How AI Supports Entrepreneurial Decision-Making in Start-Ups at Different Stages in a VUCA Environment

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ABSTRACT,

This study explores how entrepreneurs use Artificial Intelligence (AI) in their decision-making across different stages of their start-up's life cycle. Depending on the decision-making approach causal, effectual, or hybrid, entrepreneurs apply AI in different ways. Using a qualitative research design with semi-structured interviews and a validated survey, this research shows how AI is used for both creative and strategic tasks. The findings show that in early stages, where effectuation is more common, AI helps mostly by saving time and improving communication or idea generation. In more stable phases, where causal logic becomes more dominant, AI supports data analysis, forecasting and planning. This research also expands on the hybrid decision-making framework proposed in prior scholarly work. Through mapping AI applications that can help to explore new ideas (effectuation) and then structure them into plans (causation) in the same action. The research also adds to effectuation theory by connecting new theoretical insights to practical AI use. Finally, the study offers practical guidance for entrepreneurs and highlights barriers like trust issues and data privacy, which impact impactful AI adoption.

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1. INTRODUCTION

New knowledge results in business opportunities and entrepreneurs exploit these opportunities by turning the new knowledge into innovative products (Neumann, 2020). This is done through introducing new physical products, services, or new business models. These advancements often lead to job creation and foster economic growth by supporting the creation of businesses (Neumann, 2020). As a result, the creation of jobs and the reduction of unemployment rates have a significant social impact, improving economic stability (Neumann, 2020). One problem entrepreneurs face is that they operate in a volatile, uncertain, complex, ambiguous (VUCA) environment that forces them to be highly adaptive, where constant innovation is necessary to keep up with the rapidly changing technological and customer preference changes. The VUCA nature of the business world makes strategic decision-making particularly hard for entrepreneurs. External environmental problems like the uncertainty of customer behaviour, economic conditions and technological advancements makes long-term strategic planning guesswork (Ehsani & Osiyevskyy, 2020). Information constraints that come with limited reliable data are responsible for entrepreneurs making critical decisions without having a clear understanding of the risks that are involved (Ehsani & Osiyevskyy, 2020). There are three key parts in decision making that cause start-ups to fail and struggle to grow. Firstly, the decisions must be made fast. Speed in decision making allows start-ups to stay agile and allows them to implement innovations quickly (Gonçalves & Bergquist, 2022). Secondly, with informed decision making through analysing data start-ups can better identify trends, adjust their strategies and identify risks (Gonçalves & Bergquist, 2022). Thirdly, adaptability in this VUCA-landscape is essential to ensure that start-ups are not rigid in their approach and are able to adapt when needed (Gonçalves & Bergquist, 2022). At the same time, it is extra difficult for start-ups to navigate this business landscape as they face liabilities of smallness and newness (Zhang & White, 2016). Mainly because of the lack of experience, it is possible that financial stability and networks are not fully in place (Zhang & White, 2016). The lack of history contributes to the lack of trust and credibility the firm tries to establish. Smaller firms also have fewer connections which makes it difficult to secure the necessary partnerships or gaining visibility (Zhang & White, 2016). As a result, they often struggle with internal business challenges like securing funding, infrastructure and finding the right personnel which makes it difficult to scale up (Ehsani & Osiyevskyy, 2020). Thus, entrepreneurial decision making is very important. To deal with this VUCA landscape, entrepreneurs can use the benefits from the digitalisation of information which is now used by almost all start-ups around the world. Helping entrepreneurs with gathering information to get an edge on competitors. Resulting from this is another relevant development for entrepreneurial decision making, Artificial Intelligence (AI) which can help leverage limited resources and time entrepreneurs have across the start-up's life cycle. AI and GenAI are increasingly being used to improve decision-making using this data. According to studies, AI tools are also being used to help with managing uncertainty, resource allocation and strategic planning (Talebi et al., 2025). More unexplored themes focus on small to medium-sized enterprises and how to incorporate AI and GenAI into their business. This research aims to explore this area further by looking at existing entrepreneurs and seeing how they use AI. More research is needed on how Gen AI can be used for real-time decision making (Sachin Tendulkar, 2024). Real-time decision making is critical in businesses and Gen AI has the potential to support this given its ability to create and adapt to situations. This could give Gen AI a unique advantage (Sachin Tendulkar, 2024). In a broader scope, AI and Gen AI have emerged as powerful tools that could revolutionise the entrepreneurs' approach and maybe solve problems such as managing uncertainty, resource allocation and strategic planning. Traditional entrepreneurs use available data, intuition and experience to make their decisions, but this can soon turn out to be an old-school way of running a business. It may seem easy to just implement all the knowledge from AI and GenAI into your business and run it the same way experienced AI using firms have done. It unfortunately remains a fact that there is no one-size-fits-all solution for the adoption of AI. The impact it will have depends on the entrepreneurs understanding of AI, how it will be integrated and how it will be strategically applied. Actively engaging with AI as a tool will help entrepreneurs to use it as a tool to enhance instead of a replacement of the old ways. Depending on the entrepreneurs' styles of decision-making AI can be helpful in different ways. When entrepreneurs make decisions, they usually follow one of two approaches. The causal approach is more structured and goal-driven, first a goal is set and then the best way to reach it is determined. This approach is best suited to stable and predictable conditions. For AI to be useful in these kinds of scenarios is for it to help with planning and figuring out strategies to reach the goals that where set. Effectuation is the other proven approach used by entrepreneurs. Instead of detailed business plans, it focuses on taking action with the available resources (Effectuation.org, 2024). AI could be more useful in these situations when it helps with providing information about how to properly divide these resources. Reymen (2015) found that entrepreneurs may not stick to just one approach for businesses within a VUCA environment. Instead, they take a more dynamic approach where both causation and effectuation are used depending on factors such as available resources, feedback from stakeholders and market conditions. This ability to adapt is key to successfully launching and growing a business.

Looking at the complexity of the VUCA environment and the critical role of decision-making in the start-up's success, it is clearly essential to determine how AI can support entrepreneurs throughout different stages of business development. To obtain a better understanding, this research looks at the start-up life cycle model by Churchill and Lewis (1983) which consists of stages such as existence**,** survival and success**.** Each of these stages has unique challenges. By focusing on how AI can support entrepreneurial decision-making across these stages, this study aims to answer the research question: ***"How does the current state of AI support entrepreneurial decision-making in start-ups across different stages of development* (*existence, survival, success) in the VUCA business environment?"***

This study also intends to answer the sub-question: ***"What are the current barriers of adoption of AI in support of entrepreneurial decision-making in start-ups across different stages of development (existence, survival, success) in the VUCA business environment?"***

By employing qualitative research, this research paper aims to report knowledge acquired from real-world experiences from real-world entrepreneurs. It also intends to provide insights into the entrepreneurs' usages of AI in assisting in deciding when to use what AI tools. This study contributes a new dynamic framework to select the best course of action in different circumstances. It will build on existing theories about entrepreneurial decision-making, start-up development and AI-driven decision support. The findings will be useful for

entrepreneurs, start-up accelerators, investors and policymakers to make better-informed choices with the help of AI.

2.THEORATICAL FRAMEWORK

2.1 Start-Up Development Stages

Start-ups face various challenges throughout their lifecycle which can take different forms at each stage (Passaro et al., 2016). To analyse how these challenges change over time, this research paper adopts the start-up development stage model of small business growth proposed by Churchill and Lewis (1983). This model outlines five stages of development that consist of the existence, survival, success, take-off and maturity stages. Beginning with the existence stage, the main challenges are acquiring customers and delivering the end products or services (Lewis & Churchill, 1987). The number of people running the small business in this stage is often very low which puts a lot of pressure on them as they have to arrange everything (Vogel, 2021). This, in combination with the common problem of limited resources and working capital, results in a race against the clock to acquire the first paying customers (Vogel, 2021). The second stage is the survival stage where the start-up must prove they can satisfy their customers enough to retain them. At this stage the key challenge is, 'How can we, at a minimum, generate enough cash flow to stay in business and finance growth to a size that is large enough, given our industry sector and market niche, to generate an economic return on our assets and labour?' (Lewis & Churchill, 1987). The most important decisions entrepreneurs must make concern how to increase revenue and reduce costs with the limited resources available to the company (Vogel, 2021). Many start-ups remain at this stage for a long time, seeing only marginal profits and eventually going bankrupt (Lewis & Churchill, 1987). Other start-ups will grow in size and profitability and move on to the third stage, the success stage, where entrepreneurs are faced with the decision of whether to expand or keep the company stable and profitable (Lewis & Churchill, 1987). Expanding the business means taking a risk and trusting that the entrepreneur can bring the business to new hights. If this fails than financial problems can result (Vogel, 2021). Challenges that come with this path include operational challenges in the form of budgets, hiring and acquiring new employees and resources, and extensive strategic planning to grow the company (Lewis & Churchill, 1987). At the fourth stage, the take-off stage, external changes in trends may lead entrepreneurs to an expansion even when they want to keep their successful position (Team, 2024). Here the company can leverage the optimised operating, marketing and sales plans they have already implemented (Team, 2024). Key challenges and decisions to be made at this stage include finding the right financing options, figuring out how to address increased demand while maintaining quality and efficiency, and how to remain competitive in a rapidly changing environment (Team, 2024). Lastly, there is the resource maturity stage where the company has developed a plan and practices that reliably produce relatively consistent returns (Vogel, 2021). Key challenges and decisions to be made at this stage include finding a way to continue innovating, finding a way to optimize the use of resources, and breaking down long-term goals into actionable steps (Team, 2024). Throughout the life cycle of the start-up, subletting and risks change in size and form (Lewis & Churchill, 1987). The most uncertain stage is often the existence stage (Lewis & Churchill, 1987) in which the path to the market is not yet clear and the demand has not yet been proven. As a result of this lack of clarity, they often opt for the effectual approach, using what they have. As the start-up becomes more stable things become more predictable. With more data and less uncertainty, and because of this shift in uncertainty, entrepreneurs often shift towards a more causal approach in the later stages of the life cycle (Reymen et al., 2016a). The survival stage faces similar problems and is still in an uncertain position due to its fragile nature (Team, 2024). As start-ups reach the success stage, their activities become more predictable, but of course they are not risk-free. At the take-off stage risks increase again due to the uncertainty that comes with funding and proper planning (Lewis & Churchill, 1987). The last stage caries the least risk because it focuses on refining what the business knows will work (Team, 2024).

2.2 Entrepreneurial Decision-Making: Causation vs. Effectuation

An entrepreneur's decision-making is crucial in successfully organising a process under unpredictable circumstances (Reymen et al., 2015). Therefore, a decision-making tool or logic is needed (Sarasvathy, 2001). To support decision-making, Sarasvathy helped lay the groundwork of a decision model that introduces two types of processes: effectuation and causation (Sarasvathy, 2001). Effectuation is, in its simplest form, 'start with what you have and build on it as you go' (Effectuation.org, 2024). Entrepreneurs follow these five principles in their decision-making process and daily behaviour to put the effectual approach into practice (Effectuation.org, 2024). The first principle is about looking at an entrepreneur's current resources, such as who he/she is, what connections he/she has, and what he/she knows (Effectuation.org, 2024). The second principle says, don't focus on what you can gain but focus on what you are willing to lose (Effectuation.org, 2024). The third principle is about flexibility and how the entrepreneur should view setbacks as a potential for innovation (Effectuation.org, 2024). The fourth principle states that entrepreneurs should start finding partners early and the last principle looks at how the entrepreneurs should focus on things they can control (Effectuation.org, 2024). This type of decision-making differs from effectuation in that the causation decision-making process starts with the outcome and then focuses on selecting the most effective way to achieve it (Sarasvathy, 2001). It assumes that the future is predictable and therefore relies on analytics to achieve the chosen goal (Yu et al., 2024). This process works best in a static environment where selecting a key decision based on expected returns is most reliable; effectuation is more effective in a dynamic environment (Sarasvathy, 2001). Causation also seems to fit better in large companies and effectuation works better in smaller companies (An et al., 2019). According to Sarasvathy and Reymen, effectuation is more successful in the early stage of companies. Looking at Churchill and Lewis's model, it can be argued that this falls under the existence and survival stages in which a dynamic environment is present (Sarasvathy, 2001) (An et al., 2019). Later stages (success, take-off, resource maturity) benefit more from causation (An et al., 2019), due to the benefits of careful planning during scaling (An et al., 2019). In practice, entrepreneurs use a hybrid of effectuation and causation elements in decision-making, allowing them to both plan and adapt (Reymen et al., 2015). At times one approach may be more apparent but over time they will shift along the life cycle (Reymen et al., 2015).

2.3 AI in Entrepreneurial Decision-Making

AI in business decision-making refers to tools used to analyse information, identify patterns, predict outcomes, and support or automate choices, enabling companies to make faster, better-informed, and often more objective decisions (Lumenalta, 2024). Due to the VUCA environment combined with intense competition, AI has become an important factor for start-ups

(CEO, 2025). Recent advancements in AI can help start-ups to be more efficient in product development, marketing and financing (CEO, 2025). Recent studies have shown that the adoption of AI positively correlates with economic performance (Uriarte et al., 2025). Analysing large amounts of data with AI can help entrepreneurs identify new trends and customer behaviours that would be difficult to see without the use of AI (Uriarte et al., 2025). This results in more responsive decision-making in an ever-changing environment (Uriarte et al., 2025). Not every company is ready for this. Four key dimensions help analyse the company's potential for its transformation, goals, activities, boundaries and technologies (Holmstrom, 2021). Mapping these dimensions of the company can help with finding a good fit for the use of AI (Holmstrom, 2021).

2.4 AI Use with Decision-Making Logics and Start-Up Stages

The development stage of the start-up determines the impact of AI and what it is used for (Schiavone et al., 2022). In the existence and survival stages where a more effectual decision-making style is more common, AI can mainly be used to anticipate market trends and customer behaviour, and thus to improve product development by identifying customer behaviour patterns (Expert Panel, 2024). But AI is most useful in the later stages of a start-up (success and take-off stages), where causal decision-making approaches are more typical. In these stages, the points mentioned above are still used, but the focus shifts to AI driven financial forecasting to help with scaling, with a focus on improving efficiency and reducing costs (Kapuściński, 2024). As the start-up moves from the survival stage to the success stage, the main approach used shifts from effectuation to causation, and changes from a more adaptive and experimentational approach to a more data driven use of AI where decisions are made based on forecasts and expected returns.

2.5 Barriers to AI Adoption

The use of AI seems straightforward these days, but there are still some barriers between the adoption of AI by small businesses, as pointed out by Zavodna. The first barrier is a lack of trust which stems from ethical concerns that come with using AI (Zavodna et al., 2024). The second barrier is the lack of knowledge: not knowing what AI can be used for and how to use it correctly can make AI less attractive (Zavodna et al., 2024). And lastly, a lack of infrastructure can hinder the potential of AI (Zavodna et al., 2024).

A clear research gap has been identified, namely that the start-up development stage model of small business growth proposed by Churchill and Lewis is not supported by recent AI developments. Showing which AI tools are used at early stages could expand on the usefulness of the model. This gap could be present because of the use of different models that are preferred by researchers up until now.

3. RESEARCH METHODS

This chapter explains how data was collected and analysed to answer the research question: "How does AI currently support entrepreneurial decision-making in start-ups across different development stages in a VUCA environment?" A qualitative approach was chosen to get an in depth understanding on the experiences of entrepreneurs. Since this topic is still developing and not many studies exist yet on the topic, semi-structured interviews were the best way to get detailed insights. This section will describe the interview setup, participant selection, how the data was coded and how this leads to a set of aggregate dimensions.

3.1 Research Setting

Over the years, AI has seen rapid growth in capabilities and popularity. Extensive research has been conducted on the topic; however, small start-ups specifically and their current engagement in this topic are not the focus of most research. This study attempts to answer how the current state of AI supports entrepreneurial decision-making in small start-ups at different development stages in the VUCA environment. It uses an exploratory, qualitative design because there is a lack of existing empirical data on how AI currently supports decision-making of entrepreneurs in small start-ups. Because this study is done in the Netherlands with an advanced digital infrastructure and an advanced economy, the results are influenced by the fact that the Netherlands has and environment where AI tools are widely available and adoption is relatively high. With the result that entrepreneurs participating in this study may face fewer barriers when it comes to accessing and implementing AI. Alongside this there are potential other benefits of AI users in the Netherlands that take advantage of the digital infrastructure and advanced economy that is in place.

3.2 Sampling Approach

The participants in this study are purposefully and carefully selected based on the following factors: is the entrepreneur in the existence, survival, or success stage? Has the entrepreneur incorporated AI in the start-up? Does the entrepreneur have a reason for not using AI? To avoid unfair sampling, this research interviews a wide range of entrepreneurs from different sectors, countries and start-up stages. This will lead to richer insights into the overall use of AI in the decision-making process of start-ups. It also helps to explore a broader range of perspectives and identify potential supports and barriers to AI use. Some characteristics of the entrepreneurs and their startups that participated in this study are included in Table 1 that is in the appendix.

3.3 Data Collection

A primary data collection approach was used for the interviews. Next to this there was a survey conducted that also used a primary data collection method.

3.3.1 Interviews

The interview is structured in such a way that the participants' current development stage is first revealed. Then, the main decision-making style is uncovered. Furthermore, the participants are asked about the AI tools they use in their decision-making and the barriers to the adoption of other AI applications. Before starting the interview, the participants were asked for their permission to record the conversation. If they gave permission, the interview was transcribed and translated and used for this study while the participants will be maintaining their anonymity.

Most interviews were conducted online via Teams or video calls. Participants were informed about the general topics, ethics and privacy before start of the interview. The duration of each interview was between 25 and 40 minutes. Variations in time are since not every interview contained the same questions. Although a specific questionnaire was prepared in advance, the conversation line was different due to the different focus points of the start-ups.

3.3.2 Survey

In addition, a survey was completed before the interview was conducted to gain better insight into thedecision-making style the entrepreneur uses. The questions in this quantitative survey are

based on the study of Chandler (Chandler et al., 2011). Twenty questions were proposed to find out what decision-making style entrepreneurs uses. For this research report, some changes were made to the questionnaire, mainly to shorten it by combining questions. The results of the survey were not considered when taking the interview to avoid bias in the research. The alignment of both results will serve as confirmation of accuracy.

3.4 Data Coding and Analysis

The Gioia method was used to analyse the qualitative data from the interviews. This helped to transform the complex information into clear insights by organizing it into patterns via structured and rigorous coding (Jena, 2024). Conceptual categories emerge as a result which leads to an AI-supported entrepreneurial decision-making framework (Jena, 2024) and will be helpful in answering the research question. ATLAS.TI was used as a tool for qualitative data analysis. Transcripts of the interviews were first examined for relevant sentences or words that could help with answering the research objectives like applications, positives and negatives of AI use, and these quotes where then grouped into first-order codes that stay close to what was the participant originally said. Subsequently, similar codes were then further grouped and processed into themes. Finally, these themes were distilled into aggregated dimensions which supported building of the theoretical framework. The resulting second-order themes and aggregate dimensions were then compared with existing theoretical constructs from the literature on effectuation and causation (Sarasvathy, 2001), and start-up development (Churchill & Lewis, 1983). This comparison served to try to derive new theoretical implications on how AI use is affected by which life cycle stage the start-up is in and what decision-making style entrepreneurs are using.

4. RESULTS

This chapter reports the 1st-order codes and 2nd-order themes that were found in the qualitative interviews that were conducted. These data shed light on what each 3rd-order aggregate dimension is built upon. The aim of this study is to understand how AI supports entrepreneurs' decision-making and what the current barriers are to AI adoption in start-ups at different stages of development within a VUCA environment. Based on the interview data, five main aggregated dimensions were identified: AI for causal decision-making**,** AI for effective decision-making, AI for hybrid decision-making**,** perceived enablers and drivers of AI adoption, and perceived limitations and risks of AI adoption. These categories help to organize the wide range of applications and opinions on AI in entrepreneurial decision-making, and provide insights into how AI tools are applied, what value they offer, and what challenges entrepreneurs face when adopting them. The following sections describe each of these dimensions in more detail and a clear data structure can be found in the appendix under the name Figure 1 and Figure 2.

4.1 AI for Causal Decision-Making

While there is only one participant who is determined to have a causal approach to decision-making, there are still other participants who have used AI applications that fall under a causal approach. Reviewing the interview data, it is clear that there are many uses for AI in causal decision-making, but participants primarily use it to support structured, goal-oriented business decisions. One of the ways it does this is by providing detailed information on various topics that are important to know before making key decisions, or even just to learn about the topic and get a feel for it, in a quick and easy way. AI is also used for in-depth market screening and competitor analysis. For example, some participants indicate that it is useful for creating marketing strategies because it is able to screen a wide range of markets and the active players in a very short time. Then they can focus on the most interesting ones they have identified. This speeds up the process while still allowing them to make their own judgment to verify the results. *(P-6) 'I'm using that quite a lot to rationalise and give context based on competitors, especially on their business models and then I ask contextual questions to guide me on the right path, where I want to build my strategy.'*

A few interviewees also indicated that AI is useful for the strategic business analysis, especially in complex industries. *(P-7) 'This market and the healthcare markets; it's very complex and AI can really help us better understand the market.'*

Another application of AI has for causal decision-making is predictive modelling, as one participant indicated. Although this participant indicated that it is not being used as much in practice as he would like, he sees it as a real opportunity in the near future.

4.2 AI for Effectual Decision-Making

Participants described the use of AI primarily as a support tool in the decision-making process, rather than replacing their own way of working. This is especially true in the early stages of the company's life cycle. For example, AI is seen by some as an adaptive tool that is not essential to the core business operations. This underlines the fact that interviewees prefer human judgment in the decision-making process. However, it is seen as very useful as it can take over tasks that they would otherwise have to do themselves, which would take up a lot of time that could be better spend elsewhere. This underlines the fact that interviewees prefer human judgment in the decision-making process. Instead, AI is seen as an extension of human reasoning and can, in some cases, provide ideas that, if it resonates with others, could be implemented directly in the company after review. It is also used to challenge ideas and check how common tasks are carried out in companies. Another way AI is helpful in effectual decision-making is through the enhancement of creative and strategic communication. For example, it is used to better express ideas in text form, so that the idea can come across as more structured or effective. Another application that one entrepreneur mentioned was using make.com to enhance the efficiency and quality of blog posts. This helps with the overall clarity of communication between entrepreneurs and those they interact with. The most important way that AI helps is by streamlining tasks and enhancing operational efficiency. It was mentioned that AI could almost completely take over some administrative tasks and make workflow more efficient by taking notes. This allows entrepreneurs to focus better during meetings as they don't have to remember specific details about a meeting or conversation. AI is also noted to aid in workflow efficiency by condensing two-hundred-page reports into a summary of the most important information, saving a lot of time in the process. Routine tasks such as accountancy are also becoming less time consuming with the use of AI according to some respondents. One participant even suggested humans in accountancy might be completely replaced. *(P-5) 'You are now going to see in the market that people are going to become totally obsolete, in things like accountancy, due to the progress of AI.'* Two participants also used other smaller tasks that AI performs, such as extracting specific information from invoices and reading and categorising documents. Another reoccurring way respondents have reported to have saved a lot of time is through using AI in programming and coding, saying that they feel it works even better with numbers instead of letters. There are also some practical applications participants identified that boost speed and cost-efficiency of early start-ups. One participant indicated that higher-educated employees are not needed to perform creative work. *(P-10) 'In early stages in start-up you could give all creative tasks to AI and not hire an actual person early*

on.' Another participant noted that hiring team members who are familiar with AI and prompting can be a cheaper and more effective way for early start-ups to be successful.

4.3 AI for Hybrid Decision-Making

Some participants indicated that they are using AI in such a way that they combine ideation and planning within the same task. Rather than using them separately, they explained how the AI tools help them move in-between both ways of decision-making in the same process. One participant described how AI actively supports them by identifying possible directions the company could go in, also providing them with pros and cons of each direction.

AI tools such as Chat GPT were also mentioned as an aid in idea generation in the ideation phase to serve as an opposing perspective. *(P-5) 'So in ideation, if we may say so, I may use Chat GPT as devil's advocate.'* Another interviewee used AI to help generating ideas on how to approach market analysis and test different target groups. While AI is also being used to improve strategies by identifying pitfalls, it is used in the internal creative process as a kind of external validation. What all these different applications have in common is that AI may serve as a tool that can discover things that are easily overlooked or cannot immediately be anticipated.

4.4 Perceived Enablers and Drivers of AI Adoption

The data highlight several factors that contribute to the successful adoption of AI tools in start-ups. Respondents emphasised that the AI adoption supports business operations by automating non-core tasks. New start-ups in particular claim to have more time to focus on other more important decisions. This allows them to exist longer as a small business with a few employees which would normally waist a lot of time performing menial work that is now done in the matter of seconds, maybe even better than a human could. This is also seen in other scenarios such as using ChatGPT to save time on emails by summarising text. Or using Enreach to automate customer flows or using HubSpot for email communication and automated newsletter sending. Another key driver of AI, according to some participants, is the growing trust people have in it. With the technology improving and the new, paid version of ChatGPT being able to provide sources with the outputs, it becomes easier to verify the provided information. Participants said AI is now more trustworthy than ever before.

The ease of use is also highlighted to be a major factor for the entrepreneurs to adopt AI. For example, ChatGPT was often cited as very easy to use, and prompting was seen as an essential but easy-to-learn skill that is becoming more important in the business world. *(P-10) 'Prompting is the most important thing, it is quite easy to learn. So yes, you just need technical knowledge, which is not difficult to get to be honest.'*

It should be noted that AI is mostly not used by participants to make decisions, but rather as a support. For example, some participants use AI to improve strategic and professional work, for business planning and customer support, or for professional consulting tasks. *(P-3) 'That is going to happen more and more, that you just get complete advice pieces from AI.'*

4.5 Perceived Limitations and Risks of AI Adoption

A major concern expressed by several participants involved the limitations and risks they perceived when trying to adopt AI in their decision-making processes. While they acknowledged the potential of AI, most were unsure about its reliability, accuracy, and whether it could really fit into the way they currently run their business. Entrepreneurs often mentioned limitations associated with technology. Many lacked confidence in the outputs of AI and questioned the effectiveness of using it. AI was mentioned to perform very poorly in specific tasks such as target group creation because it struggles with analytically complex problems. These are problems that require deep thinking and balancing multiple factors in a complex scenario. Participants were also critical about the effectiveness of AI in decision-making, stating that they would rather see it as a tool to support decision-making instead of an independent decision maker. AI alone would not be capable of making important decisions and relying on AI to make your decisions would not help you make better decisions. This is also why participants mentioned that the quality of the outputs from the AI-generated content is currently substandard and lacks authenticity. Some participants referred to the lack of imagination and creativity in the outputs coming from AI. Reliability issues were the most frequently mentioned limitations of AI. Due to the imperfect accuracy of AI tools, most of the interviewees say they always double-check the results to avoid errors. They also stated that it is important to look for different sources when using AI to validate the outputs and not to take everything for granted. Thinking for yourself is therefore strongly advised according to the participants and judging whether the information provided is correct is ultimately still the responsibility of the user. Another limitation that was identified is that AI tools such as ChatGPT often give unexpected and inconsistent answers. You can ask the same question, and the AI will give you different answers. This further illustrates the lack of reliability that comes with using tools such as ChatGPT, which is not seen by the participants as useful for decision making, which requires consistency. Another common concern lays in the human-related AI limitations. Firstly, because some participants felt that they have limited experience and knowledge about AI which leads to less AI adoption. Additionally, many participants indicate that they do not want to become too dependent on the use of AI as they fear of losing control over what the business is about and how everything works. This results in scenarios where the entrepreneur simply does not understand why or how AI changes things. *(P-6) 'You don't know you're not an expert in the field for instance with programming. If you don't know what the code is about, then you don't know how good the code is.'*

Some participants also mentioned that they would like to see proof of AI's value before they would use it themselves. They want other entrepreneurs to show in practice that it is worth using and how to implement it easily, rather than figuring it out themselves. Additionally, a few participants mentioned that they prefer human judgement and critical thinking. They would rather make decisions based on instinct then AI led decision-making. There are also the societal-related AI limitations with people indicating that they are hesitant to use AI because of the impact it has on the environment. Because of the huge amount of computing power that tools like Chat GPT require to function and the negative consequences that come with it. They stated that they are not comfortable with the harmful effects and would only use AI if they see a direct, measurable benefit from it. The lack of legislation is also a point some interviewees were concerned about; they would like to see improvements in the coming years. Privacy and ethical aspects were also mentioned. Dealing with private customer data in particular was seen as a slippery slope and sufficient reason for participants not to use AI when sensitive information was involved. *(P-6) 'With these new AI tools, the data privacy is going to be less secure.'*

And lastly, there are the economic-related AI limitations where barriers are identified in terms of perceived value and ease of implementation. This means that some participants don't see the

need to implement AI in their business because they either don't see the value in it or find it too time-consuming or expensive to easily adopt. In addition, they expressed that after implementation, they were not sure if the workflow efficiency increased using the AI tools. This is because the time it takes to set the parameters correctly so that the AI can assess a problem is often longer than solving the problem itself.

5. DISCUSSION

This chapter reflects on the main findings and connects them to the existing theories and practical use of AI in start-ups. It will also highlight some limitations of the research as well as some suggestions for future research. The goal was to understand how AI supports decision-making across different stages of the start-up life cycle.

5.1 Summary of Key Findings

The implementation of AI in entrepreneurial decision-making is not as straightforward as just using a new tool. The results show that how AI is used depends on several factors, like what stage the business is in, what kind of decision-making style the entrepreneur uses, what resources are available, and how the entrepreneur personally feels about AI. It's not something you just add to a start-up; it's part of a bigger and more complex mix between technology, human judgment and the way the business is run. This means that using AI properly requires some thought. Entrepreneurs need to carefully manage how they use it, especially when trying to optain the benefits while also dealing with its limitations. This becomes clear when looking at how differently AI is used in practice. AI was for example found to have a supportive role for start-ups with a causal decision-making style which is more common in the success stage of the business's life cycle, that can provide value through structured and data driven support for tasks such as market screening, competitor analysis and scenario modelling. Thus AI can serve as a helper that does not take over decision-making but instead supports the entrepreneur by providing useful outputs that show aspects of a problem the entrepreneur has likely not thought about. This supports the idea in Sarasvathy's work that causation fits well with planned and goal-driven thinking. AI also plays a significant role in effectual decision-making which is more common in existence and survival stages of the start-ups life cycle. Not to make the decisions but to free up time by letting AI help with more time-consuming tasks so important decisions can be thought about more carefully. This fits well within Sarasvathy's theory of effectuation, where entrepreneurs use the resources they have and adapt as they go. In hybrid decision-making, some entrepreneurs explained that they don't just use AI for one part of the process but mix things like planning and ideation together. AI helps them come up with different directions the business could go, including ones they hadn't really thought about before, and it even gives pros and cons for each option. Tools like ChatGPT are also used during brainstorming to give feedback, challenge ideas, or point out things they might have missed, what they then use to plan out strategies. This extends the theory of hybrid decision-making by Reymen, showing that AI can support entrepreneurs in moving between effectual and causal logic within the same decision. Alongside these three types of decision-making styles the data also revealed enablers and barriers of AI adoption. With the enablers including ease of use, growing trust in AI outputs and to save time. With almost all participants agreeing that AI is becoming a necessity for businesses especially in the existence and survival stages of the business life cycle. On the other hand, common limitations were that outputs are still not seen as fully reliable and entrepreneurs should not put their full trust in AI, so they don't become over reliant on it. Human judgment is also still greatly valued, and AI is not yet seen as being capable of making choices on its own. Privacy and environmental impacts were also found to be limiting factors that were visible in all stages of the lifecycle. Although almost all participants were in favour of using AI, they did not agree in what scenarios to use it, and they had different reasons on why they did or did not use certain kinds of tools.

5.2 Theoretical Contributions

This research builds on effectuation theory by showing how entrepreneurs with different decision-making styles use AI in different ways (Sarasvathy, 2001). In early stages like existence and survival, entrepreneurs often follow an effectual logic, where they adapt as they go and use the resources they have. This study shows that in those situations, AI is used more for support tasks like idea generation, time saving, and communication. In later stages like success, entrepreneurs shift to a more causal approach, where AI is used for things like forecasting, market analysis and planning. This research also connects to Reymen et al. (2015), who describes how entrepreneurs often use a mix of both styles depending on the situation. My findings support this and show that AI can actually help combine these approaches, for example by helping to explore new ideas (effectuation) and then structure them into plans (causation) in the same action. Expanding the existing literature of hybrid decision-making and how it works in practice, this study also builds on Chandler et al. (2009), who developed survey scales to measure effectuation and causation. By identifying the start-ups decision-making approach and also looking at how AI is being used for these approaches, there could be additional scales added to more effectively measure the decision-making style of businesses. Finally, the study adds to Churchill and Lewis's (1983) start-up lifecycle model by showing how AI use changes over the different life cycle stages and how decision-making styles shift as the business grows. This study adds a new layer to an older model that didn't yet account for technology like AI.

5.3 Practical Implications

This research shows that AI can be a useful tool for entrepreneurs, but how it's used depends on the life-cycle stage the business is in and the way the entrepreneur makes decisions. Entrepreneurs should try to match their use of AI with their current decision-making style and the challenges they face in each stage. In the early stages, where resources are limited and things are still very uncertain, AI is most helpful when it's used to save time and take care of repetitive or creative tasks. In later stages, when businesses become more stable and data becomes more available, AI can be used more for strategic tasks like market analysis or financial forecasting. This means entrepreneurs need to be aware of where they are in their journey and apply AI accordingly. Another practical implication is that AI works best when it supports decisions-making not when it replaces human thinking. Many of the entrepreneurs in this study said they still rely on their own judgment and use AI more like a second opinion. In some cases, AI even gives inconsistent or unclear results. So, it's important that entrepreneurs don't rely on it blindly but instead learn how to use AI effectively, with the right balance between automation and thinking on your own. Some start-ups in this study said they were hesitant to use AI because of privacy and ethical concerns. Policymakers could help by making clear rules for using AI, so entrepreneurs can use it in a responsible way and feel more confident about it.

5.4 Limitations

This study mainly focused on interviews to get a better understanding of how entrepreneurs are using AI in their own words. This was useful because it allowed participants to speak freely and share their stories, but since every conversation went in a slightly different direction not all topics were covered in the same way. Future research could add a quantitative approach like surveys to collect more consistent data. This would help support the findings. Secondly, the data is based on what the participants think their experiences with AI are and what the results from using it are, which can differ from what they really are. Combining the interviews with studying data from the business and seeing how they use it could help future research validate these findings. Lastly, because this research only looks at businesses' AI use at a single moment, it loses its value quickly because AI tools are rapidly evolving making it possible that the results in this study loose value over time.

5.5 Suggestions for Future Research

Even though this study tries to investigate how AI is currently supporting entrepreneurial decision-making across different start-up stages, there are still plenty of areas that are yet to be explored. One thing future research could focus on is following multiple start-ups across their life cycle, showing how their AI use changes over time. Another option is to focus on a single industry, resulting in a focused target group. This will bring more directly usable results to the people of that industry. Quantitative research could also be helpful for future researchers to get an idea of what the hard numbers are on using AI in start-ups. So how much time does it save, or work is able to be done this much faster with AI. Further research about the impact on privacy and the environmental impact of AI tools like Chat GPT could also help broaden people's perspective of AI use.

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7. APPENDIX

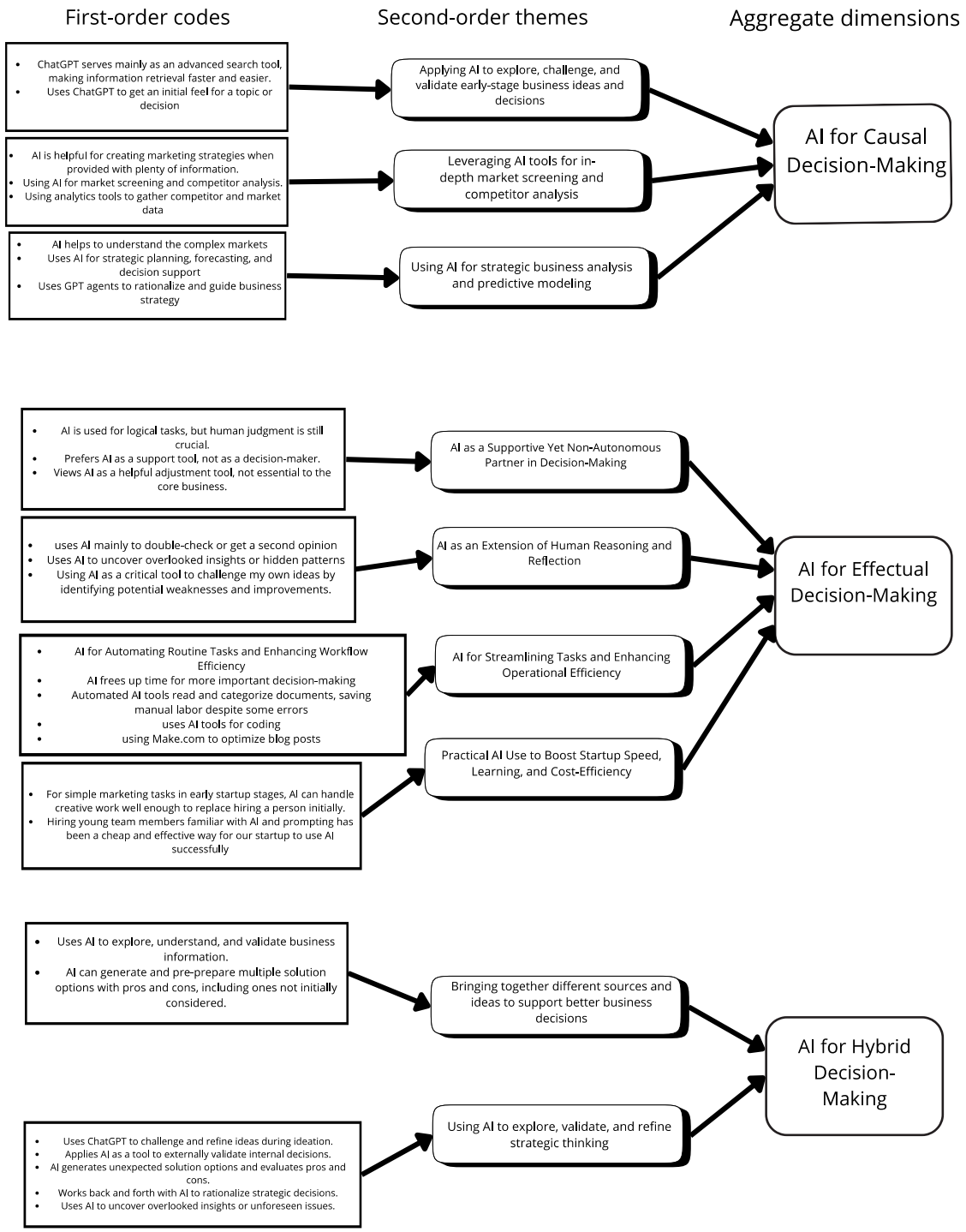

Figure 1. Data Structure

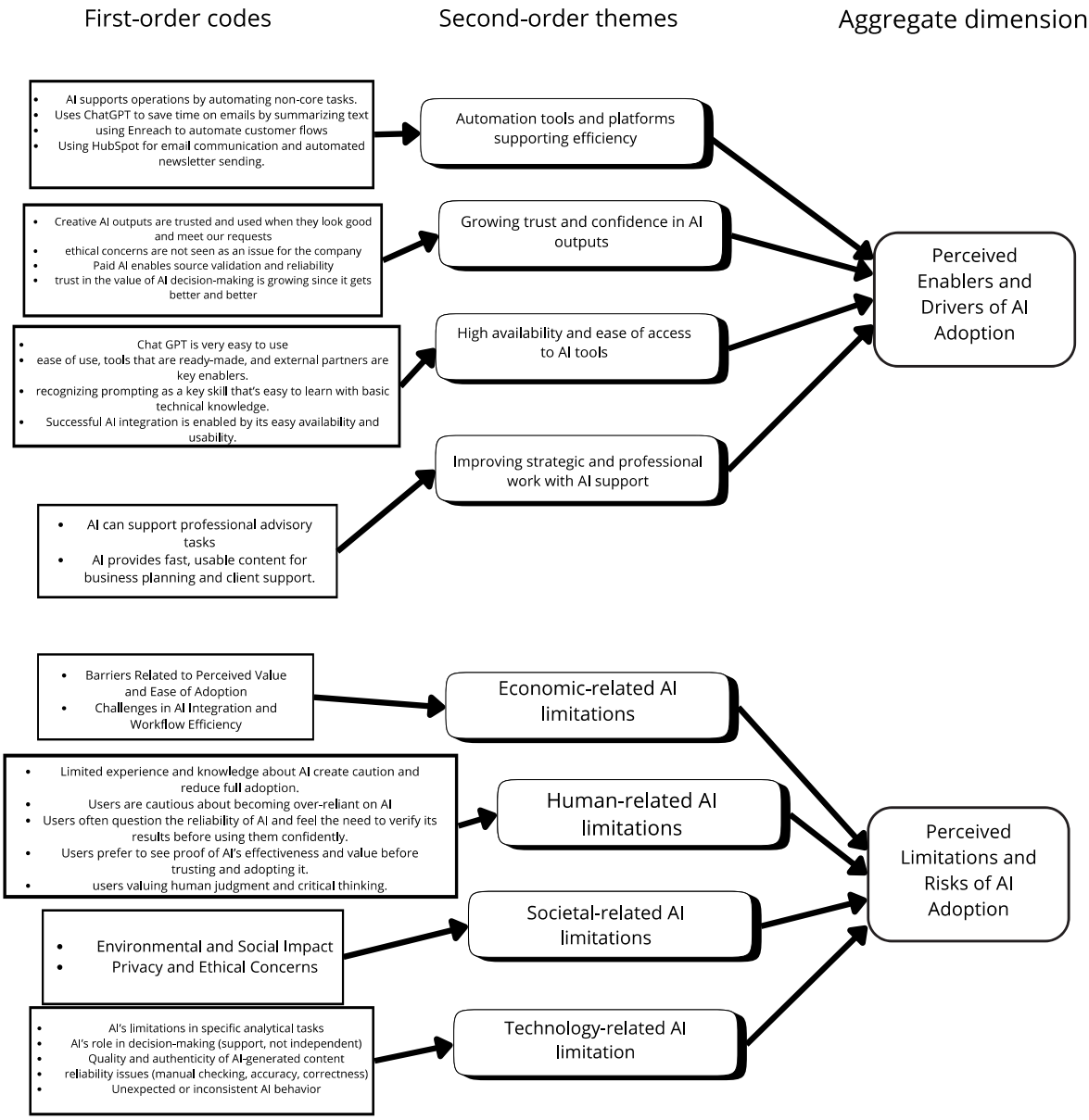

Figure 2. Data Structure

Participants	Industry	Employees>10	Employees<10	Effectual/Hybrid/Causal	Position
1	Technology Industry		X	Effectual	CEO/Manager/Director
2	Accessibility Technology		X	Hybrid	Co-owner
3	Financial Services Industry		X	Hybrid	CEO/Manager/Director
4	Environmental Technology Industry		X	Effectual	CEO/Manager/Director
5	Industrial Technology Industry	X		Causal	Co-founder
6	Performance Marketing Industry		X	Hybrid	Co-founder
7	Medical Technology Industry		X	Hybrid	CEO/Manager/Director
8	Environmental Technology Industry		X	Effectual	CEO
9	HealthTech Industry	X		Hybrid	Brand manager
10	Travel Tech Industry		X	Effectual	Co-owner

Table 1. Participants