

The impact of AI on the Business Model and Operating Model of AI companies.

THESIS

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Abstract

While at a technical level, Artificial Intelligence (AI) seems to be the future of software and shows remarkable progress, it challenges the Business Model (BM) and Operating Model (OM) of software AI companies. Therefore, many AI companies find it difficult to leverage the best of AI and harvest all the advantages that Artificial Intelligence (AI) has to offer.

In addition to existing scholarly literature and various BM and OM frameworks provided by practitioners and consulting firms, qualitative research is conducted to determine the impact of AI on the Business Model (BM) and Operating Model (OM) of AI companies. Twelve semi-structured interviews were conducted, utilising a BM and OM framework that was developed in the context of this research, based on extensive literature review.

The objective of this study is to determine the impact of AI on the Business Model (BM) and Operating Model (OM) of AI companies. Our findings imply that AI software development and deployment can be rather demanding and do have a significant impact on AI companies with regard to their Business Model (BM) and Operating Model (OM). This makes AI companies differ from other IT companies and need to pay close attention to various aspects of their Business Model (BM) and Operating Model (OM), in order to be able to fully leverage the best of AI while minimizing the risks and challenges that AI software development and deployment might entail.

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List of Abbreviations

AI Artificial Intelligence	8
BM Business Model	8
BMC Business Model Canvas	9
BMI Business Model Innovation	17
B2B Business-to-Business	47
CEO Chief Executive Officer	55
CTO Chief Technology Officer	49
CV Curriculum vitae	47
DL Deep Learning	9
GDPR General Data Protection Regulation	60
HR Human Resources	37
ICTs Information and Communication Technologies	9

ML Machine Learning	9
NLP Natural Language Processing	9
NN Neural Networks	16
OM Operating Model	8
OMC Operating Model Canvas	
PM Product Manager	47
SaaS Software-as-a-Service	41
VP Vice President	45

7



Introduction

While at a technical level, Artificial Intelligence (AI) seems to be the future of software and shows remarkable progress, it challenges the Business Model (BM) and Operating Model (OM) of software AI companies, making it difficult for them to leverage the best of AI. In this study, we aim to uncover the impact AI has on their business and operating structure.

1.1 Research Background

Artificial intelligence is the most important general-purpose technology of our time (AI), which seems to be everywhere around us (Crafts, 2021), significantly affecting numerous aspects of society and business (Makridakis, 2017). A wide variety of AI applications can be found in different industries including manufacturing, finance, law, medicine, human resources and education(Loebbecke & Picot, 2015). Airbnb and Uber are just some examples of businesses that have embraced artificial intelligence (AI) and achieved to build new business models, leading to the disruption of their industry (Lee et al., 2019). More and more organisations attempt to use AI, aiming to transform their business models and harness the potential of AI (Brynjolfsson & Mcafee, 2017).

This phenomenon has led to the rise of research into AI-related business models (Weber et al., 2022). Extensive scholarly literature provides a wide range of articles concerning the extent to which AI has affected various industries, however, the main focus of researchers is on how AI technologies can be utilized to improve operations and processes, leaving the majority of business models that include AI technology as a core component yet to be researched (Weber et al., 2022). As a result, little to no research has been conducted on how AI affects the BM and OM of AI companies.

In this research we will focus on investigating what is the impact of AI technologies on the BM and OM of AI companies, meaning companies that design, develop and deploy AI software. In order to identify the implications of AI technologies on AI companies, we will first conduct a rigorous literature review on the concepts of BM and OM. In recent years, the importance of BM in actual practice has increased, especially in light of their links to maintaining and enhancing competitive advantage (Johnson et al., 2008). In addition, rapid improvements in Information and Communication Technologies (ICTs) have also emphasized the growing significance of the Business Model (BM) concept (Al-Debei & Avison, 2010). Business models describe the value logic of an organization. They can be described as tools that outline a group of concepts and their interconnections, in order to define the way a business creates and captures value for its customers segments (Osterwalder et al., 2005). It defines the way an organisation can create and capture value. There are several visual inquiry tools that are used to operationalize the abstraction of the high-level concept of BM, with the most popular one being Business Model Canvas (BMC). Business model frameworks aim to describe, analyze, and design business model (Richardson, 2005). Based on the literature review findings, we will develop a BM and OM framework, which will be utilized to gather valuable insights on the AI impact on the business and operating structure of AI companies.

Artificial Intelligence (AI) can be defined as a technological field, which includes other technological branches, such as Machine Learning (ML), Deep Learning (DL), Natural Language Processing (NLP) and so on. The purpose of AI is to create humanlike computers capable of operating autonomously and mimicking human cognitive activity (Chui et al., 2018). Although most of those key components have already been adopted by several companies all around world, most of the great opportunities, AI has to offer, have not been utilized yet (Fanti et al., 2020). AI has generated lots of unrealistic expectations (Makridakis, 2017), which in combination with the fact that managers are left with little support from academia when aiming to incorporate AI in their business, leads to an increased risk of unwanted outcomes and failure or short-term success (Soni et al., 2019). Therefore, studying the impact of AI on the business and operating models of AI companies can also provide valuable insights into the challenges that companies face and need to overcome to successfully leverage AI capabilities and bridge the gap between the technological advancements and how organizations profit from AI technologies.

1.2 Research Objective

Although, there is a wide variety of literature discussing the impact of AI on companies in various industries such as medicine, education, law and so on, research on the impact of artificial intelligence (AI) on AI companies is still lacking. AI companies are defined as companies that develop and deploy AI and have AI in their core of their business. Therefore, the objective of this research project is to address this gap and investigate the impact of artificial intelligence (AI) on the BM and OM of AI companies. From an academic point of view, this research project aims to add to the scientific literature that investigates the relationship between AI and the concepts of BM and OM. Furthermore, it intends to provide valuable insights on the way AI companies build their BM and OM in order to be able to develop their AI software and deliver their value proposition to their clients. Finally, this study will be a source of valuable insights for AI companies and practitioners, with regard to how the concepts of BM and OM, leading to a better understanding of them.

1.3 Research Relevance

Regarding the theoretical relevance of this research, we aim to conduct a literature review in order to investigate existing literature on the impact of AI on business, based on cases that have already been examined. Furthermore, we will investigate the concepts of BM and OM, aiming to build a strong foundation around these two concepts and ensure a fair evaluation of the AI impact on these concepts. Regarding the practical relevance, this research intends to determine the impact of AI on the BM and OM of AI companies in practice. Therefore, we will conduct a number of interviews with several AI companies. This will provide a firm grasp of the actual AI impact on these firms and it will uncover the challenges that AI companies face and have to overcome in order to successfully develop and deploy their AI solutions.

1.4 Research Question

This research aims to find answers to the following research question:

Research Question: What is the impact of AI on the Business and Operating models of AI companies?

By answering this research question, which is based on the research background, the researcher aims to achieve the research objectives and determine the impact that artificial intelligence (AI) has on the business and operating models of software AI companies.

To answer the main research question, the following guiding questions have been formulated:

- 1. What is artificial intelligence (AI)?
- 2. What is a BM? How can we define it?
- 3. What is OM? How can we define it?

1.5 Research Scope

This qualitative research will focus on investigating the impact of AI on the Business Model (BM) and Operating Model (BM)of AI companies. Therefore, multiple AI companies will be interviewed and analysed.

These companies can be based in different countries, within different application domains. Specific requirements will be considered in order for organizations to be eligible for this research project. These requirements are inspired by the research of (Weber et al., 2022) and are illustrated in the following table:

Criterion	Elaboration	Rationale			
Founding year	Founding year after 2000	The sample should include contem-			
		porary companies.			
Website	Available company website in	Sufficient information for the com-			
	English	pany should be available.			
Business Model	AI technology as a core compo-	The sample should include compa-			
	nent of the product or service	nies that are relevant to the research			
		question.			
Interviewee's	Interviewee holds a hierarchi-	Ensure the interviewee is familiar			
position	cally high position within the	with the concepts of interest with re-			
	company	gard to this research project.			

 Table 1.1: Organisations selection criteria Weber et al., 2022.

The questionnaire that will be used for the interviews can be found in *Appendix A: Interview Questions*. The general topics that will be discussed during the several interviews reflect the scope and can be found below:

- Personal, Organization and Portfolio Introduction
- BM Introduction
- OM Introduction
- Perceived impact of AI on the BM and OM
- Challenges and Benefits of AI

1.6 Research Outline

This research project consists of seven chapters and it is structured as follows:

Chapter	Description
1	The first chapter provides an introduction to the research project. First, the background of the research is introduced. Following that, the research objective, relevance and research question are presented. Finally, the research scope and outline are introduced and discussed.
2	The second chapter covers the literature background of this re- search project. It includes a general introduction to the concepts of Artificial Intelligence (AI), Business Model (BM) and Operat- ing Model (OM).
3	The third chapter showcases the process we followed in order to create the framework of BM and OM, which was used during the semi-structured interviews. This BM and OM framework is based on the literature review conducted in <i>Chapter 2</i> .
4	The fourth chapter discusses the research methodology. First, the research approach is discussed, followed by the research strategy, data collection methods and data analysis.
5	The fifth chapter presents the results of this research project. First, we introduce the results of the <i>Cross-case Analysis</i> and then each case is separately being discussed.
6	The sixth chapter presents a discussion based on the results pre- sented in <i>Chapter 5</i> , the answer to the research question and fi- nally, some <i>Validity Considerations</i> with regard to this research project.
7	The seventh chapter concludes the research and the most impor- tant findings, as well as their relationship to the main objective will be highlighted.

Table 1.2: Research outline.

| Chapter /

Theoretical Framework

2.1 Artificial Intelligence

Artificial intelligence (AI) has been one of the most often mentioned technologies of our era. This interest in Artificial intelligence (AI) has been increased even more, due to the increasing volume of available data, the easier accessibility to cloud services, the plethora of data storage options and processing tools (Sena, Nocker, et al., 2021). Consequently, Artificial intelligence (AI) has attracted attention from industry and academia (Conway, 2018; Weber et al., 2022; Zhang & Lu, 2021).

The concept of Artificial Intelligence (AI) has a rather broad definition (Bringsjord & Arkoudas, 2007; Stone et al., 2016; Weber et al., 2022), which causes a lot of discussion among scholars (Bringsjord & Arkoudas, 2007). Generally speaking, Artificial intelligence (AI) is defined as a technological domain that gives the machines the ability to execute intelligent activities that could previously be completed only by humans (Huang et al., 2019; Zhang & Lu, 2021). In other words, Artificial intelligence (AI) is the domain that enables a machine to perform cognitive tasks that are generally identified with human minds, such as feeling, thinking, being creative and so on (Rai et al., 2019; Russell & Norvig, 2016; Weber et al., 2022).

Nowadays, Artificial Intelligence (AI) is affecting various aspect of people's everyday life (Huang et al., 2019; Zhang & Lu, 2021). Navigation systems, customer service chatbots are just few AI applications examples, that have a dominant part in they way we operate on a daily basis. Therefore, Artificial Intelligence (AI) is considered to be one of the most disruptive innovations that have a major impact on the society as well as economics (Reim et al., 2020).

2.1.1 Artificial Intelligence Areas

The field of Artificial Intelligence (AI) is an umbrella term that includes multiple different areas, such as Machine Learning (ML), Deep Learning, Natural Language Processing (NLP), Robotics and so on (Stone et al., 2016; Weber et al., 2022). The diagram in *Figure 2.1* illustrates some of the most popular and frequently mentioned AI areas.



Figure 2.1: Different Artificial Intelligence (AI) areas inspired by Sena, Nocker, et al., 2021.

Machine Learning

The term "Artificial Intelligence" (AI) is quite often used instead of the term "Machine Learning" (ML), and vice versa. However, these two terms are not the same, and this terminology misuse leads to great confusion and unclarity around the concepts of AI and ML. Artificial Intelligence (AI) is a broad field that includes the notion of Machine Learning (ML), which can be defined as systems that have the ability to learn from the past and predict the future (Conway, 2018; Jordan & Mitchell, 2015). Machine Learning (ML) concerns the topic of how to build machines that can improve themselves automatically via experience (Jordan & Mitchell, 2015). In other words, Machine Learning (ML) attempts to create computer systems that have the ability to gain knowledge from data (Ławrynowicz & Tresp, 2014). Machine Learning (ML) is one of the fastest developing technological areas today, located at the nexus of computer science, statistics, and artificial intelligence as well as at the heart of artificial intelligence and data science (Jordan & Mitchell, 2015). Machine Learning (ML) entails a wide range of algorithms (Das et al., 2015):

- *Supervised learning*: Supervised learning methods are the most frequently utilized Machine Learning (ML) approaches (Jordan & Mitchell, 2015). Supervised learning includes the sample training based on their qualities (inputs) and labels (outputs) (Ławrynowicz & Tresp, 2014; Zhu & Goldberg, 2009). Algorithms in supervised learning describe the relationship between input variables and observed outcomes and apply it to new inputs to predict the outcome (Jordan & Mitchell, 2015; Zhu & Goldberg, 2009). Common examples of supervised learning systems could include face recognizing, health care applications useful for illness diagnosis and so on (Jordan & Mitchell, 2015). Supervised problems can be further subdivided into categories, such as *Classification* and *Regression*.
- *Unsupervised learning*: Unsupervised learning is defined as learning on one's own through discovery and adoption, based on the pattern of input (Das et al., 2015; Ławrynowicz & Tresp, 2014). It is considered to be a more challenging than Supervised Learning, due to the unlabeled data that need to be analyzed and structured, in order to gain valuable insights. There is no indication of how the output a an unsupervised algorithm is accurate or not, therefore, assessing a predicted outcome can be very challenging (Das et al., 2015). Unsupervised problems can be further subdivided into categories, such as *Clustering* and *Associations*.
- *Reinforcement learning*: Reinforcement learning systems do not have access to input or output pairs. Instead, the learning system is rewarded after each step, and the aim is to achieve a high total reward after the system has ended the algorithm execution (Ławrynowicz & Tresp, 2014). The supervised learning problems diverge from reinforcement learning in that sub-optimal behaviors are never explicitly corrected and correct input/output pairs are not offered (Das et al., 2015).

Deep Learning belongs to the broader group of Machine Learning (ML) algorithms that aims to automatically identify key properties from unprocessed data (Ahmad et al., 2019). Deep Learning techniques have significantly raised the bar for speech recognition, visual object recognition, object detection, and many other fields (Ahmad et al., 2019). A popular deep learning technique is Neural Networks (NN), which makes use of multiple layers in order to identify patterns and structure in massive sets of data (Rusk, 2016). Each layer learns from the data upon which further layers might build; the higher the level, the more abstract the taught concepts (Rusk, 2016). Deep learning does not depend on prior data processing (Guo et al., 2016; Stone et al., 2016).

Natural Language Processing

The discipline of three distinctive domains, computer science, linguistics and artificial intelligence, is known as Natural Language Processing (NLP). It concerns how computers interact with human languages or "natural languages" (Chopra et al., 2013). More specifically, systems that utilize algorithms related to NLP, aim to enable machines to understand natural language text or speech. (Joseph et al., 2016). Researchers utilize algorithms of this domain to gain knowledge on the human process of understanding and using natural languages, resulting in the development of tools that can enable computers to understand and manipulate natural languages as well and be able to execute particular assignments (Chopra et al., 2013; Joseph et al., 2016). Some examples of NLP applications include natural language text processing and summarization, speech recognition, and so on (Joseph et al., 2016; Nadkarni et al., 2011).

Robotics

Robotics is an area in Artificial Intelligence (AI) that incorporates foundations of the following disciplines, Electrical Engineering, Computer Science and Mechanical Engineering, resulting in the development of robots. Therefore, Robotics is the area that investigates how we can build robots with intelligence, and which can be used in various industries, such as manufacturing industry, automotive industry, tourism and so on (Rajan & Saffiotti, 2017; Samala et al., 2020). The combination of Artificial Intelligence (AI) and Robotics is a disruptive power that affects business across different industries (Dirican, 2015).

2.1.2 Artificial Intelligence in business

Artificial Intelligence (AI) is considered to be one of the breakthrough technologies that can have a significant impact on the economic landscape (Hall & Pesenti, 2017; Reim et al., 2020). It has transformed several industries all over the world (Samala et al., 2020). Therefore, Artificial Intelligence (AI) applications can be found in various industries (Nagaraj & Prabhu, 2020; Samala et al., 2020). Manufacturing industry, automotive industry, healthcare, financial services, telecommunications, energy, tourism, media and entertainment are some of the industries affected by the presence of Artificial Intelligence (AI) technologies (Samala et al., 2020).

Many sectors are spending extensively to capitalize on AI technology through Business Model Innovation (BMI) as a result of the advancement and interest among managers, researchers, and the general public. More and more companies across different sectors are willing to invest in the research, development and deployment of more advanced AI systems (Reim et al., 2020). Artificial Intelligence (AI) has enormous potential for enhancing productivity, automating corporate processes, getting insight through data analysis, and interacting with consumers and workers (Hall & Pesenti, 2017).

In addition, a surge in the number of AI companies is being observed. A great number of AI startups has merged, which develop and deploy several applications with AI technology as the core of their product or service (Weber et al., 2022). According to Weber, Beutter, Weking and Krcmar (2021), Crunchbase database mentions over 27,900 startups associated with the term "Artificial Intelligence". Nowadays, AI companies especially AI startups attract many investors who are willing to invest in and capitalise on AI (Weber et al., 2022). However, it will be critical for such companies to build an effective Business Model (BM) in order to secure their long-term success and survival (Weber et al., 2022).

2.2 Business Model

The concept of Business model (BM) dates back several decades (Bellman et al., 1957; Foss & Saebi, 2017). Drucker is considered to be a pioneer of business model research as he used the phrase "logic of business" as early as 1954 (Casadesus-Masanell & Ricart, 2010). He is frequently mentioned in terminological investigations of modeling and characterizing business operations (Krumeich et al., 2012). According to Ghaziani and Vetresca (2005), the phrase "Business model" first appeared in scholarly articles in 1975 (Ghaziani & Ventresca, 2005). However, there were earlier academic publications also including the term in the full text (Bellman et al., 1957) or in the abstract as well as the title (DaSilva & Trkman, 2014). For more than a decade, the business model idea has predominated as a suitable method of analysis; as a result, it has progressively moved into the focus of both scientific study and commercial practice (Krumeich et al., 2012).

The concept of business model (BM) has grown increasingly popular among scholars, practitioners, and consultants (Chesbrough, 2010; Goyal et al., 2017; Johnson et al., 2008; Weber et al., 2022; Wirtz et al., 2016; Zott et al., 2010), especially since the emergence of the Internet at the end of the 90s (Hedman & Kalling, 2003; Magretta, 2002; Shafer et al., 2005; Timmers, 1998). Business models have been a crucial topic of discussion in various areas, including technology and business (Gordijn et al., 2005; Pateli & Giaglis, 2004). There is growing agreement regarding the significance of business models, as they are considered more and more significant to any organization for competitive advantage and they represent a strategic priority in several industries (Magretta, 2002; Mäkinen & Seppänen, 2007).

While discussing business models has become popular, there is still significant misconception regarding what they are and how they might be employed (Fielt, 2013; Shafer et al., 2005). The definition, constituent components, and configuration of business models have been widely varied in literature (Goyal et al., 2017; Kavadias et al., 2016; Krumeich et al., 2012; Shafer et al., 2005). A lot of the ambiguity and misunderstanding surrounding business models stems from the fact that many authors discuss business models when they do not always mean the same thing (J. Linder, 2000; Osterwalder et al., 2005). Moreover, the use of the business models by several authors from different fields, has resulted in a divergent understanding of it (Wirtz et al., 2016). Therefore, there is no consensus regarding the definition of business models and the literature develops primarily in silos based on the phenomena of interest to the various experts (Zott et al., 2010).

However, most people would agree that the notion of business model depicts how an organization develops, delivers, and captures value (Mahadevan, 2004; Osterwalder et al., 2011).

2.2.1 Business Model Definition

Although defining the concept of business model was one of the early objectives for scholars, the definitions have been fiercely disputed, and one universally accepted definition has not yet evolved (Cosenz & Noto, 2018; Fielt, 2013; Goyal et al., 2017; Kavadias et al., 2016; Krumeich et al., 2013; Morris et al., 2005; Schaffer et al., 2020).

According to Osterwalder, Pigneur and Tucci (2005), the authors who write about business models, can be divided into three categories (Osterwalder et al., 2005). The first category is authors that present business models as abstract notion that can describe any real-world organisation. The second category is authors that describe a number of different abstract types of business models (i.e. a classification scheme), each one describing a set of businesses with common characteristics. The last category consists of authors who provide a conceptualization or elements of specific business models.

Based on the literature review conducted at the early stages of this research, the following table was assembled and it is presented down below in order to provide some formal academic definitions regarding the concept of business model (BM) (Saebi et al., 2017).

Business Model (BM) definitions				
Author(s) Definition				
Timmers (1998)	"A Business Model (BM) determines how an organisation			
	can deliver value to specific customers segments that are			
	willing to pay for value, and convert the customers' pay-			
	ments to profit." (Timmers, 1998)			
Shafer et al. (2005)	"A Business Model (BM) describes the a company's main			
	understanding and decisions in order to create and capture			
	value for specific customer segments." (Shafer et al., 2005)			
Osterwalder and	"A Business Model (BM) defines the way companies creates			
Pigneur (2010)	and captures value, as well as how they deliver value to			
	their customers." (Osterwalder & Pigneur, 2010)			
Teece (2010)	"The way an organisation delivers value to specific cus-			
	tomer segments, and manages to make profit from this pro-			
	cess, is defined as Business Model (BM)." (Teece, 2010)			
Massa (2017)	"A Business Model (BM) defines the way a company oper-			
	ates and seeks to satisfy their objectives." Massa et al., 2017			

 Table 2.1: A selection of Business Model (BM) definitions.

2.2.2 Business Model Elements

To establish a comprehensive grasp of the business model concept, literature suggests that, in addition to clarifying its description, the extraction of relevant components be examined (Fielt, 2013; Wirtz et al., 2016). These components are also referred to as building blocks, elements, (key) questions, or functions (Al-Debei & Avison, 2010; Demil & Lecocq, 2010; Fielt, 2013; Goyal et al., 2017; Kindström, 2010; Morris et al., 2005; Peters et al., 2013; Teece, 2010; Wikström et al., 2010). A consensus on the precise components that make up a business model has not yet been established in the business model literature, as scholars do not always agree neither on a definition of business models, nor on how to represent them (Aarntzen, 2016; Magretta, 2002). Several business model frameworks and ontologies have been developed throughout the years (Massa et al., 2017; Osterwalder et al., 2005), which do not only define the elements, they also define the relationships between the elements (Gordijn et al., 2005). All of these frameworks cover distinct elements and components (Aarntzen, 2016). While some BMs mention three components (Demil & Lecocq, 2010; Koen et al., 2011; Zott et al., 2010), others define four to eight components (Johnson et al., 2008; Morris et al., 2005) and the most complex ones can consist of up to 20 components (Johnson et al., 2008; Shafer et al., 2005). This indicates that the number of BM components in itself has been highly debated in BM literature, as Shafer et al. (2005) confirmed who compared 12 BM definitions and identified 42 different components (Shafer et al., 2005). Yet all these BM frameworks share some similarities (Aarntzen, 2016). A significant similarity is that all these frameworks and their components illustrate how a firm creates and captures value (Fielt, 2013). There is a need for a business model notion that everyone could understand, one that is easy to describe. However, it is quite challenging developing such a concept that can be simple and easily understandable, while not oversimplifying the complexities of how enterprises function.

Probably the most well-known BM framework is the Business Model Canvas (BMC) (Schneider & Spieth, 2014). Business Model Canvas (BMC) is based on the theory of Osterwalder, Pigneur and Tucci (2005). In their research, they analyse the most frequently mentioned components in literature, leading to the identification of nine business model building blocks. They define business model as a tool that entails a group of components and their interconnections, and it can be used to determine the basic understanding of a company (Osterwalder et al., 2005). It determines the value that an enterprise, creates and captures for specific customer segments as well as the structure of the enterprise including their partner network that supports with the value creation and delivery (Osterwalder et al., 2005). The nine business model building blocks can be grouped into four categories or pillar, which are the Product, Customer Interface, Infrastructure Management, and Financial Aspects. These four segments together can be broken down into nine building blocks, including Value Proposition, Target Customer, Distribution Channel, Relationship, Value Configuration, Core Competency, Partner Network, Cost Structure and Revenue Model. The four pillar along with the nine business model building blocks are illustrated in Fig-

Pillar	Business Model Building Block	Description				
Product	Value Proposition	Gives an overall view of a company's bundle of products and services.				
	Target Customer	Describes the segments of customers a company wants to offer value to.				
Customer Interface	Distribution Channel	Describes the various means of the company to get in touch with its customers.				
	Relationship	Explains the kind of links a company establishes between itself and its different customer segments.				
	Value Configuration	Describes the arrangement of activities and resources.				
Infrastructure	Core Competency	Outlines the competencies necessary to execute the company's business model.				
Management	Partner Network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.				
Financial Aspects	Cost Structure	Sums up the monetary consequences of the means employed in the business model.				
	Revenue Model	Describes the way a company makes money through a variety of revenue flows.				

ure 2.2:

Figure 2.2: The "Nine Business Model Building Blocks" according to Osterwalder et al., 2005.

Shafer (2005) has conducted a research to investigate the concept of business models and their distinctive components. In his study, Shafer (2005) reviews existing literature concerning the concept of business models and identifies the components of business models most often cited therein, in order to provide managers with a better understanding on the concept of business models (Shafer et al., 2005). In particular, Shafer (2005) identified BM components, which could be observed multiple times in literature, cited twice or more times. Based on these components, he developed an affinity diagram to categorize the business model components and consequently gain additional insights (Shafer et al., 2005). In this study, 12 business model definitions are mentioned, and 42 different business model components or unique building blocks or elements are identified and classified into four primary categories: strategic choices, the value network, creating value, and capturing value. The components included in these four categories are Customer (Target market, Scope), Value Proposition, Capabilities/Competencies, Revenue/Pricing, Competitors, Output (Offering), Strategy, Branding, Differentiation, and Mission. Creating value includes the components of Resources/Assets and Processes/Activities. Value network includes the components of Suppliers, Customer Information, Customer Relationship, Information Flows and Product/Service Flows. Finally, the category of capture value, includes the components of Cost, Financial Aspects and Profit. The resulting affinity diagram can be seen below, illustrating the four major categories and their components (Shafer et al., 2005).



Figure 2.3: Components of business model affinity diagram according to Shafer et al., 2005.

The study of Wirtz, Pistoia, Ullrich, and Gottel (2016) thoroughly elaborates on the business model concept and its components. This research discusses the origin and theoretical development of business models. The researchers present an increasingly common business model viewpoint (Wirtz et al., 2016). Furthermore, they performed an analysis on a wide range of business model definitions, perspectives and components already existing in scholarly literature, and then they proposed their integrated business model framework, which also illustrates the most significant BM components according to their research (Wirtz et al., 2016).

The analysis of Wirtz, Pistoia, Ullrich, and Gottel's research (2016) on selected business model components, can be seen in *Figure 2.4*. According to the authors, business model components of various approaches within the scholarly literature seem to have a rather heterogeneous understanding (Wirtz et al., 2016). They argue that there are some significant distinctions, particularly with regard to the level of abstraction, as some authors focus their expertise on a small number of features by just taking a few factors into account, other authors show a more all-encompassing point of view (Wirtz et al., 2016). Yet only roughly 30% of the ideas under consideration are written by authors who have a thorough and broad point of view (Wirtz et al., 2016). The selected BM components that constitute the framework introduced by Wirtz, Pistoia, Ullrich, and Gottel (2016), are the following: Strategy, Resources, Network, Customers, Market Offering (Value Proposition), Revenues, Service Provision, Procurement and Finances. Finally, the authors analyse the use intensity of each component in literature as well as the spectrum of each component.

Compo- nent Author	Strategy	Resources	Network	Customers	Market offering (value proposition)	Revenues	Service provision	Procure- ment	Finances	Spectrum of the Components
Hamel (2000)	Core Strategy, Strategic Resources		Value Network	Customer Interface						٠
Mahadevan (2000)			Logistic Stream		Value Stream	Revenue Stream				٠
Wirtz (2000)	Combination of production factors for strategy implementation	Core competencies & Core assets		Market & customer segmentation	Service offer & Value proposition	Systematization of revenue forms	Combination & transformation of goods & services	Production factors & Suppliers	Financing & Refinancing	•
Hedman/Kalling (2002)	Managerial and organizational, longitudinal process component	Resources		Customers	Competitors, Offering		Activities & Organization	Factor & Production Input Suppliers		٩
Bouwman (2003)		Technical architecture		Customer Value of Service					Financial arrangements	٠
Afuah (2004)	Positions	Resources			Industry Factors		Activities		Costs	
Mahadevan (2004)				Target Customers	Value Proposition	Revenue Model	Value Delivery			\bullet
Voelpel/Leibold/ Tekie (2004)		Leadership capabilities	Value Network (Re)Configuration for the Value Creation		Customer Value Proposition					٠
Yip (2004)	Scope, Differentiation	Organization		Nature of Customers, Channels	Value Proposition, Nature of Outputs		How to transform inputs (including technology)	Nature of inputs		•
Lehmann- Ortega/Schoetti (2005)					Value Proposition, Value Architecture	Revenue Model				٠
Osterwalder/ Pigneur/Tucci (2005)		Core Competency	Partner Network	Target Customer, Distribution Channel, Relationship	Value Proposition	Revenue Model	Value Configuration		Cost Structure	•
Tikkanen et al. (2005)	Strategy & Structure		Network				Operations		Finance & Accounting	
Al-Debei/El- Haddadeh/Avison (2008a)			Value Network		Value Proposition, Value Architecture				Value Finance	٠
Demil/Lecocq (2010)		Resources & Competences, Organization			Value Proposition	Volume & Structure of Revenue Streams			Volume & Structure of Revenue costs	0
Johnson (2010)		Key Resources			Customer Value Proposition	Profit Formula	Key Processes			
Osterwalder/ Pigneur (2010)		Key Resources	Key Partners	Customer Relationships, Channels, Customers Segments	Value Proposition	Revenue Streams	Key Activities		Cost Structure	•
Intensity of use	•	•	•	0	•	•	•	٠	•	
			O Very low	N O Low (Moderate	High Very	high			-

Figure 3. Overview of selected business model components

Figure 2.4: Overview of selected business model components according to Wirtz et al., 2016.

2.3 Operating Model

Over the past few years, the concept of Operating Model (OM) has gained popularity. However, the academia has not reflected this interest of business (Bateman, 2017). The origin of the concept of an Operating Model (OM) in a business context is unknown, and some of the oldest records are from the 19th century, which are mostly related to engineering rather than business (Hanot, n.d.). According to Bateman (2017), the concept of operating model (OM) was most likely established by a commercial organization and hence is not publicly available (Bateman, 2017). Therefore, there is a need for further research on the topic of operating models, as material referring to the concept of operating model are coming mostly from consulting firms and they could potentially benefit from further academic interpretation (Bateman, 2017).

Linder and Cantrell (2000) are some of the first researchers to introduce the and they consider this model to be the operational manifestation of the business model (Bateman, 2017; J. Linder & Cantrell, 2000). However, Jeanne Ross from MIT is likely the first person to use the term "Operating Model" in an academic source, mentioning that "Companies should create an operational model to make IT a proactive rather than reactive driver in delivering business value" (Bateman, 2017; J. W. Ross, 2005).

Operating models influence every aspect of a company's business and they can help with delivering value proposition (Guimarães, 2014). They have been also used as a bridge between strategy and operations (Bateman, 2017; Cooper et al., 2012; Garton, 2017). Therefore, companies that want to achieve long-term success, maintain their competitive advantage and enhance their organic growth, need to establish a well-defined operating model and regularly reassess and optimise it (Berger, 2020).

2.3.1 Operating Model Definitions

One of the first definitions for the concept of operating model was issued by Accenture in 2000, where the term was used as "Operating Business Model" and it was defined as the organisation's core logic for creating value (Bateman, 2017; J. C. Linder & Cantrell, 2000). In 2005, Jeanne Ross at MIT defined an operating model as the necessary level of business process integration and standardisation for delivering goods and services to customers (T. J. Ross, 2005). Her viewpoint is heavily influenced by Information Technology (IT) (J. W. Ross et al., 2006).

Based on the literature review conducted at the early stages of this research, the following table was assembled and it is presented down below in order to provide some formal academic definitions regarding the concept of operating model OM):

Operating Model (BM) definitions				
Author(s)	Definition			
Operating	" OMC is a model that depicts the primary and supporting busi-			
Model Canvas	ness activities, channels, and actors of the organization. It ex-			
(2018)	plains how the organization operates to deliver value to its cus-			
	tomers or beneficiaries." (Campbell et al., 2017; Reijnen et al.,			
	2018)			
Bain in Cooper	"The OM is a template of how an organization should get orga-			
et al. (2012)	nized to deliver its best performance in support of the strategy			
	of the company it belongs to. It should provide for a language			
	and concrete tools to help managers organize their departments			
	at all levels and within different situations." (Cooper et al., 2012)			
OEE	"An OM is the design of your business that makes it possible to			
Consulting	deliver your business strategy and service proposition." (Bate-			
(2017)	man, 2017)			
SOMS (2017)	"The OM is the operational design that makes it possible to de-			
	liver the business strategy. It is the blueprint of how an orga-			
	nization operates across a range of domains to deliver its objec-			
	tives." (Bateman, 2017)			
Boeing In	"An operating model (OM) describes how the business model			
DuPont (2014)	of an organisation can be implemented. An operating model			
	is the necessary level of business process integration and stan-			
	dardization for delivering goods and services to customers."			
	(Bateman, 2017)			

 Table 2.2: Operating Model definitions.

2.3.2 Operating Model Elements

In his study, Bateman (2017) introduces a table (*Figure 2.5*), which illustrates six distinctive Operating Model frameworks developed by different companies, consulting firms and scholarly literature, and offers a summary of the key components that different organizations use to describe their operating models. The different frameworks are proposed by Boeing, which is an aircraft manufacturer, OEE Consulting, EY, and Bain, which are consulting firms, Campbell's publication (2017), and SOMS, which is a framework created from a service management research center at Loughborough University (Bateman, 2017). Every framework reflects organisations' different perspective (Bateman, 2017). However, comparing the different OM frameworks of *Figure 2.5*, some common themes among the frameworks can been identified. For instance, all frameworks, except for the framework proposed by Bain (2012), include some kind of service or value proposition. The table can be seen below in *Figure 2.5*.

	OEE Consulting (2017 ²)	Boeing In DuPont (2104)		Campbell et al. (2017) POLISM	Bain in Cooper et al. (2012)	SOMS (2017 ²)	EY (2016) Core other	
Core elements of Operating model	Service proposition (SP)	Channels		Value propositions		Customer experience (CE)	service delivery	
	Journey and process (J&P)	key activities				Delivery (D)	process	
	Management framework (MF)	Organisation		Management system	Key strategic metrics Accountability	Performance Management and improvement (PM&I)	performance management,	
	Technology and infrastructure (T&I)	business capa-	key re- sources	Information	Super- structure	Process context (PC)	IT	
	People, culture and organisation	Dilities		Organisation	Governance	Strategy governance and	Governance,	
	(P,C &O)	key partnerships		Suppliers		(S,G&L)	Org design	
	Location,			Locations	Behavioural expectations	People	and structure,	
	teams (LF&T)				Talent requirements	capability (PC)	culture and values	
Other elements		cost structure				Demand and capacity management (D&CM)	design principles	
							risk	

Figure 2.5: Summary of elements of Operating Models

2.4 Business Model and Operating Model

Based on existing literature review, Business Model (BM) and Operating Model (OM) are used interchangeably and confusion surrounds the definition of each model, as well as the relationship between them. They do, however, highlight different aspects and achieve different purposes. A business model describes how a company can capture and offer value through its products/services, value proposition, customer segments, key partners and so on. An operating model, on the other hand, represents how a company can operate in order to deliver that value. According to Sergio Caredda, while a business model (BM) is the distinctive approach in which a company run its business, operating model stands is the organizational DNA. Furthermore, processes, people, technology, and governance can be crucial components of an operating model (Caredda, 2020)

Notably, despite the massive availability of scientific literature on the concept of business model (BM), the availability of scientific literature concerning the concept of operating model (OM) is substantially low. Both these concepts are rather important and companies that want to cope with the challenges of digital world, have to pay attention not only to their business models but also operational models (Ghosh et al., 2021). Nowadays, more and more companies are creating new operating models to support their evolving business models while business models themselves change. (Berman & Hagan, 2006; Ghosh et al., 2021).

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Chapter

Business Model and Operating Model and their Intersection

This chapter is devoted to the process followed to create the Business Model (BM) and Operating Model (OM) framework for this research, which was used during the data collection through semi-structured interviews. First, we describe the distinctive steps of this process in both textual and visual format, and then we provide an analysis of the distinctive Business Model (BM) and Operating Model (OM) framework design.

In order to conduct the required semi-structured interviews and collect all the data needed to answer the research question, it was crucial to provide our perspective on the concepts of business and operating models. Based on the literature review performed at the early stages of this research project, we were able to identify a great number of scientific papers that analyse the concepts of business models and operating models, and mention various components that constitute those models. To decide which components should be part of our business model and operating model, we followed the process illustrated in *Figure 3.1*.



Figure 3.1: Business and operating models creation process.

3.1 Business Model Framework

To create our business model (BM) framework, we followed a process consisting of three iterations. During the first iteration, the study of Shafer, Smith, and Linder (2005) was used as a starting point to assemble our business model. The framework of Shafer, Smith, and Linder (2005) represents a business model without oversimplifying the nuances of how businesses operate (Peters et al., 2013). This study mentions four major categories of BM components: strategic choices, creating value, capturing value, and the value network (Shafer et al., 2005). Strategic choices include the components of Customer (Target market, Scope), Value Proposition, Capabilities/Competencies, Revenue/Pricing, Competitors, Output (Offering), Strategy, Branding, Differentiation, and Mission. Creating value includes the components of Resources/Assets and Processes/Activities. Value network includes the components of Suppliers, Customer Information, Customer Relationship, Information Flows and Product/Service Flows. Finally, the category of capture value, includes the components of Cost, Financial Aspects and Profit.

In the second iteration, we compared the initial group of the BM components we had selected, to the BM components mentioned in the study of Osterwalder and Pigneur (2005). According to this study, there are nine building blocks that constitute a business model, which are Value Proposition, target Customer, Distribution Channel, Relationship, Value Configuration, Core Competency, Partner Network, Cost Structure and Revenue Model. After the second iteration, we had a selected group of BM components, which included the following components: Target Customer, Value Proposition, Capabilities/ Core Competencies, Revenue/Pricing, Resources/Assets, Processes/Activities.

In the third and last iteration, we validated the components selected after the second iteration, utilizing the study of Wirtz, Pistoia, Ullrich, and Gottel (2016). According to this research, the Market Offering (Value Proposition) and Resources are the two components, which the authors agree on their significance the most (Wirtz et al., 2016). Therefore, the components of Value Proposition and Key Resources, were selected to be part of the final BM framework. On the other hand, there is either little or no consensus regarding the components of Strategy, Revenue, and Procurement (Wirtz et al., 2016). As a result, it was decided that the component of Procurement and Strategy should not be mentioned in the final BM framework. Regarding the component of Revenues, Wirtz, Pistoia, Ullrich, and Gottel (2016) state that the low use intensify of the revenue component is rather surprising, as revenue has a significant role in determining a company's positioning (Wirtz et al., 2016). In combination with the dominant appearance of revenues in various BM frameworks (Osterwalder et al., 2005; Shafer et al., 2005; Wirtz et al., 2016), it is considered crucial to also include this component in our final BM framework. Last but not least, the components of Key Activities & Processes, Key Partnerships, Customers Segments, Customer Relationships, Business Capabilities, Distribution Channels and Cost Structure, are all included in the final BM framework, as the intensity of use in literature is characterised as high

(Wirtz et al., 2016).

The three-iteration process we followed to assemble the final BM framework for this research, is illustrated in the following figure:

Iteration 1		Iteration 2	_>	Iteration 3
Customer (Target Market, Scope)	V	Target Customer		Customer Segments
Value Proposition		Value Proposition		Value Proposition
Capabilities / Competencies		Capabilities/ Core Competency		Business Capabilities
Revenue / Pricing	;	Revenue / Pricing		Revenue Streams
Competitors		- Competitors -]	
Output (Offering)		Output (Offering)]	
Strategy				
Branding		-Branding		
Differentiation		Differentiation		
Mission		- Customer (Target Market, Scope)		
Resources/ Assets		Resources/Assets		Key Resources
Processes/ Activities		Processes/ Activities		Key Processes & Activities
Suppliers		Partner Network		Key Partnerships
Customer Information		Customer (Target Market, Scope)		Customer Segments
Customer Relationship	, ;	Customer (Target Market, Scope)		Customer Relationships
Information Flows		- Information Flows-		
Product/ Service Flows		Product/ Service Flows		
Costs		Cost Structure		Cost Structure
Financial Aspects		- Financial Aspects -		
Profit		- Profit		

Figure 3.2: Business Model (BM) component selection.

3.2 **Operating Model Framework**

An Operating Model (OM) framework is a visualization that describes how the organization operates in order to deliver value to specific customer segments (Campbell et al., 2017). It can be a single model or a combination of models, tables and so on (Campbell et al., 2017). When companies build their Operating Model (OM), they need to focus on three key components: processes, people, and technology (Reijnen et al., 2018).

In his research, Bateman (2017) discusses and analyses a number of Operating Model (OM) components. Inspired by this study, we developed the OM framework for this research. In particular, we performed an analysis on all the OM components mentioned in Bateman's research (2017) and we were able to determine which elements should be included in our Operating Model (OM) framework. *Table 3.1* shows the analysis process we followed. As can be seen, we collected all the distinctive OM components, and merged them into broader categories. Furthermore, we provided

a descriptive name to each category and then we selected components, with criterion the intensity of use. Specifically, all the components that were mentioned twice or more times in Bateman's study (2017), were considered to be in the final Operating Model OM framework. For the selection process, we considered only the core components mentioned in the original table of Bateman's study. Furthermore, we have excluded the component of *Distribution Channels*, which appears just once in the original table, and finally, the component of *Location* was not included in the final framework due to the rare use of component in existing literature:

OM Elements	OEE	Boeing	Campbell	Bain in	SOMS	EY
	Con-	In	et al.	Cooper	(2017)	(2016)
	sulting	DuPont	(2017)	et al.		
	(2017)	(2004)		(2012)		
Value (Service)	X	X	X		X	X
Proposition						
Distributions		X				
Channels						
Management	X		X	X	X	X
Framework &						
Systems						
Organisation &	X	X	X	X	X	X
Culture						
Key		X	X			
Partnerships						
Talent	X			X	X	
Management						
Technology &	X		X			X
Infrastructure						
Business		X		X		
Capabilities						
Key Activities	X	X			X	X
& Processes						
Key Resources	X		X			
Business		X				
capabilities						
Location	X		X			

 Table 3.1: Operating Model definitions.

Based on the analysis presented in *Table 3.1*, we came to the conclusion that an operating model (OM) consists of the following elements: *Technology & Infrastructure*, *Culture & Organisation, Talent Management, Management Frameworks & Systems, Value Proposition, Key Activities & Processes, Key Partnerships, Key Resources* and *Business Ca*-

pabilities.

3.3 Business Model and Operating Model Framework

The first step in our analysis intends to identify the components that could constitute our BM model. After finalising that first step, we concluded that *Cost Structure, Revenue Streams. Customer Segments, Customer Relationships, Distribution Channels, Value Proposition, Key Activities & Processes, Key Partnerships, Key Resources* and *Business Capabilities* should be part of the BM framework. In the second step of our analysis, we investigated possible OM components. At the end of this step, it was decided that the OM components should be *Technology & Infrastructure, Culture & Organisation, Talent Management, Management Frameworks & Systems, Value Proposition, Key Activities & Processes, Key Partnerships, Key Resources and Business Capabilities*. As it can be observed, there are some components that overlap between the two models, which are *Value Proposition, Business Capabilities, Key Partnerships, Key Resources* and *Key Activities & Processes*. This is also reflected on the final BM and OM framework we have designed, which illustrates the BM components, OM components as well as the common components between the two models.

The final BM and OM framework is presented in following figure:



Figure 3.3: Final BM and OM Framework.

In summary, there are four components that constitute the operating model, which are *Technology & Infrastructure, Organization & Culture, Management Frameworks Systems* and *Talent Management*. There Business Model (BM) consists of five components, which are *Cost Structure, Revenue Streams, Customer Segments, Distribution Channels* and *Customer Relationships*. Last but not least, there are five common components, which are *Value Proposition, Business Capabilities, Key Partnerships, Key Resources* and *Key Activities & Processes*, and they are illustrated in the intersection of two models.

Chapter

Research Methodology

In this chapter, the research methodology is being discussed. Specifically, we describe the research approach, research strategy and last, the data collection and analysis methods.

4.1 Research Approach

This section provides a summary of the research approach used to answer the main research question, which is:

Research Question: What is the impact of AI on the Business Model and Operating Model of AI companies?

A qualitative research approach is taken in order for the researcher to be able to provide an answer to the main research question. According to Yin (et al., 2002), this type of approach is most preferred when a phenomenon needs to be observed in a real-world context. In contrast to the quantitative research approach, which is useful when 'factual' data is necessary to address the research question, qualitative research approach is used to answer questions regarding experience, meaning, and perspective, usually from the participant's point of view (Hammarberg et al., 2016). Qualitative research entails gathering, organizing, and analyzing textual data derived from discussions (Hammarberg et al., 2016; Liamputtong, 2009).

4.2 Research Strategy

In this section, we describe the research strategy that we followed in order to answer the main research question. An overview of the research strategy is illustrated in *Figure 4.1*. The research is divided into six distinctive phases, starting with the phase of *Research Design* and ending with the phase of *Discussion*. In order to understand the

flow of work, one can follow the horizontal arrows illustrated in *Figure 4.1*, moving from left to right. In Research Design, we discuss the research background, objective, relevance, question, scope and outline. The research outline is summarized in Table 1.2. In *Literature Review*, a meticulous analysis of various scientific sources has been carried out, setting the foundation for the next phase of this research. In BM and OM Framework Design, we designed a BM and OM framework based on the literature review that we have conducted previously. This framework facilitated the data collection process. In *Data Collection*, the required data for this research was collected. The main data collection method used was semi-structured interviews. Furthermore, we performed an analysis on the textual data gathered. Next, we present the results of this analysis, which can be found in *Results*. First, we present the cross-case analysis, comparing the data collected from all the semi-structured interviews, and then we describe each case separately. Finally, in Discussion, we discuss the research results in order to answer the main research question. In addition, we discuss some validity considerations concerning this research and at the end, we provide our research conclusion.



Figure 4.1: Outline of the Research Strategy.

4.3 Data Collection

In this section, we discuss the methods used to collect the required data for this research. The methods chosen to collect all the required data, are by conducting a thorough literature review and a number of semi-structured interviews.

4.3.1 Literature Review

This research project started with a literature review. From an academic standpoint, the goal of the literature review is to establish the context and comprehend the theories behind the main research question. This procedure aids in the narrowing of the content and provides a foundation for understanding essential concepts that will be later used to form questions for the semi-structured interviews. Therefore, after performing a literature review, we were able to set the foundation knowledge regarding the basic concepts of this research, including the concepts of Business Model
In terms of information sources, the emphasis will be put in scientific articles, thesis reports and other sources, which can be accessed via the University repositories and Google Scholar among others. The main keywords used for this research had been "Business Model", "Operating Model", "Artificial Intelligence", "Artificial Intelligence Impact", "Artificial Intelligence Challenges" and so on.

4.3.2 Interviews

The main method of data collection in this research, is semi-structured interviews. Semi-structured interviews are the preferred qualitative data collection method, when a researcher seeks views on a focused topic (Hammarberg et al., 2016). After conducting a literature review, the next step was to construct a qualitative questionnaire with questions based on findings of the literature review. The questionnaire is related to the main research question on the impact of AI on the business model and operating model of AI companies. Furthermore, the interview approach should be determined upfront in order to ensure the quality of the data required for this research.

The main structure of the interviews was determined by the questions that can be found in *Appendix I*.

Interview Protocol

In order to ensure data quality and privacy, we created an interview protocol, which was used as a guide during the conduction of semi-structured interviews. All the interviews were recorded and further transcribed. The interviewees were asked up-front if they agreed to the recording of the session. Thanks to these recordings we can precisely transcribe the interviews. The transcribing facilitates the analysis of the qualitative data collected by the interviews. The duration of the each interview was defined based on the number of the questions forming the questionnaire and also considering the availability of the interviewees. Therefore, the interview protocol consists of the following points:

- 1. Appropriate interview duration between 30 and 60 minutes. (The interviewees were informed when they were first contacted.)
- 2. I would like to record the interview in order to transcribe the interview at later stages of this research, do I have your consent?
- 3. The transcript of the interview will be anonymized and they cannot be tracked back.
- 4. Do you have any questions before we start the interview?

4.4 Data Analysis

Qualitative data analysis attempts to make sense of huge amounts of data by reducing the volume of raw information (Wong, 2008). It includes examining a large number of transcripts for similarities and differences, then identifying themes and constructing categories (Wong, 2008). The data gathered in this research was primarily text-based, stemming from interview transcripts. Coding is a predominant part of the qualitative data analysis and it was utilized in this research project to analyse all the collected data.

Coding

The primary process used by researchers to analyse qualitative data is coding. Coding is the process of organizing and classifying qualitative data to identify different concepts and determine the connections between them (Corbin & Strauss, 1990). In this research project, a theory is developed using the grounded theory method by analyzing and comprehending the variations in the data gathered through semi-structured interviews (Chun Tie et al., 2019). There are three main types of coding in grounded theory research:

- **Open Coding:** Open coding is the process, during which a researcher examines a collection of qualitative data, such as interview data, and attempts to create smaller distinctive data components. In addition, the researcher needs to label and interpret these components based on their characteristics and qualities.
- Axial Coding: Axial coding is the process that the researcher needs to follow in order to analyse and identify connections and relationships between the sets of codes, which were created during the open coding phase. Afterwards, the researcher needs to combine these sets of data components into broader categories based on the identified connections.
- Selective Coding: In elective coding, the researcher selects one main category that entails the essence of their study. It should be a single large idea that captures a common pattern in the data. Then they determine the connections that exist between this broad category and the remainder of the codes and data. Last but not least, they need to eliminate any categories or codes that do not have enough evidence to support them.



Results

In this chapter, the results of this research are presented. First, we introduce the crosscase analysis, which is illustrated in both written and graphic format. In the second section of this chapter, we present each distinctive case and we provide the most significant insights per case.

5.1 Cross-case Analysis

In this section, we present the cross-case analysis. A table summarising the cross-case analysis results is shown in *Subsection 5.1.2*.

5.1.1 Overview of Interviewees and Presented Cases

Firstly, we showcase an overview of all the AI companies that participated to the semi-structured interviews. *Table 5.1* provides an overview of all AI companies, including information on the *Application Domain*, *Employee Count* and *Role of Interviewee* of each company.

By *Application Domain*, we indicate the area or segment of market, for which each AI company has developed their solution. Several application domains have been identified, including Workflow, Human Resources (HR) and Recruitment, E-Health, Retail and E-commerce and so on. *Employee Count* indicates the number of employees working in the company, often referred to as *Company Size*. Finally, the *Role of Interviewee* is mentioned in the following table, indicating the position that the interviewee is holding within the company. The twelve interviewees included founders, co-founders, Chief Executive Officers (CEO), Chief Technology Officers (CTO), Product Managers and Vice Presidents (VP) of Product.

After taking into consideration privacy and ethical reasons, all the data collected for this research is anonymized and letters (i.e. A-L) are used in order to identify the described cases by interviewees. The required data for this research was collected through semi-structured interviews, twelve in total and they are spread over twelve participants from twelve different companies. Most of these companies are based in the Netherlands (10/12), one is based in the UK and one is based in Greece. The duration of each interview varied from 30 to 60 minutes. All the interviews were conducted by one interviewer and transcripts were made for each interview.

Company	Application Domain	Employee Count	Role of Interviewee
A	HR and	10	Co-founder
	Recruitment		
В	Workflow	6	Co-founder
С	HR and	300	VP of Product
	Recruitment		
D	HR and	140	Product Manager
	Recruitment		
E	Ecommerce	12	Co-founder
F	HR and	2	Co-founder, CTO
	Recruitment		
G	Robotics	30	CEO
Н	Intelligence and	9	CEO
	Analytics		
Ι	HR and	8	Co-founder, Head
	Recruitment		of Data Science
J	Intelligence and	35	CEO, Head of
	Analytics		Growth
K	Fintech	7	Co-founder, CTO
L	Workflow	6	Founder

 Table 5.1: Overview of Companies.

In the following subsections, each company or case is separately presented. An overview of each company and their portfolio is provided and briefly described. Moreover, we highlight the most significant insights of each interviewee, related to the main research question.

5.1.2 AI Impact on the Business and Operating Models

Based on the data collected through the semi-structured interviews, the following table has been created and it illustrates the impact of AI on all the distinctive components of the Business Model (BM) and Operating Model (OM) of AI companies:

		1	NO Pu	ie M8	i nom I	moJ moJ		ləboM ssənizuð					ləbo	M gniter	ədO
	Elements	Value Proposition	Business Capabilities	Key Partnerships	Key Resources	Key Activities & Processes	Cost Structure	Revenue Streams	Distribution Channels	Customer Segments	Customer Relationships	Technology & Infrastructure	Organization & Culture	Management Frameworks/ Systems	Talent Management
	Summary	High	Moderate	Moderate	Moderate	Moderate	High	Moderate	Low	Moderate	Low	High	Low	Low	High
	A	Low	Moderate	Moderate	High	Moderate	High	Low	Low	Moderate	Low	High	Low	Low	High
	8	High	Moderate	Moderate	Low	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	High
	υ	Moderate	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	High
AIIm	٥	High	Moderate	High	Moderate	Moderate	High	Moderate	Low	Low	Low	High	Low	Low	Moderate
pact per	Е	High	High	Modera N te	Modera N te	Modera N te	Modera N te	Low	Low	Low	Low	High	Modera N te	Low	High
Compa	ч	High	High	Aoderate I	Aoderate	Aoderate	Aoderate	Low	Low	Aoderate I	Low	Aoderate	Aoderate	Low	Low
ny	U	High	Moderate	Moderate	High	High	Moderate	High	Moderate	Moderate	Moderate	High	Low	Moderate	Moderate
	т	Moderate	Moderate	Low	Moderate	Low	Moderate	Moderate	Low	Moderate	Moderate	High	Moderate	Moderate	Moderate
	-	High	High	Low	Moderate	High	Low	High	Low	Low	Low	Moderate	Low	Low	Low
	٦	High	High	Moderate	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	High	Low	High
	К	High	High	Low	Low	Low	High	Low	Low	Moderate	Moderate	Moderate	Low	Low	Low
	-	Moderate	Moderate	Low	Moderate	Low	High	Moderate	Low	Moderate	Moderate	High	Low	Low	High

Figure 5.1: Perceived AI impact on BM and OM of all AI companies.

High Impact

Based on the previous table, which illustrates the AI impact on the different elements of business model (BM) and operating model (OM), as perceived by each interviewee, we conclude that the most impacted elements are *Value Proposition*, *Cost Structure*, *Technology & Infrastructure* and *Talent Management*.

Specifically, the component of *Value Proposition* is considered to be the component with the highest impact, as most interviewees stated (8/12).

The next most impacted element is *Technology / Infrastructure* with a great number of participants (7/12) arguing that this OM element is highly affected by their AI-enabled solutions.

Finally, the elements of *Cost Structure* and *Talent Management* are also highly impacted by AI, according to most interviewees (6/12).

Moderate Impact

The AI impact on the majority of BM and OM components, is considered to be moderate, indicating that these elements are affected by the AI-enabled portfolio but not to a great extent. These components are *Business Capabilities, Key Partnerships, Key Resources, Key Activities & Resources, Revenue Streams, Customer Relationships* and *Customer Segments*.

According to most interviewees (9/12), the AI impact on the BM component of *Customer Segments* is characterised as moderate. Similarly, the elements of *Business Capabilities*, *Key Partnerships*, *Key Resources*, *Key Activities* / *Resources* and *Customer Relationships* are moderately impacted by AI, based on many interviewees (7/12).

Finally, the components of *Customer Segments* and *Revenue Streams* are also impacted to some extent by AI, however, this impact is considered to be moderate (6/12).

Low Impact

The BM and OM components that are the least impacted or affected by Artificial Intelligence (AI) are *Distribution Channels, Organisation & Culture* and *Management Frameworks/ Systems*.

Most interviewees (8/12) stated that *Management Frameworks/ Systems* and *Distribution Channels* are very slightly impacted by the development and deployment of AI technologies.

Furthermore, the AI impact on the OM component of *Organisation & Culture* is considered to be low, as many participants stated during the semi-structured interviews (6/12).

5.2 **Presentation of Cases**

In this section, each case will be presented and described based on the most significant data collected during the semi-structured interviews.

5.2.1 Company A

Company A is an AI-startup based in The Netherlands and active in the application domain of HR and Recruitment. The company has been operating for 5 years now and it consists of 10 people in total. The interviewee holds the position of co-founder in the company.

Company A has developed an Software-as-a-Service (SaaS) solution which makes use of different AI methods and computer vision in order to provide information about potential candidates to companies that seek to hire people. Their product assesses different traits of candidates such as their cultural fit to that specific company, confidence, and motivation or stress management capabilities. Based on that assessment they can provide a report about the candidate to their client.

The interviewee mentions they are familiar with the term business model and specifically, they define business model as the way that they make their services available to their customers and they make revenue, and basically "what they do". On the other hand, they state that they are not familiar with the concept of operating model, highlighting that the concept of operating model is not widely used in the "start-up world", as the investors do not usually refer to it. However, their perceived definition of an operating model is the way they develop their service or product and provide it to their clients.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Key Resources, Cost Structure, Technology & Infrastructure,* and *Talent Management*. On the other hand, the components of textitValue Proposition, Revenue Streams, Distribution Channels, Customer Relationships, Organisation & Culture and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Business Capabilities, Key Partnerships, Key Activities & Processes* and *Customer Segments* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Cost Structure: The cost structure is the most affected component of their Business Model. This element is highly impacted, due to the fact that the use of Artificial Intelligence (AI) requires a lot of investment, research and development (R&D) and resources compared to a traditional IT company.

Key Resources: Key resources, including computing power or cloud-based services, play a significant role to the development of their AI-based product, therefore, the impact on them is considered to be rather extensive. Additionally, the impact is high on human resources.

Talent Management: Talent Management is highly impacted, as specialised personnel is rather important to the company in order to be able to develop and provide their AI-based services to their clients.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *High Costs*, *Technology* & *Infrastructure Issues*, *Data Challenges* and *Legal Issues*.

In particular, the interviewee highlighted the following challenges:

High Costs: One of the very first challenges that the company had to face was the high costs of investment in Research and Development (R&D). This investment was crucial for Company A to start their business. In addition, the cost of developing their AI software is significant, as they the development of AI requires big amounts of computing power.

Data Challenges: Another challenge that Company A has to cope with, is Data Challenges. The interviewee states that the company handles a big amount of data, due to their AI-enabled product which makes use of various AI techniques. Therefore, data management is crucial. Data management includes cleaning data, labelling data and so on.

The following table summarizes the perceived AI impact on the BM and OM components of Company A:

		Impact of AI	
Elements	Low Impact	Moderate Impact	High Impact
BM and OM Common Elements			
Value Proposition	Х		
Business Capabilities		х	
Key Partnerships		х	
Key Resources			х
Key Activities & Processes		х	
Business Model			
Cost Structure			х
Revenue Streams	Х		
Distribution Channels	Х		
Customer Segments		х	
Customer Relationships	Х		
Operating Model		•	
Technology & Infrastructure			х
Organization & Culture	Х		
Management Frameworks/ Systems	Х		
Talent Management			х

Figure 5.2: Perceived AI impact on BM and OM of Company A.

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5.2.2 Company B

Company B is an AI-startup based in The Netherlands and active in the application domain of Workflow. The company has been operating for 2 years now and it consists of 12 people in total. The interviewee holds the position of co-founder in the company.

Company B has developed has developed an AI solution, which brings privacy by design. Their customers can send them data, which Company B processes, utilizing AI and data science techniques, and sends it back to the customer. In this way, customer do not have to worry about data privacy.

The interviewee mentions they are familiar with the term business model as well as with the term operating model. Specifically, they state that a business model describes or defines how a company create value, while an operating model describes how a company delivers the value.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Talent Management* and *Cost Structure*. On the other hand, the component of *Key Resources* is slightly impacted. Finally, the impact on *Technology & Infrastructure, Business Capabilities, Key Activities & Processes, Revenue Streams, Key Partnerships, Customer Segments, Distribution Channels, Customer Relationships, Management Frameworks/Systems and Organisation & Culture is considered to be moderate.*

In particular, the interviewee highlighted the impact on the following component:

Talent Management: The impact on this element is high for Company B. According to the interviewee, talent management is a very important aspect of any AI company. AI companies need the best talent in order to be able to develop their AI solution and make it available to their clients.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *Talent Issues*, *Unpredictability* and *High Costs*.

In particular, the interviewee highlighted the following challenges:

Unpredictability: Building AI software and having it ready for production can be very challenging. In contrast to IT companies that develop regular software, AI companies have to face the challenge of outcome unpredictability. As they cannot always predict the output of their AI solution, which is not the case for traditional software, where the outcome is always the same.

Talent Issues: "AI is technology and technology is built by people", therefore, finding and hiring the right talent to help with the AI solution development can be very

challenging. Especially, during and after the pandemic of Covid-19, where big software companies such as Google, can recruit people from any country, making it even harder for AI start-ups to find the right talent and be able to afford it.

The following table summarizes the perceived AI impact on the BM and OM components of Company B:

	Impact of AI			
Elements	Low Impact	Moderate Impact	High Impact	
BM and OM Common Elements				
Value Proposition			Х	
Business Capabilities		х		
Key Partnerships		Х		
Key Resources	Х			
Key Activities & Processes		х		
Business Model		•		
Cost Structure			Х	
Revenue Streams		х		
Distribution Channels		х		
Customer Segments		X		
Customer Relationships		X		
Operating Model		•	•	
Technology & Infrastructure		X		
Organization & Culture		х		
Management Frameworks/ Systems		х		
Talent Management			Х	

Figure 5.3: Perceived AI impact on BM and OM of Company B.

5.2.3 Company C

Company C is an AI company based in the UK and active in the application domain of HR and Recruitment. The company has been operating for 3.5 years and it consists of almost 300 people. The interviewee holds the position of Vice President (VP) of Product.

Company C has developed a solution which makes use of different AI methods in order to help other companies find and hire the right talent. Specifically, they assist their clients with matching resumes to job ads. Furthermore, their platform can help with the optimisation of employer branding campaigns. Based on job locations and purchasing ads across job sites, they can predict which job ads their clients should spend money on, how many applications these jobs have across all geographies and what jobs their clients should turn on or off and on different career sites.

The interviewee mentions they are familiar with both concepts of business model and operating model. Regarding the concept of business model, they state that business models entail the ability of a company to sell, the company's growth prospects, their stable revenues streams and their customer base. All in all, a business model is closely related to how a company can sell their product and make revenue, grow their business and expand its current client base. Regarding the operating model, the interviewee defines it as the way a company operates and it can deliver value to their clients.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Talent Management*, *Technology & Infrastructure* and *Cost Structure*. Finally, the impact on *Value Proposition*, *Business Capabilities, Key Resources, Key Activities & Processes, Revenue Streams, Key Partnerships, Customer Segments, Distribution Channels, Customer Relationships, Management Frameworks/Systems* and *Organisation & Culture* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Technology & Infrastructure: Talent management is highly impacted by their AI-based portfolio, as the company needs to have the right talent to develop and run the AI software. Therefore, the company highly invests in their employees' training and development.

Talent Management: Talent management is highly impacted by their AI-based portfolio, as the company needs to have the right talent to develop and run the AI software. Therefore, the company highly invests in their employees' training and development.

AI CHALLENGES

The interviewee states that the challenge that their company has to face is *Explainability and Education*.

In particular, the interviewee highlighted that:

Explainability and Education: Market education, client education, as well as internal education with regard to their AI software is the greatest challenge the company has to face. According to Company C, it is important to ensure that the product is not a "black box". They do not want their product to be a system that people cannot understand how it works. Therefore, explainability and education are two highly important aspects for the company.

The following table summarizes the perceived AI impact on the BM and OM components of Company C:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition		х		
Business Capabilities		х		
Key Partnerships		Х		
Key Resources		Х		
Key Activities & Processes		х		
Business Model		-	-	
Cost Structure			Х	
Revenue Streams		х		
Distribution Channels		х		
Customer Segments		Х		
Customer Relationships		х		
Operating Model		-		
Technology & Infrastructure			Х	
Organization & Culture		х		
Management Frameworks/ Systems		х		
Talent Management			Х	

Figure 5.4: Perceived AI impact on BM and OM of Company C.

5.2.4 Company D

Company D is an AI company based in The Netherlands and active in the application domain of HR and Recruitment. The company has been operating for 20 years and it consists of 140 people in total. The interviewee holds the position of Product Manager (PM).

Company D is a Business-to-Business (B2B) company, which has developed an AI product that makes use of different AI algorithms in order to develop software, with main component a CV parser, which is a piece of software that reads a resume or Curriculum vitae (CV) and extracts information from it. In this way, they have automated a process used to be a manual and repetitive human task. In addition, the company provides a searching and matching solution, which can match a CV to a job vacancy and vice versa.

The interviewee mentions that they are familiar with the term Business Model but not with the term Operating Model. According to them, a business model describes the basic revenue generation dynamics of a company. They highlight that business model is mostly related to the structure through which the company can create revenue.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Key Partnerships, Technology & Infrastructure* and *Cost Structure*. On the other hand, the components of *Customer Segments, Distribution Channels, Customer Relationships, Management Frameworks/Systems* and *Organisation & Culture* are slightly impacted. Finally, the impact on *Business Capabilities, Key Resources, Key Activities & Processes, Revenue Streams* and *Talent Management* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Value Proposition: The core of the business is based on AI. Therefore, the entire value proposition is closely related to the AI-based product. The interviewee argues that AI is not just a component of their product but it was the core of their portfolio from the beginning.

Talent Management: According to Company D, AI software development is quite complex, therefore, the company needs people with the right AI skill set. In addition, they state that more people are needed for AI development than any other kind of software development. Last but not least, it is argued that there is such high demand for AI developers and engineers, that the company needs to protect its people, and keep them motivated.

Technology & Infrastructure: The hardware requirements are different compared to traditional IT companies, due to the fact that AI development requires powerful servers. Furthermore, more cost are going to hardware and people maintaining hardware.

AI CHALLENGES

The interviewee states that the challenge that their company has to face is *Explainability & Education*.

In particular, the interviewee highlighted that:

Explainability & Education: Customers have too high expectations from AI solutions, without being fully aware of what the capibilities of Artificial Intelligence (AI) are. Therefore, it is crucial for AI companies to educate their customer and manage expectations.

The following table summarizes the perceived AI impact on the BM and OM components of Company D:

	Impact of AI				
Elements	Low	Moderate	High		
	Impact	Impact	Impact		
BM and OM Common Elements		•			
Value Proposition			Х		
Business Capabilities		х			
Key Partnerships			Х		
Key Resources		х			
Key Activities & Processes		х			
Business Model		-			
Cost Structure			Х		
Revenue Streams		х			
Distribution Channels	X				
Customer Segments	X				
Customer Relationships	X				
Operating Model					
Technology & Infrastructure			Х		
Organization & Culture	X				
Management Frameworks/ Systems	X				
Talent Management		х			

Figure 5.5: Perceived AI impact on BM and OM of Company D.

5.2.5 Company E

Company E is an AI-startup based in The Netherlands and active in the application domain of E-commerce. The company has been operating for 3 years and it consists of 12 people in total. The interviewee holds the position of Chief Technology Officer (CTO) and co-founder in the company.

Company E has developed AI software that generates digital avatars, which apparel companies can use to showcase 3D garment designs. Specifically, Company E maps customers' garment designs to avatars. They offer models-as-a-service, which their clients can select from to demonstrate their collections. They try to replace traditional photography of human models and transform the whole fashion industry.

The interviewee mentions that they are familiar with the term business model but not with the term operating model. The interviewee defines business models as the way a company can structurally define their value creation process for their customers.

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AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS
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When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Business Capabilities, Technology & Infrastructure* and *Talent Management*. On the other hand, the components of *Distribution Channels, Customer Relationships, Revenue Streams* and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Key Partnerships, Key Resources, Key Activities & Processes, Cost Structure* and *Organisation & Culture* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Technology and infrastructure: The impact on this element is significantly high. Due to the technology needed to develop, maintain and optimise their AI services.

Talent Management: This element is rather significant for Company E, as the majority of employees within the company AI-related talent. It is really important not only to recruit the best talent but also to keep them engaged and interested, to provide them with resources in order to give them development improve opportunities and consequently prevent retention. Furthermore, it is important to stay up to date with regard to what is happening in the AI field research.

Key partnerships: The AI impact on this element is moderate, however, the company mentions that they seek to keep very close ties with other AI companies, and form an AI start-up community. This community can provide further knowledge sharing, funding opportunities and co-operations among different AI start-ups. Furthermore, the partners that the company needs to do work with, are usually either hardware or other software providers, which can contribute to their AI solution development.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are the following: *Technology & Infrastructure* and *High Costs*.

In particular, the interviewee highlighted the following challenge:

High Costs: The main challenge that Company E has to face is the high costs related to the high amount of computing power, which is required for developing their AI solution. Company E specifically mentions that they need powerful servers and machines to train their models on, which can be extremely expensive and challenge their cost structure.

The following table summarizes the perceived AI impact on the BM and OM components of Company E:

	Impact of AI			
BM and OM	Low	Moderate	High	
Elements	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition			Х	
Business Capabilities			Х	
Key Partnerships		Х		
Key Resources		Х		
Key Activities & Processes		X		
Business Model				
Cost Structure		X		
Revenue Streams	Х			
Distribution Channels	Х			
Customer Segments	Х			
Customer Relationships	Х			
Operating Model		•		
Technology & Infrastructure			Х	
Organization & Culture		х		
Management Frameworks/ Systems	Х			
Talent Management			Х	

Figure 5.6: Perceived AI impact on BM and OM of Company E.

5.2.6 Company F

Company F is an AI-startup based in The Netherlands and active in the application domain of HR and Recruitment. The company has been operating for 2 years now and it consists of 2 people in total. The interviewee holds the position of CTO and co-founder in the startup.

Company F has developed an Software-as-a-Service (SaaS) solution which makes use of different AI techniques to help companies that find and hire C-level executives, such as, director, CEO, CFO and so on, easy and fast. The biggest part of their AIbased solution is to compare companies. For instance, if a company needs to find a new CFO, they can use this AI solution to gain more information from other companies which they share some similarities with, and therefore, be able to hire the right person. In addition, Company F provides the ability to integrate this AI-enabled tool with platforms, such as LinkedIn, and help their clients with recruitment.

The interviewee states that they are familiar with the term business model but not with the term operating model.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition* and *Business Capabilities*. On the other hand, the components of *Revenue Streams*, *Distribution Channels*, *Customer Relationships*, *Management Frameworks/Systems* and *Talent Management* are slightly impacted. Finally, the impact on *Key Partnerships*, *Key Resources*, *Key Activities & Processes*, *Cost Structure*, *Customer Segments*, *Organisation & Culture* and *Technology & Infrastructure* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Cost Structure: The impact on the cost structure is considered to be moderate. However, the interviewee states that the use of Artificial Intelligence (AI) can be very challenging, requiring a lot of investment, research and development (R&D) and resources. This makes AI companies face higher costs compared to traditional IT companies.

Organization Culture: The interviewee states that this OM element is slightly impacted, as the AI startup consists of just two people right now. Therefore, they cannot observe significant impact on this specific component.

Furthermore, the interviewee argues that the components that are not affected by AI, are *Value Proposition*, *Revenue Streams*, *Distribution Channels*, *Customer Relationships*, *Organisation & Culture and Management frameworks & Systems*.

AI CHALLENGES

The interviewee states that the challenge that their company has to face is *Data Challenges*.

In particular, the interviewee highlighted that:

Data Challenges: There are various challenges related to data, such as data quality, data availability, data processing, and data storage. All these challenges make AI-based software development more complex and difficult to build than software that does not include any AI. Additionally, challenges with regard to data, such as poor quality of data can have rather bad implications on the AI solution and consequently to the business.

The following table summarizes the perceived AI impact on the BM and OM components of Company F:

	Impact of AI			
BM and OM	Low	Moderate	High	
Elements	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition			Х	
Business Capabilities			Х	
Key Partnerships		х		
Key Resources		х		
Key Activities & Processes		х		
Business Model			-	
Cost Structure		х		
Revenue Streams	Х			
Distribution Channels	Х			
Customer Segments		х		
Customer Relationships	Х			
Operating Model				
Technology & Infrastructure		х		
Organization & Culture		х		
Management Frameworks/ Systems	Х			
Talent Management	Х			

Figure 5.7: Perceived AI impact on BM and OM of Company F.

5.2.7 Company G

Company G is an AI-startup based in The Netherlands and active in the application domain of Robotics. The company has been operating for 8 years and consists of 30 people in total. The interviewee holds the position of CTO and co-founder in the startup.

Company G has developed an AI-based product which leverages Neural networks (NN) capabilities and it is used for logistics. Their AI-enabled product can pick items, such as parcels, which are always different in size and shape, and then they trained a neural network to generalise and find the best possible grasp poses of those items to simulate them and to put them on a shorter, so they can be scanned and sent to the different locations.

The interviewee states that they are familiar with the term business model but not with the term operating model.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Key Resources, Key Activities & Processes, Revenue Streams* and *Technology & Infrastructure*. On the other hand, the component of *Organisation & Culture* is slightly impacted. Finally, the impact on *Business Capabilities, ,Key Partnerships, Cost Structure, Distribution Channels, Customer Segments, Customer Relationships, Talent Management* and *Management Frameworks/Systems* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Value Proposition: For Company G, the impact of AI on this component, is considered to be high, as the core of their product is based in AI. They state that their portfolio is 100% AI-enabled and their business would not be feasible without the use of Neural Networks (NN).

Revenue Streams: The interviewee states that this component is highly impacted. Due to the fact that AI is a hype nowadays, leads to the increasing number of sales and new customers. In addition, the marketing of their AI solution is easier to achieve, as there is a growing number of potential customers highly interested in AI solutions.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *Unpredictability, Explainability & Education* and *Legal Issues*.

In particular, the interviewee highlighted the following challenges:

Unpredictability: The main challenge Company G faces it the unpredictability of their AI solution outcome. AI makes it difficult for the company to guarantee the exact

percentage of successful outcome to their customer.

Explainability & Education: According to Company G, another challenge that they need to face and overcome is the challenge of explainability, with regard to clients. The company needs to provide thorough explanations and guidance regarding their AI-based product to their customers in order to help them understand exactly how their solution works and how they can benefit from it.

Legal issues: According to the interviewee a significant pillar of AI development is legal. They highlight the importance of being liable towards their customers and considering any legal aspect related to their solution.

The following table summarizes the perceived AI impact on the BM and OM components of Company G:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements	•	•		
Value Proposition			Х	
Business Capabilities		х		
Key Partnerships		х		
Key Resources			Х	
Key Activities & Processes			Х	
Business Model				
Cost Structure		X		
Revenue Streams			Х	
Distribution Channels		х		
Customer Segments		х		
Customer Relationships		х		
Operating Model	•	•		
Technology & Infrastructure			Х	
Organization & Culture	Х			
Management Frameworks/ Systems		х		
Talent Management		X		

Figure 5.8: Perceived AI impact on BM and OM of Company G.

5.2.8 Company H

Company H is an AI-startup based in Greece and active in the application domain of Workflow. The company has been operating for two years and consists of 9 people in total. The interviewee holds the position of Chief Executive Officer (CEO) in the company.

Company H provides customer AI-based services to their clients. Their services includes a wide range of AI-enabled solutions, with the main two being a fraud detection system and a Natural Language Processing (NLP) and text mining system.

The interviewee mentions their familiarity with the term business model but not with the term operating model. According to them, a business model is the mechanism, which consists of business processes, procedures, and resources that can make a technology, a product available to the market and return back revenue.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the OM component that is highly impacted is *Technology* & *Infrastructure*. On the other hand, the components of *Key Partnerships, Key Activities* & *Processes* and *Distribution Channels* are slightly impacted. Finally, the impact on *Value Proposition, Business Capabilities, Key Resources, Cost Structure, Revenue Streams, Customer Segments, Customer Relationships, Organisation & Culture, Talent Management* and *Management Frameworks/Systems* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Technology & Infrastructure: Very specialized technologies needed for AI development such as data processing in the cloud and the infrastructure which are very AI specific. Furthermore, streaming technologies for real time systems are another AI-specific technology needed. Generally speaking, there are various technologies needed related to AI.

Talent Management: The impact on this components is characterised as moderate. The interviewee states that AI-related hires are limited, and the company needs to invest in hiring but also retaining their talent, with keeping their employees purposeful while being competitive in their market. They highlight that this factor is also highly-related to the factors of Culture & organisation within the company. Last but not least, the interviewee states that "One description does not fit all", indicating that there are various specialisations in AI field, leading to different people needed for specific AI positions.

Management Frameworks & Systems: The impact on this components is characterised as moderate due to the fact that the management frameworks that this company uses are not different from the frameworks that other IT companies use. However, there are some differences, as traditional agile frameworks do not work perfectly for AI

development.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *Explain-ability & Education* and *Talent Issues*.

In particular, the interviewee highlighted the following challenge:

Explainability: The first challenge that the interviewee mentions is explainability and eductation. They mention that clients usually are not sure about what to expect from AI solutions, and they do not have the required knowledge around AI. Therefore, Company H needs to educate their clients, providing them with trainings and continuous customer support.

The following table summarizes the perceived AI impact on the BM and OM components of Company H:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition		х		
Business Capabilities		х		
Key Partnerships	X			
Key Resources		х		
Key Activities & Processes	Х			
Business Model				
Cost Structure		х		
Revenue Streams		х		
Distribution Channels	X			
Customer Segments		х		
Customer Relationships		х		
Operating Model				
Technology & Infrastructure			Х	
Organization & Culture		х		
Management Frameworks/ Systems		Х		
Talent Management		х		

Figure 5.9: Perceived AI impact on BM and OM of Company H.

5.2.9 Company I

Company I is an AI-startup based in The Netherlands and active in the application domain of HR and Recruitment. The company has been operating for two years and consists of 8 people in total. The interviewee holds the position of co-founder and head of data science in the company.

Company I develops an AI solution that matches people within the niche of Data Science and AI, to job vacancies. Their product is partially AI-based including a recommendation system, which utilizes Neural Networks (NN) techniques.

The interviewee states that they are familiar with the term business model but not with the term operating model. They define business model as the way that a company can monetise the product or service that they create.

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AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS
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When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Revenue Streams, Key Activities & Processes, Value Proposition,* and *Business Capabilities.* On the other hand, the components of and *Key Partnerships, Cost Structure, Distribution Channels, Customer Segments, Customer Relationships, Organisation & Culture, Talent Management* and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Technology & Infrastructure* and *Key Resources* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Technology & Infrastructure: According to the interviewee the impact of the AI-based portfolio on this component is characterised as moderate. The fact that the company develops

Management Frameworks & Systems: The impact on this components is characterised low, as the company does use Agile for developing their software an

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *Explain-ability & Education* and *Accountability*.

In particular, the interviewee highlighted the following challenge:

Accountability: According to Company I, an important challenge that they face and need to overcome, is accountability. They need to ensure that the matching results of their software are as accurate as possible and do not included any bias. Therefore, it is important for Company I to try and mitigate any bias involved into their AI model.

The following table summarizes the perceived AI impact on the BM and OM components of Company I:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements		•		
Value Proposition			Х	
Business Capabilities			х	
Key Partnerships	X			
Key Resources		х		
Key Activities & Processes			Х	
Business Model			•	
Cost Structure	X			
Revenue Streams			Х	
Distribution Channels	x			
Customer Segments	x			
Customer Relationships	x			
Operating Model		•	•	
Technology & Infrastructure		X		
Organization & Culture	X			
Management Frameworks/ Systems	х			
Talent Management	x			

Figure 5.10: Perceived AI impact on BM and OM of Company I.

5.2.10 Company J

Company J is an AI-startup based in The Netherlands and active in the application domain of Intelligence and Analytics. The company has been operating for two years and it consists of 35 people in total. The interviewee holds the position of CEO and Head of Growth in the company.

The company has developed an AI solution which utilizes AI techniques such as, Machine Learning (ML) and Natural Language Processing (NLP), in order to help primarily multinational companies with technology scouting. According to them the core of their product is based in NLP processing because their software is a semantic search engine.

The interviewee states that they are familiar with the term Business Model but not with the term Operating Model. Regarding the interviewee's interpretation of Business Model, they mention that they associate the term Business Model firstly with the term Revenue Model and afterwards with the concept of Business Model Canvas (BMC).

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Business Capabilities, Organisation & Culture,* and *Talent Management*. On the other hand, the components of *Key Resources, Key Activities & Processes,* and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Key Partnerships, Cost Structure, Revenue Streams, Distribution Channels, Customer Segments, Customer Relationships* and *Technology & Infrastructure* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Cost Structure: The cost structure of the Company J is impacted to a significant extent by AI-enabled portfolio. According to the interviewee, the long-term effort of developing and deploying AI software is significantly expensive. First of all, having the right people onboard is really expensive, for example, they have an employee onboard whom they hired from Google in Switzerland, and recruiting and on-boarding this talent can be very expensive. Additionally, they mention that main category of costs that is mostly affected by the use of AI, is the investment cost. On the other hand, the operational costs are not impacted to the same extent, even though server expenses can be also significant.

Organisation and Culture: This component is highly impacted due to the fact that the company culture of Company J is highly affected by AI. Company J identifies themselves as "AI-believers", indicating that the core of their company is closely related and dependent on the AI solution that they offer. They strive to utilize AI in the product they develop but also outside of the product. In other words, they try to leverage

AI as much as possible, both in their main product as well as in the procedures that they have established within their company, and use various AI tools aiming to obtain useful knowledge from them.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *High Costs* and *Legal Issues*.

In particular, the interviewee highlighted the following challenges:

High Costs: The challenge that company J had to tackle at the beginning was finding the investment needed for starting their AI startup, because in order to build such an advanced AI product, a significant amount of money was required and it was not easy to find investors willing to invest in an unfinished product. Therefore, the initial investment cost necessary at the beginning was a great risk for the company.

Legal Issues: The interviewee mentions that they have to overcome potential legal issues related to the data they use, such as General Data Protection Regulation (GDPR) data, for which they need to ensure security and privacy. However, they mostly do search for openly available data online to minimize this risk as much as possible.

The following table summarizes the perceived AI impact on the BM and OM components of Company J:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition			x	
Business Capabilities			Х	
Key Partnerships		х		
Key Resources	х			
Key Activities & Processes	Х			
Business Model		•		
Cost Structure		х		
Revenue Streams		х		
Distribution Channels		х		
Customer Segments		х		
Customer Relationships		х		
Operating Model				
Technology & Infrastructure		X		
Organization & Culture			Х	
Management Frameworks/ Systems	Х			
Talent Management			x	

Figure 5.11: Perceived AI impact on BM and OM of Company J.

5.2.11 Company K

Company K is an AI-startup based in The Netherlands and active in the application domain of Fintech. The company has been operating for two years and it consists of 7 people in total. The interviewee holds the position of CTO and co-founder in the company.

Company K has developed an AI system that analyses markets and generates trading algorithms for these markets utilizing different AI techniques, such as Machine Learning (ML) and Deep Learning (DL). They highlight that the core of their product is AI-based.

The interviewee mentions they are familiar with the term business model but not with the term operating model. According to them, a business model is how a company "can make money" and what drives the company's value. The interviewee describes the BM as a model which has input and output.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Value Proposition, Business Capabilities,* and *Cost Structure.* On the other hand, the components of *Key Partnerships, Key Resources, Key Activities & Processes, Revenue Streams, Distribution Channels, Organisation & Culture, Talent Management,* and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Customer Segments, Customer Relationships* and *Technology & Infrastructure* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Cost Structure: Company K states that they have high costs, as any other company in AI field, mostly due to the servers expenses as their product is based in deep learning and machine learning. Servers require a lot of power, resulting in high bills from cloud providers. This is a main difference in their Business Model compared to traditional IT companies, according to Company K.

Technology & Infrastructure: Company K make use of servers from AWS or Google, particularly AWS SageMaker, which is a machine learning and deep learning engine. Additionally, they use TensorFlow software and Pytorch application, which are just tools to install servers or certain services from these rep providers you use, which are software tools used for machine learning and artificial intelligence. However, they state that traditional AI startups can also use these tools and techniques. For instance, companies like Netflix and Spotify which are big traditional non-AI IT companies use these kinds of techniques. According to them, AI differs from other technologies due to the high volume of data and larger sets of data they need to analyse and manipulate. This is the main difference between AI and other IT companies.

Customer Segment: Company K, argue due to the fact that some people do not trust AI, it is harder to sell their AI products to some specific customer segments. For instance, more traditional customers such as insurances, banks and so on, are not they most convenient customer segments to sell AI-enabled products. Especially, when deep learning techniques are involved, expandability of the AI, explainability and compliance issues are some of the factors they need to consider when selecting the customer segments they want to serve.

Management Frameworks/Systems: According to Company K, most IT startups or companies use Agile, particularly Scrum and Kanban, as their main management frameworks. As, these frameworks facilitate technology development and deployment. However, these are not AI-specific management frameworks, they are more IT-specific and they are used by most IT companies.

AI CHALLENGES

The interviewee states that the challenges that their company has to face are *Data Challenges* and *Unpredictability*.

In particular, the interviewee highlighted the following challenges:

Data Challenges: Company K mentions that the main challenge that they need to face, especially compared to other traditional IT companies, is that they cannot always know the outcome of their product. They cannot guarantee upfront that their AI product will have the right output, immediately affecting the value proposition to your customer.

Unpredictability: An additional challenge that Company K had to face when starting their AI startup, was the initial cost of investment, which they had to make available in order to start developing their AI solution,

The following table summarizes the perceived AI impact on the BM and OM components of Company K:

	Impact of Al			
Elements	Low Impact	Moderate Impact	High Impact	
BM and OM Common Elements				
Value Proposition			Х	
Business Capabilities			Х	
Key Partnerships	Х			
Key Resources	Х			
Key Activities & Processes	Х			
Business Model				
Cost Structure			Х	
Revenue Streams	Х			
Distribution Channels	Х			
Customer Segments		X		
Customer Relationships		X		
Operating Model				
Technology & Infrastructure		X		
Organization & Culture	Х			
Management Frameworks/ Systems	Х			
Talent Management	Х			

Figure 5.12: Perceived AI impact on BM and OM of Company K.

5.2.12 Company L

Company L is an AI-startup based in The Netherlands and active in the application domain of Workflow. The company has been operating for four years now and it consists of 6 people in total. The interviewee holds the position of founder in the company.

Company L operates as an AI-based consultancy firm prototyping and developing AI-based solutions in order to consult corporate clients as well as other startups. Their AI-based services include voice recognition, customer service automation, predictive maintenance and so on.

The interviewee states that they are familiar with the term business model but not with the term operating model. According to the interviewee, business model is the way a company can build a predictable revenue stream or the way a product or service that adds value and brings recurring revenues to the company.

AI IMPACT ON THE BUSINESS MODEL (BM) AND OPERATING MODEL (OM) COMPONENTS

When asked about the impact of AI on the distinctive components of the BM and OM, the interviewee stated that the BM and OM components that are highly impacted are *Technology & Infrastructure, Talent Management*, and *Cost Structure*. On the other hand, the components of *Key Partnerships, Key Activities & Processes, Distribution Channels, Organisation & Culture* and *Management Frameworks/Systems* are slightly impacted. Finally, the impact on *Customer Segments, Customer Relationships, Value Proposition, Business Capabilities, Key Resources* and *Revenue Streams* is considered to be moderate.

In particular, the interviewee highlighted the impact on the following components:

Technology & Infrastructure: Company L states that the impact on their technology and infrastructure is considered to be high. As they highly rely on software and hardware that can facilitate the development of their AI-enabled solutions. Additionally, Company L is highly dependent on cloud infrastructure providers, such as Amazon Web Service (AWS), Microsoft Azure and Google Cloud Platform, due to the computational power needed for training AI models.

Revenue Streams: The interviewee argues that the revenue streams of Company L are moderately impacted by AI. Although, their main revenue streams are similar to any other consultancy firm, Company L benefits from the AI-enabled solutions due to the fact that it is easier to sell their services in terms of marketing. Customers are rather interested in AI solutions, resulting in creating more revenue.

The interviewee states that the challenges that their company has to face are *Unpre-dictability* and *Data Challenges*.

In particular, the interviewee highlighted the following challenges:

Unpredictability: According to Company L, AI solutions are difficult to implement, and the outcomes can be very unpredictable. Therefore, it is hard for them to guarantee the results of their model. In addition, their AI-enabled services can be slow or even fail, resulting in inaccurate outcomes of the system and high risks for the company.

Data Challenges: The interviewee states that one of the most important challenges that their company had to overcome especially when they were starting the AI software development, was to find data. As, their AI-enabled services are highly dependent on data availability, it was crucial to able to find the necessary quality data to use for training their AI models.

The following table summarizes the perceived AI impact on the BM and OM components of Company L:

	Impact of AI			
Elements	Low	Moderate	High	
	Impact	Impact	Impact	
BM and OM Common Elements				
Value Proposition		х		
Business Capabilities		Х		
Key Partnerships	Х			
Key Resources		х		
Key Activities & Processes	Х			
Business Model				
Cost Structure			Х	
Revenue Streams		х		
Distribution Channels	X			
Customer Segments		х		
Customer Relationships		х		
Operating Model				
Technology & Infrastructure			Х	
Organization & Culture	X			
Management Frameworks/ Systems	X			
Talent Management			Х	

Figure 5.13: Perceived AI impact on BM and OM of Company L.

Chapter 6

Discussion

In this chapter, we discuss and analyse the results of this research project mentioned in *Chapter 5*. First, we discuss the AI impact on the business model (BM) components, followed by the AI impact on the operating model (OM) and then, the AI impact on the common BM and OM components. Furthermore, we provide some attention points for AI companies to consider, some reflections on the theoretical concepts and an elaborated answer to the main research question. Finally, validity considerations for this research are being presented and analysed.

6.1 AI Impact on the Business and Operating Models

In order to define the impact of AI on the business and operating models of AI companies, we break the two concepts of BM and OM into their main components. First, we identify and analyse the AI impact on each component of BM and OM, and then we summarize the impact on the each model accordingly.

Business Model

Based on the literature review we conducted at the early stages of this research project, we determined that a Business Model (BM) consists of the elements illustrated in the following figure:



Figure 6.1: Business Model (BM) Elements.

In order to identify what is the impact of AI on the business model of AI companies, we first observe the impact of AI on each distinctive component of their Business Model (BM). Based on the data collected through the semi-structured interviews, we identified that the BM component that is most highly impacted is *Cost Structure*. On the other hand, the components that are affected to a very slight degree or the AI impact on them is characterised as low, are the elements of *Distribution Channels* and *Customer Relationships*. Finally, the components of *Revenue Streams* and *Customer Segments* are moderately affected by AI.

Cost Structure: The AI impact on this BM element is high.

Cost Structure describes all costs incurred while operating under a specific business model (Osterwalder et al., 2005). In order to determine their most important costs, companies need to consider various aspects of their business, such as which key resources or key activities are the most expensive (Osterwalder & Pigneur, 2010). The vast majority of the interviewees states that their company's cost structure is significantly impacted by AI. They highlight that costs related to AI are the main difference between AI companies and traditional IT companies that develop software without utilizing AI technology. There are three main factors contributing to high costs for AI companies, which are the initial investment cost, technology and infrastructure cost, and talent management cost. Interviewees have mentioned that a significant amount of initial investment is needed in order for the company to be able to start operating. Therefore, investment cost is considered to be an important factor affecting AI companies' cost structure. Regarding the technology and infrastructure, there is a wide variety of software as well as hardware requirements that AI companies need to meet in order to able to develop their AI solutions. Powerful servers, great amounts of computing power, sufficient data availability, and cloud infrastructure are just some of these requirements. All these technological requirements add to the high costs of AI development and deployment. Last but not least, talent management is a significant expense for AI companies, which need to invest significant amounts of money in order to attract, recruit, onboard, train and retain talent. The combination of human resources and IT costs, leads to high amounts of fixed costs.

Distribution Channels: The AI impact on this BM element is low.

The element of *Distribution Channels* concerns the way or tools a company seeks to interact with specific customer segments in order to deliver value (Osterwalder & Pigneur, 2010; Peters et al., 2013; Teece, 2010). According to most interviewees, their AI-enabled portfolio does not affect the distribution channels they utilize in order to reach their customers. They argue that distributions channels that they use are the same with the channels that any other IT company uses, such as website pages. Therefore, they conclude that the AI impact on this BM element is low.

Customer Relationships: The AI impact on this BM element is moderate.

The BM component of *Customer Relationships* defines the type of relationship, a company aims to establish with each customer segment they serve (Osterwalder & Pigneur, 2010; Peters et al., 2013). Customer relationships can be from personal to automated interactions. ICT capabilities within organisations, present a great opportunity to capitalize on already-existing customer relationships by identifying and meeting customers' demands, creating long-lasting relationships with them, and better satisfying their wishes (Peters et al., 2013). Nowadays, companies can collect customer data and utilize it to uncover further business opportunities, discover new key customer segments, as well as strengthen their connections with their existing customer segments (Dubosson-Torbay et al., 2002; Peters et al., 2013). According to most interviewees, the element of Customer Relationships is moderately affected by AI. The majority of these AI companies maintain regular customer relationships, like any other IT company. However, they argue that the complexity of their AI solutions can lead to AI companies seeking to build closer relationships with their customers in order to provide further elaboration, training, guidance and customer service on their AI solution.

Customer Segments: The AI impact on this BM element is moderate.

The BM component of *Customer Segments* describes the different groups of people or organisations a company intends to serve (Osterwalder et al., 2005). It is a rather significant element of business model, as customers comprise the heart of any business model (Osterwalder & Pigneur, 2010; Peters et al., 2013). Most interviewees state that the impact of AI on this element is moderate.

Revenue Streams: The AI impact on this BM element is moderate.

The BM component of Revenue Streams describes the amount of cash a company gen-

erates from each customer segment they serve (Osterwalder & Pigneur, 2010). This element provides the answer to the question, for what value each customer segment is truly willing to pay (Peters et al., 2013). According to many interviewees, the AI impact on this component is considered to be moderate. There are various reasons affecting the impact of AI on their revenue streams. The increasing popularity of Artificial Intelligent (AI) and the fact that AI is considered to be a hype nowadays, makes it easier for AI companies to sell their AI solutions. Most interviewees argue that due to the increasing number of customers interested in AI, promoting and selling their AI solutions as well as attracting new customers, have become easier to achieve for AI companies.

Operating Model

Based on the literature review we conducted at the early stages of this research project, we determined that an Operating Model (OM) consists of the elements illustrated in the following figure:



Figure 6.2: Operating Model (OM) Elements.

Similarly to the process we followed for Business Model (BM), in order to determine the impact of AI on the Operating Model (OM) of AI companies, we first observe the impact of AI on each distinctive OM component. Based on the data gathered through semi-structured interviews, we identified that the OM components that are highly impacted are *Technology & Infrastructure* and *Talent Management*. On the other hand, the components that are slightly affected by AI or in other words the AI impact on them is characterised as low, are the elements of *Organisation & Culture* and *Management Frameworks & Systems*. As it can be observed in *Figure 5.1*, there are no OM components that are moderately impacted by AI, according to the interviewees.

Technology & Infrastructure: The AI impact on this OM element is high.

Technology & Infrastructure is one of the two most highly impacted OM components. This component includes the software and hardware infrastructure needed from AI companies in order to be able to develop and deploy their AI solutions. AI software development and deployment can be more complex and demanding than the development of other types of software. The main reason contributing to this fact is the large amount of data that AI companies need to manipulate and which can be very challenging. AI companies need to meet significant IT requirements in order to provide their AI-enabled solution. These requirements include powerful servers, great amounts of computing power, sufficient data availability, quality and storage, cloud infrastructure and networking infrastructure.

Talent Management: The AI impact on this OM element is high.

Talent Management entails attracting, recruiting and retaining talent. This Operating Model (OM) element is significantly impacted by AI, according to the vast majority of interviewees. The complexity of AI software development, leads to talent management being a critical factor for every AI company. AI companies and especially AI start-ups need to stay ahead of the competition and ensure their AI software quality, which results in AI companies highly investing in their talent management. There are main factors that affect this OM component. First of all, AI companies need to attract the best talent with the right expertise, depending on the AI technology they use. However, AI companies around the world are struggling to recruit the right AI talent (Cyranoski, 2018). AI sector is a rather broad with many subcategories, therefore, it is difficult for AI companies to identify the right talent with the right skill set and hire them. According to Company H, "One description does not fit all", meaning that an AI employee might be an expert in a specific AI technique, however, that does not indicate that this person is suitable for any AI company. Furthermore, due to high demand of AI talent, it is hard for AI companies to find the desired talent. They are forced to invest significant amounts of money in order to attract, recruit and hire this highly-skilled talent. Last but not least, some of the interviewees mentioned that they need to "protect their people". As there is intense competition in the AI industry right now, AI companies search and contact employees who already work at other AI companies. Therefore, AI companies especially AI start-ups need to pay close attention to inspiring and motivating their talent in order to retain it. Providing training, and consistently inspiring and motivating employees to perform to the best of their abilities, are two critical aspects of talent management for AI companies.

Organisation & Culture: The AI impact on this OM element is low.

Organisation & Culture is a crucial OM component. By *Organisation*, we indicate the way a company is structured, and how different tasks and activities are assigned, coordinated, and supervised (Bashir & Verma, 2018; Shahzad et al., 2012). *Culture* includes the common views and values that are developed by a company's leaders and then reinforced through various techniques, influencing employee perceptions,
behaviors, and understanding. Employee performance is greatly influenced by company culture and organisation, which can also lead to the increase of productivity (Shahzad et al., 2012). Therefore, most AI companies pay close attention to this component in order to effectively manage, motivate and retain their AI talent, and consequently boost their company's productivity. Evidence shows that AI implementation triggers changes in the culture and organisation of businesses (Benbya et al., 2020). However, based on the gathered data, we concluded that the AI impact on the organisation and culture of AI companies, is considered to be low. Most AI companies mention that it is crucial to try and cultivate an AI-related culture within their companies, however, their overall culture and organisation does not really differ from the organisation and culture that other IT companies have established.

Management Frameworks & Systems: The AI impact on this OM element is low.

By *Management Frameworks & Systems*, we indicate a collection of interconnected objects that support a specific strategy to achieve a specified goal (Budler & Trkman, 2019). SWOT (strengths, weaknesses, opportunities, and threats) analysis and Business Model Canvas (BMC) are examples of management frameworks (Budler & Trkman, 2019). Additionally, in this component, we include the different project management frameworks that AI companies use. Project management frameworks are collections of common project management templates and tools that can be used to plan and execute a project. Most participants state that the impact of AI on their management frameworks and systems, is estimated to be low. As most of these AI companies usually use agile project management frameworks in order to develop their AI software, particularly Scrum and Kanban. However, agile project management frameworks has achieved widespread acceptance in the software development industry (Uikey & Suman, 2012).

Common components of business and operating models

Based on literature review, we concluded that the following components could belong to both the operating and business models:



Figure 6.3: Common components of business and operating models.

After conducting the semi-structure interviews, we identified that the AI impact on these components is as described below.

Value Proposition: The AI impact on this BM and OM element is high.

Value Proposition is the most often mentioned component in business models as well as in operating models. It is a core component, which defines the collection of products and services that creates value for a particular customer segment (Osterwalder & Pigneur, 2010; Peters et al., 2013). *Value Proposition* provides answer to questions, such as how the company creates value for its customers and what customer needs or problems the company attempts to satisfy with their offering. According to the majority of interviewees, the impact of AI on Value Proposition is characterised as high. They state that the core of their product or service offering is absolutely reliant on AI, as their solution could not properly function without AI. As a result, their business is extremely dependent on AI, meaning that their business could exist without use of AI technology. Therefore, the element of Value Proposition is extremely affected by AI.

Business capabilities: The AI impact on this BM and OM element is moderate.

Business Capabilities define the identity of a company as seen by both its employees and clients. The capacity to outperform rivals while utilizing a set of unique and challenging-to-replicate commercial traits is known as capability (Brits et al., 2006). The definition of this element is not always clear to practitioners, with most of the interviewees asking for further elaboration on this specific element during the interviews. Most AI companies highlight that this component is moderately impacted by AI, as their business capabilities are closely related to their AI-based portfolio. They mention that the capabilities that make them competitive and stand out compared to their competitors are very much associated with the AI capabilities they have inhouse. Therefore, the AI impact on the element is considered to be moderate.

Key Partnerships: The AI impact on this BM and OM element is moderate.

Key Partnerships is considered to be a crucial component of the value chain or value network (Peters et al., 2013). This component entails suppliers, partners, and coalitions (Peters et al., 2013; Stein, 2001; Teece, 2010). *Key Partnerships* are a cornerstone of many company models and are formed for a variety of reasons, including business model optimization, risk reduction, and resource acquisition (Osterwalder & Pigneur, 2010; Peters et al., 2013). The impact on this element is moderate. There are several reasons contributing to this fact. First of all, the main partners that AI companies are interacting with, are mostly other software and hardware companies that play a crucial role in the AI development and deployment. In addition, many interviewees mention that it is a priority for them to keep close ties to other AI companies and forming an AI community.

Key Resources: The AI impact on this BM and OM element is moderate.

The component of Key Resources represents a collection of competencies and skill sets that a company has on hand and allows them to outperform their competitors (Peters et al., 2013; Stein, 2001). Key Resources can include physical, financial, intellectual, and human resources, which are needed to enable an enterprise to develop and make available their product or service, their value proposition, to their customers (Osterwalder & Pigneur, 2010; Peters et al., 2013). The impact of AI is considered to be moderate on this component. The interviewees highlight that the main AI impact they observe is on the human resources. Human resources, also referred to as talent, are critical for every AI company as it is also discussed in the OM component of Talent Management. The development and deployment of AI software requires the right skill sets and expertise, therefore, it is important for every AI company to have the right talent in-house. Another resource mentioned by some interviewees, is Intellectual Property (IP), which is a topic that gains more and more popularity (Kop, 2019; Rocha, 2017) and it seems to concern not only researchers but also AI companies. Intellectual Property (IP) rights, including copyrights, aim to encourage and maximize creativity, cultural diversity, technical development, and freedom of speech (Kop, 2019). More and more AI companies are starting to consider how they can secure their AI innovations and creations utilizing IP incentives.

Key Activities & Processes: The AI impact on this BM and OM element is moderate.

The element of *Key Activities & Processes* is defined as the actions a company has to take in order to operate successfully and which are required to allow this company to create and offer a value proposition, reach markets, maintain customer relationships and earn revenues (Osterwalder & Pigneur, 2010; Peters et al., 2013). The AI impact on this element is moderate, as most participants state. They argue that the processes that they have to follow to develop and deliver their AI-enabled solutions to their clients, are affected to some extent by AI but they do not differ significantly from the processes that other software companies follow. Although, there are particular processes and activities that companies need to follow due to their AI-enabled solutions, the majority of them are just processes related to software development and deployment that any IT company needs to do in order to deliver their value proposition to their clients.

6.1.1 Answer to the main research question

As stated in *Chapter 4*, this research aims to answer the main research question, which is:

Research Question: What is the impact of AI on the Business and Operating models of AI companies?

The main objective of this research was to determine the impact of Artificial Intelligence (AI) on the Business Model (BM) and Operating Model (OM) of AI companies. Due to the vast but vague literature concerning the concept of business model, and the noticeable limited literature on the concept of operating model, it was considered to be valuable for this research to design our own BM and OM framework. In this way, we attempt to add some more clarity regarding these two concepts. Therefore, in order to observe the impact of AI on the Business Model (BM) and Operating Model (OM), we first analysed the impact of AI on each distinctive component of these concepts.

Based on the data collected and the analysis performed, it was determined that the development and deployment of AI software is a rather challenging task that adds complexity to the business model and operating model of AI companies. AI, including machine learning and deep learning, has an impact on AI businesses. leading to the conclusion that AI development does differ from the development of other software that do not involve AI techniques. As a result, AI businesses do not look exactly like software businesses.

The BM and OM of AI companies, are impacted to different extent, due to the fact that the different components of their BM and OM are not affected the same by AI. Based on the results of this research, we concluded that the most impacted elements of the BM and OM, are the elements of *Value Proposition, Cost Structure, Technology & Infrastructure,* and *Talent Management*. Therefore, AI businesses need to take into seriously consideration the way that their AI solution can affect these four aspects of their business and operating model and eliminate model complexity as much as possible, in order to leverage the best of AI.

6.2 Challenges that AI companies face

In this section, we address challenges that AI companies face and need to overcome.

Artificial intelligence (AI) development differs from the development of other technologies and it comes with various challenges. The nature of Artificial intelligence (AI) and its subcategories, such as machine learning (ML) and deep learning (DL), can be a source of significant challenges for AI companies. During the phase of semistructured interviews, several challenges have been identified. *Table 5.1* summarizes these challenges per company:

AI Challenge	А	В	С	D	E	F	G	Η	Ι	J	Κ	L
Talent Issues		X						X				
Data Challenges	X					X					X	X
Technology &	X				X							
Infrastructure Issues												
Unpredictability		X					X				X	X
Accountability									X			
Explainability &			X	X			X	X	X			
Education												
High Costs	X	X			X					X		
Legal Risks	X						X			X		

Table 6.1: Summary of the perceived AI challenges per company.

Talent Issues

"The future of AI is going to be a battle for data and for talent" (Cyranoski, 2018). Having the right talent capabilities in-house, such as people with expertise in machine learning or any other AI-related field, is crucial for any AI company (Cyranoski, 2018; Davenport & Ronanki, 2018). Lack of knowledge prevents AI companies from embracing AI technology smoothly and it impedes their AI journey. One of the most commonly mentioned challenges is finding people with the necessary skill set and knowledge, such as data scientists and AI engineers for developing and deploying AI software. There are various reasons contributing to this challenge. First of all, it is the niche skill set that people need to have, and makes them rare in the market. Artificial Intelligence (AI) is a rather broad field, which includes many other areas such as Machine Learning (ML) and Natural Language Processing (NLP), and people who are experts in one area might not have much knowledge on another area, therefore, it is not easy for AI companies to find talent with the right skill set. In addition, the high demand for AI talent creates even more difficulties for AI companies especially start-ups, which struggle to attract and recruit talent (Raff, 2018). AI companies need to dedicate great amounts of budget to recruit, on-board, train and retain the right AI talent. This is an even more important challenge for AI start-ups that have to compete with big well-established IT companies all over the world which are able to provide significantly high salaries in order to attract talent (Cyranoski, 2018). This phenomenon has become even more present during the pandemic outbreak due to

Data Challenges

Another AI challenges mentioned by the interviewees was data challenges. Artificial intelligence (AI) models, particularly deep learning and neural network models, require massive amounts of data to be trained effectively (Benbya et al., 2020). The volume and quality of data can significantly affect the efficiency of the AI solution (Al Ridhawi et al., 2020). Insufficient amounts of data, poor data quality, limited data storage and data privacy risks, could lead to poor results from the AI software, therefore, AI companies need to be aware of these challenges when starting developing their AI solutions and be able to tackle them (Dwivedi et al., 2021).

Technology & Infrastructure Issues

Artificial intelligence (AI) software development can be very complex and resourcedemanding. Therefore, AI companies need to meet several requirements with regard to technology and infrastructure, in order to be able to develop and deploy AI effectively. For instance, high computing capacity is one basic requirement for AI development. Training AI models and model inference, which is the process of generating predictions in production, demand sufficient computing resources, including CPUs and GPUs. Furthermore, high storage capacity is another crucial IT requirement. As AI's demands for large volumes of data increase, cloud technologies, such as Amazon Web Service (AWS), Microsoft Azure and Google Cloud Platform, are essential for AI companies (Al Ridhawi et al., 2020). Last but not least, networking infrastructure is important for AI companies, especially for AI companies that utilize deep learning algorithms, as deep learning is very reliant on communication and networks.

Explainaility and Education

The ability to explain the logic behind a decision, classification, or forecast is referred to as *Explainability* (Dwivedi et al., 2021; Yampolskiy, n.d.). According to the interviewees and existing literature, explainability is a significant challenge for many companies that develop AI software (Deeks, 2019). The complexity of artificial intelligence technologies such as deep learning systems, neural networks and so on, makes the task of explanation and interpretation rather difficult, leading to artificial intelligence quite often referred to as black box systems (Deeks, 2019; Dwivedi et al., 2021; Holzinger et al., 2019). A common concern about artificial intelligence (AI) algorithms is that they function as "black boxes", resulting in unclarity on how and why these algorithms lead to particular decisions, recommendations, or predictions (Deeks, 2019). Another term associated with explainability is the term of interpretability (Cath, 2018), which is often mentioned in machine learning literature (Dwivedi et al., 2021). Both explainability and interpretability are considered to be highly important characteristics of AI systems, as they could possibly contribute to the increase of algorithmic fairness, transparency and accountability (Cath, 2018). Therefore, AI companies need to develop policies that examine the impact of artificial intelligence on decision making, conduct system audits, and provide regular training on their systems. *Education* is also related to the challenge of *Explainability* and it was mentioned several times during the data collection through semi-structured interviews. According to several AI companies, educating everyone from top leaders to the end users, is crucial for any AI company in order to ensure a smoothly and efficient AI adoption (Fountaine et al., 2019). AI startups need to educate end users as well as people within their business around technical solutions that are not very easy to understand. Therefore, it is essential to explain to people without AI technical expertise how their AI solution works and what they should or not expect from this specific solution.

Unpredictability

Unpredictability is another important factor related to the development of AI. It is closely connected with unexplainability but they are not quite the same (Yampolskiy, 2020). Unpredictability can be described as the inability to predict what are the steps that an intelligent system will take to achieve the desired, usually predefined results (Yampolskiy, 2020). The unpredictable nature of AI systems, also known as intelligent systems, makes it difficult for end users to comprehend the ramifications of the systems. Furthermore, unpredictability contributes to the problems of software verification and overall AI safety (Yampolskiy, 2019).

Accountability

Accountability refers to the expectation that a company can ensure the proper functionality of their AI-enabled product or service, which they design, develop and deploy (Francesca et al., 2011). Therefore, accountability is considered to be an important factor when developing any AI system (Goodman et al., 2020). However, it is quite common for any AI software to be criticized for not being interpretable enough (Kim et al., 2020). This fact has been also highlighted by participants to the semistructured interviews, which have mentioned that one of the main challenges that they encounter in their AI company, is ensuring accountability with regard to the accuracy of the predictions and eliminate biases as much as possible. Lack of accountability could possibly result in users hesitating to utilize their AI products or services (Kim et al., 2020). Therefore, the existence of well-established regulations that promote fairness and transparency in AI software, is crucial.

High Costs

It is evident that AI development and deployment can be extremely expensive for AI companies. Therefore, high costs is one of the most mentioned challenges during the

interviews. Several participants mentioned that they had to cope with large amounts of investment costs at the beginning of their business, due to the the high fixed costs related to data collection and processing, computing power, human resources and so on.

Legal Risks

AI solutions of all types, present a range of legal risks (Cath, 2018). Companies need to be mindful about a variety of legal issues related to the development and deployment of artificial intelligence (AI) applications. First of all, the data used by AI algorithms can be quite sensitive. Inaccurate data governance systems and algorithms used in AI applications can lead to inaccurate predictions, placing AI companies at risk of legal troubles. Other legal challenges that AI companies need to consider are related to Intellectual Property (IP) and copyrights, privacy and data protection issues, AI product liability, AI algorithms' unfairness, bias and discrimination and so on (Rodrigues, 2020).

6.3 Reflection on the theoretical concepts

Despite the plethora of scientific literature concerning the concepts of Business Model (BM) and Operating Model (OM), as well as the various BM and OM frameworks created by practitioners and consulting firms, there is still substantial unclarity around these two concepts.

The most significant confusion concerns the concept of Operating Model (OM). The vast majority of the participants to the semi-structured interviews (10/12) stated that they were aware of the term business model but they were not familiar with the term operating model. As mentioned already in *Section 2.3*, there is insufficient amount of scholarly literature investigating the concept of operating models, and the majority of OM frameworks stem from consulting firms and other companies (Bateman, 2017). This fact might be a an important reason contributing to the unclarity around the concept of operating models. We can see this trend in *Figure 6.4*.

	Term Av	vareness
Participants	Business Model	Operating
		Model
A	\checkmark	
В	>	~
С	~	~
D	~	
E	~	
F	~	
G	~	
н	~	
I	~	
J	~	
к	~	
L	~	

Figure 6.4: Familiarity of the interviewees with the terms BM and OM.

Regarding the concept of Business Model (BM), all of the participants (12/12) stated that they were familiar with it. During the interviews, participants were asked to provide a definition or their interpretation of the Business Model (BM) concept. Most interviewees associate Business Model (BM) with the way a company captures value and generates revenue. While providing a Business Model (BM) description, most participants mentioned their company's software distribution model e.g. SaaS model, revenue model and pricing model.

Based on gathered data , it was evident that most interviewees associated the notion of business model with the revenue model. This trend has been addressed in scientific literature as well. Morris, Schindehutte and Allen (2005) mention in their paper that

a reason why there is a significant amount of confusion surrounding the concept of business model is because it is often used interchangeably with the terms of revenue model and economic model (Morris et al., 2005). However, revenue model represents a central and frequently mentioned component of Business Model (BM), according to scholarly literature (Osterwalder et al., 2011; Osterwalder et al., 2005; Wirtz et al., 2016).

Another common misinterpretation concerns the connection between the concept of business model and pricing model. Pricing model is also a component of the business model, and concerns the pricing of the product and service offering (Krumeich et al., 2012).

Revenue model and pricing model are two financial-based components, which are rather significant in business models, as they define if a business model is performing well from an economic point of view (Krumeich et al., 2012). Therefore, they are considered part of a broader component, which is the *Financial model*. This broader model consists of other components as well, namely *Funding model* and *Distribution model* (Krumeich et al., 2012). The financial aspect of a company is a key business model components, and it influences the value proposition that an enterprise creates and delivers to its customers. It may be utilized to address issues with regard to costs, pricing, and revenue (Al-Debei & Avison, 2010; Peters et al., 2013).

6.4 Validity Considerations

In this chapter, the validity considerations of this research are discussed and analysed based on the different dimensions mentioned by Yin (Yin, 2009). Quality is a significant aspect of every research project (Oyelami & Olivier, 2015). In order to assess the quality of each case study, we need to consider four specific validity aspects, which are: *Construct Validity, Internal Validity, External Validity and Reliability* (Oyelami & Olivier, 2015).

6.4.1 Construct Validity

Construct validity concerns the justification of the data collected for this research project in order to provide an answer to the main research question (Oyelami & Olivier, 2015). The preferred data collection method was semi-structured interviews. Based on the semi-structured interviews, we were able to collect all the required data, analyse it and answer the main research question. Before conducting the interviews, we contacted potential participants, who met specific requirements, also mentioned in *Research Scope*. Specifically, the interviewees were required to be familiar with the concepts discussed in this research and also, they should have a specific within their companies, such as founders, co-founders, Chief Executive Officers (CEO), Chief Technology Officers (CTO), Product Managers and Vice Presidents (VP) of Product of

established AI companies. Finally, we have established an interview protocol, which was followed in every interview.

One possible consideration related to construct validity is the mono-approach data collection, as we only used semi-structured interviews to gather all the required data. To tackle this, we made sure to ask interviewees to provide their contact information in order to be possible to reach out to them, in case follow-up questions were needed.

6.4.2 Internal Validity

The second important quality assessment taken into consideration for this research project is internal validity. Internal validity focuses on the examination of evidence and findings of each case (Oyelami & Olivier, 2015). To ensure internal validity, we have established an interview protocol, which was followed while conducting each semi-structured interview.

Based on the data gathered during the interview phase of this research, we summarised each case and analysed the results of each case in textual and visual format i.e. using tables to summarize the AI impact on the components of BM and OM. When it was crucial to mention a specific case or provide statistics regarding the cases, the researcher made clear references to that specific case.

In addition, interviews were transcribed and in this way, it was easy to re-evaluate the data, when needed. The interviewees were asked a number of questions, however, they were not always able to provide an answer to those questions. In cases, where the information was not clear, relevant or certain, it was decided to exclude this information.

6.4.3 External Validity

Another validity aspect we need to consider, is external validity. External validity examines whether the findings of a research can be generalized and considered outside the scope of the current research (Oyelami & Olivier, 2015).

One aspect of this research that can be examined in the context of external validity, is the fact that each company was represented by only one person in the interviews. Semi-structured interviews are considered to be a challenging method of data collection, in combination with the single source of data, it can be an external validity risk. However, in order to ensure external validity, the researcher selected people for interviews based on specific criteria including their role in the company and their experience. In case, the interviewee was not familiar with the concepts discussed during the interview and the quality of the collected data was uncertain, the researcher could ask for additional people to contact from the same company. This was the case with Company E, as the collected data from the initial first interview was uncertain and the researcher decided to ask for an additional interview with another person

from the same company.

6.4.4 Reliability

The last dimension we need to consider for ensuring research quality, is reliability. The objective of this dimension is to decrease the errors and bias in the research (Oyelami & Olivier, 2015).

The initial number of interviews conducted was 15, however, in order to ensure the reliability of this research, it was decided to include only 12 of the interviews. After thorough examination, 3 interviews were excluded from this research and their results were not taken into consideration, due to lack of reliable and quality data. Each interview lasted from 30 minutes to 1 hour, spread over 12 different organizations, which are based in 3 different countries; The Netherlands, The UK and Greece.

Another potential risk in terms of reliability is the method used by the researcher to estimate the AI impact on the different BM and OM components. During the interviews, the participants were asked to provide a degree from 1 - 5, based on the perceived AI impact on each components of their BM and OM. During the analysis of the data, the researcher categorised the AI impact as "High", "Moderate" and "Low" The mapping between the degrees and the different impact categories, is as follows: *Low Impact:* Degree 1 and 2, *Moderate Impact:* Degree 3 and 4, and *High Impact:* Degree 5.

l Chapter

Conclusion

The main objective of this research was to determine the impact of Artificial Intelligence (AI) on the Business Model (BM) and Operating Model (OM) of AI companies, which are companies that develop and deploy AI, therefore, the core of their service or product is AI-enabled. According to existing literature, the concepts of BM and OM are rather vague, and there is significant unclarity around the definitions of these two concepts. In order to be able to provide a fair evaluation of the impact of AI on the business and operating models of AI companies, we first had to perform a thorough literature review, aiming to provide some more clarity on the crucial concepts of Business Model (BM) and Operating Model (OM).

Based on literature review, we were able to develop a Business Model (BM) and Operating Model (OM) framework (*Figure 3.3*). This framework consists of the three parts. The Business Model (BM) part, the Operating Model (OM) part and last but not least, their intersection. The BM part includes five distinctive components, which are *Cost Structure, Revenue Streams, Distribution Channels, Customer Segments,* and *Customer Relationships. Technology & Infrastructure, Organisation & Culture, Management Frameworks/ Systems* and *Talent Management* are the four components that constitute the OM part. Finally, there are five components that can be found in both models and these are *Value Proposition, Business Capabilities, Key Resources, Key Partnerships* and *Key Activities & Processes.* This BM and OM framework was utilized in the interview process. In total, twelve semi-structured interviews were conducted in order to collect data, which we later analysed and in order to gain valuable insights on the AI impact on each of these components and consequently, on the Business Model (BM) and Operating Model (OM) of AI companies.

Our findings imply that 10 out of the 14 components that constitute the BM and OM framework, are affected by AI, from a moderate to a high extent. Therefore, it is evident that AI software development can be challenging for companies and it can have a significant impact on their Business Model (BM) and Operating Model (OM). This makes AI companies differ from other IT companies, and they need to take into

serious consideration various aspects of their business when they start developing their AI solutions, in order to be able to fully leverage the best of AI while minimizing the risks and challenges that AI software development and deployment might entail.

7.1 Contributions

This section presents the contributions of this research. Each contribution point is summarized and mentioned below:

- This research adds to the existing literature that investigates the impact of artificial intelligence (AI) on the business and operating models of AI companies. A thorough literature review as well as 12 interviews with executives of AI startups were conducted, in order to achieve our research objective.
- This research provides valuable insights for practitioners and entrepreneurs, into the business value of AI and Business Model (BM) and Operating Model (OM).
- This research contributes to research on business models, strengthening the BM as a theoretical construct. A BM diagram was created based on an extensive literature analysis of business models.
- This research contributes to research on operating models, strengthening the OM as a theoretical construct. An OM diagram was created based on an extensive literature analysis of operating models.
- This research identifies and offers insights into common challenges that AI companies face and need to consider.
- This research adds to the limited literature that concerns the concept of Operating Model (OM). Additionally, we provide an analysis between the two concepts of BM and OM, including the distinctive components that constitute each model and the relationship between them.

7.2 Future Work

This section presents some points that have emerged for future research. Possible future research projects could be on the following topics:

- A study on the impact of artificial intelligence (AI) on the business and operating models of AI companies, using a bigger sample size in order to gain more valuable insights on the topic.
- A study on the impact of artificial intelligence (AI) on the business and operating models of AI companies, which are not scale-ups or start-ups. In this kind

of research, a greater number of participants will be needed, therefore, we recommend a multiple cross-case analysis be conducted. The proposed research will complement this thesis project by adding insights from bigger enterprises.

• A study on the impact of artificial intelligence (AI) on the business and operating models of AI companies that operate in a wider variety of application domains. In this research project, companies from six different application domains were interviewed. However, it would be even more insightful to gather data from companies belonging to other application domains as well.

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Appendix A

Interview Questions

Personal introductions

- Could you please introduce yourself (background, experience, job title)?
- What is your experience with Operating Model (OM) and Business Model (BM)?

Organizational Introduction

- Could you introduce the organization?
- Could you briefly describe your product portfolio?
- What part of your portfolio is based on AI? Please give me a percentage.

Business Model

- Are you familiar with the term Business Model? How would you define Business Model?
- What is your high-level Business Model? What elements does your Business Model consist of?
- What do you think is the impact of AI on your Business Model and your product portfolio?

Operating Model

- Are you familiar with the term Operating Model?
- What is your high-level Operating Model? What elements does your Operating Model consist of?
- What do you think is the impact of AI on your Operating Model?

Based on literature review, I have created the following graph of BM and OM. What do you think about it? Which components did you consider when establishing your

BM and OM? Looking at it, which components do you think are mostly affected by AI according to your company?



Could you please fill the following table in based on the degree to which you think each of the components is affected by AI according to your company?

	1	2	3	4	5
Value Proposition					
Business Capabilities					
Key Partnerships					
Key Resources					
Key Activities & Processes					
Cost Structure					
Revenue Streams					
Distribution Channels					
Customer Segments					
Customer Relationships					
Technology & Infrastructure					
Organization & Culture					
Management Frameworks/					
Systems					
Talent Management					

Additional Questions

- What challenges did you face when included AI-based products in your portfolio?
- What challenges are you still facing?
- How did you benefit from including AI-based products in your portfolio?
- Are you available for follow-up questions?



Raw Interview Transcriptions