the competitive edge always, (…) working inside the company and you are learning about the company, (…) that knowledge is a competitive advantage of that company, which they don't want to give to the AI models." (S7)		
"The non presence of bias in getting all of this data interpreted." (S11)	**Mixed opinions on whether AI is biased or not**	
"AI has no bias, which also means that it'll just take it in as it is. It's not gonna tell you whether it's good or bad." (S15)		
"Getting things done without bias." (S4)		
"AI can act unethically simply because it has learned to be discriminatory based on our data." (S7)		
"You need to have a panel of 10 people reviewing the results. (…). And that's how you can make it unbiased." (S1)		
"(…) AI can act unethically simply because it has learned to be discriminatory based on our data." (S7)		
"AI is a mass hype in the way of solving the problem." (S6)	**Startups are adopting AI because they need to ride the hype-wave**	Appropriate AI application: Navigating between market trends and business goals
"It is really the trend in the market right now." (S1)		
"I don't think the technology is hyped. But the urgency to integrate it, the urgency to leverage it, the urgency to use it – that is hyped." (S6)		
"I think that it's a trend the same as iPhone is a trend." (S8)		
"I don't think it's a hype in terms of what it can give to the world. It's a big shift. It's a big change." (S14)		
"Today [AI] is also something that you must have, but it's like everyone has it now, so it's not that it's going to be a differentiator. But you are in trend." (S9)		
"We're just going to assume that we use AI to solve the problems. (…) So right now, we're taking advantage of the hype as well." (S4)		
"All our services might be hyped." (S5)		
"You need to block yourself from the noise. (…) and because [AI adoption] is so easy and because it's so cool and because it's hyped it can be noise." (S8)		
"And if I have a suggestion on the other hand, don't go into the hype. Think, if it's really useful and if it's really needed and not just because, it's hyped." (S14)		
"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases, and so on, (…), and the AI solutions can take you off focus." (S14)	**Startups need to stay focused on their goals and just adopt AI as it fits such goals**	
"(…) building an AI solution can be a black hole. That means it can suck up a lot of energy from the founders and take that time away from spending that with customers." (S4)		

"And companies need to know to stay focused on their vision and on their target market and understand their use case. If they get disturbed from this, it can hurt the business." (S2)		
"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases, and so on, and having the AI technology, the AI solutions can take you off focus." (S14)	**AI usage can distract founders from important business focus**	
"Just like it, it can be noise, okay? And you need to block yourself from the noise. You need to constantly figure out the noise from the important. And because it's so easy and because it's so cool and because it's hyped it can be noisy." (S8)		
"That means it can suck up a lot of energy from the founders and take that time away from spending that with customers. So, I think that's been our learning and we should probably look at it the other way." (S4)		
"[AI] diverges us from our focus, (…)." (S12)		
"Not negative. I don't think there's something negative in it, but it does bring a lot of distraction that isn't necessarily good." (S10)		
"So, the challenge that we have as a company is to have the right data (…)" (S11)	**High data quality and quantity are key components for successful AI implementation**	Data management in AI: Fostering data quality, access and continuous improvement for trust and performance
"You need (…) quality of data, and that is the hard part (…)" (S4)		
"(…) AI is all about the data that you feed to the AI systems, and the more intelligent your data is, the better the AI." (S15)		
"Our challenge as a company is, how we are going to process that data and how it looks for a customer and how you add value to customer with the way you're using these types of data." (S12)		
"You need not only quantity of data, which is easy to get, you need quality of data, and that is the hard part to get." (S5)		
"It's a way that you can do your job better with more accurate data." (S10)		
"So, the challenge that we have as a company is to have (…) a great amount of data." (S11)		
"ML is a continuous process of integrating as many data points as you can to feed the technology, (…), [to] create more accurate results." (S10)		
"(…) as you feed more to that algorithm, that AI will becomes (?) smarter, which will then add more value to your service (…)." (S4)		
"You need not only quantity of data, which is easy to get (…)" (S11)		
"For some companies it was super hard to access data or type of server or infrastructure that has AI." (S5)	**Lack in data access is a challenge in AI adoption**	
"So, the challenge that we have as a company is to have the right data and a great amount." (S4)		
"Huge amount of data is pretty much raw." (S13)		
"It is never fully trained. Right now, we can do something with it, but we can be much better. We can be unbiased and much more." (S1)	**Continuous optimization and training with new**	
"We train it ourselves." (S1)		

"Data is not static, so that's why you have a process of making it learn somehow." (S16)	**data is vital for high-performance AI**	
"And for us to make sense of [the data], we have to re-engineer and harmonize and at the same time, optimize [the data]. So, ML is pretty much helping us in re-engineering, harmonizing and optimizing this data, which then enables us to deliver the output for our clients." (S4)		
"The reason why it takes time is as you would appreciate, AI is all about the data that you feed to the AI systems, and the more intelligent your data is, the better the AI." (S15)		
"(…) but as they expand the relationship with you, as you feed more to that algorithm, that AI will become smarter, which will then add more value to the service that they get from you." (S4)		
"One thing that's emerging with that exposure that I had with AI and ML today, is really the accuracy of the prediction based on the data that we are feeding the algorithm." (S3)	**Accuracy is necessary to build trust in AI**	
"Like our accuracy in predicting employee resignation is currently at 88% (…) that is insane." (S4)		
"With all the data that I've seen right now and using our own calculation and the accuracy of that calculation, we've seen technologies now being able to really tell possible decision making." (S4)		
"So, ML is a continuous process (…), so that you can actually be more accurate on the result that you're providing. So, it's more about accuracy." (S10)		
"So, it's a part of their evaluation process, how accurate you are. So that's what makes them trust more or less in you depends on how accurate your results are." (S13)		
"There are the challenges are always, how accurate the AI works and how much human input does it require?" (S8)		
"We need to research [AI]. We need to understand exactly how we are going to use it, how we're going to implement it." (S10)	**Founders should have a good understanding about the AI technology**	Human-AI synergy: The demand for knowledge, skills and collaborative interaction
"I did not understand [AI]. I was afraid of something that I didn't know. I never built something with AI (…) I wasn't able to visualize what it takes and how it worked." (S1)		
"But for us, with my Co-Founder, who has a PhD in ML, we were able to develop something that we have validated in the market that we're serving, (…)." (S4)		
"But if you have at least a high-level understanding of how these things work, it'll be easy for you to jump on board and at the same time deliver understanding for how things work and deliver more than what is expected from your product." (S5)		
"I should have invested on data science people. Because I've utilized different skillsets in building our core technology which drained our financials (…)." (S3)	**AI implementation requires highly qualified and skilled workforce**	
"There's a lot of know-how behind it that you need to understand (…)." (S10)		
"Work with a CTO or a product owner that knows how AI works, or somebody that knows how to hire and look for this type of talent. Because that's going to make your life way easier." (S13)		
"And I'm allocating a good portion of our revenue to really upskill our people." (S4)		

"If my employees are highly skilled, they're gonna be able to do more. They're gonna be able to deliver more, which will then equate to delivering more to our clients and hopefully transform that into more revenue that will make my investors happy." (S11)		
"Our startup is committed on further training, because I'm seeing this opportunity as an added value to our business." (S14)		
"The challenge is, that the people that do AI, like data scientists or AI engineers, these specialists are super expensive." (S5)		
"So now as a CEO, my challenge is to have the right people, that make things happen and get my product done." (S12)		
"I should have invested on data science people. Because I've utilized different skillset in building our core technology which drained our financials (…)." (S3)		
"And you need, for now, you need more tech-oriented people to use it. Others don't know how to use it." (S10)		
"Work with a CTO or a product that knows how AI works, or somebody that knows how to hire and look for this type of talent. Because that's going to make your life way easier." (S13)		
"Basically, if you have good developers, intelligent people, I think the current solutions allow you to very quickly learn the whatever needs to be learned in order to use it and leverage it." (S15)		
"I would believe finding the balance between a fact and feeling driven decision related to the acceptance of customers is something which humans can do better, but not faster. It may take longer for a human, but it has more depth (…)." (S6)	**A combination of AI and human work is needed**	
"AI has no bias, which also means that it'll just take it in as it is. It's not gonna tell you whether it's good or bad. (…) I am very confident to say that AI will never replace human, because AI has no capability of identifying the good and bad."(S2)		
"(…) how much human input does it require? It is important that there is a human in the loop to while using AI (…)" (S10)		
"AI technologies can deliver (…) high-quality answers." (S10)	**AI is increasing startups productivity and performance by making them work significantly faster**	Leveraging AI as productivity catalyst: Increasing pace, efficiency, and performance
"[AI] gives you the ability (…) to multitask and do many things and scale (…)." (S16)		
"Productivity in generating leads has increased 22% month to month." (S4)		
"So in my case, I create a month of work in just one or two weeks. So I believe that is a great impact." (S2)		
"[AI] saves a lot of time" (S14)		
"(…) my development team is using an AI co-pilot and it decreased their development time around 40 - 50%. That's a lot." (S1)		
"We'll save you 90% of the time." (S12)		
"(…) see how it answers [your companies] needs, either from the work environment, the everyday aspects of it, marketing, design development, scheduling (…)." (S11)	**AI is a multifaceted tool that helps startups to enhance their efficiency on a every day basis**	
"AI generated customer surveys with AI supported target group matching will help to decide better and faster." (S7)		
"As a product manager AI is helping me in researching the market, researching users, and creating user stories." (S15)		
"I think in terms of text, it helps me a lot. Like it helps me correcting texts and stuff like that. That's most of it." (S12)		
"But not only that, also for the daily life. Even for coders and for developers, tools help them with their code writing, help them to develop." (S13)		

"It's just a broad usage for every aspect of the startup, as I mentioned. It can help in just everyday life of every team. Increasing productivity in general. All over." (S8)		
"As a founder, it helped me to prioritize things better." (S2)		
"So, where we use it as a company are on two things. On my end to automate commercial processes and on my team's end to automate certain technical processes." (S5)		
"I can tell you right now, probably all founders are using AI to get their jobs done easier." (S16)		
"(…) I think it's a great tool that every company should try to figure out how to integrate and see how it answers their needs (…)." (S11)	**Founders advice to leverage AI for business optimisation possibilities**	
"Now it's on your end to play the cards right and see how you could adapt it to your technology or your workflows as a founder." (S10)		
"We are now looking at the future five steps ahead. So always think five steps ahead and look for an opportunity in the technology." (S1)		
"So, AI is a critical component for innovation." (S12)	**AI stimulates innovation within startups**	Utilising AI as a competitive advantage: Driving innovation, improving value creation and enhancing customer-focused strategies
"Discover new things about your solution." (S2)		
"But because of ML, it was easy for us to acquire all of these data, re-engineer it, like specifically identifying what are the features what are the specific data sets that we wanna look at to create new products." (S5)		
"Because it's opening so many doors and gives so many opportunities that before were not that easy to take." (S8)		
"It's not going to be a differentiator. In a couple of months or years, people are going to assume that you're using AI in the product. It's not an innovation, it's part of your process. " (S3)		
"Because right now we're in an early stage and they see innovation on our end." (S8)		
"The market and the solutions are evolving fast and new solutions lead to new possibilities to create new solutions working with the new solutions." (11)		
"It did help because they see the innovation of what we're doing with AI." (S4)		
Why do you think it's harms innovation? "Just because I said for example one company that does legal services to AI, so it's gonna kill a lot of startups that have legal services in creating legal services in one way or another. There's gonna be one solution or a few solutions that answer a lot of the needs." (S13)	**AI harms startup innovation**	
"With AI we (…) deliver value to customers faster and more reliable." (S1)	**AI as a driving force for increasing customer value and satisfaction**	
"So you're going to be more precise on the way you're creating the solution for your customers." (S4)		
"We are using it to create, like, real value for our users, not just for the sake of using it." (S11)		
"(…) if your business is applying these core technologies, you will be able to deliver more than what [your customer's] are expecting from you. Because AI, as they grow old, they become smarter. They learn more." (S15)		

"(…) applying AI to all of this data, like formulating all these formulas and algorithm that will consistently digest all of this data, we will be able to deliver more value to our clients." (10)		
"(…) I think as an AI startup, we all need to care about balancing the value added to the [clients] and the cost they pay. So this is still a challenge that we work on from AI perspective." (S5)	**AI should be used as a strategic tool for advanced value creation by startups, rather than an image optimizer**	
"AI is going to be involved in many places at the same time, so the solutions that startups are going to create have to be really good and focused." (S2)		
"Making sure they are not building AI just for the sake of AI, but rather delivering value. Like it can be AI, but it can be something else behind it. Just deliver value!" (S11)		
"If you want to keep your business running, if you want to stay in the market and be the preferred the choice of your clients, I think it's about time that you apply an AI in your overall business strategy." (S8)		
"Like the goal is to deliver value, not actually to develop technology." (S15)		
"Delivering value is more important than the AI itself. " (S4)		
"The market and the solutions are evolving fast and new solutions lead to new possibilities to create new solutions working with the new solutions. It is like a chain. Problem A can be solved by creating B. Now with B problem C can be solved to create D. With D we can solve problem E etc. And always changing and adapting to the environment. And through AI this is going to change much faster." (S6)	**New business opportunities evolve through AI driven market change**	
"In the future, the job of a nurse might be paid better than that of a doctor." (S7)		
"It might be that the startup market changes from tech to something else, to a more product driven and investment heavy sector." (S9)		
"We are now looking at the future five steps ahead. So always think, five steps ahead and look for an opportunity in the technology. That's very important." (S1)		
"Offering a new set of products will be possible, as it can be offered in a scaled and cheap way with AI (…)." (S5)		
"(…) As AI startup we all care about to balance the value added to the companies and the cost they pay. So those are still some of the challenges that we work on from AI perspective." (S10)	**Value creation of business model**	
"AI is going to be involved in many places at the same time, so the solutions that startups are going to create have to be really good and focused." (S2)		
"Making sure they are not building AI just for the sake of AI, but rather delivering value. Like it can be AI, but it can be something else behind it. Just deliver value!" (S11)		
"If you wanna keep your business running, if you want to stay in the market and be the preferred the choice of your clients, I think it's about time that you apply an AI in your overall businesses strategy." (S8)		
"If you mention that you're an AI company that's not going to be your advantage with investors or with clients. It is just part of you. You have to change the narrative of the innovation and of the solution that you're building." (S1)		

"Like the goal is to deliver value, not actually to develop technology." (S15)		
"(...) look for an opportunity to get a patent. (...). Because now your technology is protected, at least for an x number of years you're the only one that's gonna take advantage of it." (S4)	**Securing competitive advantage uniqueness and intellectual ownership, and a customer-centered business approach**	
"We train the AI in, in a way that is unique." (S8)		
"We have trained [the AI ourselves]. So, I'm not scared [that our technology can be replicated by someone else] at all." (S1)		
"Our patent is very important to secure competitive edge. It's hard to patent a machine learning algorithm, (…)." (S4)		
"The way we calculate our data is different from the ordinary calculation that's available." (S4)		
"(...) startups always need to be very focused, laser focused on your target market, on your solution, on your business use cases and so on. So we will always know our users better and our market better so we can offer better solutions. That's the best thing you can do." (S14)		
"So, we're still keeping that (our old values) when compared to our competitors (…)" (S2)		
"So when we deploy our AI in the companies, we are learning about that and we are keeping it secure. That information and that knowledge gives us the competitive advantage over others." (S3)		
"If you really deeply understand your customers, then you are using AI as a competitive advantage." (S8)		
"Trying to create the biggest value and nicest experience for our target group in comparison to our competitors. The nicest solution will always be chosen and relevant." (S14)		
"You really need to know something about your customer and you are able to create a solution for that customer in a way that nobody else is able to create. And then if you have used AI to speed up that process, then it's even better." (S9)		
"And for startups. Many startups are going to die. Many startups are going to die with these new infrastructures." (S9)	**AI enhances the competitive landscape instead of being a unique differentiation feature, thus AI is not sufficient for securing competitive advantage**	Steering through the AI-driven competitive landscape: The critical impact of strategic adaptation on the survival of startups
"It's going to be a very competitive landscape. (...) AI is not going to be like the main differentiator for your company. Because it's going to be accessible for others. So, you're going to be more precise on the way you're creating the solution for your customers." (S5)		
"I don't know if it is necessary to implement it immediately but sooner or later one probably has to keep up with the competition and the new ways of working. (...) The competition is tough out there. We always have to adjust and rethink our strategy: Are we still relevant for our initial target group?" (S6)		
"(…) the tech startup scene is going to have more competitors (…), and it's not going to be a competitive advantage (?)." (S5)		
"It's not going to be a differentiator. In a couple of months or years, people are going to assume that you're go using AI in the product. It's not an innovation, it's part of your process." (S8)		
"It is a very competitive landscape. (…) AI is not going to be like the main differentiator for your company." (S5)		
How do you secure your competitive advantage? "It's actually the hardest part, because AI is not a competitive advantage of our company specifically." (S12)		
"I mean by that is AI alone cannot be your competitive advantage." (S16)		

"Just bringing an expert in and seeing the market, that everything is moving towards AI. We did not want to fall behind and see the power of AI run away. Not just see what everyone is doing with it but being part." (12)		
"[AI] going to be more accessible for everyone. (…) more competitors that are going to implement AI (…) it's not going to be a competitive advantage." (S5)		
"It used to be a competitive advantage if you used [AI]; it was a differentiator. But that's not the case anymore." (S7)		
"And I think a lot of these companies will probably go away just because they don't offer anything of their own. They just package AI in another way." (S8)		
"New companies cannot replicate you because your differentiator is not the AI, it's your deep understanding of the customer."		
"(...) when talking about my advantages and comparing myself to competitors, I'm not saying: 'Look, we use AI like this, and they're not using it like this.' Because, okay, we can be one step ahead of them, but it's not something that can stay forever." (S12)	**Intensified market competition and survival challenges for startups due to AI**	
"Yes, it's getting more competitive, and suddenly your competition is not only other startups, but also AI. We notice that a lot. I'm a bit scared (…)." (S12)		
"And the speed of change, it means new companies can be killed pretty easily (…)" (S1)		
"So you're going to have more competitors." (S14)		
"So the market is going to be more fragmented, the market is going to be more competitive." (S5)		
"So I believe that if you don't control AI, your life is going to get controlled in a certain type of way. (...), if you use it, you need to know how to use it correctly, to get the best out of it. (…), but if you don't adapt, you're going to stay behind." (S2)	**AI as a catalyst for the rapid transformation of the business industry and the imperative need for adaptation**	
"It's a big shift. It's a big change. It's a huge technology that was brought to the world (…). It was, obviously here before that, but the easiness to access and use it." (S14)		
"Now [AI] it's going to be more accessible for everyone." (S5)		
"I believe that we're entering the fourth industrial revolution, which is the AI revolution. So, what we're going to start seeing is companies commoditizing AI." (S9)		
"Everyone would agree with me on that (…) AI is really the way forward." (S8)		
"(…) So I think that's how AI is actually shaping the tech industry right now; in terms of valuation and (…) the growing interest from clients." (S4)		
"Now, our time has changed." (S10)		
"AI is becoming more and more widespread and also more and more powerful." (S7)		
"Security companies, financial companies, they probably have a much future risk. " (S2)		
"So there are going to be two types of companies, the one that use infrastructure. (…) That are the most startups being created now. And there are other companies like ours that are going to be specialized companies that use these types of new infrastructures to adapt quick to the new models of AI that can be created with more data points." (S5)		
"And on the other hand, if you don't adapt, you're going to stay behind." (S11)		

"Because, okay, we can be one step ahead of them, but it's not something that can stay forever. In a month or in two months, they will be, they will get aligned with that as well." (S12)		
"So, there's a lot of startups popping up." (S2)		
"Because if you don't adapt to these new AI technologies that are coming right now, you're going to be in problems because other companies, your competition might adapt quicker as you, and they will take advantage of that." (S13)		
"(…) but that's been the pace of rapid growth in the last six months as well." (S1)		
"It's a little bit stressful seeing that everything's moving so fast and you wanna catch up and you don't wanna be left behind. But yeah, it's wrong to stop it. It's like a try or die." (S8)		
"I believe it [AI] will change the pace of everything, of the industry a lot a lot. Everything will be faster. Faster to develop, to research, to create, to find out." (S6)		
"It hurt (…) survival rate of startups because you're gonna get replaced by AI." (S9)	**Startups are particularly challenged by time- and cost-constraints and enabled by agility in the process of AI adoption**	
"And in one year this startup is not gonna have a business anymore. It will be replaced by AI." (S9)		
why do you think it's harms innovation? "Just because I said for example one company that does legal services to AI, so it's gonna kill a lot of startups that have legal services in creating legal services in one way or another. There's gonna be one solution or a few solutions that answer a lot of the needs." (S8)		
"I'm afraid that soon these services can answer 90% of our of our solutions, just because they're getting to be much smarter." (S12)		
"[Evaluate if] the implementation effort and time of AI smaller than the outcome in the end. [Can] the startup effort putting in this time effort in its' current state?" (S5)		
"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases, (…) and the AI solutions can take you off focus." (S14)		
"I think that for startups specifically, not much has changed why a startup will be successful. (...) You really need to know something about your customer, and you need to create a solution for that customer in a way that nobody else is able to create." (S13)		
"How much time will it take to implement AI (…) does this amount make sense (…) in our current situation as a startup, where we have to be fast in deciding and implementing, because everyday costs us a lot of money, (...). It is a constant battle with our cash burn rate." (S6)		
"(…) tech startups are usually just the first to adopt new technologies. It's much easier for them to integrate new technologies." (S4)		
"(...) because we're a startup, we're two, it's only me, a technical person." (S2)		
"Startups are flexible and can change their workflows fast and use this to do things big companies can't do." (S9)		

"Usually, startups are, compared to the traditional companies, smaller and more agile. (…) If we wanna try something, (...) we're trying it. And big enterprises and big companies are moving a bit slower. It's harder to make decisions." (S12)		
"So AI is a critical component (…) for getting a competitive advantage with customers." (S5)	**AI is strategically important for creating competitive edge in the tech startup industry**	
"[AI] It's not an add-on, but it's a must have." (S9)		
"Because if you don't adapt to these new AI technologies that are coming right now you're going to be in problems because other companies, your competition might adapt quicker as you, and they will take advantage of that." (S13)		
"Yes, it's getting more competitive, and suddenly your competition is not only other startups, but also AI. We notice that a lot. I'm a bit scared (…)" (S12)		
"I think that startups can use AI as a competitive advantage over large companies." (S3)		
"Any software or any startup has an AI unit as a competitive advantage." (S10)		
"I don't know if it is necessary to implement [AI] immediately but sooner or later one probably has to keep up with the competition and the new ways of working." (S6)		
"(…) the AI solutions can take you off focus." (S14)	**AI helps start-ups compete more easily with existing companies**	
"So, there's a lot of startups popping up." (S2)		
"Every startup can use AI in some way or another. (...) Any software or any startup has an AI unit as a competitive advantage. It makes you run things faster and break things faster. That's what I think. So it's better for startups." (S10)		
"The industry of AI and startups is developing and evolving very quickly." (S3)		
"I think every startup will integrate AI in one way or another in the next few months, (…). It's just something you can't ignore in any use case, in any sort of app or platform." (S5)		
"So I think startups can really nimble and they can use AI to get a real speed and competitive advantage in the market. So I think that AI is benefiting the startups." (S10)		
"Profitability or proof to be able to reach profitability." (S10)	**Key success factors of startups remain the same**	**The main startup success factors are business focus, customer focus, and focus on problem-solving**
"There are two things that I'm looking at to say that a startup is successful. If you are delivering value to your clients (...). Delivering value to the clients that is measurable. And at the same time, delivering return on investment of your investors." (S3)		
"Because the reason for existence of a startup has not changed. That is to solve a particular pain point for a customer. That is the reason why any startup exists. (…)." (S5)		
"If you wanna keep your business running, if you wanna become and stay in the market and be the preferred choice of your clients, I think it's about time that you apply AI in your overall business strategy." (S8)		
"Yes. If beneficial for your startup you can outrun competitors in different ways: for example in-depth quality of service and speed." (S6)		
"I think that for startups specifically, not much has changed why a startup will be successful." (S13)		

"For every startup, I think the only success is customer traction, customer adoption. There is no other, every other success is false success or secondary." (S1)		
"But as a startup, (…) you can't aim at too many things at once. You must be very focused on what you are working on, on your target market, on your use cases. Having AI technology and solutions can take you off focus." (S14)	**1. component for startup success: Business focus**	
"You are becoming more appealing to potential customers because as I said earlier, the way to the future is really AI and ML." (S4)		
"So we always need to know our users better and our market better so we can offer better solutions." (S14)		
"Because the reason for existence of a startup has not changed, that is to solve a particular pain point for a customer (…)." (S5)	**2. component for startup success: Customer focus**	
"I think they should focus on the customer. (…). You really need to know something about your customer and you are able to create a solution for that customer in a way that nobody else are able to create." (S3)		
"There are two things that I'm looking at to say that a startup is successful. If you are delivering value to your clients, that means that clients stay with you, expanding their relationship with you (…)." (S4)		
"I wanna see that customers are getting value, from what we do, that they are paying for it, they have a willingness to pay, and they are getting value like that." (S8)		
"For every startup, I personally think the only success is customer traction, customer adoption. There is no other. Every other success is false success or secondary." (S1)		
"We always need to proof, that a significant amount of customers is willing to pay for your solution (…)." (S15)		
"AI is not going to solve the problem. Before thinking about how to use AI, think about why and what are you trying to solve (…)." (S3)	**3. component for startup success: Focus on problem solving**	
"If you don't understand the market that you're working in or the problem that you're solving, AI is not going to be for you." (S13)		
"Did you manage to understand what problem you need to solve? Because that's what you need to get involved with: the real problem and the solution." (S8)		
"A first success would be, if we understand the problem and (…) if we're getting into the right direction. Now (…) you create the product with the feedback of customers, and then you sell the product. You manage to monetize this product early on, in a fast way (…)." (S5)		
"We believe it will help for fundraising." (S1)	**AI as an attractiveness factor for investors**	**Strategies for stakeholder management in AI start-ups**
"But I think now it's like you need to have it [AI integrated in your business model], but it's not really an advantage. But it's good that you have it. It's a good deal. It can help." (S12)		
"It did help because they see the innovation of what we're doing with AI." (S5)		
"But [the investors] see in an early stage, the founders are actually gonna make it happen. So, I think it impacted because they see the innovation." (S4)		

"I think, AI is really driving not only the valuation of a startup. If investors will see you as a smart, tech-enabled startup focused on applying AI, automatically your valuation of your business will go up." (S15)		
"And whenever investors would see, okay, so you have a patent on your algorithm, you can see the spark in their eyes, (…)." (S4)		
"AI is very interesting to funders." (S10)		
"The investors like it." (S8)		
"So the investors know the how and what we do, where we integrate [AI], where we use it in our product. But they don't care about how we use it (…). And I don't think we've used it to pinpoint stuff with investors." (S12)	**Investors focus on founders and scalable problem solutions rather than AI**	
"What they value most are the founders, if the founders are capable of building this rather than how they're gonna do it. So if you're the right founder that is going to be able to execute with AI or without AI, that's another thing." (S5)		
"AI has not made a big difference in terms of my ability to raise investment. (...) every investor has looked for which problem I am solving (...) and if it can really be scaled and become big. But just the fact that we are doing AI (...) has not help us (…)." (S3)		
"I think investors have learned so much from [the NFT hype]. And that's probably one of the reasons why, even if you are in the AI or ML space, they're very careful in putting their money in there, because of that experience that they had with NFT and Web3. " (S4)		
"You are becoming more appealing to potential customers because as I said earlier, the way to the future is really AI and ML." (S4)	**Building customer relationships and partnerships**	
"But the bottom line is we have the same technology. (…) . Some people will do it better, but for us to become the preferred choice of our clients, we focus on relationship." (S14)		
"They value relationship, they value the conversation that they had with you." (S11)		
"So we focus on becoming a partner rather than a service provider. And I think that's one thing that I'm able to figure out at the very early stage of our business that made us the preferred choice of our clients today." (S7)		
"(…), for corporations, they're also going to have access to this type of technology, which means that they are going to be able to create something that they couldn't create before."	**Using AI to create and deliver value for stakeholders**	
"On our case, since we're a specialist company, AI is not innovation. It's how we're going to get the job done. (...) companies are going to hire me not, because of the AI, they're going to hire me, because I provide the right outputs and I'm creating those outputs by using AI."		
"(…) we're dealing with enterprise clients operations globally, they see that applying AI will enable them to understand better on how they can improve their global operations." (S4)		
"(…) AI will become smarter, which will then add more value to the service that they get from you. So I think that's how AI is actually driving that the tech and industry right now in terms of valuation and at the same time the interest of the clients."		

"Offer a new set of products (…) offered in a scaled and cheap way with AI, instead of additional HR needed and deliver value to customers faster and more reliable" (S5)		
"(...) You wanna get a be better value for your business, and getting a patent will definitely boost your value, not just from an investment side, but also from a client acquisition perspective." (S4)		
"They wanna take advantage from your service offering. Delivering value to the clients that is measurable. And at the same time, delivering return on the investment to your investors." (S3)		
"So these are two things that I think will be key indicators of a startup success if you are giving that value that you promised to your clients, and at the same time you are giving your investor that return that they have expected from your business." (S8)		
"So AI is a critical component for (…) improving your human force that you have." (S14)	**Investing in employee training to increase performance**	
"If my employees are highly skilled, they're gonna be able to do more. They're gonna be able to deliver more, which will then equate to delivering more to our clients and hopefully transform that into more revenue that will make my investors happy." (S13)		
"There's a lot of know-how behind it that you need to understand (…)." (S10)		
"And I'm allocating a good portion of our revenue to really upskill our people." (S4)		
"If my employees are highly skilled, they're gonna be able to deliver more, which will then equate to delivering more to our clients and hopefully transform that into more revenue that will make my investors happy." (S8)		