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Evaluation of Business Models for Artificial Intelligence Startups

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MASTER'S THESIS

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Abstract

Context: A business model refers to the way a company generates revenue and profits by offering goods or services to customers. It outlines the company's strategy for creating value and capturing value through its customer segments, channels, relationships, revenue streams, and costs. The purpose of a business model is to ensure the sustainability and profitability of a business in the long term. It provides a framework for making strategic decisions and helps a company understand how it operates and how it can remain competitive in the market.

Artificial Intelligence (AI) is growing in importance in industrial applications due to its ability to process vast amounts of data quickly and accurately, enabling businesses to make informed decisions and improve their operations. AI-powered technologies such as machine learning, deep learning, and computer vision are being integrated into various industries, from manufacturing and transportation to healthcare and finance, to automate manual tasks and optimize processes. The increasing availability of data and improvements in computing power have made it possible for AI to play a transformative role in improving efficiency, reducing costs, and enhancing customer experiences.

Business models are important for AI startups because they define the company's strategy for creating and capturing value in the market. They help startups understand how they can monetize their AI technology and determine the most appropriate revenue streams, customer segments, and pricing strategies. Having a well-defined business model also enables AI startups to secure funding and build relationships with investors, customers, and partners, and provides a road map for scaling the business and achieving sustainable growth.

Objective: Our study concentrates on determining the most effective methods for evaluating startups that utilize artificial intelligence. Additionally, we aim at identifying what business model elements are important and potentially different for AI startups, in order to provide founders and other stakeholders with guidance for AI startup success. Furthermore, we will provide suggestions to enhance the understanding of the sector for entrepreneurs and investors by providing them with perspectives from their peers.

Approach: Our study uses a qualitative case study analysis through interviews with *artificial intelligence* startup founders and support experts that provide us with different points of view regarding the business model and its variables. The data collection is performed using semi-structured interviews, where the structure of the questions is based on the *Business Model Canvas*.

Results: The results of the research include all the recommendations collected during the seven interviews with three startups founder and four support experts. With a cross-case analysis, we identified the most important sections of the *Business Model Canvas*, based on the experience of the interviewees. We found the *value proposition*, the *key resources* and the *key activities* to be the most important among the *Business Model Canvas* sections for AI startups. Based on the interviews, we also added to these points the *market fit* and the *regulations* of great importance for AI startups. Additionally, we identified what are the two most used approaches to business model evolution within the field of *artificial intelligence*. The first one drives evolution through periodical meetings at different hierarchical levels, the second one drives evolution through the overall strategy that guides the choices of the employees.

Conclusions: This research allows a better understanding of the AI startup's market mechanisms through the study of failure and success factors. Given the identified results this thesis will provide entrepreneurs with a document that encloses information and best practices to help them make informed decisions on critical factors like product strategy, business model and team composition. In addition, people responsible for scouting and evaluating startups in investing companies will be able to conduct a more effective and focused process by leveraging the experience collected through the interviews.

Contents

1 Introduction

1.1 Topic and Context

In the early 2000s digital oriented startups started appearing in the market with innovative solutions that aimed at disrupting the market and competing with big corporations. These technologies were often built on cutting-edge ideas and revolutionised the prior landscape when implemented correctly. However, some of these startups, especially before 2010, failed to impose themselves against more substantial companies. The reason behind this failure is the difficulty for digital entrepreneurs to find a business case for their idea which results in the inability to implement it in the market.

In this context, the business model starts gaining a lot of importance as a concept that helps the startup to improve the business implementation of the technology. This tool has been used a lot for software development startups that have become the main big trend of the last twenty years. In particular, in the last 10 years, within this field, *artificial intelligence* gained a lot of relevance due to its capability to reduce resources needed and make existing processes faster and more precise. Moreover, this technology requires a high level of attention regarding new development and innovation. In fact, another important topic that will be included in this study is the evolution of the business model in this field and how the startups tackle it against disruptive innovation and incremental innovation.

1.2 Focus and Context

Artificial Intelligence is a rapidly growing field with tremendous potential for transforming the way we live and work. As a result, many entrepreneurs are seeking to found startups focused on AI technologies. However, starting a successful AI startup is not an easy task. There are many variables to consider, such as the technology itself, the market demand, the competitive landscape, and the legal and ethical considerations. In this context, the research question emerges:

What are the most important variables to be considered when founding a startup focused on AI technology?

This question is crucial for entrepreneurs who are looking to navigate the complexities of the AI startup landscape and build a successful company. By identifying the key variables that contribute to the success of AI startups, this research can provide valuable insights for entrepreneurs, investors, and policymakers alike.

Therefore, building a successful AI startup is not just about having a great idea or a superior technology. It also requires a solid business model that can adapt to changing market conditions and customer needs. In this context, the following research question arises:

What are common patterns that can be observed in the evolution of an AI startup business model?

By studying the evolution of successful AI startups, this research aims to identify patterns and trends that can help entrepreneurs refine their business models and increase their chances of success. Understanding how AI startups evolve over time can provide valuable insights into the key factors that contribute to their success, such as customer acquisition, revenue streams, and strategic partnerships. This research can provide valuable guidance for entrepreneurs, investors, and policymakers who are looking to navigate the complex landscape of the AI startup ecosystem.

In our study, the business model is investigated in the shape of the *Business Model Canvas*, as a baseline framework for the study. This is used to find important aspects for a specific area of software development, *artificial intelligence*. The business model is a really broad concept that for the purpose of this study has been identified in the tool named *Business Model Canvas* to create a more coherent analysis among different interviewees. In the same way, *artificial intelligence* is a term that includes several kinds of technologies like machine learning, deep learning, natural language processing and a few others. This research focuses on an overview of all these different technologies that fall under the *artificial intelligence* branch.

This exploratory analysis aims at developing not only thanks to existing literature but also through interviews with experts. Here new concepts will be discovered, deepened and then validated with other interviewers, hence the study will be driven by the experience of the participants. Therefore, as mentioned, the analysis will rely on the real-life experiences of experts in the field, and the variable that composes the *Business Model Canvas* will be investigated to understand trends and differences between interviewees.

Our study contains several interviews collected using semi-structured surveys, that allowed an in-depth analysis of the findings as we go along with the interviews. The selected interviewees fall under two different categories, AI startup founders and support experts. This distinction will be critical for the development of the research as we will have two different points of view regarding the same process. This analysis will give perspective to both parties, and improve the understanding of the most important variables for both categories and the reasoning behind them. Therefore, in our study, we expect to find trends on how to develop a business model for *artificial intelligence* startups, where the participants agree with each other. However, we also expect to find differences between different fields of application of the technology and different categories of interviewees.

Within startup interviews, we also expect to find different approaches to tackle business model evolution and remain competitive during the growth of the company and during external changes, in the market and in technology.

The scope of this study is to provide startups with a useful tool that allows them to rely on the experience of other people that went through similar challenges and can compare these experiences on their own to find out what is the best way to boost their idea. At the same time, the experts in the form of coaching experts working for an accelerator, as well as venture capitalists or consultants, can have an overview of what are the most important points to analyse and improve for a startup in this field. This awareness comes from the results of an observation of what their colleagues think is more important, and from understanding the dynamics of their evaluation process.

1.3 Relevance

As mentioned in previous paragraphs, the business model has gained great importance thanks to the development of the digital startup landscape. Currently, it is one of the most important concepts to develop for a new company. The *Business Model Canvas*, which will be the baseline framework for this research, is the most used tool to define its variables. The choice of diving into business models of *artificial intelligence* startups is a consequence of the importance gained by this technology in the last five years with its limitless industrial applications. Therefore, while existing literature focuses on broader topics like software development, our study aims to go into detail in the specific area of AI, to identify important variables and why they are important.

In this field, as we will see in our study, there are also several new ideas that are ground-breaking, but they cannot be launched because there is no business case for them. Therefore, the goal is also to help translate ideas into solutions and, at the same time, help support experts getting different perspectives on how to help and evaluate the startup. For the latter, the choice to have two different categories of participants has been critical to collect experiences from opposite points of view.

1.4 Structure Overview

Our study has a classical dissertation structure, after the introduction, it dives directly into the literature review where papers regarding the business model, *artificial intelligence*, software development and business model evolution are investigated.

In the following section, the chosen method is explained with specifics regarding the approach to the study and the explanation of the research questions. Additionally, this section contains all the information regarding the data collection process, who are the participants how are the interviews structured and the analysis procedure.

Subsequently, the results are reported by dividing startup founders, the first three interviewees, from the support experts, and the following four, concluding with a cross-case comparison that identifies similarities and differences between interviewees.

In the discussion section, the results are analysed, the first step consists of the interpretation of the results previously reported in the cross-case comparison. Here we try to understand the meaning behind the reasoning of the participants collected during the interviews. Moreover, the implications and the limitations of the research are investigated and discussed.

Finally, in the conclusions, we give brief answers to the research questions that sum up the findings identified in the discussion. Additionally, we highlight insights that were discovered during the study and opportunities for future studies that have not been included in our study.

2 Background

The relevance of *artificial intelligence* in the world's industry has grown more and more in the last years, in this chapter we are going to explore what are the reasons behind this outbreak. In fact, more and more big companies started implementing AI solutions that allow them to increase the quality of their products while reducing costs.

An increasing number of startups are emerging with the scope of creating software that works with an AI engine. Concurrently, we can also see an increase in the importance of the business model, this common trend can be explained by the fact that often these startups are founded by people with only technical backgrounds without the experience to translate their ideas into viable businesses. The Business Model is an important tool for this transition, it allows the startup to take into consideration all the important variables to place the product on the market.

In addition, *artificial intelligence* has a few specific characteristics that differentiate it from others in similar markets. For example, the fact that it can work without human supervision with a certain level of autonomy requires developers to put some constraints to not lose control of it. It is also easy to replicate if the training data is public which is why proprietary data are critical in this field. Finally, it may clash with regulations regarding privacy and ethics, so it should be tested against biases and reliability. At the same time, the continuous improvement of crucial resources like computing power, platform availability, and internet connectivity together with new constraints due to new regulations require a continuous evolution of the business model.

2.1 Artificial intelligence

In order to identify successful business models for AI startups, it is crucial to have a deep understanding of the definition, history, industrialization, and future of *artificial intelligence*. Firstly, understanding the definition of *artificial intelligence* is essential to differentiate between different AI technologies and their capabilities. It helps startups identify which specific type of AI technology they should be developing and what unique value they can offer to customers.

Secondly, having knowledge about the history of AI and its evolution can provide insights into the past successes and failures of AI startups. This knowledge can be used to avoid mistakes made by others and to build on successful business models. Thirdly, understanding the industrialization of AI and the current state of the industry is important to evaluate the potential competition and the existing market demand for AI products and services.

Finally, predicting the future of AI and the potential impact of emerging technologies and market trends can help AI startups to identify new business opportunities and adapt their business models to changing market conditions. By having a comprehensive understanding of AI, startups can better identify successful business models, reduce risks, and increase their chances of long-term success in the dynamic and rapidly evolving AI industry.

Definition

Up to the present day, the concept of *artificial intelligence* has created a lot of confusion among experts looking for a universal definition. For example, it has been described as a system's ability to learn from data and to use these teachings for a specific purpose [11]. A more creative definition can be *AI will be such a program which in an arbitrary world will cope not worse than a human* [7].

Our study will be developed on the assumption that an *artificial intelligence* system is capable of replicating to a certain level the ability of the human brain to interpret data, adapt to its task, and learn from the data how to serve a specific purpose.

History

The literature is vague on the origin of *artificial intelligence*, however, we can identify its birth in the period after the second world war. In Haenlein and Kaplan's paper [9] the history of this technology is described using a four seasons metaphor:

- Spring represents the years of the mid-20th century, scholars start to try to replicate human intelligence. The Turing Test dates from this period, which is an assessment to measure the level of "intelligence" of the system.

- Summer and Winter represent the ups and downs that AI had in the following years, the two decades following the first season were very successful for the technology that was able to advance thanks to considerable investments from governments, however, the lack of data and computing power stopped the development in the last years of the 20th century.
- The Fall season starts in the first years of the 21st century when researchers change their approach to AI creation. Before the code was composed of a set of rules that allowed the code to act within defined constraints. This changed during this period, with new techniques like neural networks and deep learning the system is capable of learning how to behave while processing data.

On the other hand, in the article by Buchanan [3] the writer goes through the steps of AI development, which gives an idea of how the technology had a homogeneous evolution together with other technologies that are in contact with it. Additionally, the paper highlights how different fields contributed to AI development, starting from philosophy and literature, electrical engineering, and computer science.

Industrialization

In our daily life, we are already using products that have an AI engine, like spam filters and aeroplane auto-pilots. AI in the industry is taken for granted almost everywhere, but it has not always been easy, this technology unlike others had to develop for several years before becoming applicable in real situations. Therefore, only recently there has been a stronger boost towards the business implementation of this technology with innovative applications in new areas, which resulted in a revolution in the job market creating a great number of new opportunities. This excitement that has grown more and more lately can be justified by a strong increase in available data and infrastructure, which facilitated the development of projects that were unfeasible before. However, different industries have different development paces, this mainly depends on the amount of investment allocated, the regulations to be followed, and the flexibility of the type of business. Therefore, it is clear why the last fields to adopt this technology are healthcare, education and public administration. On the other hand, the first fields that implemented AI were those consisting of software systems, and data analysis.

An obstacle that must be taken into consideration when implementing AI solutions is the ethical constraints of the technology. The final purpose of AI products is to act by themselves without human supervision, this requires a certain level of autonomy, which results in problems regarding accountability, privacy, robustness, and biases. One important example is the military industry, where the technology is already well-advanced thanks to considerable investments from the strongest governments, however, further improvements are held back by concerns regarding ethical consequences.

Future

The success of AI artefacts in fields like games, self-driving vehicles, and automated assistants prove how much this technology is already influencing our daily life. The increasing importance of AI requires the implementation of a set of new regulations that limit the consequences of mass usage. There are a few points that are worth mentioning which are:

- Standards against biases, by acting upon training and test sets of the AI model.
- Accountability, in some cases like military weapons and medical diagnosis, someone should be held responsible in case of failure.
- Privacy, AI models need data to improve their effectiveness, the necessary data sometimes consists of sensitive information that cannot be used.
- Employment, AI systems are often more efficient and more effective, and less expensive than human beings, low-skilled workers are already being replaced by robots, and in the future, the same will happen to more and more job positions.

The main challenge as stated by Haenlein and Kaplan [9] is that AI is a highly technical technology in continuous self-evolution, and the policymakers do not have the competencies necessary to regulate it.

Companies

In the last decade, companies from all fields started implementing AI in order to create a new product or service or just to improve internal processes efficiency and gain a competitive advantage. However, for this project, the companies that are taken into consideration for the analysis are those whose main business is the creation of an AI-powered product or service. These companies mainly fall within the software companies that create software with the special feature of having an AI engine. The reason behind this choice is that during this project we want to address companies that create an AI solution and differentiate them from the others, while companies that only want to improve process efficiency usually outsource the AI model creation.

2.2 The business model

A business model is essentially the strategy that a company uses to generate revenue and create value for its customers. For AI startups, the business model is especially important as it determines how the company will commercialize its AI technology and bring it to market. Understanding the definition of a business model is important because it sets the framework for how a startup will operate and generate revenue.

Moreover, understanding the relevance of the business model is important because it allows startups to stay competitive in the dynamic and fast-moving AI industry. As the technology and market conditions change, so too must the business model evolve to maintain relevance and competitiveness.

By having a comprehensive understanding of the definition and relevance of the business model, AI startups can develop and refine their own business models, adapt to changing market conditions, and increase their chances of long-term success.

Definition

The business model is a concept that created some disagreements among scholars in the last decades regarding its definition, purpose and creation process. However, it is possible to find some points in common within the different definitions of modern researchers. Therefore, we can say that the business model is *a description of an organization and how that organization functions in achieving its goals* [15]. In the scope of this study, we identify the Business Model as a management tool that describes what company activities generate value and defines how this value is created. Additionally, for this research, the *Business Model Canvas* created by Alexander Osterwalder will be used to break down the model into its main points Figure 1.

Relevance of the Business Model

As explained in Teece's paper [19], the concept of the business model is not included in theories regarding economics and business studies. The reason is that economics theories usually describe ideal situations where the consumers buy what is produced and the producers do not need to find solutions to user requirements.

We can also see how the business model became more and more important with the rise of the internet and software companies [20]. This is most likely linked to the fact that in new startups the management positions are occupied by experts with a lot of technical knowledge about the product and little understanding of the market and how to translate an idea into a viable business.

Nowadays, the business model is rooted in the startup mentality and has become a critical concept for developing a business idea. with the digitalization era, it is critical now and in the future to exploit the business model to maximize employees' competencies and organizational capacities [17].

Business Model Canvas

The *Business Model Canvas* is one of the most widely used frameworks for business model creation. It was introduced by Alexander Osterwalder in 2008 and has gained widespread adoption in the startup and entrepreneurship communities. The canvas provides a visual and structured framework for entrepreneurs to describe, design, and analyze their business models. However, it is worth noting that there are other frameworks for business model creation that are also widely used, such as the Lean Canvas, Value Proposition Canvas, and SWOT analysis. Each framework has its own strengths

and weaknesses, and the choice of which to use may depend on the specific needs and goals of the startup. Nonetheless, the *Business Model Canvas* has become a popular and highly regarded tool for entrepreneurs and investors alike, and is widely recognized as one of the most effective frameworks for designing and analyzing business models.

When it comes to choosing a framework for AI startups to design their business models, the *Business Model Canvas* has several advantages over other frameworks. Here are some reasons why the *Business Model Canvas* is often preferred for tech solutions as found out in the paper from Kamariotou and Kitsios [10]:

1. Flexibility: The *Business Model Canvas* is a flexible framework that allows startups to create and test various business model hypotheses. This is particularly useful for AI startups that are exploring different business models as they develop and commercialize their technology.

2. Focus on value proposition: The *Business Model Canvas* places a strong emphasis on the value proposition of the startup, which is critical for AI startups that are trying to differentiate themselves in a crowded and competitive market.

3. Visual representation: The *Business Model Canvas* is a visual tool that provides a clear and concise overview of the startup's business model. This is particularly useful for AI startups that need to communicate complex concepts and technical details to investors and other stakeholders.

4. Adaptable to changes: The *Business Model Canvas* is designed to be easily adaptable to changes in the market or the startup's strategy. This is important for AI startups that operate in a rapidly changing and evolving industry.

5. Compatibility with other frameworks: The *Business Model Canvas* can be used in conjunction with other frameworks, such as the Lean Canvas or Value Proposition Canvas, to provide a more comprehensive analysis of the startup's business model.

Overall, the *Business Model Canvas* provides a useful and practical framework for AI startups to design, refine, and communicate their business models to stakeholders. While other frameworks may also have their advantages, the *Business Model Canvas* is often the preferred choice for AI startups due to its flexibility, emphasis on value proposition, visual representation, adaptability, and compatibility with other frameworks.

The *Business Model Canvas* is the business model template that will be used for the analysis in our research. In specific, it will be used for the creation of interview questions and for the interpretation of the results. Moreover, by choosing a specific template the interviewee will be able to answer the questions relying on specific sections of the template making the answer more precise and structured. This choice has been made because the author was familiar with this framework and it is one of the most used templates around the world for digital startups. In the next paragraph, we will dive into the definition of the different sections of the *Business Model Canvas* as described by the author of this framework, Alexander Osterwalder that we reproduce [in figure 1] [16].

Sections of the *Business Model Canvas*. The *Business Model Canvas* is divided into 2 big areas. the left one focuses on the internal variables related to the business and the right one on external variables related to the customer. These two areas meet in the centre with the *value proposition* which is the meeting point between the business and the customer. The template is then divided into nine blocks that represent the variables of the business model:

- ***Key partners*:** section including all those parties that the startup needs to deliver its product, for example, complementary external companies or suppliers.

- ***Key activities*:** this section reports the processes that the startup does to deliver their *value proposition*.

- ***Key resources*:** these are the actual resources needed to complete the *key activities*, this section includes for example budget and personnel.

- ***Cost structure*:** this is the cost of doing business, hence all the expenses that the startup will encounter to deliver the solution.

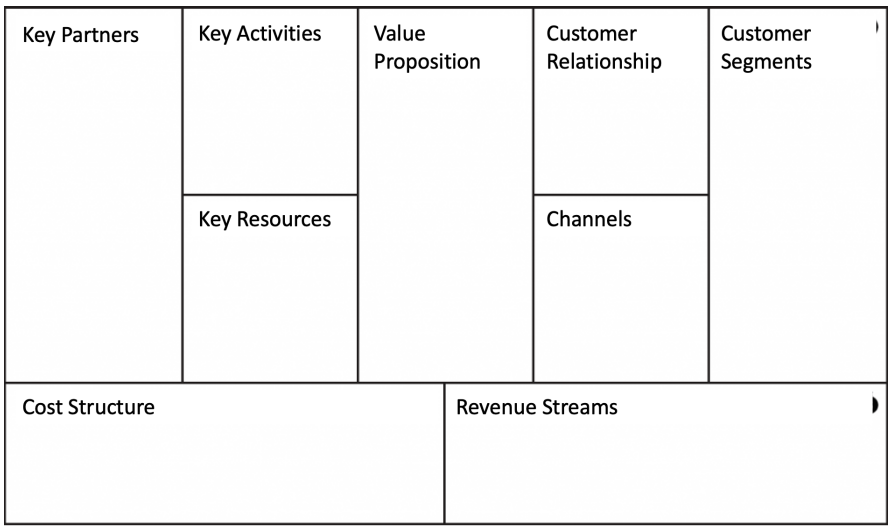

Figure 1: The *Business Model Canvas* by Alexander Osterwalder.

- ***Value proposition*:** as mentioned before this is the meeting point between the customers and the business. It covers the needs that the solution is going to solve and how.
- ***Customer relationship*:** this section defines the form of relationship that the startup is going to use to deal with customers.
- ***Channels*:** the *channels* sections represent the ways that the startup chooses to reach out to the clients.
- ***Customer segment*:** this section contains one or more groups of customers that the startup is targeting. This includes the characteristics common to all the people in this segment.
- ***Revenue streams*:** here it is described the method that the business uses to translate their solution into financial gain.

2.3 Business Models in AI

The ability to translate an idea into a business opportunity depends on several different technical factors like know-how, computing power, and data availability. And some other business factors like use case significance, cost structure, and sustainability in the long term. Therefore, it is important to find patterns that can help in the starting process to guide the entrepreneur in defining these aspects. The evaluation approach used for this project will be applied to both technical and business factors. As mentioned before AI requires specific assumptions to be safely developed, therefore some aspects are more important than others. This study will analyse the most important factors as identified by the article by Rajala on business models in the software environment [18]:

- Product proposition and strategy – This section explains the product's value for the users, and the plan to introduce the product in the market.
- Team and Resources – Diversity within the team, skills availability, and communication. Resources include infrastructures, data, investments and how difficult they are to get.
- Distribution – This section describes what are the methods that allow the connection and communication between the company and the customers.
- Revenue structure – Revenue sources from direct sales and other financing activities.
- External factors – This is the most difficult section to define because it includes the external variables relevant to the product and potentially unlimited. For example, some of them may be the market, the financial environment, the customers, and the competition.

A project similar to the research in our thesis is described in the paper by Ulrich Kerzel [12]. The author here focuses on creating a framework to facilitate the integration of *artificial intelligence* to improve the processes of existing companies. In a similar way, it investigates how *artificial intelligence* impacts the business in all its variables. On the other hand, our study is focused on AI startups and how to maximize their business opportunities without an AI-induced change in their business model. Additionally, instead of creating a new framework, our research focuses on describing the *Business Model Canvas*, analysing which one are considered more important and why.

2.4 Business Model Evolution

In the business analysed in our study, the business model must evolve together with the technology in order to maintain a competitive advantage. The concept of business model evolution comprehends all those changes that modify the structure of the initial business model throughout its lifetime. As stated in Demil and Lecocq's paper on *business model evolution* [5] it involves actions such as using a new kind of resource, developing a new source of revenue, and reengineering an organizational process. However, an increase in the volumes of revenues or costs is not included because they only represent the growth of the company and not the evolution of the business model.

It is also important to define a distinction between *business model evolution* and *business model innovation*. In the existing literature, the two terms are often used as synonyms, however, in some specific situations, they can also have two different meanings. Both concepts are related to the adaptation of the business model to maximize the opportunities of the market. In the paper by Chesbrough on opportunities and barriers of *business model innovation* [4], we have a few examples of consolidated companies that innovated their business models to stay competitive in their markets. However, while *business model evolution* is more related to evolving the business model while maintaining processes and technologies currently in use, *business model innovation* is used when applied to consolidated companies that need to change their business because of new technology or some other external event threatening market stability.

Therefore, we can conclude that *business model evolution* is more related to growing the business, while *business model innovation* is more related to reacting and adapting to changing circumstances. Sometimes, management fails to address *business model evolution* and doing so condemns the company to a scripted recession. A newborn startup should be aware that its products and the market are going to evolve, therefore it is important to consider a certain level of flexibility to allow easier growth.

3 Method

3.1 Research Approach

This study uses thematic analysis as the leading research method, which allowed us to fully exploit the experiences and opinions of the interviewees. Therefore, for this study the inductive approach has been adopted, as we can see it has been used for similar research [8]. This approach allows for conducting exploratory research that starts from a theoretical framework and then uses the collected data to create a new theory. Additionally, it allows the identification of unbiased patterns from data and focuses on the most relevant themes.

As mentioned, the research strategy applied is thematic analysis united with grounded theory, the first is a qualitative method for analyzing data, and the second is a reiterative method of analysis to identify relevant themes starting from the codes.

The data collection will be performed by interviewing experts that founded or work in an AI startup or people that are experts in evaluating or coaching new startups. The interview questions are divided into two sets depending on the nature of the interviewee. This data collection method allows the interviewer to start an open discussion that can provide all types of insights and therefore increase the amount of information collected.

Given that this research will be based on the experience of the interviewees, it's important that the research evolve during the interviews, the flexibility of thematic analysis allows changes in the scope throughout the study. However, using this method can have also some downsides, for example, it may be difficult to maintain the focus with a large amount of different data [1].

3.2 Research Questions

In the first chapter of this study, we can see that the literature in the three main areas of this study, business model, *artificial intelligence*, and *business model evolution* is still evolving, but there is a growing body of research in the field. We have seen how *artificial intelligence* Industrial application has grown in the last few years thanks to data and technical infrastructure improvement. At the same time, the use of the business model as a tool to define the business has increased, especially for software startups. Finally, as the business model is a concept defined at the very beginning it needs to follow the development of the business which means it has to follow a continuous evolution to adapt to changing circumstances and the growth of the company. Therefore, the identified research questions are:

- What are the most important variables to be considered when founding a startup focused on AI technology?
- What are common patterns that can be observed in the evolution of an AI startup business model?

The research questions in this particular case are very useful to identify relevant codes between those extracted from the interviews and make the research more focused and precise. The research process starts with the individuation of the raw codes. However, they need to be transformed into themes, which happens by grouping them for their relevance regarding a specific topic. Therefore, after the identification of the codes, it's important to define the most relevant ones in line with the research questions. From this point, we can identify patterns using themes, analyzing their distribution, or using direct quotations because the interviewee believed the concept is critical from his experience. These themes are then used to analyze the results of the study to lead the discussion towards meaningful answers to the research questions.

3.3 Data

3.3.1 Participants

The nature of this research requires individuals who can explain and have experience with the process of creating a start-up through the use of the business model. Additionally, the scope of this project further narrows the field to those startups that use AI as their main technology. Therefore, the participants need to have several years of experience so that they can share what they have done and

how. These very specific requirements can be identified in two main categories of participants. The first one consists of entrepreneurs that founded or work as high-level executives in young startups that focus on AI technologies [Table 1]. In this case, only startups younger than 5 years have been chosen to better assess the impact of the business model in these realities and what are the best practices to be applied in newborn businesses. The second category of interviewees is represented by people in charge of helping and evaluating startups during the first development period, such as coaching experts, consultants, and investors [Table 2]. The interviewees have been contacted using the network of contacts of both the writer and the supervisor and also using social media like LinkedIn.

	Industry	Technology	Founded in	Duration	Role
A	Software dev	Computer Vision, NLP	2018	45 minutes	CTO and founder
B	Privacy	Deep learning algorithms	2019	60 minutes	CEO and founder
C	Healthcare	Computer Vision	2018	45 minutes	CEO and founder

Table 1: Startup founders interviews

	Industry	Background	Experience	Duration	Role
D	Startup accelerator	Innovation Mgmt	6 years	45 minutes	General Director
E	Venture Capitalist	Finance & Technology	5 years	45 minutes	General Partner
F	Consulting	Strategy Design	5 years	45 minutes	Strategy Consultant
G	Healthcare	Clinical Technology	2 years	60 minutes	AI consultant

Table 2: Experts interviews (experience is referred to the years working in the indicated role)

3.3.2 Interviews

As mentioned before, participation in these interviews by experts in the sector requires a very specific strategy for data collection. That being the case, the data collection started with a defined set of questions to guide the conversation. However, this set evolved and developed throughout the process to adapt to newly acquired information, to deepen new insights that the interviewer believes are relevant and to make the most of the opportunity to talk with experts in this field. Therefore, the data collection is performed using a semi-structured interview method which consists of a set of defined questions with the goal of guiding the discussion. Moreover, the interviewer to lead a conversation needs to adapt to the topic discussed so the questions must adapt accordingly by adding new ones or changing them to improve the quality of the information acquired.

The creation of the set of questions starts with the analysis of the existing literature, asking the right question is critical to improving the quality and quantity of relevant data. The literature research allows the interviewer to understand what the gaps in the literature are and create questions to fill these gaps and generate knowledge. In this case, the literature involved in this process has already been mentioned in chapter two, where the literature review was used not only to introduce the topic but also to gain insight into the research questions and the survey to investigate them. However, even after a deep study of the field, for evident reasons, the interviewees will have greater experience in the field. This is an advantage to exploit by learning how to improve the questions interview after interview in order to increase the chances of collecting more relevant data and decrease biases and off-topic questions.

Typically a paper focuses on only one set of questions, this research required two different kinds of interviewees, startups and evaluation experts. Thereafter, the questions must be in line with the occupation of the interviewee the same for the two groups because they have different roles in the process of value creation of an AI startup. Appendix A (support experts) and Appendix B (startup founders) show the two final sets of questions that the interviewer used for this data collection process.

3.4 Procedure and analysis

The initial phase of the study will require a deeper investigation of relevant concepts like the business model, *artificial intelligence*, and *business model evolution*. This information will be extrapolated from

existing literature and will provide the basis for the research. We will define in detail what a company business model is and find how to build a proper solution for a generic business model. Additional restrictions to the definition of *artificial intelligence* have been defined to narrow down the scope of the research. These specifications helped also in the creation of the list of questions for the interviews and the definition of the pool of people to interview.

The interviews, as specified before, are taken with two different sets of questions that investigate the same process so that it is possible to perform a cross-case analysis even with different kinds of participants. Two semi-structured interview documents (see Appendix A and Appendix B) will be created, these will only be used to guide the interview towards the most relevant topics of the research, but the interviewer can also improvise if he thinks that some topics require more investigation. The time allocated to each interview is 45 minutes except for two that were prolonged to one hour by necessity.

The interviews were conducted using Microsoft Teams and recorded using the same tool, the recordings were then reviewed and transcribed into text. Finally, the created documents were analyzed to find interesting leads and useful codes using Atlas to organize the process. The codes will be used to conduct the thematic analysis that has been mentioned before. This will be performed between the different cases and the findings found in the different interviews will be compared.

The findings are then reported in the results, where tables and other additional visual representations will be exploited to better clarify the links between the interviewees and the themes. Additionally, it will be made use of direct quotations with explanations from the interviews to report specific important findings that require deeper investigation. Finally, the results will be compared with existing literature in order to integrate them into the theoretical framework.

The study will include the following deliverables:

- A report that explains the findings and research process to explain the scope in which this research is relevant and the level of reliability.
- Recommendation and consideration regarding the best practices to build a successful business model based on the results of the evaluation model.

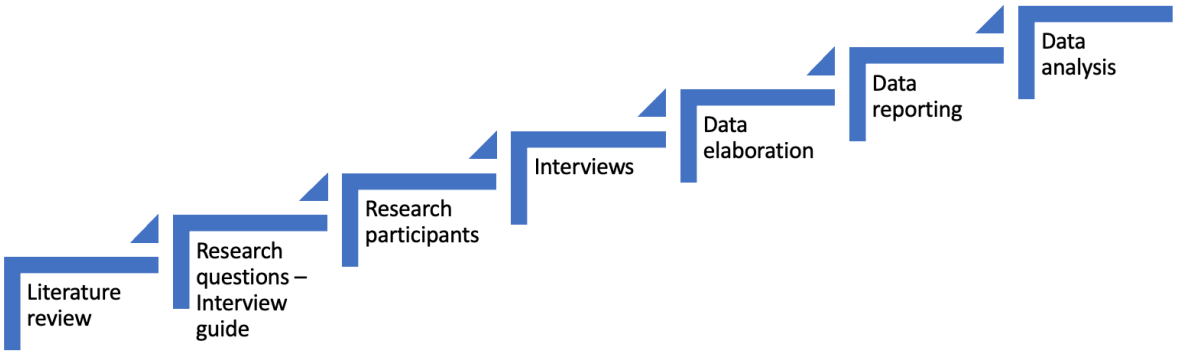

Figure 2: Research Process.

4 Results

The following chapter will present the data collected during the research project. The results will be reported in textual and where possible also in visual form using tables and other representations.

The report will include the data collected using seven semi-structured interviews, with seven different interviewees. All of them come from different organizations, this decision was taken because in a small startup, the founder is the one that has the better overview of the company and there is no need to explore it also with other employees. If there are two or more founders, often in such small realities, they usually already discussed and agreed on the main topics that are examined during this interview.

We have then two different points of view, from a startup founder perspective and from an evaluation expert perspective, the founders usually take the role of CEO or CTO or other high management positions inside the company, on the other hand, experts have typical support jobs which could be counselling the startup or evaluate it. The big difference between participants in the latter group is the field where they work (healthcare, hardware, software). As mentioned in the previous section two sets of questions have been used dividing them between expert questions and startup questions, each interview lasted between 45 minutes and one hour.

The following section will report a structured list of interviews with the findings of each one of them in order to create a detailed result report with all the information anonymized. After this first part, there will be a cross-case result report where the themes within the interviews will be compared with one another, with the aid of an additional table. The themes have been identified with the support of the *Business Model Canvas* and additional frameworks to identify the topics in which the codes could be grouped.

Table 3 is a summary of the interviews conducted for this project, it gives a clear overview of the field of action, the point of view, the number of codes, the number of times they have been grouped and finally the key aspect that the interviewee decided to highlight.

	Field	POV expert/startup	Number of codes	Identified themes	Key aspect
A	Software development	Startup	17	9	Transparency client feedback
B	Privacy	Startup	18	10	Market-appropriate price model
C	Healthcare	Startup	13	6	Data Availability is key in AI
D	Startup Accelerator	Expert	15	8	Clear strategy and innovation element
E	Venture Capitalist	Expert	19	9	Team skills and competencies
F	Consulting	Expert	15	8	AI projects must be feasible and valuable
G	Healthcare	Expert	18	8	AI requires a relevant business case

Table 3: Overview of the interviews

4.1 Interview A

The first interviewee founded a startup in 2018 focused on AI software service integration for companies, where he's now working as CTO and head of production and R&D. The company mainly focuses on computer vision, natural language processing and predictive analysis. His experience is substantiated by having founded two more startups in the past and having also worked in R&D.

He sees the business model as a document that helps understand the needs covered by the solution and analyse what are the strengths and weaknesses of the organization. An additional benefit he identifies in a well-built business model is the startup's positioning in the market, which can be defined by observing the different sections.

For his current startup he decided to follow a structured process developed by learning from his previous mistakes. The startup was born from the business model, using as a framework the *Business Model Canvas*, this document was integrated inside a business plan, which contains more precise information regarding secondary activities followed by an overall strategy.

The strategy collects all the elements that in the future will be critical for the evolution of the business model. Its evolution must be cyclical and structured in order to maintain its core starting assumptions. He is also aware that in a field where technology is in continuous evolution such as AI, the business model must keep up with innovation, in this case, the document is updated on average every three months.

In his experience, in the business model, the most important points that need to be considered in general when starting a new AI company are:

- Transparency in the communication with the client, who must be included in every step of the development to create together a suitable solution.
- Fairness in the price discussion, it must be justified by the size of the project and cannot deviate too much from the preliminary estimation.
- Caring about clients' problems, it's important to engage in discussion to find the best solution and provide the support they need also after deployment.
- The tested *value proposition* is a consequence of the three points above, when you have developed *customer relationship*s you are able to validate the product with them.

When questioned about the environment he says that the competitors in this case have different business models compared to the startup at issue. They usually aim more at reliability and stability, which involve older and more expensive solutions, these are mainly big software. He added that they are allowed to increase prices because they have the brand and a solid customer base, which is something that startups usually do not have. On the other hand, he believes that by being smaller the startup is able to have a more customized solution with newer technologies and lower prices that allows it to compete against big companies.

When talking about AI, he insists to highlight the following points. Working with AI is different from working with other types of software. In fact, AI is mainly a support technology that if implemented correctly can heavily boost an existing process. Therefore, especially for unsupervised models, the developers must completely understand the process they are improving. AI needs a large amount of data to improve performance, so data availability is crucial for the development of a model, even though, in some cases, it is possible to create synthetic data. Another important role in AI development is represented by regulations regarding ethics, when the startup was founded, it was decided that compliance with the regulations was a must to earn trust and be successful in the market.

4.2 Interview B

In 2019 the second interviewee founded a startup that works in the field of privacy for advertising practices. It uses machine learning models to reduce the amount of sensitive data necessary for online customer targeting. Before starting his career as an entrepreneur, he worked as an innovation consultant and an academic researcher.

In his opinion, the business model is one of the first documents that the startup needs to cover because it collects all the requirements that must be satisfied by the company to deliver value successfully. He specifies that the most important areas to be defined are the *value proposition*, the *customer relationship*, and the revenue model. He says these are the sections that influence the most the *market fit* analysis and suitability of the solution for the clients.

Even though the startup is very young, it already experienced several changes in various aspects of its business model. The interviewee thinks that the business model especially in the first years must be in continuous evolution, it is important to perform real-time testing to assess how the new technology is adapting to the market. In this case, for example, the biggest change has been in the pricing model, at the beginning it started as a free solution, but the companies were reaching out to receive the product but then they did not use it. Therefore, it has been decided to adopt a freemium model with a free basic solution and then the price for additional features is negotiated with the individual company. The startup found out that if they are paying for the solution, they are also more likely to use it. He insists that settling the pricing model and the prices was an important step to define the startup positioning in the market. It was also a challenging step because they needed to define a competitive price that did not devalue the company.

The previous discussion depends also on how the guarantor is applying the GDPR rules regarding privacy. For example, during this period he is addressing mainly the most important IT companies, and as a result, the smaller ones consider fines coming from privacy malpractices as costs of doing business. Therefore, the companies that were reaching out to acquire the solution, then they did not use it because they had no incentives.

He says then that the external factors that influence the operations of the startup can be multiple. However, the startup operates to cover a regulatory need with a new business model which is similar to ID companies, but it has some differences. Therefore, the competitors were not easy to identify

and there are not many. Therefore, they do not particularly influence the business operations, on the other hand, the startup is dependent on development regarding regulations and customer policies.

After the pricing model and the resources have been settled the startup moved its focus to the product proposition, the current evolution goal is to improve the predictive model to make it more precise and untied to the sensitive data of the customers. In general, other improvements to the solution are usually driven by customers' feedback.

Additionally, there is an evolution plan in place constituted of two road maps, a high-level one that is reviewed every quarter, and a more detailed one with deadlines and priorities that is updated every two weeks.

4.3 Interview C

The founder and CEO of the third startup has a background in software consultancy and product management. This startup has been founded in 2018, it operates in the field of computer vision applied to healthcare facilities, like hospitals or nursing homes. He says that previous experience working in a startup helped him understand the importance of the business model, especially in the first step of development to gain a better understanding of the value creation process.

He specifies that the business model should contain information regarding what is the need that the company is addressing. More precisely, who are the people that the company is targeting, and how the mandatory requirements are accomplished through processes and resources. At the same time, the business model can make the startup more aware of the obstacles and the limits of its own business.

Computer Vision is an innovative technology that only in the last few years has been able to improve to the level it could be implemented in a business environment. About the products' real-life implementation, the interviewee insists that such technology is still improving very fast, therefore the evolution of the product must go together with the evolution of the technology. As innovation is often unpredictable it is important to implement continuous research and development to keep up with technological advancement. Additionally, the successful implementation of the solution depends on the algorithm, on the data availability and on the ability to cooperate with the facility users, both patients and physicians.

Particularly he investigates data availability, which in the healthcare environment is very important. Firstly, the model needs data to be trained for all the different situations, to recognise even the smallest change in normal behaviour. Secondly, there is no margin for errors as in healthcare the low quality of the product or the training data may result in loss of human lives.

As the interviewee has mentioned before, resources are a very important point to define when creating a business plan. The startup's team is one of the most important resources to be defined, it must include all the expertise needed for the development of the technology and the business launch.

Moreover, he added that product validation is crucial in the development of the solution, so it is important to keep a continuous feedback loop with the client for the whole duration of the creation process. The best practice would be to test it with an early release in order to have more targeted and specific feedback to improve the design.

An additional critical process for successful integration, he says, is the clients' training specific for those that are going to interact with the solution. This activity requires also having a developed customer support service in order to be available whenever the customer needs help.

As the interviewee said before the business model can provide insights to understand the obstacles and the limits of the technology, in this case, the regulatory restrictions regarding sensitive information can limit the amount of data available to train the model. Finally, the reliability of the product is a must in this case and cannot be overlooked, therefore the implementation requires a lot of testing and a preliminary assessment period.

4.4 Interview D

The first expert interviewed for this study works as a consultant and general director for a hardware startup accelerator, where he has been since 2017. In the past, he experienced different roles in multinational organizations like product management, R&D and innovation strategy. The accelerator portfolio counts twelve startups with direct investments and four additional ones that are supported by providing consultancy services. The Accelerator is mainly focused on hardware technologies, however,

in the last three years he experienced that every new technology contains software and most of them fall into the category of *artificial intelligence*.

The startup selection follows a standardized process, which aims at defining the startups that will enter the portfolio as a direct investment, as part of the consulting support program or as a startup that will be re-evaluated in the future. He specifies that the first step of the evaluation process is performed by the internal team consisting of experts with different backgrounds and competencies. This is the first screening that reduces the number of applicants from around 400 to twenty for the following phase.

Subsequently, the rules of the investment are defined, this process is standard and some clauses are negotiable to find an agreement between the two parties. Finally, there is the due diligence phase consisting of two phases, the first one comprehends a review of all the startup's documents, and the second one is more qualitative and is conducted by an external committee that assesses the technological and strategic side through an interview. Based on the reports produced in the previous steps a decision is made within the internal team.

During the document examination process, it is expected for the business model to be included in the business plan. However, working with startups at a very early stage means that they may not have a business model yet. In these cases, the accelerator evaluates the startup, if it meets all the other expectations the internal team is going to provide support for its development.

When reviewing the business model, the interviewee says that it must contain all the information that describes how the startup is able to make money. Additionally, it is important to include in the business plan all the high-level strategic documents, such as strategy, values mission and vision and market positioning. The interviewee analyses hundreds of business models for each investment cycle, so it is important to understand what the biggest red flags are. He believes that a business model must include the reason why the startup is special, and what differentiates it from the others. This aspect can often be found inside the *value proposition*, which section must also contain the answer to these questions:

- Who is the customer?
- What is the customer's problem?
- What is the proposed product?
- How does the product solve the problem?

As he mentioned before in the last few years there has been a great improvement in AI performance, and now it is used as the main technology also in hardware products. The accelerator had to update its internal competencies to be able to understand innovation, he specifies, in 2017 there were no investments in AI because the technology was not ready.

4.5 Interview E

The second expert interviewee has some experience in his early career in innovation consulting and M&A for technology companies. He has been working since 2017 as a general partner in a venture capitalist, he is in charge of supervising transactions, investments and legal and financial aspects. On the due diligence side, he covers strategy and commercial evaluation. This venture capitalist focuses specifically on European software startups.

The evaluation process starts with a first screening operated by the internal team. The first assessment relies on what he says is the first pillar of this sector, understanding the technology. However, aligning with the technology is not only understanding it but also identifying if it is in line with internal values.

In the second step, the evaluation moves to a more technical analysis of intellectual propriety, where experts assess if there is any issue from that point of view. This is followed by a more qualitative step based on an interview between the team and the startup. This interview is critical to define if the startup has the skills, competencies, and individual personalities to develop an innovative solution, the interviewee specifies that it is very subjective because it is strictly based on the perceptions of the team.

The business model is analysed during the second more technical step, the interviewee believes it is critical that it includes the resources used and the processes to transform them into value. This

analysis must also include the constraints and the limitations that the business may face. He says that an additional critical analysis must be performed for the market positioning, the entrepreneur must be aware of whether the technology can survive without the support of other partners in the market or if it needs to be integrated within external systems. The latest trend among recent AI technologies is to develop small functionality that can be integrated into other systems. In these cases, it is important to specify in the business model who is going to integrate it, who are the partners and, in general, which other parties are involved. The relations between all the mentioned parties say a lot about the bargaining power of the startup.

A final point the interviewee wanted to mention is that during the development of the solution and afterwards also during the development of the business the startup must be in direct contact with the clients. He explains that in his experience companies that act through intermediaries lack quality in the development and the evolution of the solution. This often happens because the success of the startup and the satisfaction of clients are usually not the top priorities of the intermediaries. *Artificial intelligence* requires a good relationship with the customers and clear and continuous communication between the two parties that should be motivated to find the best solution possible.

The interviewee added that the best way to define an easy-to-update business model capable of evolving over time and adapting to e circumstances is to create a document as light as possible. This document must include the most important three or four basic assumptions on which the business is built, for example:

- I make this product
- I sell it to this customer
- Because he has this problem

Within these concepts, you define as many hypotheses as you want and you keep testing them to find out if they are still valid after any change.

4.6 Interview F

The third expert interviewee has been working as an innovation and strategy consultant since 2017, with a background in IT and project management. In the last three years, he has been working mainly on the implementation of *artificial intelligence* in the healthcare sector.

He explains that the business model is crucial when working with innovation because it collects all the information to explain how the company operates and how it generates money. In his opinion, two concepts are critical for a deep evaluation of the business model: the created value and feasibility of the solution. Therefore, when evaluating the business model of a company the first thing to check is whether the solution offered is valuable or not. This means assessing if it covers a real need of the customer if the customer is willing to pay for it, and also if it is ethical.

He specifies, for a product to have value needs to be linked to a specific business case. For example, it must save money or improve the customer experience. Therefore, he believes that these variables need to be measured using specific metrics, for some of them it is easy (amount of money saved), while for others it is critical to define KPI and use available data to assess the impact.

Once the value is verified, it is crucial to also investigate the feasibility, which depends on technical aspects and viability. An important aspect of the evaluation of an AI business model is its positioning in the market, the competitors, the suppliers, and the customers. As mentioned by the previous interviewee, he also believes that the business model must define whether the solution is a new and disconnected product or an add-on for an existing system.

He also added that *artificial intelligence* is gaining more and more relevance in the healthcare sector, thanks to its scalability. In this field, there is always a lack of working staff, and the automation brought by AI is critical to address this problem. However, scalability presents several challenges, such as data diversity, privacy and the implementation of the same process within different environments. These problems convince healthcare facilities to implement their own system, which can help increase process efficiency but, at the same time, they could be faster and more precise when implemented elsewhere. The main solution to this problem is to share only the model and let every facility deal with the training, which allows them to avoid regulatory issues related to data privacy and improve the model using more and different data.

When working in the *artificial intelligence* field it is important to define what product is needed and to refine it to make it more and more precise. A common error that is made during the development is trying to implement as many features as possible, which is a competitive advantage if it is done accordingly to customer feedback. However, often there is a willingness of doing too much, resulting in a product with more features but with less quality and more unstable.

4.7 Interview G

The last interviewee falls within the category of experts, although she may also be considered an entrepreneur as she has ownership in some projects regarding the implementation of AI models in clinical environments. She works in a research lab that aims at accelerating research, development and implementation of AI in the healthcare area.

She began by saying that they have two distinct implementation programs, the first one, mentioned above, comprehends the in-house development of AI models and the introduction inside healthcare facilities. The second one consists of a coaching activity, provided to selected external startups, with the goal of implementing them in a real environment. Most of these consulting activities target those products that are stuck in development without a proper business case to introduce the technology in the market. In these cases, there is no business model for the product, in fact, the business case must be defined to create a business model for the startup.

She believes that the business creation process should start with finding a relevant problem and building a *value proposition* upon it so that when you build the technology you already have a business case. On the other hand, if you start with the technology there is always the risk that the product is not needed in the market.

The business case defines the value of the solution for the customers. The interviewee specifies that the definition of value for a product, especially in healthcare, can vary on the situation and the problem that needs to be solved. Therefore, in a quantitative way, we can measure it in saved costs, when it helps shorten the stay of a patient or a more efficient way of using drugs. But also in a more qualitative way, assessing how to create a better experience for patients and support for physicians. When you start with the problem you should always verify these measures in order to understand how you are impacting the market and how beneficial is for the stakeholder to introduce this new product.

Another step of the process is to understand who are the stakeholders involved in the development and use of the technology. In healthcare, the roles are not well defined the customer is often a specific hospital or the state itself, on the other hand, the user is often the patient or the physician. This role division between client, customer and user must be investigated when creating the business model to align the different perspectives. Therefore, during the design and development phases, all the stakeholders must be included to better understand all their requirements.

The interviewee says that especially for the users, the validation process is crucial to test the compatibility between the product and the environment. This process is where the laboratory of the interviewee intervenes the most providing the startup with the means to test the technology and communicate with the user. Additionally, for the validation inside a clinical infrastructure, it is crucial to have data availability and internal technical knowledge to succeed in the implementation.

She concludes the interview by mentioning that in healthcare regulations are of great importance, which means that getting approval is a very strict and long process. The developers must be aware that every tool, every library, and any distribution mean must be documented and approved.

4.8 Cross-case comparison

This section aims at highlighting the points in common and the differences between the results of different interviews. The comparison will be a report of the different points of view across all the interviews including also an analysis that investigates the differences between experts and startups.

The first aspect to investigate is the importance of the business model for the development and launch of an AI startup. All the interviewees based on their experience believe the business model to be the most effective tool, especially in the first steps of the startup creation. Nevertheless, when talking to startup investing and coaching experts, the company can be viable even without a business model. Once assessed that the company has an innovative view that is aligned with the experts' view, the next step would be to investigate the business variables and analyse the best configuration for the

	Startups			Experts				
Areas	**Interview A**	**Interview B**	**Interview C**	**Interview D**	**Interview E**	**Interview F**	**Interview G**	**Total**
BM importance	X	X	X	X	X	X	X	7
Market fit	X	X	X	X	X		X	6
Mission/Vision	X	X		X	X	X	X	6
Key partners					X	X	X	3
Key Activities	X	X		X	X		X	5
Key Resources	X	X	X	X	X	X		6
Value Proposition	X	X	X	X	X	X	X	7
Customer Relationship	X	X	X			X	X	5
Channels					X	X	X	3
Customer Segments		X		X	X			3
Revenue model	X	X				X		3
Regulations	X	X	X	X		X	X	5

Table 4: Overview of the cross-case analysis

business model. This conceptual exercise results in the creation of a model that will give a structure to the business before the launch.

Additionally, in the interviews reported in the previous paragraph, we can see how the participants have similar views on the content of the business model, although there are differences in the priority given to different sections. This means that the interviewees use business models to achieve different goals, which testifies how broad the scope of this tool can be and how many interpretations it can have.

- The first interviewee describes it as a document that helps to get a better understanding of the needs covered by the solution and the market positioning.
- The second interviewee describes it as a document that collects all the requirements that must be satisfied by the company to deliver value successfully.
- The third interviewee describes it in a similar way to the first one adding the resources and the processes that create value (the how).
- The fourth interviewee describes it as a document that explains how the company makes money.
- The fifth interviewee describes it as a document that raises awareness on the how, mentioned also by the third interviewee, and on the constraints of the technology.
- The sixth interviewee describes it as a document that is focused completely on "the how" with the goal of explaining how value is created and how it makes money.
- The seventh interviewee describes it as a document that specifies the addressed business case and the value created to fill the technology gap.

Another aspect that almost everyone agrees on is the *market fit*, whose definition can be found across different sections of the business model. For example, the *market fit* can depend on the revenue model, as specified by the second interviewee, but also on the *customer segment* mentioned by the fourth, as well as the partners by the fifth. In the interviews where the *market fit* is mentioned, the participants specify also that it is very important for adapting the technology to the market, which, in their opinion, is even more important than the *value proposition*. Regarding this, interviewee B made a remark saying that even if the technology is disrupting the market, the customers are still the same. In case the customer is a big corporation without the flexibility to change its approach, the startup must adapt to accommodate the client. Interviewee E insists that most of the latest AI technologies are integrated into existing systems, which is why the new technology needs to be adaptable to work together with all the different systems that can benefit from it.

The interviewees gave the same importance to the evolution of the business model, which comprehends every aspect of the business model. The elements that remain constant throughout the evolution are the basic assumption at the basis of the startups as specified by interviewee A. Nonetheless, most of the participants focused primarily on the evolution of the product proposition which is critical in a fast-evolving sector like AI, then, other aspects of the business model change as a result of the evolution of the solution. The second interviewee talks about both an evolution in the product proposition and in the revenue structure, where the startups switched from a free model to a freemium one.

Another difference that can be found between interviewees is the frequency of the evolution process iterations, namely the meeting scheduled in advance to address the topic. As we can see from the interviews above, startups usually have a defined roadmap where they gather every few weeks to discuss where to improve. This is not always the case, sometimes the environment requires a fast adaptation because of a sudden innovation in the technology or the market.

Before diving into the business model sections, it is relevant to mention that, especially for interviewees more linked to the healthcare sector, communication in AI is essential when interfacing with the client. For example, the three interviewees that work in healthcare said that patients are often afraid that new technologies will substitute human contact. In these cases, the startups together with the physicians are in charge of explaining the objectives of the product and how it will affect the treatment.

It is also worth mentioning the importance of the *mission* and the *vision* considered critical by almost every interviewee, these are not part of the business model, but they influence the choices of the management on the variables inside it.

Even though they are not sections of the business model, the themes above have been analysed because they are strictly connected. Among the aspects of the business model, the one that has been mentioned the most is the *value proposition*, which was indicated as one of the most important points to develop for AI by every interviewee. Even if they all agree on the importance of this section, the participants apply different approaches to it.

- Interviewee A highlights how important it is to have a tested *value proposition*, which is connected to the client's direct feedback during the development of the solution.
- Interviewee B works in a B2B environment, and he believes that, when working with other companies, the focus should be on how much money is the client saving from using the solution.
- Interviewee C agrees with the first one on the importance of a tested *value proposition*, adding that it is achieved by relying on product testing in the early stages.
- Interviewee D, from an expert perspective, believes that it is critical that startups understand and maximise their main element of innovation, in order to focus on that and differentiate from competitors.
- Interviewee E focuses more on the go-to-market, the approach with the client and how is the product enhancing the user experience
- Interviewee F considers the *value proposition* to be the reflection of the demand that there is for the product. As the evaluation is divided into feasible and valuable the product must have demand but also must be developable with available resources.
- Interviewee G suggests that the *value proposition* should be built starting from a problem perspective so that the product will already address a business case. The threat when developing from a technology point of view is that the product can be innovative but there is no demand in the market.

The second point, which is mentioned by everyone except the last interviewee, is the *key resources*. This point mainly comprehends three variables, that are agreed upon by every interviewee, these are the composition of the team, the knowledge and skills and the data availability. The participants think that the knowledge to create AI models cannot be outsourced, it is important to have the technical skills available within the team. The interviewed experts believe that the knowledge they can provide helps more with the transition of technological innovations into the market. Finally, data availability in AI is a primary resource, essential for the training of the model, it can come from an internal database, or from the client and it is possible to use also synthetic ones.

As can be seen from the table above, the two themes of *channels* and *key partners* have in common that they have not been mentioned by startups, but by three out of four experts. Interview E believes that when presenting a product in a market, having strong *key partners* and *channels* provides the startup with bargaining power. Especially for products that need to be integrated into other systems, it is critical to have solid contracts and relations with *key partners*. The *channels* section is only mentioned by the startups inside the *value proposition* for what regards the client feedback and how

to effectively receive it. What we can see from the experts is similar, the fifth interviewee insists that the distribution should happen directly from the startup to the client. In this case, intermediaries are going to be detrimental to the purchasing experience of the client and the feedback loop of the producer.

The importance of *key activities* has been mentioned by five interviewees, two from the startups' pool and three from the experts' pool. The interviewees that belong to the first group believe that the activities must be carried on with transparency towards the client and the regulatory authorities. In AI these two precautions can be particularly effective as they allow the client to be included in the product development and at the same time to be in line with the regulations. On the other hand, experts are more focused on research and development of the technology, they believe that innovative products could become outdated faster than more consolidated solutions. In addition to that, especially in healthcare, there is the need to create a stable product and in case of adjustment or improvement to the system guarantee a linear transition to the newer version.

The concept of transparency, already mentioned in the previous paragraph, is also strictly connected to *customer relationship*s. Transparency and fairness between the two parties are basic assumptions to create a two-way healthy communication route between clients and the startup. This connection is essential for the development process for a continuous feedback cycle reducing waste due to unfit solutions. Another point that can belong to both the *key activities* and *customer relationship*s sections is the client's training. This activity in AI is critical for the successful implementation of the solution in every environment in order to teach users to deploy the full potential of the product.

The *customer segment*s section is mentioned by three interviewees, they all insist that the AI startup, once defined the needs and requirements that the solution will address, needs clear targeting to define the customers that want and need the product. The *customer segment* also influences the revenue model, interviewee B explains how important was for the startup to understand what the market was used to in terms of payment methods and price structure.

A final mention goes to regulations, which are not traditionally part of the business models but should be included when talking about *artificial intelligence*. The large majority of the participants mentioned the importance of this topic, in particular, interviewees C, F and G. These last three are working in the healthcare sector, and they are the interviewee that had the most problem related to this. In addition, interviewee B works in privacy and regulations, and he has seen an increase in GDPR compliance and an improvement in the alignment of AI companies towards the AI regulations discussed by the EU.

5 Discussion

In this section, the previously reported results will be analysed to find insight into the information collected from the interviews. This insight will be also compared against the initial literature review to understand what new information can be reported as findings. Finally, a case will be developed to support and explain the conclusions. This section will also include implications in the research landscape and limitations due to research choices.

Our research presents an analysis that addresses the gap in the studies regarding the best practices and the most important variables to understand the development of the business model for *artificial intelligence* startups. The chosen approach for this research is to first introduce and explore the topic using existing literature. This first step is followed by semi-structured interviews with startup executives and founders and experts in support activities for this type of company. The data collected from the mentioned interview mainly follows the structure of the *Business Model Canvas* which has been used for the formulation of the survey questions. However, in the results, it is possible to find also additional topics, that needed to be included because considered critical by the interviewees.

The results section reports a very clear picture of what the pool of participants believes is important and what, on the other hand, is deemed as less important. In some cases, it is possible to see a distinction between startup founders and support experts of interviewees, which will be deepened in the next section.

In summary, it is visible how every participant thinks that the development of the business model is crucial when founding and growing an AI startup. In the same way, almost every interviewee gives great importance to the *market fit*, which can be defined by looking into different sections of the *Business Model Canvas*. The mission and vision are topics outside the canvas that drive the decision for the business model. Most of the interviewees give higher priority to the *value proposition* and *key resources* variables, which are considered the main sections to create tangible value. *customer relationship*s and *key activities*, based on the number of participants that mentioned them, can be considered less important but still critical for the success of AI implementation. It is also relevant to observe how *channels* and *key partners* have been mentioned only by experts and not by startup executives. *customer segment*s and revenue models are given less importance by the interviewees as they have been mentioned by fewer people. Finally, regulations need to be included in our research even though they are not a classic business model section, they have a big role in business applications of *artificial intelligence*, and they must be taken into consideration by every startup related to this technology.

In the next chapters, these results will be first analysed to understand the meaning of the information collected, then the consequences of these results will be identified and finally, the research limitations and the threats to validity will be defined.

5.1 Interpretations

In this study, there are a lot of references to the *Business Model Canvas*, which is not the only framework that can be used for business model development, but it is the most used among professionals. This choice was then reinforced by the interviewees that confirmed this tool to be the model that best represents the variables that influence business activities. This is the reason why the results section mainly reports on areas related to the business model. However, to include all the information provided by the participants, our study mentions also additional areas that need to be considered for AI startups.

The first few questions were aimed at getting to know the participants and understanding their view of the business model. This first assessment allowed us to align on the experience of the interviewee and his level of familiarity with the business model. Secondly, the investigation moves to the content and to the goal that the business model serves. As seen above, the interviewees agree on its importance and definition, as well as the content, but they use it for different purposes and consequently give different importance to the different sections. Our study aims to analyse these variables in the *artificial intelligence* context, understand which ones are the most important for the participants, and describe what is needed to improve the outcome of all these variables combined.

Before diving into the business model, an important mention should be given to the mission and vision. These two concepts are not part of the *Business Model Canvas*, as they are usually included in the strategy section of the business plan. Why are they included in this research? These two concepts

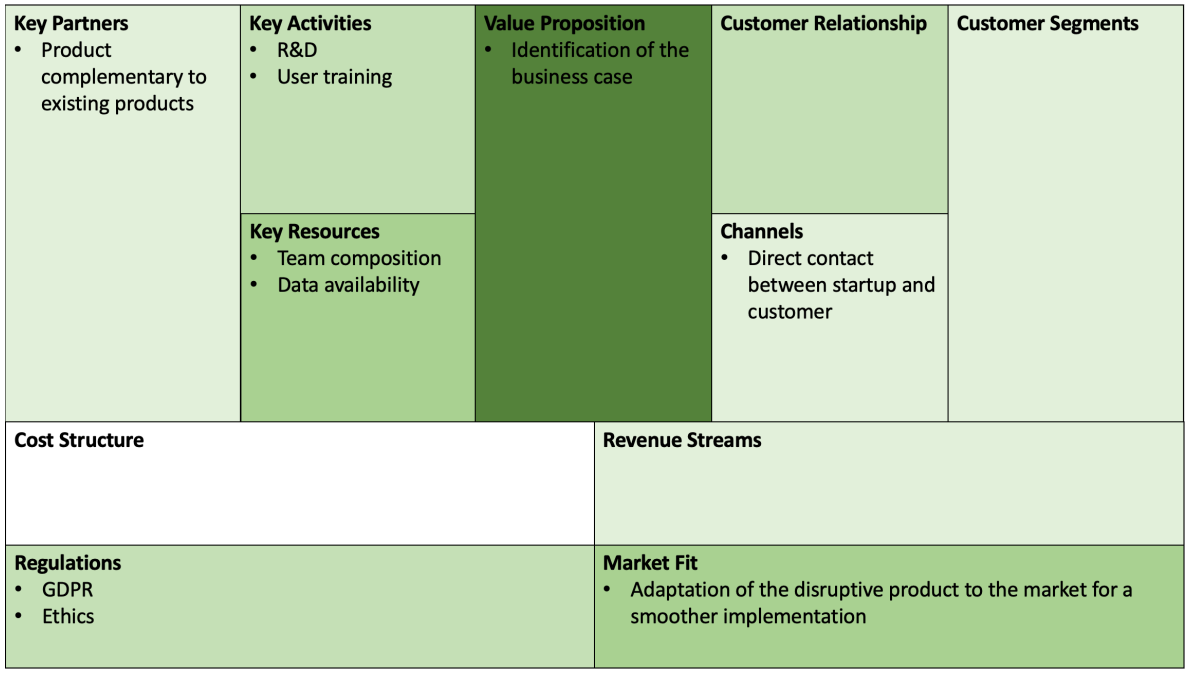

Figure 3: *Business Model Canvas* for AI startups.

have been mentioned several times by the interviewees and must be taken into consideration because they are assumptions that drive the business model's definition. Together with the overall strategy, they need to be taken into account in order to implement any change and any modifications needed throughout the startup life-cycle. As we will see later in this chapter, the business model variables of AI startups and the choices to be made require a high level of flexibility in the organization. This flexibility can be achieved only if it is driven by the mission, the vision and the strategy.

Additionally, The mission and vision of an AI startup play a critical role in the creation of a business model and company strategy. The mission defines the core purpose of the startup, while the vision outlines its long-term aspirations and goals. In the context of AI startups, the mission and vision help to guide the development of the business model and company strategy by providing a clear direction and focus. The mission and vision serve as the foundation for the startup's value proposition, product development, marketing, and overall business strategy. These findings are also part of Kulkov's analysis of value-creation processes for AI startups in the healthcare industry [13], where the mission and vision are intended as catalysts for the translation of the company's strategy into the business model.

The mission of an AI startup should reflect the company's values and purpose. It should explain what the startup does, who it serves, and what sets it apart from its competitors. The mission should be clear, concise, and compelling, and it should provide a framework for decision-making that aligns with the startup's values and goals. The vision of an AI startup should outline the company's long-term goals and aspirations. It should provide a clear picture of where the startup wants to be in the future and how it plans to get there. The vision should inspire and motivate employees, customers, and investors to support the startup's goals and objectives.

The analysis of the business model starts with the *value proposition* section, which was commonly considered to be one of the most important sections by every participant. This can be easily explained by the fact that *artificial intelligence*, as we have seen in the literature, is a new and quickly evolving technology. Consequently, the development and deployment of the solution must be driven by the *value proposition*. The objective is to assess how the innovative product can disrupt the market or radically improve business functions, together with the definition of how is this technology built and what are the goals that will allow the startup to meet the market needs.

For AI startups, a well-defined *value proposition* is critical because it allows them to focus on customer-centric innovation. AI technology can be complex, and many customers may not fully understand how it works or how it can benefit them. Therefore, the *value proposition* must clearly

articulate the unique value that the AI startup's product or service provides and how it can solve specific customer problems. The relevance of this analysis is confirmed by the paper from Lindic and da Silva [14] that specifically focuses on the *value proposition* as a success factor for AI and other technologies that require a constant customer-focused innovation. A well-defined *value proposition* enables AI startups to prioritize the development of the features and functionality that are most important to customers. This customer-focused approach can help AI startups create products and services that are more likely to succeed in the market. It can also help AI startups differentiate themselves from competitors by delivering a unique *value proposition* that resonates with customers.

Following the *value proposition*, the *key resources* take a very important place in developing AI technologies. This statement is supported by the fact that almost all interviewees believe it to be one of the crucial sections of the business model. However, resources within a company can have a wider meaning that includes several very different variables. For example, the budget, the time before the official launch, or the accessibility to technological infrastructure. In the case of *artificial intelligence*, there are three of these variables that can be identified as more relevant than others when developing the business.

From the interviews, we identified critical resources to take into account, which represent the composition of the team, the knowledge and skills accessibility, and the data availability. The team composition is critical in startups more than in big companies as the environment is smaller and less stable, and the employees need to adapt to unexpected issues and lack of expertise. As mentioned in the results, especially in interviewee E's paragraph, the experts evaluate the diversity and the knowledge within the team to assess the abilities of the people working in the startup. This subjective assessment usually follows the feelings of the evaluating expert, but it is also followed by a more objective and targeted evaluation. In fact, in these cases, technical expertise cannot be overlooked, it is possible to outsource some skills, but it is less effective because external people are less motivated and less attached to the company's values. In addition to technical skills, experts look also for charisma and entrepreneurial ability, therefore, the expert during evaluation interviews must be able to assess both soft and hard skills. This evaluation is based mainly on the experience of the expert and his idea of the characteristics that are needed for successful leadership. A structured team is critical for the startup to be able to solve problems and disputes that may arise from internal or external sources.

An additional resource, very important when developing *artificial intelligence* models, is data availability. Nowadays, data is the fuel of most businesses, but we can say that in the case of *artificial intelligence* data is not only the fuel but also the wheels and the engine. In fact, in the *artificial intelligence* field data is used for the analysis of a solution, for the training of the model, and for its maintenance. Additionally, the quantity and the quality of data are directly correlated to the precision and the value of the algorithm itself.

In conclusion, the *key resources* section requires having a clear idea of the knowledge and the skills needed, being aware of what the business is missing and defining roles and responsibilities. This will allow the startup to quickly compensate for the lack of expertise in case of issues. The participants agree that this ability to adapt in order to fill a gap and compensate for unexpected problems will help the startup and the people grow together. In the last decade, the amount of open-source data that an AI company can find has drastically increased, which is why as mentioned by interviewees D and F data availability gives you less competitive advantage than when they started working in the field five years ago. However, the topic is still crucial for this technology, since a great amount of high-quality data is required to improve the precision of the model. Nowadays, there are several ways that allow a startup to acquire data, open-source databases are not the only way to acquire data anymore, as mentioned by interviewee A, often data are provided by the client itself, especially when working in a B2B environment. Finally, an additional way to increase the amount of available information is by generating synthetic data that can be used to train the model.

key activities represent another crucial section of the business model, the participants of the interviews reported some examples of different processes that can be identified in this area. From the cross-case comparison, we analysed recurring points of view across the interviews, and from that, we can identify three trends that are specific to AI.

The first key activity is research and development, Which is clearly important to almost every company in every sector. However, when dealing with *artificial intelligence*, it is a basic requirement without which the product cannot stay competitive for long. AI startups must interface every day with new technologies that are in a phase of rapid evolution, and that often results in solutions that

are unstable, hard to implement and quickly outdated. Therefore, this process requires continuous implementation to keep their product up-to-date and effective for the customers.

An additional activity, mainly highlighted by those that interact with healthcare facilities, is user training. This process is critical to ensure an effective implementation of *artificial intelligence*, which is a technology that once implemented is going to strongly modify the existing processes and sometimes these changes may not be easy to implement. Therefore, the startup must be in charge of informing the customers of how the product is going to change their job, what are the improvements brought by this innovation and how to properly use it. Communication between startups and clients is crucial because the lack of it can bring resistance to innovation, and consequently, especially in AI, resulting in a difficult implementation.

The last point is included in this section even though it is not a key activity, but a way of delivering internal activities to the customers. The concept of transparency is very common in different fields, in *artificial intelligence* it is required for regulation. As we have seen before *artificial intelligence* is strictly regulated regarding privacy and processes. This is already a valid reason why redacting detailed documentation and having continuous communication with the client is very important. Additionally, transparency in the communication with the client allows the startup to gain the trust of the clients, not only towards the company but also towards the technology and facilitate its implementation.

In previous paragraphs, we noticed how often the interviewees agreed with each other regarding the importance of the specific section. However, having two different kinds of interviewees, experts and startup founders, allows the research to have two points of view that may differ. During the interviews, this difference appeared for *key partners* and *channels* sections as we can see in table 4. These two sections were mentioned only by participants belonging to the support function area, namely evaluation or coaching experts. On the other hand, they are seen as less important by startup founders.

The first highlighted area is the *key partners* section, the experts insist that this is critical in AI because in the last three years, most of the new technologies are implemented within products that already exist in the market. Such behaviour requires the startup to interface with companies that already have roots in the market. Therefore, having agreements in place with companies for the implementation of the product gives the startup bargaining power when discussing investments and contracts with suppliers.

When talking about *channels*, experts believe that the sale of the goods must be direct from the supplier to the customer without intermediaries. This statement has two explanations, firstly, intermediaries do not have the same commitment that can drive people inside the startup to sell and believe in the product. Secondly, in the case of intermediaries, the communication flow between the startup and the client is not continuous and this may cause misunderstandings leading to lower customer satisfaction and fewer product improvements.

The difference in priorities between supporting experts and startup founders can be attributed to their respective focuses. While startup founders are often more focused on the development of their product, experts place equal or greater emphasis on the deployment of the solution in the market. This difference can also be observed in the way that startups prioritize their product proposition. For startups, the product proposition plays a critical role in capturing and retaining customers in a highly competitive market, whereas for experts, the emphasis is on ensuring that the product meets the needs and demands of the target audience. As a result, startup founders often seek to develop a unique and compelling product proposition that sets them apart from their competitors, whereas experts prioritize the functionality and reliability of the product in meeting user needs. Ultimately, while both groups share the goal of developing a successful product, their differing priorities and approaches can have a significant impact on the development and deployment of the solution in the market.

Up until now, we have analysed the most important sections using the *Business Model Canvas* as the main reference. However, one of the most important points that emerged from the interviews is the *market fit*, which is not part of the Business Model Canvas. As mentioned in the result chapter, we can see how different interviewees indicate different business model areas to identify how to measure how the product suits the market in which it is deployed. The *market fit* is not something that is important only to *artificial intelligence*, this evaluation is critical for every product launched also in other sectors. However, we want to highlight what are the reasons why it is so important in this specific field.

Generally, this variable is used to evaluate the applicability and conformity of the product to the market, meaning the coverage level of the developed product over the target needs. Why is this metric so important? The *market fit* includes both the evaluation of the product and the market, so it is a

shared responsibility between different sections of the business model:

- The product proposition, where the product is defined together with the needs addressed and how to solve them.
- The *key activities* that need to be adapted to the market and the regulations.
- The *customer segment*s since the clients need to be willing to spend the money required to solve their problem.

In AI, in addition to the points above, there are two more specific concepts that make this concept crucial for the successful implementation of the product and adaptation to the market.

- The *key partners* are crucial since AI often allows startups to create products that can be implemented within other systems. This process can happen only when the product is in line with all the requirements of the market and can, consequently, be associated with another product.
- A second important aspect specific to disruptive technologies such as AI is that customers do not always want to change, taking the example of interviewee B, if the new product improves the existing process the client is happy to embrace the new technology. However, if they believe something was working already, like the price structure, it is important to maintain similarities to not deviate too much from what existing clients already have.

The evolution of the business model for artificial intelligence startups is a multifaceted topic that is of great importance to professionals in this field. As AI is a relatively new technology that is still in its developmental phase, it often creates sudden disruptions that can significantly impact startups working with this technology. These disruptions can take various forms, including changes in market demand, advancements in AI research, and shifts in industry standards and regulations. Given the dynamic nature of the AI industry, it is not surprising that all interviewees have plans in place to navigate these disruptions, even though their chosen approach may differ significantly. Some startups may focus on developing innovative AI applications to stay ahead of the curve, while others may prioritize building partnerships and collaborations with established industry players. Additionally, some startups may choose to specialize in a specific niche or vertical, while others may opt for a more broad-based approach. Despite these differing approaches, it is clear that the ability to adapt and evolve in response to changing market conditions and technological advancements is essential for the long-term success of AI startups. In this context, the evolution of the business model for AI startups is a critical topic that will continue to be closely monitored and analyzed by professionals in the field.

In the first case, function managers play a crucial role in ensuring the smooth and efficient operation of the organization by scheduling periodic meetings at the operations level. These meetings serve as a platform for identifying short-term goals and the corresponding actions needed to achieve them in the next cycle. By aligning their actions with the organization's overall strategy, function managers can ensure that the day-to-day operations are optimized to support the long-term objectives. In addition to the operational level meetings, the organization also schedules more high-level meetings attended by the upper management to identify the long-term evolution strategy. These meetings are critical in providing a broader perspective on the organization's direction and how to achieve its strategic objectives over the long term. During these meetings, the top management team reviews the organization's strengths, weaknesses, opportunities, and threats (SWOT) and identifies emerging trends and competitive threats in the market. By analyzing the SWOT and other relevant data, the top management team can make informed decisions about the organization's future direction and identify the strategic initiatives needed to achieve its goals. These high-level meetings play a critical role in aligning the organization's long-term strategy with its short-term operational goals, enabling it to achieve sustainable growth and success over time.

In other cases, a startup may adopt a different approach to scheduling meetings to identify short-term goals and actions. Instead of holding periodic meetings, the organization may have an overall strategy that drives its operations. This approach allows the team to work more autonomously, without the need for frequent check-ins. However, in the dynamic business environment that startups operate in, there may be significant changes in external factors that cannot be foreseen. These changes can have a significant impact on the organization's ability to achieve its long-term objectives, and in such cases, a meeting must be urgently called to discuss future actions. During these urgent meetings,

the startup's team reviews the organization's overall strategy and identifies the necessary changes to adapt to the new external factors. This may involve revisiting the organization's vision, mission, and values, identifying new opportunities for growth, and developing new short-term goals and actions that align with the revised strategy. Furthermore, these urgent meetings may also involve a review of the organization's capabilities and resources, identifying areas where additional investment or talent acquisition may be necessary to ensure the organization's success in the long term. In conclusion, while some startups may have an overall strategy that drives their operations without periodic meetings, the ability to pivot quickly and adapt to changes in the external environment is critical for the long-term success of any organization. Urgent meetings can provide the necessary framework for reviewing and revising the organization's strategy and developing new short-term goals and actions to ensure continued growth and success.

When *artificial intelligence* is involved, the evolution of a startup's business model is heavily influenced by the product proposition. There are two distinct approaches that startups can take to drive this evolution, each with its own advantages and disadvantages. Both approaches have their advantages and disadvantages, and the choice of approach depends on the specific needs of the startup. Startups that are more established and have a clear vision for their product proposition may benefit from the first approach, while those that are more focused on experimentation and rapid innovation may benefit from the second approach. The importance of the value proposition in the evolution of an AI startup business model is underlined in the paper by Kim on sustainable business models for artificial intelligence [6]. By understanding the unique value that the product or service provides to customers, startups can differentiate themselves from competitors, tailor their products or services to meet customer needs, generate revenue, drive innovation, and ensure long-term sustainability. In conclusion, the evolution of a startup's business model is driven by the product proposition when artificial intelligence is involved. By choosing the right approach to drive this evolution, startups can effectively plan their growth and adapt to the changing needs of the market.

The regulatory field in *artificial intelligence* is still an ongoing discussion that is being debated by the commissions responsible for each country and even more high-level like the European one. Interviewee B founded a startup that interacts directly with this topic, its product solves a need created by the regulations on privacy (GDPR). However, in this field privacy is not the only topic that regulations need to cover, automated systems require also setting guidelines regarding ethics and limits to ensure the reliability of the products. The GDPR is the point of reference regarding privacy and data quality in Europe, where the use of sensitive data is strictly regulated. On the other hand, for the definition of ethics standards, the EU created a document called *EU guidelines on ethics in artificial intelligence*.

An additional critical point highlighted by Bellamy in his paper focused on algorithmic biases [2] is that ethics awareness in AI startups is critical to reduce biases because AI systems are only as unbiased as the data they are trained on and the algorithms used to make decisions. If the data used to train AI systems is biased, the resulting AI systems will also be biased. This can lead to harmful outcomes, such as perpetuating existing social and economic inequalities, discriminating against certain groups, and violating basic human rights. In order to reduce biases in AI systems, AI startups need to be aware of ethical issues related to AI and take proactive measures to address them. This involves understanding the potential impact of AI on society and engaging in ethical practices that promote fairness, accountability, and transparency. One way to increase ethics awareness in AI startups is to establish an ethics committee or board that is responsible for identifying and addressing ethical issues related to AI. This committee can work with other stakeholders, such as customers, regulators, and civil society organizations, to develop ethical guidelines and standards that promote responsible AI development and deployment.

Another important variable to take into consideration is how the regulations are applied, interviewee B, which is the one that has the most experience in the field, states that for the time being the GDPR guarantor is mainly targeting big companies. Therefore smaller companies see fines as a cost of doing business and as a company that works to cover a regulatory need the company of the second participant depends directly on how these rules are applied.

In figure 3 the variables listed in the previous paragraphs are illustrated. The different shades of green depict how many times the section has been mentioned throughout the interviews. The darkest shades of green means that the section has been mentioned by the highest number of interviewees, in the same way, the section coloured with the lightest shade of green has been mentioned by fewer inter-

viewees. The bullet points within the sections are the characteristics that the interviewees identified as most important for *artificial intelligence* startups. For those that have been left empty, the meaning is that the section is critical for the interviewee but not for reasons specific to *artificial intelligence*.

5.2 Implications

As highlighted in our literature review, the research presented in this paper addresses a relatively unexplored area of study, specifically the evaluation of business models and the *business model evolution* of AI-based startups. While there are existing papers that investigate the business model of software products in a broader sense, our research offers a fresh perspective by narrowing the focus specifically to the unique characteristics of *artificial intelligence*. In our analysis of the existing literature, we found that much of the research on software development assumes that the findings are generally applicable to all areas, including *artificial intelligence*. However, our research indicates that this assumption is not entirely accurate. While there are some similarities between the two areas, AI has distinct characteristics and challenges that require a more nuanced analysis of its business model. This distinction is crucial in understanding the implications of our study, and we made a concerted effort throughout our research to identify findings that were specifically related to *artificial intelligence* and those that could be generally applied. By doing so, we hope to provide valuable insights and recommendations that are tailored to the unique needs and challenges of AI-based startups, while also contributing to the broader conversation on *business model evolution* in the tech industry.

Therefore, our research not only provides valuable insights and recommendations for AI-based startups and investors but also serves to broaden the understanding of the *business model evolution* in the field of AI. By collecting real-life experiences of both startup founders and external experts, our study offers a multi-perspective approach to the topic, helping to reduce biases and recognize valuable propositions. One of the advantages of having two groups of interviewees is that they can understand each other's perspectives, which can help bridge the gap between the technical and business aspects of AI-based startups. The startup founders tend to be more technically focused on developing the product and leveraging the technology, while external experts are more market-focused and consider how to introduce new technologies to the market. Our research aims to provide an objective understanding of the topic by considering different points of view. By using expert experiences, we hope to offer a starting point that can be enriched with their own experiences to accomplish their objectives. Ultimately, this study seeks to contribute to the overall development of the AI industry by bringing together diverse perspectives and experiences to inform the evolution of business models in the field.

5.3 Limitations

Our study acknowledges its limitations that may constrain the generalizability of our findings, but they can also serve as a basis for future research. The identified limitations mainly pertain to the availability of resources, such as participants for the interviews. It is worth noting that startup founders and experts in the field are often overburdened with responsibilities, leaving them with very little time for additional commitments like interviews. As a result, our sample size may not be comprehensive enough to capture the full range of experiences and opinions. Future studies could explore more effective strategies for recruiting participants or considering other sources of data, such as company reports and customer reviews. Additionally, our research is limited by its focus on a specific industry and geographic region, which may not be representative of other contexts. Thus, further studies could expand the scope to include other regions and industries.

While our research provides a comprehensive analysis of the current trends in the field of *artificial intelligence*, it is important to note that there were some limitations to the study. Firstly, due to limited resources, we were unable to include participants from outside Europe, which could have provided valuable insights into differences and similarities across different regions. Additionally, it would have been beneficial to have participants with expertise in other software fields to help identify contrasting perspectives. Another limitation was the lack of legal expertise to analyze the impact of ethics and regulations in AI in more detail. Despite these limitations, the information collected was sufficient to provide a complete theory on the subject, and our research highlights the need for further investigation in these areas. By addressing these limitations, future studies can broaden the scope and provide a more comprehensive understanding of the complexities of the field.

6 Conclusion

In this conclusion section, we provide answers to the research questions posed in our study and reflect on the key findings and implications. Our research aimed to uncover best practices for evaluating AI-based startups, and we have achieved this through a comprehensive analysis of the companies business models and interviews with relevant stakeholders. Additionally, we have offered recommendations to entrepreneurs and investors to enhance their understanding of the sector. Moving forward, there is potential for further research to delve deeper into business models for AI startups and explore new and emerging trends in the field.

6.1 Answering the research question

Research question 1: What are the most important variables to be considered when founding a startup focused on AI technology?

Our study has a focused approach to the field of AI, which has emerged as a prominent technology in recent years and has undergone significant industrialization. As a result, numerous companies worldwide have implemented AI to improve their operational efficiency and effectiveness. We have selected this topic due to the scarcity of specific information available in the existing literature. Nowadays, most startups use the *Business Model Canvas* to define variables that describe their product proposition and resource allocation for go-to-market. In this research, we aimed to identify the crucial variables that must be considered for AI technologies, and how they should be tailored to better fit a specific company. To address our research questions, we conducted insightful interviews with experts in the field, which provided us with valuable insights.

During this study, we were able to identify the most important variables among those within the *Business Model Canvas*, that are specific to AI:

- *Product proposition*, because of the importance of delivering a solution that covers all the targeted needs. For AI this is even more important since innovative technologies require skilled AI engineers for reliability and it is driven by technology innovations.
- *Market fit*, because a disruptive technology like *artificial intelligence* needs to adapt to the market in order to align with users' requirements and simplify the transition.
- *Key resources*, where an AI business model requires skills available within the team and data availability, without which the product would not meet the quality requirements, especially in the healthcare field.
- *Key activities*, where research and development are even more important for AI solutions because it is a technology in continuous evolution. An additional process that is critical for the successful implementation of AI is user training which allows users to learn how to deploy effectively the solution.

The contrasting perspectives between the startup founders and support experts regarding the *key partners* and *channels* sections are particularly noteworthy. Our findings, as presented in the previous chapter, revealed that while support experts were more inclined to prioritize variables relating to go-to-market strategies, the startup founders tended to place greater emphasis on the product and its development. These divergent viewpoints underscore the complex and multifaceted nature of building a successful AI startup, as different stakeholders may have varying priorities and opinions on what constitutes success. It highlights the importance of understanding and balancing the diverse perspectives of stakeholders to achieve a cohesive and effective business model. As such, future research could explore ways to bridge the gap between the different viewpoints to develop a more comprehensive approach to business model development for AI startups.

Research question 2: What are common patterns that can be observed in the evolution of an AI startup business model?

Our research revealed that there are two distinct approaches to *business model evolution* among AI startups. The first approach is driven by periodical meetings, which involve scheduling multiple sessions

at various levels to guide the evolution of the business model. The frequency of these meetings can vary depending on the individuals involved, with upper management typically convening two to four times a year, while operational-level meetings occur every other week or once a month. This approach requires more advanced planning, but it provides a structured and organized approach to *business model evolution*.

On the other hand, the second approach is driven by the overall strategy of the startup. This approach is more fluid and dynamic, with the business model evolving in response to changes in the market or other external factors. While this approach is less structured, it allows for greater flexibility and agility in responding to new challenges and opportunities.

Both approaches have their advantages and disadvantages, which depend on the specific characteristics of the business. For instance, the periodical meetings approach may be more suitable for startups that require a higher degree of coordination and control, while the strategy-driven approach may be more effective for those that require more flexibility and adaptability. Understanding the benefits and limitations of each approach can help startups determine which approach is best suited to their needs and goals, and how they can effectively use it to evolve their business model.

Moreover, our findings suggest that the decision to choose between these two approaches is often influenced by the level of maturity of the startup. For early-stage startups, the strategy-driven approach may be more suitable as it allows for more experimentation and iteration in response to market feedback. As startups mature and their operations become more complex, the periodic meetings approach may become more necessary to ensure that the various stakeholders are aligned and moving in the same direction.

6.2 Reflections

The decision to conduct this research was driven by the tremendous growth of the software development industry in recent years, with a particular focus on *artificial intelligence*. This study aims to provide a deep understanding of the development of AI products, which is a crucial sub-field of software development. However, it is important to note that there are other sub-fields of software development that can also be studied using a similar approach, and it would be fascinating to explore their unique characteristics and compare them to AI development. To examine these and other related topics, some suggestions will be provided in the following paragraph. By studying other sub-fields of software development, we can gain a broader understanding of the industry as a whole and identify emerging trends, potential areas of improvement, and best practices. This, in turn, can help startup founders and other practitioners to develop their ideas into successful and impactful products. The insights gained from this study can provide valuable guidance to founders and developers in the field of AI and beyond. By understanding the critical success factors in software development and leveraging the best practices, practitioners can develop innovative solutions that can make a real difference in the world. Thus, this research has the potential to facilitate progress and innovation in the software development industry and help shape the future of technology.

The decision to categorize the participants into two distinct groups, instead of solely focusing on one, was a deliberate choice made to gain insights from multiple perspectives. This approach allowed us to explore the topic from the viewpoints of startup founders, as well as support experts and business model evaluators. By including multiple perspectives, the study aimed to provide a more comprehensive understanding of the topic at hand, and ultimately offer more practical and valuable insights to the participants. Furthermore, dividing the participants into these two groups facilitated a more holistic analysis of the data, which provided a more nuanced understanding of the results. For instance, the startup founders were able to gain insights into the perspectives of the support experts and evaluators, which helped them to refine their business models and improve their chances of success. On the other hand, the support experts and evaluators were able to better understand the needs and goals of the startup founders, allowing them to provide more targeted and relevant support. Overall, the approach of categorizing the participants into two groups allowed for a more well-rounded analysis of the data, which provided valuable insights for all involved parties. By adopting this approach, we were able to gather data that would have been impossible to obtain with a more limited study design, ultimately leading to more meaningful and actionable results.

Our research employed a qualitative approach through semi-structured interviews, providing us with an opportunity to delve into the topic from the perspectives of the interviewees. The process involved adapting the survey after each interview, incorporating pertinent topics and elaborating on

others. This approach proved to be advantageous for our investigation. In particular, the ability to generate additional questions during the interviews permitted us to explore the underlying meaning behind the responses, thereby gaining valuable insights. Furthermore, this approach enabled us to have a more flexible conversation with the participants, as it allowed for natural follow-up questions to be asked based on the responses provided. Overall, the semi-structured interview approach allowed us to obtain a more comprehensive understanding of the participants' experiences and perspectives on the topic.

6.3 Future work

As previously stated, this thesis has a narrow focus on the business models within the *artificial intelligence* startup field. Despite this, there are still several potential topics to explore in order to further this research.

We have seen what are the variables for each section and what are the reason why they are important. it would be relevant to investigate ways to measure them. After examining the variables for each section and their importance, it is crucial to explore suitable techniques to measure them. Such analysis will not only enhance the understanding of the data but also aid in decision-making processes. Quantitative variables are typically more straightforward to measure and analyze, leading to more intuitive results. However, measuring qualitative variables can be quite challenging, often requiring a different approach to data collection and analysis. Therefore, it is vital to consider appropriate tools and methods that can accurately capture and evaluate both quantitative and qualitative variables. Such an approach can help in identifying patterns, trends, and correlations in the data, ultimately leading to informed and effective decision-making.

As stated earlier, our research is founded on the *Business Model Canvas*, which is a popular tool among practitioners. Nevertheless, there are other frameworks, such as the VTDF or BMI, that serve the same purpose as the *Business Model Canvas*. Exploring these alternative models could provide valuable insights into the similarities and differences between them. Therefore, a comparative study utilizing these frameworks could shed light on their relative strengths and weaknesses, which could be instrumental in selecting the most suitable tool for a particular business or project.

The limitations paragraph notes that all participants in the study were European, which raises questions about the generalizability of the findings beyond this region. It may be worthwhile to explore the implications of our research in other geographical contexts, as the perspectives and experiences of individuals in different regions may vary significantly. For instance, regulations concerning privacy, ethics, and infrastructure can differ greatly depending on the continent. Therefore, it would be insightful to conduct a comparative analysis that considers the impact of such variations on the outcomes of our study.

There is scope for further exploration of GDPR (General Data Protection Regulation) and ethics guidelines from a legal perspective, as this can provide valuable insights into the impact of these variables on AI products. A thorough examination of the legal frameworks surrounding these issues can help us understand the specific requirements and limitations that need to be considered while developing and deploying AI products. Additionally, it can offer guidance on how to navigate ethical challenges that may arise while using AI technology.

While the current scope of the study is already focused on AI, it can be narrowed down further to specific areas such as deep learning, natural language processing (NLP), or computer vision. By examining these areas, it is possible to identify relevant differences that can inform the development of AI products in those domains. For instance, investigating deep learning can help to understand how to design deep neural networks that effectively process and analyze large amounts of data. In contrast, exploring NLP can provide insight into how to develop intelligent natural language interfaces that can accurately interpret and respond to human language. Similarly, investigating computer vision can offer guidance on how to build visual recognition systems that can analyze and interpret images and video. By focusing on specific areas of AI, we can gain a deeper understanding of the underlying algorithms and techniques that are commonly used in those domains. This, in turn, can inform the design and development of more effective and efficient AI products. Additionally, it can help to identify any unique challenges or considerations that need to be taken into account when developing AI products in those domains. Therefore, narrowing down the scope of the study to specific areas of AI can provide valuable insights into the development of more sophisticated and advanced AI applications.

Finally, it would be intriguing to conduct a comparable study in other fields of software development to comprehend the significant characteristics of those areas and draw comparisons with *artificial intelligence*. Such a study could provide a deeper insight into the nuances of different software development fields and the variables that contribute to success. By conducting such a study, we can gain a better understanding of the commonalities and differences between various fields of software development, and how these fields compare to the unique characteristics of AI development. This can help us identify the variables that are critical to success in each field and provide guidance on how to leverage those variables while developing software products.

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A Interview questions for support experts

1. What is your background?
2. Tell me about your job, what is your main area of interest? With whom do you interact the most within the startups?
3. How long have you been doing this job?
4. Describe to me your evaluation process, what are the steps to evaluate the worth of the startup?
5. In your experience and in your evaluation process, how important is the business model of the startup?
6. What kind of business model
7. What is the scope of the business model in your opinion?
8. What do you look for first when analysing the business model? (must have, should have, should not have, must not have) (red flags)
9. What do you think are the main common differences between the business model of AI startups and other types of startups?
10. In your opinion, what are the main success factors for an AI startup? (Ask the following if not mentioned)
    (a) Product relevance
    (b) Skill diversity
    (c) Data availability/Data quality
    (d) Protection from replication
    (e) Resources (computing power)
    (f) Key requirements for trustworthy AI
11. In your experience, what is the best way to deal with change in a field in constant evolution?
12. What do you think it's the biggest change in your field in the last 5 years?
13. (Do you know someone else I could ask to?)

B Interview questions for startup founders

1. What is your background?
2. What is your role in the company? How much time have you been working here?
3. Can you describe to me your business model? What is your main product? Who are the customers? How big is it? When was it launched?
    - Who created it?
4. When starting the business, has your company created a Business Model document?
    - How has it been created?
    - How is it filed?
    - Is it periodically updated?
5. What is the scope of the business model in your opinion?
6. What aspects of your business model do you think has given you a competitive advantage over other companies in the market?
7. What other aspects do you think had put you in a position of disadvantage?
8. In your opinion, what are the most important business model/success factors for an AI startup? (Ask the following if not mentioned)
    (a) Product relevance
    (b) Skill diversity
    (c) Data availability/Data quality
    (d) Protection from replication
    (e) Resources (computing power, libraries)
    (f) Key requirements for trustworthy AI/Ethical constraints
9. What are the most important aspects to be taken into consideration in the business model? Have there been changes from the first draft? (evolution, change of priority)
10. What are the problems you expect in the next few years? (Change in the environment, new technologies, ...)
11. Have you already formulated an evolution strategy that addresses these problems and aims at scaling the business?
12. Where do you see the company in 5 years?
13. If you could go back, what would you do differently?
14. (Do you know someone else I could ask to?)