The Scientific Approach to Pivoting

A Qualitative Study Identifying Factors Influencing Its Adoption in Startups.

Radboud Universiteit

Author: Milan van Ampting

Student Number: S1063643

E-mail: milan.vanampting@ru.nl

Supervisor: Prof. Dr. B. Hillebrand

Second Examiner: Dr. R.A.W. Kok

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Abstract

This study examines the role of factors that influence the adoption of the scientific approach to pivoting. This scientific approach to pivoting refers to a structured, evidence-based method for strategic decision-making. Prior studies have highlighted the effectiveness of this approach, but empirical understanding of factors that influence its adoption remains lacking. Therefore, the question: "*What factors influence the extent to which startups adopt a scientific approach to pivoting?"* is formulated to guide this research. This research question is answered by a qualitative research design, involving 28 semi-structured interviews with key decision-makers of startups that have executed a pivot. The analysis of the interviews revealed six factors influencing the adoption of the scientific approach to pivoting: theoretical expertise, entrepreneurial experience, team capacity, resource availability, client pressure, and investor pressure. Additionally, this study revealed that the startup stage is an important antecedent, influencing the factors: team capacity, resource availability, client pressure, and investor pressure. This study contributes to the extant literature by offering a more comprehensive understanding of the adoption process, complementing prior work that mainly focused on the outcome of the scientific approach to pivoting. It also offers practical implications for startup entrepreneurs, incubators, and investors. The identification of these factors enables practitioners to create conditions that stimulate the adoption of the scientific approach to pivoting.

Key words: scientific approach, pivoting, strategic decision-making, startup

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Introduction

The operations of a startup are often executed in an environment with high uncertainty, where pivoting is critical for the survival and growth of the firm (Burnell et al., 2023). In comparison to mature firms, startups have to make decisions under very uncertain and dynamic circumstances (Folta, 2007; McMullen & Shepherd, 2006; Townsend et al., 2018). These decisions include considerations of whether their current strategy is sufficient, or strategic corrections should be executed to achieve the firm's goals (Ries, 2011). It often results in changes in a firm's strategy that reorient the strategic direction. This leads to a reallocation or restructuring of activities, resources, and attention. This process is called pivoting (Kirtley & O'Mahony, 2023). There has been an increase in management research on pivoting as a mechanism for firms to cope with uncertain and changing circumstances.

A major challenge for startup entrepreneurs is decision-making under uncertainty. Entrepreneurs often have to decide to pivot or persevere in different circumstances (Ries, 2011). The extant literature suggests that many entrepreneurs rely on a classical approach in their decision-making, which is driven by the intuition and heuristics of the entrepreneur (Camuffo et al., 2020). These entrepreneurs frequently fail to take the simplest steps toward the exploitation of their ideas (Bennett & Chatterji, 2023). This highlights the need for an alternative approach that can improve the quality of entrepreneurial decision-making under uncertainty. The literature describes the scientific approach to pivoting as such an alternative (Camuffo et al., 2024). This approach relies on systematic hypothesis testing driven by data rather than using intuition and heuristics in the classical approach (Camuffo et al., 2020). The structure of the scientific approach to pivoting consists of four sequential steps. It starts with developing a theory explaining how the firm creates value and identifying its core problems. Secondly, hypotheses should logically flow from the developed theory. These hypotheses are then rigorously tested through experimentation. Finally, the results of these experiments are critically evaluated to guide strategic decisions (Camuffo et al., 2024; Novelli & Spina, 2024). Startups that rigorously follow the steps of the scientific approach are more likely to improve performance in terms of revenue and growth (Camuffo et al., 2024).

Despite growing attention to the pivoting process as a solution for uncertainties, there is a lack of guidance for the scientific approach in the literature. The implementation of the scientific approach to pivoting in practice is still underexplored. Studies have emphasized the effectiveness and advantages of the scientific approach to pivoting (Camuffo et al., 2024).

However, the literature lacks an understanding of the factors that influence the adoption of the scientific approach to pivoting. The extant literature describes many factors that trigger pivoting, but factors that specifically influence the adoption of the scientific approach have not been studied empirically yet. Factors are defined in this study as prerequisite conditions and active forces that shape the possibility of adopting a scientific approach to pivoting (Nikas et al., 2007).

The adoption of the scientific approach to pivoting is not a binary process. The adoption can occur to varying extents, which is called scientific intensity (Camuffo et al., 2024). Scientific intensity reflects how consistently startups apply the core principles of the scientific approach. Startups that systematically test hypotheses and follow the steps precisely have a higher scientific intensity than startups that only partially follow the described steps. Understanding what factors influence the scientific intensity can help clarify how the scientific approach is adopted across different startup contexts.

This study seeks to generate in-depth insights into the adoption of the scientific approach to pivoting by startups. It takes a holistic perspective by identifying the factors that influence the extent to which startups implement a structured, hypothesis-driven approach. The concept of scientific intensity is used to describe the varying extents of adoption among the startups. To guide this explorative study, the following research question has been formulated: "*What factors influence the extent to which startups adopt a scientific approach to pivoting?"*

Addressing the research question provides insights into three academic streams: entrepreneurial decision-making, the lean startup literature, and the scientific approach to pivoting. By examining the factors that influence the adoption of the scientific approach to pivoting, this study builds upon the literature of entrepreneurial decision-making. This literature focuses on how entrepreneurs make strategic choices under uncertainty (Shephard et al., 2015). With additional insights into how specific factors shape scientific decision-making, the conditions in which startups make particular decisions are clarified. This study deepens our understanding of entrepreneurial behavior in uncertain environments. Furthermore, this study contributes to the literature related to the Lean Startup theory (Ries, 2011). Knowledge about factors influencing the adoption of the scientific approach to pivoting will expand insights into efficient and lean practices for startups. This further refines the Lean Startup framework by identifying under what conditions these principles will be adopted. Finally, the study will contribute to the literature on the scientific approach to pivoting (Camuffo et al., 2020). A deeper understanding of the role of factors in the adoption will contribute to the

understanding of the scientific approach to pivoting. Identifying and elaborating on the influence of these factors explains why certain startups adopt a scientific approach and others do not. This contributes to a more holistic understanding of the emerging field of the scientific approach to pivoting, which is currently mainly focused on the outcome of this approach. The combination of the different contributions to existing literature emphasizes the theoretical relevance of this study.

Besides the contributions to existing streams of literature, this study has implications for practitioners. Entrepreneurs, incubators, and investors of startups can benefit from the increased understanding of the factors influencing the scientific approach to pivoting, generated by this study. Entrepreneurs can improve their decision-making by understanding the influence of specific factors on the scientific approach to pivoting. This knowledge allows them to make more informed choices when recognizing certain factors. Incubators and investors can also benefit from this study. The identification of factors that influence the adoption makes it possible to stimulate this adoption. They can create conditions in which the scientific approach can be adopted effectively. This can eventually lead to a higher scientific intensity. This increased scientific intensity can improve the performance of startups, aligned with the goal of many incubators and investors.

The study is structured to create an in-depth understanding of the factors that influence the adoption of the scientific approach to pivoting. The first section provides a theoretical framework that describes the existing literature related to the pivoting approach and its potential factors. This is followed by the methodology section, which describes the methods and techniques used in this study. Subsequently, a description of the results will be given, derived from collected and analyzed data. The last sections consist of the discussion and conclusion of this study.

2. Theoretical Framework

2.1 Pivoting in Startups

The term pivoting has been increasingly studied as a mechanism for firms to cope with uncertainties in their environment or internal processes. Strategic change has been studied for a long time in management research, but the concept of pivoting gained increased attention following the publication of The Lean Startup (Ries, 2011). Pivoting is described as a structured directional correction of the current strategy. Entrepreneurial literature highlights the importance of experimenting and pivoting for startups. Startups can benefit from the changes in strategic direction as a response to different factors (Andries et al., 2021; Camuffo et al., 2020; Shepherd & Gruber, 2021). Many firms can benefit from these pivots, startups in particular. Startups can take advantage of pivots because they must act under uncertain conditions (Folta, 2007; McMullen & Shepherd, 2006; Townsend et al., 2018). Firms that are undergoing crises can turn adversity into opportunity using pivoting (Andries et al., 2020; Salvato et al., 2020). This often leads to changes in the firm's value proposition in response to external events (Leroi-Werelds et al., 2021). Literature specified the concept of pivoting as a radical type of organizational change and strategic reorientations (Hampel et al., 2020; McDonald & Gao, 2019). The different definitions and contributions can be summarized by the following definition of pivoting: A change in a firm's strategy that reorients the firm's strategic direction through a reallocation or restructuring of activities, resources, and attention (Kirtley & O'Mahony, 2023).

The extant literature highlights the importance of pivoting as a response to a threat or opportunity. However, the practical implementation of the scientific approach to pivoting remains underexplored. Limited insight into the factors that influence its adoption creates challenges for the practical implementation. The extant literature proposes various factors that are related to pivoting. However, an in-depth understanding of factors that influence the adoption of the scientific approach to pivoting is lacking. It is important to understand these factors because literature has shown that the scientific approach to pivoting positively influences the performance of startups (Camuffo et al., 2024). Understanding the influencing factors can help identify ways to stimulate the adoption of this scientific approach. The following sections will explain the scientific approach and present factors derived from the literature that may influence its adoption. This will provide a theoretical foundation for exploring the role of different factors in the adoption of the scientific approach to pivoting.

2.2 Scientific Approach to Pivoting

According to the scientific approach to pivoting, entrepreneurs can behave like scientists during entrepreneurial decision-making (Camuffo et al., 2024). It bases decision-making on systematic hypothesis testing, rather than on the intuition and heuristics of the entrepreneur in the classical approach (Camuffo et al., 2020). The scientific approach is considered a structured approach, which bases its hypotheses and decisions on collected data. Using this structured data-based approach can help entrepreneurs cope with uncertain circumstances. The scientific approach to pivoting is based on a clear structure that guides the pivoting process.

Key Steps in the Scientific Approach

The literature distinguishes four key steps to navigate the process in a specific sequence (Novelli & Spina, 2024). The first step is to develop a theory of value, specifying how the firm creates value and why its business proposition is viable. This helps entrepreneurs understand why certain problems affect their business. The developed theory generates a firm-specific point of view that clarifies the key assumptions of the decision-makers (Camuffo et al., 2022). Secondly, the developed theory, which is based on the assumptions of the decision-makers, is broken down into different hypotheses. These hypotheses should logically flow from the developed theory. An important condition for the hypotheses is that they should be testable by experimentation of the firm (Leatherbee & Katila, 2020). The third step is to test the hypotheses through experimentation. This includes the gathering of relevant data related to the hypotheses. Collected data creates valuable feedback for the entrepreneur. The collected data can support or refute the previously formulated hypotheses. Testing the hypotheses is a crucial step that influences entrepreneurial decision-making. The fourth and last step consists of an evaluation of the evidence and data that is collected. Based on this evaluation, decisions will be made related to the strategy of the firm (Camuffo et al., 2024).

Following these steps structurally leads to more informed decisions about pivoting or persevering in certain projects. The extant literature suggests that adopting the scientific approach improves the precision of entrepreneurial decision-making. This precision can be defined as reducing the likelihood of pursuing projects that eventually fail and increasing the chances of pursuing projects that eventually prove successful (Camuffo et al., 2020). Therefore, resources can be allocated to projects more efficiently and will not be wasted on

projects that eventually fail. Consequently, firms that adopt a scientific approach tend to perform better in the long term (Camuffo et al., 2024).

Scientific Intensity

Although the scientific approach provides a clear structure, startups differ in how consistently they apply the principles in practice. The adoption of the scientific approach to pivoting is not binary. The degree of adoption can vary, which is defined as the scientific intensity. In this study, adoption refers to the extent to which a startup implements the core elements of the scientific approach: theory, hypothesis, testing, and evaluation during the pivot. Therefore, the construct scientific intensity is used to describe the degree of adoption. Startups with high scientific intensity follow the different steps of the scientific approach in a rigorous, consistent, and evidence-driven manner. Startups with a low scientific intensity incorporate only some scientific activities during the pivoting process (Camuffo et al., 2024). Table 1 identifies the typical activities that represent the scientific approach for every step. The more of these activities a startup conducts and the more thoroughly the startup is in doing so, the higher the startup scores on scientific intensity.

STEPS	ACTIVITIES	SOURCES
THEORY	-Formulating a clear and well-articulated theory of value, explaining how the firm creates value. -Consider alternative strategies.	(Camuffo et al., 2024; Valentine et al., 2024)
HYPOTHESIS	-Derive hypotheses logically from the theory. -Formulating explicit and testable hypotheses. -Basing hypotheses on prior evidence.	(Camuffo et al., 2024; Valentine et al., 2024)
EXPERIMENTING & TESTING	-Conducting experiments to validate or refute hypotheses. -Collect relevant data related to hypotheses. -Ensuring experiments are rigorous and representative.	(Camuffo et al., 2024; Valentine et al., 2024)
EVALUATION	-Defining evaluation criteria before conducting experiments. -Using evaluation to improve clarity related to strategic decision-making.	(Camuffo et al., 2024; Valentine et al., 2024)

Table 1. Activities Scientific Approach

2.3 Factors Potentially Influencing the Scientific Approach to Pivoting

To increase understanding of the adoption of the scientific approach to pivoting, this study investigates the influence of certain factors. The benefits of the scientific approach have been discussed in previous studies. However, empirical research on the influence of different factors that influence the adoption of the scientific approach is lacking. Various factors potentially influencing the adoption of the scientific approach can be derived from the literature. Factors in this study are defined as prerequisite conditions and active forces that shape the possibility of adopting the scientific approach to pivoting (Nikas et al., 2007).

A multi-level framework is used to structure the various factors. This framework distinguishes four levels at which the factors can be analyzed: entrepreneurial level, firm level, ecosystem level, and macro environment level (Flechas Chaparro & De Vasconcelos Gomes, 2021). Using this framework creates a systematic and holistic view of the different factors. It allows for exploring different influences in the complex environment in which startups operate. The following sections will elaborate on factors that potentially influence the adoption of the scientific approach to pivoting across the four levels.

Entrepreneurial level

The entrepreneurial level consists of the personal characteristics, cognitive-affective attributes, heuristics, and biases that can influence the entrepreneur's decision-making (Flechas Chaparro & De Vasconcelos Gomes, 2021). At this level, three factors that potentially influence the adoption of the scientific approach are derived from the literature: educational background, entrepreneurial experience, and cognitive biases. The educational background of the entrepreneur, referring to the level and the field of education, may influence the familiarity with scientific principles. Entrepreneurs who have received an academic education are more experienced with formulating and testing hypotheses (Leatherbee & Katila, 2020). Entrepreneurial experience, defined as the development of specific human capital within the entrepreneurial domain, may also increase familiarity with these scientific principles. Experience gained in previous roles can influence decision-making in the current profession of the entrepreneur (Ucbasaran et al., 2010). When previous roles heavily relied on scientific principles, this may be translated into the current decision-making of the entrepreneur. Familiarity with scientific principles, due to educational background or entrepreneurial experience, might therefore influence the adoption of the scientific approach to pivoting.

Cognitive biases refer to systematic errors in judgment that can distort individual perception and decision-making and may also influence the adoption of the scientific approach to pivoting (Kuntze & Matulich, 2016). Examples such as confirmation bias and escalation of commitment can result in entrepreneurs tending to be attached to their original ideas during strategic decision-making (Staw, 1981; Sarangee et al., 2014; Schmidt & Calantone, 2002). Entrepreneurs who are more vulnerable to these biases may therefore be less likely to base their decision-making on evidence and might therefore not adopt the scientific approach rigorously.

Firm Level

The firm level refers to internal characteristics of the firm that influence the entrepreneurial decision-making (Flechas Chaparro & De Vasconcelos Gomes, 2021). Three factors are identified at this level as potentially influencing the scientific approach to pivoting: resource availability, startup stage, and team composition. The resource availability, which is the financial and human capital available to support strategic change, may influence the adoption of the scientific approach (Knight et al., 2024). Executing the scientific approach to pivoting requires financial and human resources. Following the steps of the scientific approach requires time for employees to analyze and execute the steps. Testing the hypotheses in the market requires financial investments. When these resources are scarce, the firm might not adopt the scientific approach. Resource availability is related to the extent to which startups are developed, defined as the startup stage. Many startups have limited time and resources to prove their business model (Blank, 2013; Starr & MacMillan, 1990). Early-stage startups face the most problems concerning resource availability. Mature startups, which operate longer and have a stronger foundation, have in many cases a higher resource availability (Skala, 2019). Mature startups may therefore be more likely to adopt the scientific approach than early-stage startups.

The composition of the team may also influence the adoption of the scientific approach. The team composition refers in this study to the diversity in backgrounds and skills within the firm’s team. Diversity in team composition may affect the functioning of the team and the strategic decision-making (Flechas Chaparro & De Vasconcelos Gomes, 2021). Teams that possess a range of analytical and decision-making skills may be more likely to apply the principles of the scientific approach in their decision-making.

Ecosystem Level

Startups are embedded in ecosystems that influence how strategic decisions are made. These ecosystems can be defined as a community of independent participants that are related to each other and collectively generate ecosystem output (Flechas Chaparro & De Vasconcelos Gomes, 2021). Incubator support, stakeholder involvement, and investor influence are factors that may influence the adoption of the scientific approach to pivoting. Incubators are organizations that support the establishment and growth of startups with tangible and intangible resources (Hausberg & Korreck, 2020). The support of incubators can guide startups in their decision-making. This guidance can include training in entrepreneurial decision-making. Scientific principles in entrepreneurial decision-making can also be included in these trainings (Leatherbee & Katila, 2020). When startups are trained by incubators about these principles, this may lead to the adoption of the scientific approach to pivoting.

Stakeholders such as partners, investors, and suppliers can be involved in the entrepreneurial decision-making (Hampel et al., 2020). When stakeholders have specific expectations during pivots, this may influence how startups approach the pivot. When stakeholders expect clear explanations of entrepreneurial decisions based on data, this may encourage the startup to adopt the scientific approach to pivoting. Investors are a specific type of stakeholders who mainly provide financial resources for the startup. Startups that heavily rely on these financial resources can be influenced by the opinions of the investors (Bandera & Thomas, 2022). This makes investors influential stakeholders during strategic decision-making. The investors' opinions or vision may therefore lead to the adoption of a specific approach.

Macro Environment Level

The macro environment level includes external conditions that influence the context in which startups operate (Flechas Chaparro & De Vasconcelos Gomes, 2021). Institutional context, industry trends, and technological shifts are macro-environmental factors that may influence the adoption of the scientific approach to pivoting. The institutional context refers to laws and regulations that firms must adhere to (Foss et al., 2019). For example, when safety standards become more stringent, firms want to ensure they comply with these regulations during their operations. When firms want to structurally implement specific regulations, the scientific approach to pivoting might be favored instead of basing decisions on intuition. Pivots can also be the consequence of industry trends, which are defined in this study as shifts in demand or behavior within the industry. Technological shifts refer to changes in the availability or use of

technologies. These technological shifts and industry trends can both lead to the evolution of customer preferences and needs (de Reuver et al., 2009; Giesen et al., 2010). To respond to these evolved customer preferences and needs, firms can decide to pivot. Structurally following the steps of the scientific approach to pivoting requires time. When firms want to respond quickly to these external pressures, it might not lead to the adoption of the scientific approach to pivoting.

Table 2 provides a clear overview of the definitions of the potential factors that influence the adoption of the scientific approach to pivoting.

LEVEL	CONSTRUCTS	DEFINITION	SOURCES
ENTREPRENEURIAL LEVEL	-Educational background	-The entrepreneur's level and field of education	(Leatherbee & Katila, 2020)
	-Entrepreneurial experience	-The development of specific human capital within the entrepreneurship domain.	(Ucbasaran et al., 2010)
	-Cognitive biases	-Systematic errors in judgment that can distort individual perception and decision-making.	(Kuntze & Matulich, 2016)
FIRM LEVEL	-Resource availability	-The financial and human capital available to support strategic change	(Knight et al., 2024)
	-Startup stage	-The extent to which startups are developed (in terms of revenue and growth).	(Skala, 2019)
	-Team composition	-The diversity of backgrounds and skills within the firm's team.	(Flechas Chaparro & De Vasconcelos Gomes, 2021).
ECOSYSTEM LEVEL	-Incubator support	-Support of external organizations with tangible and intangible resources.	(Hausberg & Korreck, 2020)
	-Stakeholder involvement	-The extent to which stakeholders are involved in the strategic decision-making	(Hampel et al., 2020)
	-Investor influence	-The extent to which investors can influence the strategic decision-making.	(Bandera & Thomas, 2022).
MACRO ENVIRONMENT LEVEL	-Institutional context	-Laws and regulations that firms must adhere to.	(Foss et al., 2019)
	-Industry trends	-Shifts in demand or behavior within the industry	(De Reuver et al. 2009)
	-Technological shifts	-Changes in availability or use of technologies	(Giesen et al., 2010)

Table 2. Definitions Potential Factors

2.4 Conceptual Model

The following conceptual model has been derived from the extant literature and integrates factors potentially influencing the adoption of the scientific approach to pivoting. These factors served as a theoretical foundation to study their influence on the scientific approach empirically. Moreover, this study seeks to expand the theoretical model and to identify additional factors that influence the adoption of the scientific approach to pivoting.

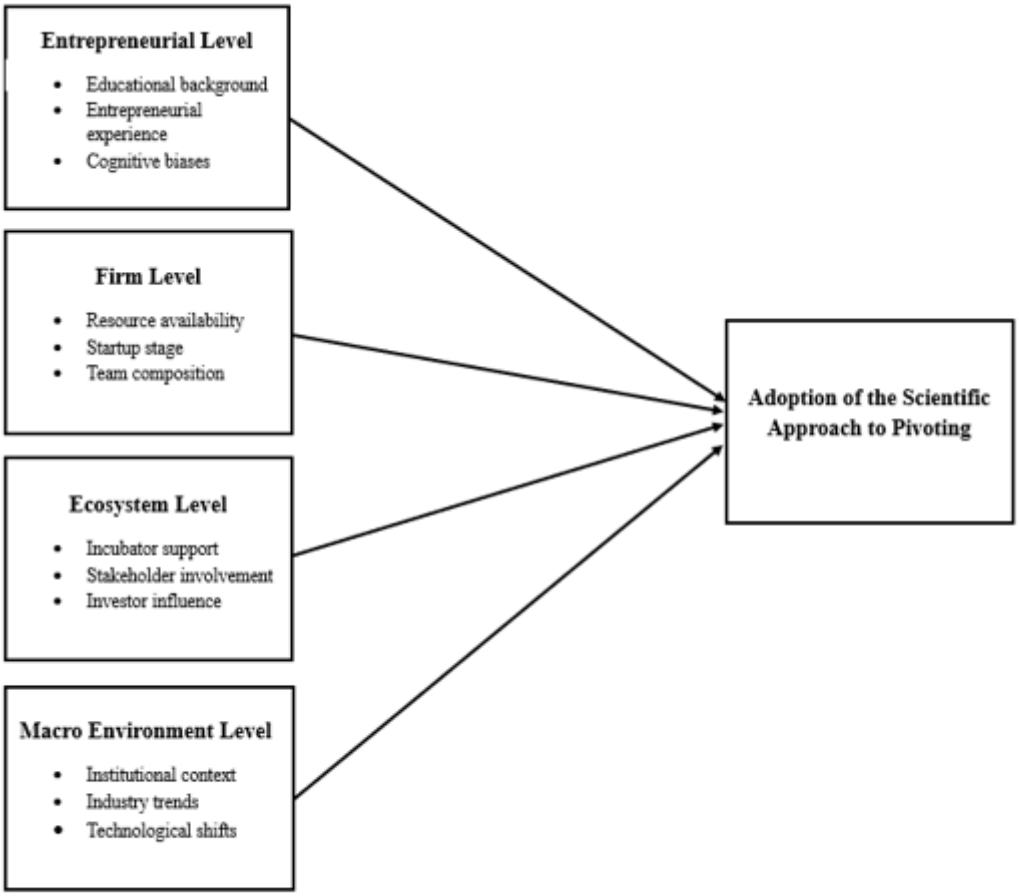

Figure 1. *Conceptual Model*

3. Methodology

3.1 Research Design

In this chapter, the research design, data collection method, analysis procedures, and ethical considerations are explained. This study conducted a qualitative research approach, using in-depth, semi-structured interviews to investigate the role of different factors that influence the adoption of the scientific approach to pivoting. A qualitative in-depth interview approach is appropriate in this research because it allows for the collection of rich data about the decision-making processes of entrepreneurs during the pivot. The influence of factors on the adoption of the scientific approach to pivoting can be considered complex. The uncertain and dynamic environments in which startups operate can complicate this process even more. In-depth interviews are particularly suited to uncover nuanced insights in these complex situations (Johnson, 2012). This study employed a retrospective design because it explored what factors influenced the adoption of the scientific approach to pivoting based on participants' past experiences.

During this qualitative study, cooperation took place with six peer students. The collaboration focused on the selection of suitable startups and the collection of data. This made it possible to increase the number of interviews in this study, generating more robust data in the limited available time for this study. For every interviewed startup, one pivot has been studied, which enabled comparisons across the pivots of startups. Comparing the pivots across different startups allowed this study to explore which factors are relevant in explaining differences in the adoption of the scientific approach to pivoting. The startups varied in terms of scientific intensity. The examination of the influence of factors across cases with varying levels of scientific intensity allowed the identification of patterns that influenced the adoption. The generated explorative patterns are intended to contribute to the existing theory.

3.2 Sampling Strategy

The sample that has been used in this study was selected through a purposeful sampling strategy. Executing this strategy allowed the selection of information-rich cases (Patton, 2002). In this study, each case refers to a single startup that has executed a pivot. For every case, a single interview has been conducted. The interviews were focused on one specific pivot executed by the startup. The pivots have been studied individually because every pivot is shaped by different conditions and challenges, resulting in different influencing factors.

Information-rich cases in this study are startups that executed a pivot with some degree of scientific intensity. The pivot carried out by these startups served as the unit of analysis.

The first criterion for the case selection was that the cases meet the characteristics of a startup. For the proper conduct of a cross-case comparison, the startups should all have comparable characteristics. In this study, a firm is considered a startup if it has existed for no longer than five years and it incorporates an element of innovation within its business model (Skala, 2019). This innovative element was, in most cases, identified by their product or services. Both criteria have been assessed before the initial contact with the startup. The assessment of years of existence and innovativeness was based on publicly available information, for instance, on the company's website. This assessment has been verified during the actual interviews.

The second criterion for the case selection was that the startups have executed a pivot. This is essential because the study focused on the understanding of what factors influence the adoption of the scientific approach to pivoting. Startups that have not executed a pivot were therefore not suitable for this study. For the identification of suitable cases, the following definition of pivoting is used: A change in a firm's strategy that reorients the firm's strategic direction through a reallocation or restructuring of activities, resources, and attention (Kirtley & O'Mahony, 2023). The potential cases are contacted by e-mail or phone. During this initial contact, the concept of pivoting was shortly explained, and the startups were asked if they had executed a pivot. Startups that confirmed this pivot fulfilled this criterion.

The third criterion for the case selection was to ensure there was a spread in degrees of scientific intensity among the cases. This spread was necessary to allow meaningful comparisons to recognize patterns across the cases. Therefore, the selection was not solely focused on cases with high scientific intensity but also on cases with low scientific intensity. These low scientific intensity cases were useful for exploring what factors prevented startups from rigorously implementing scientific principles during the pivot. This is done by making a rough estimate during the first contact with the startup, where there has been asked about how they executed the pivot.

The sample has been constructed by the combination of expert consultation and the network of the research group. Experts with extensive networks of startups have been consulted to select suitable cases. The experts who have been consulted are active in the organizations: StartUp Nijmegen, Mercator Launch, Ondernemersvereniging Neder-Betuwe, and Startlife

Wageningen, which are all closely related to many startups. The experts were informed during a physical meeting or phone call about the purposes of the study and the selection criteria. The experts were asked to find cases with high scientific intensity, because these cases were harder to find in the network of the research group. The potential cases provided by the experts were contacted by phone or e-mail by the research group, resulting in nine cases that have been included in the sample. The network of the research group provided nineteen cases for the sample. The network of the research group consisted of personal connections with startups, such as business contacts, former colleagues, and student entrepreneurs. Potential suitable cases derived from the researchers' network were also contacted by phone or e-mail to confirm if they fit the criteria and to ask if they wanted to cooperate. This resulted in a broad and diverse sample of 28 startups to investigate the factors influencing the adoption of the scientific approach to pivoting. An overview of cases can be found in Table 3.

CASE	INDUSTRY	ROLE	DURATION (MIN)	STARTUP STAGE	ACQUIRED BY	CONDUCTED BY	INTERVIEW MODE
1	Coaching	Founder	66	Mid-stage	Network	Duo	In-person
2	Retail	Founder	43	Early-stage	Network	Duo	In-person
3	Marketing	Founder	35	Early-stage	Network	Duo	In-person
4	Fashion	Founder	53	Early-stage	Network	Duo	In-person
5	Sport software	Founder	45	Mid-stage	Incubator	Duo	In-person
6	Retail	Founder	49	Early-stage	Incubator	Duo	In-person
7	Sport products	Founder	46	Early-stage	Network	Duo	In-person
8	Home technology	Founder	57	Mid-stage	Network	Solo	In-person
9	E-commerce	Founder/COO	37	Mid-stage	Network	Duo	In-person
10	Events	Key decision-maker	32	Early-stage	Network	Duo	In-person
11	Software	Founder	84	Mid-stage	Network	Duo	Video call
12	Event planning	Founder	63	Early-stage	Network	Duo	Video call
13	Space technology	Founder	54	Late-stage	Incubator	Duo	Video call
14	Bio-tech	Founder	66	Late-stage	Incubator	Duo	Video call
15	SEO	Founder	28	Mid-stage	Network	Duo	In-person
16	Real estate	Founder	45	Early-stage	Network	Solo	In-person
17	Software	Founder	52	Mid-stage	Incubator	Duo	In-person
18	Healthcare	Founder	49	Late-stage	Network	Duo	In-person
19	Bio-tech	Founder	60	Mid-stage	Incubator	Duo	Video call
20	IT	Founder	43	Mid-stage	Network	Duo	Video call
21	Consultancy	Founder	55	Mid-stage	Network	Duo	Video call

22	Pet products	Founder	25	Mid-stage	Network	Duo	Video call
23	Boats	Key decision-maker	39	Mid-stage	Network	Solo	In-person
24	Technology	Founder	58	Mid-stage	Incubator	Duo	Video call
25	Software	Founder	37	Early-stage	Network	Duo	Video call
26	Healthcare	Founder	36	Mid-stage	Incubator	Duo	Phone call
27	Events	Founder	31	Mid-stage	Network	Solo	Video Call
28	Healthcare	CEO	37	Late-stage	Incubator	Solo	Video call

Table 3. Overview Cases

3.3 Data Collection

The required data have been collected by conducting 28 semi-structured interviews. The interviews have been conducted between April and May 2025. Most of the interviews have been conducted by two researchers. During the interviews, one researcher focused on the interview guide and led the conversation, while the other researcher made notes and asked follow-up questions when appropriate. This division of roles ensured that the interviews remained focused while also allowing for exploration of unexpected insights. More valuable information can therefore be derived from the interviews.

Semi-structured interviews were used for the data collection. This structure uses a pre-defined interview guide that covers different topics while leaving space for spontaneous, relevant questions on the topic. This created a balance between focus and flexibility that fits the explorative approach of this study. The interviewees can, by using this method, generate in-depth insight into what factors influence the adoption of the scientific approach to pivoting. The interviewees of this study consisted of key decision-makers of the startup. The key decision-makers in most startups are the founders (Banerjee et al., 2024). Therefore, they have extensive knowledge about the pivoting process in their startup, which makes them suitable as interviewees. The key decision-makers participated in interviews of approximately 45 minutes, which provided sufficient time to cover different elements of the pivoting process. The interviews were conducted in person, by video call, or by phone, as presented in Table 3. The interviews have been recorded with permission from the participants. Afterward, the recordings are transcribed verbatim to ensure correct analysis.

The interview guide covered different elements, which are derived from the theoretical framework. The interview guide started with demographic questions to gather background information about the entrepreneur and the startup. After this, the respondent was asked to describe a specific pivot in detail. This part of the interview focused on how the pivot was

executed and which steps of the scientific approach were followed. Follow-up questions were used to explore the extent to which the scientific approach was implemented and to identify factors that influenced the implementation of the scientific approach at the different steps. In the next part of the interview, more explicit questions have been asked, related to factors that have not been mentioned yet. These questions are based on the potential factors influencing the scientific approach to pivoting in section 2.3. The interview guide can be found in Appendix 1.

3.4 Data Analysis

The collected data is analyzed by using a thematic analysis approach across the different cases. This approach fits this research because it enabled systematic analyses of qualitative data. It focuses on finding themes and patterns in the data. Therefore, six phases should be followed: familiarize with data, generate initial codes, search for themes, review themes, define and name themes, and produce the report (Braun & Clarke, 2006). In this research, multiple analyses have been conducted.

The first analysis is the assessment of the scientific intensity of the cases. For every case, the different steps, theory, hypothesis, testing, and evaluation have been individually analyzed. After that, the overall score of the case was determined in qualitative terms of low, medium, and high. Dividing the cases based on scientific intensity improves the interpretation of the factors influencing the adoption of the scientific approach to pivoting. It creates a clearer understanding of how and why certain factors are associated with higher or lower levels of adoption. Determining the scientific intensity also enabled the exploration of patterns in the data.

After determining scientific intensity, the factors influencing the adoption of the scientific approach to pivoting have been analyzed. This analysis combined deductive and inductive coding principles. The transcripts have been read carefully, and open coding was used to allow the exploration of new insights based on the data. At the same time, deductive codes based on the theoretical framework were applied to the data, such as the potential factors influencing the scientific approach. However, the analysis remained open for new insights that can contribute or refine this theoretical framework. In the next phase, these deductive and inductive codes have been combined into a selection of themes. The different themes reflect the factors that influence the adoption of the scientific approach to pivoting. The coding tree can be found in Figure 2.

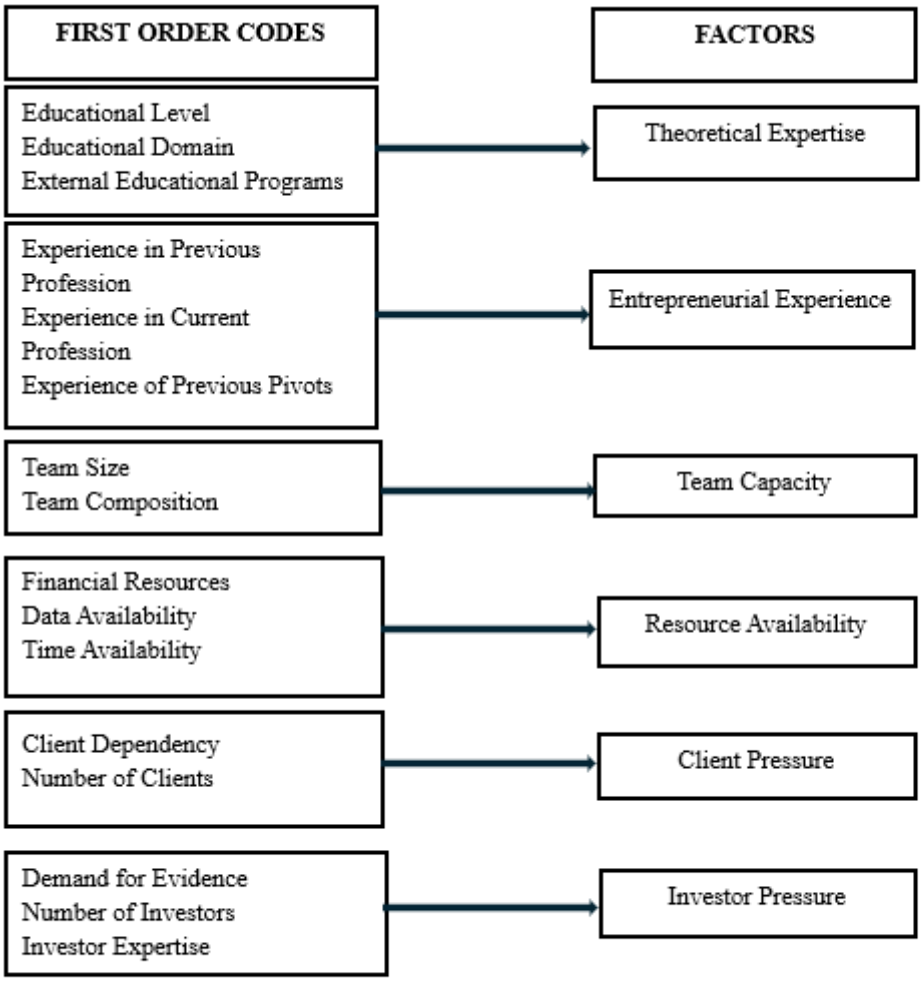

Figure 2: Coding Tree

The previously explained thematic analysis has been conducted for every case. After that, a cross-case analysis was conducted. A cross-case analysis was conducted to deepen the understanding and explanation through examination of similarities and differences across the cases (Miles et al., 2014). The goal of the cross-case analysis was to identify patterns between different cases. The startup stage emerged as a recurring theme that shaped other influencing factors. To investigate the possible pattern between scientific intensity and startup stage, each case has been categorized based on the startup stage. This startup stage has been assessed based on four criteria derived from literature: validation of business model, team, finance, and revenues (Kumbhat & Sushil, 2018). These elements have been qualitatively assessed and combined, resulting in low, medium, and high overall scores. This led to the categorization of early-stage, mid-stage, or late-stage startups, respectively. Although some elements appeared as codes, the analysis was conducted separately and based on the literature. The purpose of

this analysis was to enable the exploration of the pattern between scientific intensity and startup stage across the cases. The startup stage for every case is presented in Table 3.

3.5 Ethical Considerations

This study complied with academic ethical rules and strict standards of research integrity, which are in line with academic ethical guidelines. Research integrity is important because sensitive data about organization-specific decision-making has been used. The involvement of decision-makers also made it necessary to prioritize ethical practices like informed consent, confidentiality, and data integrity. This study followed the APA guidelines regarding research ethics (Smith, 2003). Participants in this study all received detailed information about the purpose and procedures of the research. The respondents could have stopped participation during the research without personal consequences. Participation was voluntary in this research, and participants had the right to decline any questions they wanted. Permission to record the interview has been requested beforehand. Confidentiality has been achieved by anonymizing personal and company details, preventing external readers from identifying these individuals or companies. The data that has been collected is securely stored and is solely available to the researcher and the examiners of this study. Reflexivity is important for the ethical conduct of research, specifically during the cooperation with peer researchers. To ensure integrity, reflection took place related to the potential biases of the different researchers. This was necessary to gain objectivity during the data collection. The researchers were neutral during the interviews and did not ask leading questions. The presence of two researchers during the interviews increased this objectivity. In this research, AI has been used to improve academic writing and for translational purposes. Specifically, it has been used to refine grammar and to improve clarity. AI was not used for other purposes, such as data analysis. AI tools are vulnerable to biases that influence the objectivity and findings of the research. Therefore, this analysis has been conducted manually to ensure that the findings and interpretations are based on the collected data. By following these principles, this study ensured academic integrity and increased the credibility of the study.

4. Findings

In this chapter, the findings derived from the analysis of the conducted interviews are presented. The scientific intensity of the 28 cases has been assessed based on the four steps of the scientific approach to pivoting: theory, hypothesis, testing, and evaluation. The analysis resulted in a sample of six cases with high scientific intensity, fourteen cases with medium scientific intensity, and eight cases with low scientific intensity, as stated in Table 4. The sample showed a spread in scientific intensity, providing a rich basis for comparing why startup entrepreneurs adopted the scientific approach to pivoting rigorously and why certain startups did not.

CASE	THEORY	HYPOTHESIS	TESTING	EVALUATION	SCIENTIFIC INTENSITY	STARTUP STAGE
1	high	high	medium	high	high	Mid-stage
2	low	low	medium	low	low	Early-stage
3	medium	low	medium	medium	medium	Early-stage
4	medium	low	medium	medium	medium	Early-stage
5	high	high	high	high	high	Mid-stage
6	low	low	medium	low	low	Early-stage
7	low	low	medium	low	low	Early-stage
8	low	low	low	low	low	Mid-stage
9	low	low	low	low	low	Mid-stage
10	low	low	medium	low	low	Early-stage
11	high	medium	high	high	high	Mid-stage
12	low	low	low	low	low	Early-stage
13	high	medium	high	high	high	Late-stage
14	medium	low	medium	medium	medium	Late-stage
15	medium	medium	medium	medium	medium	Mid-stage
16	low	low	low	low	low	Early-stage
17	low	medium	low	low	low	Mid-stage
18	high	medium	high	high	high	Late-stage
19	high	medium	high	high	high	Mid-stage
20	medium	low	high	medium	medium	Mid-stage
21	high	medium	medium	medium	medium	Mid-stage
22	low	medium	low	low	low	Mid-stage
23	low	low	medium	low	low	Mid-stage
24	low	low	medium	low	low	Mid-stage
25	low	low	medium	low	low	Early-stage
26	medium	low	high	medium	medium	Mid-stage
27	low	low	medium	low	low	Mid-stage
28	medium	medium	medium	medium	medium	Late-stage

Table 4. Scientific Intensity & Startup Stage

The overall scientific intensity varied across the cases, but the components varied within the sample as well. In general, testing appeared as the most rigorously implemented step of the scientific approach, with the highest scores. Hypothesis formulation has been assessed with the lowest scores. The analysis suggests that startups often test strategic decisions related to pivots. However, these tests were not always supported by clearly articulated hypotheses or assumptions. This suggests that although many startups implement experimental behavior during the pivot, they do not always implement it based on the steps of the scientific approach.

The analysis of the interviews revealed a pattern between scientific intensity and startup stage. Early-stage startups in this sample were never categorized as having high scientific intensity. This suggests that the startup stage plays a role in the adoption of the scientific approach to pivoting. This pattern can be explained because when startups are developing, the team capacity, resource availability, client pressure, and investor pressure change. The startup stage functions as an antecedent to these factors.

The findings of this study can be summarized in the empirical model presented in Figure 3. This model outlines six key factors influencing the adoption of the scientific approach to pivoting: theoretical expertise, entrepreneurial experience, team capacity, resource availability, client pressure, and investor pressure. The startup stage is not included as a direct factor influencing the scientific approach to pivoting, but as an antecedent for four factors. The startup stage indirectly influences the adoption of the scientific approach to pivoting.

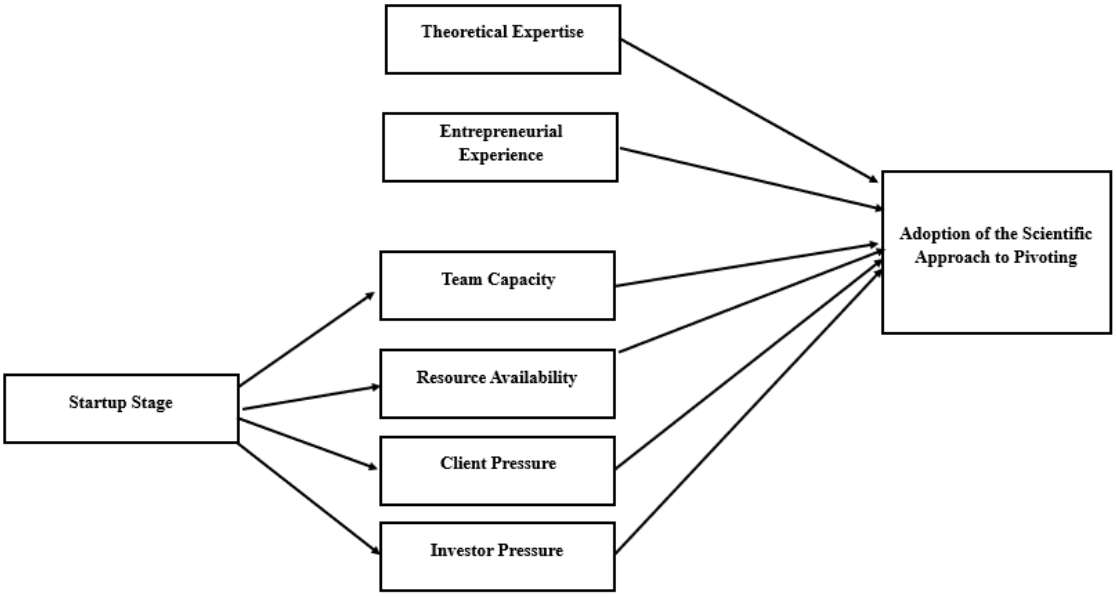

Figure 3 : Empirical Model

Some of the factors in Figure 3 are in line with the potential factors mentioned in Chapter 2, while others are refined or excluded. Entrepreneurial experience and resource availability were, for instance, confirmed in their original form. The potential factors, educational background, stakeholder involvement, and team composition, were refined based on the data, resulting in new factors: theoretical expertise, client pressure, investor pressure, and team capacity. Other potential factors, such as cognitive biases, institutional context, industry trends, and technological shifts, were not strongly supported by the data. These factors were mentioned in the interviews as influential for the pivot itself, rather than specifically influential for the adoption of the scientific approach to pivoting. Therefore, these factors have been excluded from Figure 3. In Appendix 2, the influential factors of the individual cases can be found. The following sections explain the empirical model with illustrative quotes derived from the interviews.

4.1 Theoretical Expertise

Theoretical expertise refers to the extent to which key decision-makers possess theoretical knowledge related to strategic decisions in a management context. Theoretical expertise is shaped by the educational level, educational domain, and external educational programs. Educational level is considered, in most cases, influential on the adoption of the scientific approach to pivoting. Key decision-makers with a higher level of education often demonstrate structured decision-making based on data and analytical tools. The level of education is, therefore, considered important for adopting the scientific approach. The different aspects of the scientific approach are more explicitly taught at a higher level of education, which resulted in implementing these aspects during the pivot.

"Especially the applied science degree. You spend a lot of time on desk research, building matrices, conducting interviews, collecting data, identifying possible conclusions from that data, and then validating those conclusions economically before making your final step. Yes, I do think that's very crucial. We also learned some of that during vocational education, but I think there you work more intuitively" (Case 13, Founder).

This quote illustrates that a higher level of education improved their expertise with structural and scientific principles, compared to more practical principles, which are taught at a vocational level. Other respondents mentioned that their academic education led them to implement scientific principles during the pivot. The academic education made the key decision-makers capable of testing hypotheses and critical evaluation.

Besides the level of education, the domain of education is also important for the adoption of the scientific approach to pivoting. Some cases with low scientific intensity mentioned that they have not adopted the scientific approach because they had no knowledge about working scientifically in business, specifically. The absence of relevant business skills resulted in key decision-makers relying more on their intuition during the pivot than on structural data-driven methods, as stated:

"I actually think that really put me at a disadvantage. I am not a businessperson, I haven't had any business education. So a lot of those concepts, I had to figure out myself. And approaching that in a structured way, that is just not in me" (Case 17, Founder).

Respondent 17, who has completed multiple academic studies, clarified that an academic education alone does not necessarily ensure expertise with scientific principles in management. This highlights that both the level and the domain of education are important. Academic education can enhance analytical competencies, but the applicability of these competencies in a management context is also important for the adoption of the scientific approach to pivoting.

The theoretical expertise towards the scientific principles in management is not limited to formal education provided by institutes such as universities. External educational programs that are offered by incubators can also improve the theoretical expertise of the key decision-makers in startups. The programs provided by incubators are often focused on structured data-based decision-making. This provides the basics for scientific principles in management. The theoretical expertise is therefore considered more broadly than just academic degrees.

4.2 Entrepreneurial Experience

In contrast to theoretical expertise, which focuses on scientific principles in theory, entrepreneurial experience focuses on knowledge gained in practice. This entrepreneurial experience is gained in the current or previous profession, including earlier pivots. Key decision-makers who have gained entrepreneurial experience in other firms or their current startup are often more familiar with structural and data-driven principles, which often leads to a higher scientific intensity.

Less experienced entrepreneurs tend to rely more on their intuition initially, resulting in lower scientific intensity during the pivot. However, these less experienced entrepreneurs mentioned they learned from the pivot and should execute the pivot differently with their current knowledge, as stated:

"I think I could have executed the pivot more effectively with the knowledge I currently have. However, you have to make a pivot, and this was my first one." (Case 2, Founder).

This quote illustrates that the founder lacked the knowledge and experience to execute the pivot effectively at the time. The increased entrepreneurial experience could, according to this founder, lead to a more structured and efficient pivot in the future. The experience gained from previous pivots, in the current startup, or other business contexts often affects the subsequent pivots. The experience about what strategies or principles succeeded or failed in previous pivots is incorporated into future pivots. This often leads to more structured and rational decision-making, as stated:

"The experience to make less emotional decisions, the experience to look at things more rationally" (Case 19, Founder).

This illustrates that the increased experience of the founder changed the decision-making from emotional and intuitive to more rational and evidence-based. When initial intuition-based pivots prove less effective, founders reflect on the limitations of the approach. This can lead to the realization that there is a lack of data use, which leads to uncertainty about the outcome of the pivot. Experience from prior pivots leads in this way to more data-based decisions, which results in a higher scientific intensity for future pivots, as described:

"So we take that with us from the previous pivot. That we should rely more on data, being a bit more certain about the market you join. That is definitely something we have learned" (Case 23, Key decision-maker).

This founder mentioned that learning moments as a consequence of entrepreneurial experience increased the use of scientific principles. When these principles lead to positive outcomes, they will be more rigorously implemented in future pivots, increasing the scientific intensity.

4.3 Team Capacity

Team capacity is considered an important factor related to the startup stage, influencing the scientific intensity of startups. Team capacity refers to the ability of the team in the startup to execute a pivot scientifically. The team capacity is shaped by team size and team composition. Both are important for the explanation of the scientific intensity and are influenced by the startup stage.

The size of the team, referring to the number of people working at the startup, often impacts the scientific intensity. The number of people who are involved in the execution of the pivot is specifically important. Startups with a small team reported that the daily operations consumed most of the time from the team. These daily operations are focused on problem-solving and surviving in the startup's uncertain environment. Executing scientific principles during the pivot consumes time from the team and is therefore not prioritized in this stage. This resulted in intuition-driven decision-making, with low scientific intensity. When the team size increased, this often resulted in employees gathering data and testing, which led to more data-driven decision-making, increasing the scientific intensity, as mentioned:

"So I asked him to do a competitor analysis, to see whether any other companies were doing this" (Case 2, Founder).

This quote illustrates that after the increase in team size, an employee was focused on doing research. This employee collected data, which was later used to guide the pivot. This resulted in a shift from more intuitive decision-making to more scientific decision-making based on data.

Besides the size of the team, the composition of the team also plays an important role in the implementation of scientific principles during the pivot. Teams with a diverse set of skills and expertise are better able to collect data and to conduct tests to guide strategic decision-making. Homogeneous teams that consist of employees with the same expertise and skills have problems with the execution of the scientific approach, as stated:

"In our specific case, we had one disadvantage: our team consisted only of engineers… In an ideal situation, there would be a better distribution, so in the limited time you have, you can ensure a higher-quality data collection." (Case 13, Founder)

This reflection highlights that increasing the team size does not guarantee diversity within the team. This is often the case in highly technological startups, which focus on hiring employees with a technological background. In this case, this led to a lower quality of data collection, creating difficulties for the rigorous implementation of the scientific approach to pivoting.

When startups develop further from early-stage to mid- or late-stage startups, they typically expand their team in terms of size. This expansion resulted in most cases in an increase in diversity of skills and expertise. Therefore, the development of the startup stage resulted in most cases in more time and capability towards data collection and the execution of the scientific approach to pivoting.

4.4 Resource Availability

Resource availability is a factor influencing the scientific intensity, which is related to the startup stage. This study found that the availability of the resources: finance, time, and data, is important for executing structured data-driven pivots, increasing the scientific intensity.

Early-stage startups often operate with limited cash, leading to a short financial runway. Spending time and finances on structural testing and data collection shortens this runway even more, and therefore, it is often skipped in the early stages of startups, as stated:

"If you have more time, you can support a decision much better and more thoroughly. But at some point, you have to make a decision based on the data you have at that moment. Under time pressure and especially financial pressure, you can not research and substantiate your pivot endlessly." (Case 28, CEO).

When startups mature, the financial resources often increase as a consequence of stable revenues and the attraction of venture capital. This results in a longer financial runway, creating more time for structural testing and data collection.

"In the future, ideally, you want enough people and capacity in every department to research these kinds of decisions for you first. If your company has built up a larger buffer, it is not a problem if a decision takes a bit longer." (Case 22, Founder)

This quote illustrates that the increase in financial resources decreases the time pressure. This decrease in time pressure leads to more thorough research and testing, influencing strategic decision-making and increasing the scientific intensity.

Besides the time and financial resources, this study revealed that data is an important resource influencing the adoption of the scientific approach to pivoting. Key decision-makers in low- and medium-stage startups mentioned that the low customer base resulted in a lack of relevant data to base their strategic decision-making on. This lack of data resulted in decisions made based on intuition, rather than on data, as mentioned:

"If all the data were complete, then you could base your choice purely on data… But usually that is not the case. And then intuition is often a faster way." (Case 9, Founder/COO)

Key decision-makers in late-stage startups note that increasing user bases and richer datasets enable them to pivot based on evidence. As stated by this late-stage founder:

"*Now we can make decisions based on external figures… That would not have been possible if we were still an early-stage startup."* (Case 28, CEO)

When data is available, key decision-makers in startups use this data to guide their decision-making, resulting in less intuitive and more scientific decision-making. The combination of limited data, time, and financial resources in early-stage startups led to a lower scientific intensity. When startups develop from early stages to later stages, these resources are commonly expanded, increasing the scientific intensity.

4.5 Client Pressure

Client pressure emerged as a factor influencing the adoption of the scientific approach to pivoting. This factor refers to the extent to which clients shape how strategic decisions are made within startups. The number of clients and the dependency on these clients determine the client pressure, which eventually influences the scientific intensity. The analysis further revealed that client pressure is influenced by the startup stage.

Early-stage startups typically have a limited number of clients, and therefore each client represents a relatively large share of the firm's revenue. This amplifies the influence of the individual clients, often forcing startups to pivot to fulfill the client's current needs. The pressure to fulfill the needs of the clients results in rapid and intuitive decision-making, as stated:

"A potential client, actually our only lead in real estate, asked us if we wanted to do it. So we pivoted because he wanted to…I think if he did not say that, we did not pivot in this way, especially not in such an intuitive way." (Case 16, Founder)

This quote illustrates that the dependency on a single client can dominantly influence strategic decision-making. The client pressure not only determines whether a pivot occurs but also influences the pivoting approach. This pressure often leads to intuitive and fast decisions, decreasing the scientific intensity.

When startups develop, the number of clients and the dependency on individual clients shift. The increasing customer base and a more diversified revenue decrease the client pressure for medium- and late-stage startups. The key decision-makers of medium- and late-stage startups are due to the decrease of client pressure less forced to intuitive and reactive strategic decision-making.

"If you already have a product in the field, generate some cash flow, have twenty customers providing monthly revenue, and a proven model. You pivot differently than when you are still proving yourself, or even at the birth of proving. That is an absolute difference, you can not afford someone leaving the table...You have to react fast" (Case 13, Founder)

This quote illustrates that the client pressure changes when startups develop. Early-stage startups often pivot intuitively under client pressure. When startups develop to medium and late stages, the reduced client pressure enables key decision-makers to adopt a more structured and data-driven approach, instead of a fast and reactive approach. This increases the scientific intensity.

4.6 Investor Pressure

Investor pressure emerged as a factor influencing the adoption of the scientific approach to pivoting. The investor pressure refers to the extent to which investors shape how strategic decisions are made within startups. The demand for evidence, the number of investors, and the investor expertise shape the investor pressure, which eventually influences the scientific intensity. The startup stage has been found as influential on the investor pressure in the analysis.

When startups develop, they attract more external investors. These external investors can have demands regarding milestones or metrics, leading to more structured and data-driven decisions. The strategic decisions have to be justified to more investors in late-stage startups compared to early-stage startups, increasing the investor pressure. Startups often require financial resources to execute the pivot. Evidence was often required by the investors before investing in the startups, as stated:

"Investors like it when they invest in something that is certain. So I needed something to convince the investors." (Case 18, Founder)

The need to convince the investors led to data collection and testing to justify the strategic decisions related to the pivot. The use of data guiding strategic decision-making increased the scientific intensity.

Investors can influence the scientific intensity in other ways than demanding evidence. Besides financial capital, they can provide knowledge and expertise for the startup. These "knowledge investors" are often preferred for the startups, as described:

"One of the investors worked in consumer psychology. So right now we are working on an ambassador program to get current customers to recruit new ones, and he is helping with that…… So I think that having an investor who brings knowledge of the industry is very valuable…..He works even more data-driven than we do." (Case 18, Founder).

This quote illustrates that "knowledge investors" are often preferred for startups, because they provide expertise besides financials. Their expertise is often used to encourage the startups to work even more structurally and data-driven. This resulted in an increased scientific intensity.

5. Discussion

This study has identified several factors influencing the adoption of the scientific approach to pivoting. The analysis based on 28 interviews conducted at startups has identified that theoretical expertise and entrepreneurial experience related to scientific principles of key decision-makers positively influence the adoption of the scientific approach to pivoting. In addition, the factors: team capacity, resource availability, client pressure, and investor pressure have been considered influential on the adoption of the scientific approach to pivoting. The startup stage influences these four factors. Early-stage startups often have a lower team capacity and resource availability than late-stage startups. The client pressure and investor pressure also change during the development of the startup, eventually influencing the adoption of the scientific approach to pivoting. Together, these factors explain when and under what conditions startups pivot scientifically.

5.1 Theoretical Implications

By exploring the factors that influence the scientific approach to pivoting, this study contributed to several fields of literature. The existing literature related to the scientific approach to pivoting mainly focused on the outcome of the pivot. Camuffo et al. (2024) concluded that startups with a higher scientific intensity eventually outperform startups with a lower scientific intensity. In contrast to focusing on the outcome of the scientific approach to pivoting, this research contributed to this field of research by focusing on the factors that influence the adoption. The identification of different factors resulted in a more holistic understanding of the adoption of the scientific approach. It increases understanding of under what circumstances startups adopt this approach, besides focusing mainly on the outcome of this adoption.

This study found that theoretical expertise with scientific principles in management is an important factor influencing the adoption of the scientific approach to pivoting. This finding is in line with the work of Leatherbee & Katila (2020), who stated that the scientific principles, like the formulation of hypotheses and conducting experiments, can be taught. While their study highlights the teachability of scientific principles in a management context, it does not address how this theoretical expertise influences the adoption of the scientific approach to pivoting. This study contributes to this gap by explaining how the theoretical expertise of key decision-makers positively influences the adoption of the scientific approach to pivoting. Moreover, this study stresses that the theoretical expertise is not acquired solely

through a formal education, such as an MBA. Key decision-makers of startups can also gain theoretical expertise by external educational programs provided by incubators, for instance. These contributions lead to a broader perspective related to the theoretical expertise of scientific principles in the management context, which eventually influences the adoption of the scientific approach to pivoting.

This research revealed that the startup stage indirectly influences the adoption of the scientific approach to pivoting by affecting several factors. As startups develop, changes occur in team capacity and resource availability. It builds upon prior work suggesting that startup characteristics evolve over time (Skala, 2019). This study contributes to this work by explaining how this evolution influences the adoption of the scientific approach to pivoting. In addition, this study adds to the work of Knight et al. (2024) by identifying data availability as a critical resource that affects pivoting decisions. While the previous work primarily focused on financial and human resources, this research shows the importance of data. Moreover, it explained the variance of data availability throughout the development of startups, eventually influencing the adoption of the scientific approach to pivoting.

This study found that clients and investors can exert pressure that affects the adoption of the scientific approach to pivoting. This is aligned with the prior work of Hampel et al. (2020), which stresses that stakeholders can affect decisions concerning the pivot. This study contributes to their work by emphasizing that the pressure of these stakeholders varies in different startup stages. In early-stage startups, the clients exert more pressure, often leading startups to pivot intuitively. In later stages, the pressure of startup investors increases, resulting in more scientific pivots. This insight contributes to the literature by emphasizing that stakeholder pressure is not static but can evolve over time during the development of startups.

5.2 Practical Implications

This study provides several practical insights for entrepreneurs, incubators, and investors of startups. For entrepreneurs, the findings of this study clarify the factors that influence the adoption of the scientific approach to pivoting. By using this knowledge, entrepreneurs can proactively create conditions in which the scientific approach to pivoting can be adopted. For instance, they can improve their theoretical expertise related to scientific principles through education, making them more capable of executing future pivots scientifically. In this way, entrepreneurs can stimulate the adoption of the scientific approach themselves. This is

important because an increase in scientific intensity often improves the performance of the startups in terms of revenue and growth (Camuffo et al., 2024). This enables the startup entrepreneurs to execute the pivots more structurally and effectively, leading to long-term success.

For incubators, this research confirms that they can influence the execution of the strategic decisions of startups. For instance, they can influence the theoretical expertise of scientific principles for startup entrepreneurs. Based on the new insights, incubators can adapt their training programs, focusing on scientific principles to improve the theoretical expertise of startup entrepreneurs. In this way, incubators can reduce intuitive decisions of startups and lead them to more scientific decisions during their future pivots. Eventually, these adapted training programs can potentially support startup growth, aligning with the mission of many incubators.

This research also has practical implications for startup investors. This study reveals that investor pressure can positively influence the adoption of the scientific approach to pivoting, particularly when investors demand evidence to justify strategic decisions. This demand can stimulate key decision-makers in startups to rely more on data and evidence during their pivot, increasing the scientific intensity. This increased scientific intensity can result in more successful pivots, stimulating revenues and growth of startups. When startup investors know how they can improve scientific intensity, this can serve as a tool for improving their return on investment.

5.3 Limitations

While this study provided valuable insights into the factors influencing the scientific approach to pivoting, several limitations can be identified. First, the data collection process was shared with six other researchers, resulting in a comprehensive amount of data, providing a rich basis for the analysis. However, this also resulted in some of the semi-structured interviews not being conducted by the author of this study. This limited the ability to capture non-verbal communication during these interviews. This non-verbal communication can, in some cases, influence the interpretation of the data and therefore influence the analysis.

Second, the sample size of 28 cases provides a strong foundation for the exploration of factors influencing the adoption of the scientific approach to pivoting. However, limitations for external validation are still present due to the limited sample size. The sample consisted exclusively of startups in the Netherlands. The context-specificness of the startups creates

potential issues regarding the transferability of the findings across the cases. Startups that operate in different ecosystems are shaped by different cultural, institutional, and economic factors. Therefore, generalization of the findings to other contexts may have limitations.

Finally, each case consisted of a single interview with a key decision-maker of the startup. The study solely relied on primary data derived from the interviews. Secondary data, such as internal documents or reports, has not been used. This limits the ability for triangulation of the data. Triangulation of the data, using multiple data sources and comparing these, contributes to a better interpretation of the data and provides a stronger substantiation of constructs (Eisenhardt, 1989). The reliance on a single data source may limit the depth and robustness of the findings.

5.4 Directions for Future Research

This explorative study built a foundation for understanding the factors influencing the adoption of the scientific approach to pivoting. It also creates several avenues for future research. One direction of future research is the adoption of the scientific approach to pivoting in early-stage startups. The findings of this study suggest that early-stage startups lack the resources, data, and team capacity to implement the scientific approach to pivoting rigorously. However, this remains a gap in the literature of how early-stage startups may overcome these limitations and could successfully implement these scientific principles of pivoting. Future research may focus on how early-stage startups can implement these scientific principles efficiently.

The current study relied on qualitative research methods to uncover factors influencing the adoption of the scientific approach to pivoting. This created an in-depth and explorative insight. However, quantitative research could be executed to test the strengths of the relationships between the factors and the adoption of the scientific approach to pivoting. Quantitative approaches can, for instance, test how the factors: theoretical expertise, entrepreneurial experience, team capacity, resource availability, client pressure, and investor pressure predict the scientific intensity. The larger sample size also improves the generalizability of the insights. A quantitative study can therefore result in statistical validation of the findings and increase the generalizability.

The role of the startup stage can also be the foundation of a new avenue of research. This study found that the startup stage influences the team capacity, resource availability, client pressure, and investor pressure, which eventually influence the adoption of the scientific

approach to pivoting. Future research could conduct longitudinal research to follow startups over time and collect data at different startup stages. This research can create more in-depth insights about how the adoption of the scientific approach to pivoting evolves, and whether the influences of the factors change when startups develop.

6. Conclusion

This research explored the factors that influence the adoption of the scientific approach to pivoting. The analysis of 28 interviews with Dutch startups resulted in an in-depth understanding of factors influencing the scientific approach to pivoting. The theoretical expertise and entrepreneurial experience of the key decision makers in startups influence how rigorously scientific principles are implemented during the pivot. The factors: team capacity, resource availability, client pressure, and investor pressure are also identified as factors influencing the adoption of the scientific approach to pivoting. In addition, this study found that the startup stage influences these four factors. Early-stage startups often have limited team capacity and resources, which increase during their development. The client and investor pressure also change during the development of the startup, which eventually influences the adoption of the scientific approach. By identifying these factors, this study revealed under what conditions startups adopt a scientific approach to pivoting, enabling practitioners to stimulate this adoption.

This study contributed to the existing theory of the scientific approach to pivoting. Previous studies mainly focused on the outcome of the scientific approach to pivoting. However, this study focused on what factors shape the adoption of the scientific approach to pivoting. By focusing on the factors influencing the adoption, this study contributes to a more holistic view of the scientific approach to pivoting.

The new insights regarding the factors influencing the scientific approach to pivoting have implications for practitioners. Identifying these factors and their influence in different startup stages creates possibilities for practitioners to stimulate the adoption of the scientific approach to pivoting. This stimulus can be important because previous research stressed that a higher scientific intensity improves the growth and revenue of startups. Startup entrepreneurs can use the insights to gain theoretical expertise related to scientific principles in management, to improve their capability of executing pivots scientifically. This could result in a higher scientific intensity, leading to increased growth and revenue for the startup. The insights can also contribute to society. Stimulating the scientific approach to pivoting results in better

allocation of resources and more effective decisions related to the pivot. Resulting in less waste of resources and an increase in successful innovation projects, benefiting society.

The limited sample size of 28 startups and the context-specificness of these startups have limitations for the generalization of this study. Therefore, a quantitative study including a larger sample with startups from different international contexts can be suggested to improve this generalizability. This quantitative study can also focus on the strengths of the relations of the factors and the adoption of the scientific approach, resulting in valuable knowledge.

To conclude, this research increased the holistic understanding of the scientific approach to pivoting by investigating the factors influencing the adoption. Several factors are identified influencing this adoption. These insights can improve the stimulation of the adoption of the scientific approach to pivoting, ultimately enhancing startup performance.

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Appendices

Appendix 1: Interview Guide

Section	Content
Consent	Before the interview begins, participants will be asked for their consent to record the conversation. They will be informed about the purpose of the recording, how the data will be used, and assured that their responses will be treated confidentially and anonymized where necessary.
Introducing questions + respondent, and firm demographics	Can you introduce yourself? What is your educational background? What is your professional background? Can you briefly describe the startup and its core business model, and describe your role and key responsibilities within the startup? When was the firm founded? How many employees does the firm have?
Explanation of Pivoting	Here we provide a brief explanation of the concept of pivoting: "*A strategic change of direction in the business model or value proposition."*
General Pivot Questions	Could you describe the first time you considered or executed a pivot of the startup since its inception (entrepreneur) / since you became (partly) responsible for this process (other decision-maker)? What Decisions have you made? In what stage of the startup was this pivot undertaken? Why did you undertake the pivot in this way? What were the main reasons for undertaking it in this way? What was your role during this pivot?
Scientific Intensity-Theorization	Can you take us back to the moment before the pivot? What made you feel a pivot was necessary? (Have you identified a problem or opportunity?) How did you identify this? Did you map out the current situation and your intended direction? How did you approach that? Do you always approach situations in this way?
Scientific Intensity – Hypothesis	What assumptions did you have about the outcome of the pivot? What were those assumptions based on? Were these assumptions clearly articulated? How did you make them concrete? Do you always work like this? Were the assumptions measurable? Can you give a concrete example of a goal or expectation tied to this pivot? Why did you believe this would occur?
Scientific Intensity – Experimentation	Did you conduct any tests or experiments before fully committing to the pivot? (e.g., A/B testing, interviews, launching a minimal viable product) What actions did you take? How did it look like? Why did you do this in this way? Why did you not choose for a different way? What were the results of these tests?

Scientific Intensity – Evaluation	What did you do with the results of the tests? What was the next step? How did you decide whether or not to proceed with the pivot? Why did you handle it in this way? Were the results aligned with your expectations? If not, how did you respond?
Reflection	Do you consider the pivot successful? Why or why not? Would you approach the pivot similarly next time? Why or why not?
Interview questions based on factors that may influence the scientific intensity	Below are optional questions related to potential factors influencing the scientific approach to pivoting. These more explicit questions are used as backup when the interviewee has difficulty identifying the factors.
Entrepreneurial level	Educational background How has your educational background enabled you to carry out the pivot in the way you did? Are there specific things you took from your education, or lessons you learned, that influenced your approach? Entrepreneurial Experience How has your professional background prepared you to approach the pivot the way you did? Are there experiences or insights from your past that you used during the pivot? Cognitive Biases Have you ever doubted whether to go through with the pivot, even when there seemed to be strong evidence that it was necessary? What do you think caused those doubts? What do you believe was behind them?
Firm level	Resource availability Did time pressure or limited (financial) resources influence the way you executed the pivot? In what way? Startup stage Has your decision-making process changed as your startup has grown? How did this change/why did it remain the same? Team composition Has your team influenced how decisions were made? For example, because team members bring different perspectives or expertise? What roles did team members take on during the pivot?
Ecosystem level	Incubator support Have you participated in any incubator or accelerator programs? What did you gain from that experience? Did this influence how you approached the pivot?

	Stakeholder involvement To what extent do you consider the opinions of stakeholders such as customers, suppliers, or partners when making decisions about pivoting? What do you do with their feedback? Why do you handle it that way? Investor influence Does your startup have investors? Have you adjusted your pivoting approach to align with investor preferences? Do investors expect you to communicate pivots in a particular way?
Macro environment level	Institutional context How much attention do you pay to new trends in your startup's industry? How do you respond to those trends? What actions do you take? How do you incorporate those trends into your decision-making? Industry trends Have laws, regulations, or external policies played a role in your decision to pivot? Technological shifts To what extent have technological developments such as digital tools influenced how you approached the pivot?
Concluding questions	Is there anything else about your startup's decision-making, pivoting strategies, or experimentation process that you feel is important but wasn't covered in this interview? Do you have any questions for us about this study or how the findings will be used? Would you be open to follow-up discussions if any clarifications or additional insights are needed?

Appendix 2: Factors of Individual Cases

CASE	THEORETICAL EXPERTISE	ENTREPRENEURIAL EXPERIENCE	TEAM CAPACITY	RESOURCE AVAILABILITY	CLIENT PRESSURE	INVESTOR PRESSURE
1	Positive		Positive			
2	Positive	Positive	Positive			
3	Positive	Positive				
4	Positive					
5	Positive		Positive	Positive		
6		Positive				
7	Positive			Positive	Negative	
8						Positive
9		Positive		Positive		
10	Positive		Positive		Negative	
11	Positive	Positive		Positive		
12						
13	Positive	Positive	Positive	Positive	Negative	
14						Positive
15	Positive					
16				Positive	Negative	
17	Positive	Positive	Positive	Positive		
18	Positive	Positive				Positive
19		Positive		Positive		
20	Positive					Positive
21	Positive					Positive
22		Positive		Positive		Positive
23	Positive	Positive				
24			Positive			
25	Positive			Positive		
26	Positive	Positive				
27				Positive		
28	Positive			Positive		Positive

Appendix 2: Factors of Individual Cases

***** The positive and negative scores represent the relation between the factor in the specific case and the scientific intensity.