



Fostering Sustainable Innovation: Exploring the role of Leadership Dynamics in Business Model Experimentation

*A Qualitative Case Study about Norwegian startups in the
Energy Sector*

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Master Thesis, MSc in Economics and Business Administration,

Major: Strategy and Management

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This thesis was written as a part of the Master of Science in Economics and Business Administration at NHH. Please note that neither the institution nor the examiners are responsible – through the approval of this thesis – for the theories and methods used, or results and conclusions drawn in this work.

Acknowledgements

This thesis was written in collaboration with the Digital Innovation for Sustainable Growth (DIG) Centre at the Norwegian School of Economics as part of the RaCE project. RaCE explores how established firms can navigate and drive radical technological change.

Specifically, I researched on the project Innovating Leadership to Innovate in Organizations (LEAD IN), in which I investigate how leadership can foster sustainable innovation. I am grateful and want to thank DIG for the educational experience and support I received during the process of this project.

I would like to extend my gratitude to the case companies that generously shared their time and knowledge with me. Their candid contributions and valuable insights have enriched my thesis extensively. I also want to thank Innovation Norway for their assistance in identifying suitable case companies.

Furthermore, I express my sincere appreciation to my supervisors, Synnøve Nesse and Anne Line Grepne, for their guidance and commitment throughout this project. I am grateful for their expertise, constructive feedback, and willingness to discuss research topics with me.

Lastly, I would like to acknowledge the support of my friends and family during this time.

Norwegian School of Economics (NHH)

Bergen, Spring 2023

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Abstract

Leadership plays a critical role in achieving sustainable innovation within the energy sector. Research to date has focused on individual leadership functions and traits displaying that the unique set of skills of individual leaders allows them to act as change agents for innovation. Yet innovation is a process that involves collective leadership. To date, research on how such collective forms of multiple individuals work together remains to be explored. Therefore, this study examines how collective forms of leadership influence the process of business model experimentation to facilitate sustainable innovation. Leadership is likely to be highly dynamic and can take different forms of collective forms during the process of experimenting with the business model. The findings demonstrate that leadership functions and decision-making processes become increasingly more collaborative and informal, involving input from multiple people. Leadership shifts from a formalized individual function to informal collective approach as the startups grow in size over time. Interestingly, startups that engage in business model experimentation experience a shift back to elapsed phases of leadership. As more people join the startup and experimentation is elevated, leadership becomes formalized during business model experimentation, rather than being spread out over multiple people in a collective form. This study aims to shed light on the significance of collective leadership and business model experimentation fostering sustainable innovation, providing valuable insights for practitioners and academics.

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1. Introduction

The world and its inhabitants are facing serious threats due to climate change. Droughts, floods, heatwaves, melting glaciers, rising sea levels, and other challenges are currently emerging around the globe. Indeed, organizations in many sectors contribute to this, in terms of greenhouse emissions (US EPA, 2022). To change climate change effects and ensure long-term firm sustainability and survival, sustainable innovation is becoming increasingly important. Leadership has been shown to be pivotal to sustainable innovation, in driving the sustainable innovation management process development and keeping wanted impact of any innovations and the business itself under control. This is key to achieving desirable results while offsetting environmental impacts contributing positively to the Sustainable Development Goals (SDG) (Schaltegger and Wagner, 2011; Hamel 2006). Leadership is of particular importance when it comes to business model experimentation to achieve business processes that can facilitate sustainable innovation (Jørgensen & Pedersen, 2018). Hence, in this thesis I examine the role of leadership in achieving sustainable innovation through experimentation with business models over time.

Research on leadership that fosters innovation has predominantly focused on individual leadership. Leadership is, as often argued, the driver of change, facilitated by someone with the ability to influence others (Hughes et al., 1993). While leadership is defined in multiple ways, it typically includes the notion of influencing others' activities to achieve desirable outcomes (Burns, 2012; Denis et al., 2012). Innovation is vital for the success of an organization and leadership is argued to be a key factor that impacts innovation by organizations (Hughes et al., 2018; Anderson et al., 2014). There has for instance been very extensive research on transformational leadership which suggest an individual manager inspires and stimulates teams to foster innovation (Bass, 1999; Leithwood & Jantzi, 2005). However, while innovation is often described as a collective leadership effort (Denis et al., 2001), research on collective forms of innovation leadership and how this collective leadership creates sustainable innovation, is scarce (Nesse & Grepne, 2022). Further, while sustainable innovation is thought to be linked to business model experimentation, much is unknown about the relationship between leadership, business model innovation and sustainable development. Denis et al. (2001) argues that substantive change in organizations is more likely to develop when the organization has collective leadership practices in which the different members work together. Research in this area has shown that shared leadership behaviors positively

contribute to team effectiveness (Ensley et al., 2006) and that leadership arises throughout organizations as an emerging organizing process by different actors in situations (Uhl-Bien, 2006). Taken together, while relationship between leadership and sustainable innovation, and between business model experimentation and innovation is described in literature, how collective leadership is influenced business model experimentation and in turn sustainable innovation remains seemingly unexplored.

To date, literature on sustainable innovation, leadership and business model experimentation have been separate research focus areas. To contribute to addressing this gap, this thesis will investigate the influence of business model experimentation on leadership and in turn sustainable innovation. Experimentation is a key function of sustainability transitions and has been recognized as a key factor in transaction research (Bocken et al., 2019). To succeed in business model innovation for firms to become more sustainable, companies need to experiment. The challenge of innovating and designing a business model can be described as business model experimentation (Jorgensen and Pedersen, 2018). The thesis aims to study how leadership influences sustainable innovation as firms grow over time, through the exploration of leadership dynamics that affect business model experimentation. The research therefore aims to answer the following research question: *How do leadership dynamics change over time as an organization grows, influencing business model experimentation to foster a commitment towards sustainable innovation?*

This research question is explorative, given that this is a nascent field of research (Edmondson & McManus, 2006). To examine the research question, the thesis has a qualitative and inductive research approach developed around the Eisenhardt case-study method in which firms are compared to look for similarities and differences in the potential relationship between leadership, business model experimentation and the development of sustainable innovations. The qualitative case study will contrast multiple small to medium sized (SME) firms in Norway.

Against this backdrop, the next chapter will discuss relevant literature streams concerning leadership, sustainable innovation, and business model experimentation. In the third chapter the methodology of the thesis will be described. Chapter four displays the findings of the research, followed by theoretical and practical implications of the findings in chapter five. The last chapter, six, will conclude the research.

2. Theoretical Framework

This chapter presents a theoretical framework that builds on previous research and literature and is centred on three key concepts: sustainable innovation, leadership process dynamics, and business model experimentation. The chapter will explore how leadership influences an organization's commitment to achieving sustainable innovation how the process of leadership dynamics influences business model experimentation to foster sustainable innovation. The theoretical framework is fundamental to the study, which aims to address the gap in research on the role of leadership, and specifically business model experimentation, in promoting a commitment to sustainable innovation.

2.1 Sustainable innovation driven by leadership

2.1.1 Innovation

Innovation, a tendency to devise novel and improved ways of doing things, has existed throughout human history. Recently, the significance of innovation in driving economic and social change has led to the creation of several research centers and departments (Godin, 2006). This has prompted a cross-disciplinary approach to innovation studies to better understand it from different perspectives (Fagerberg et al., 2013).

Research on innovation has brought several streams and developed into different views over time. Schumpeter (1934), one of the first to delve into innovation, identified five types of innovation: new products, new methods of production, new sources of supply, exploration of new markets, and new ways of organizing businesses (Schumpeter, 1934). Despite these categories, most of the economic focus has been on the first two types of innovation, which are typically more tangible and visible than the others. Nonetheless, innovation in any of these categories can contribute to economic growth and development. The commercialization of a new product requires not only the technical knowledge to produce it but also an understanding of the target market and how to distribute the product. Similarly, a new production method may require a substantial investment in new machinery, which may not be feasible without financial resources (Kline and Rosenberg, 2010). New sources of supply require knowledge of new materials and access to new sources, while exploiting new markets requires a solid understanding of local culture and customs. Moreover, innovation can take various forms depending on the firm's objectives, such as creating new business models, improving

processes, or delivering better services (Fageberg, 2006). The ability to innovate is becoming increasingly critical in today's fast-changing business environment, and firms that fail to innovate risk being left behind by competitors.

Next to the five types of innovation, the concept can be categorized further in incremental and radical innovations. Incremental innovation involves gradual improvements in existing products and operations to enhance efficiency and customer value (O'Reilly & Tushman, 2004). Conversely, radical innovation breaks from traditional practices and results in fundamental changes in organizational activities (Damanpour, 1991). While incremental innovation is crucial for short-term competitiveness, radical innovation is necessary for long-term survival (Pisano, 2015; Nesse & Grepne, 2022). This understanding of innovation is closely linked to leadership and business model experimentation as leadership and its dynamics play a crucial role to drive innovation within organizations, including implementation of new processes and business models. Leadership dynamics affect the engagement of startups in incremental innovations, as well as the experimentation with business models to foster innovation.

2.1.2 Sustainable innovation

Competitiveness in markets is no longer seen as only focusing on current markets, but also on new markets through innovation (Montalvo et al., 2011). Sustainability challenges often require innovation and sustainable innovation connected to new business models is often regarded to be a valuable win-win situation (Porter and Kramer, 2011). With vast increases of capital flowing into sustainable innovations, new global markets are created while allowing smart specialization of certain regions (Montalvo et al., 2011). Boons and Wagner (2009) argue that business models provide a conceptual link between the economic performance of firms at higher system levels and sustainable innovation.

As adapted from Carrillo-Hermosilla et al. (2010), sustainable innovation can be described as “innovation that improves sustainability performance” (Carrillo-Hermosilla et al., 2010; EC, 2008). Innovations that are required to enhance sustainability performance need to move past incremental adjustments, requiring adjustments of larger parts of production and consumption systems. Literature characterizes innovations that go beyond incremental (product- and process-related) improvements. There can be innovations leading to the object of change such as processes, products, and services (Boons et al., 2013). Moreover, the organization of

production and consumption at the sectoral, organizational, and system levels, and the complex product architectures of product innovation need to be considered (Boons et al., 2013). Profit for firms differs between discrete and complex product architectures, which has different implications for business models of firms (Hall and Vredenburg, 2003). Product architectures in literature is described as the way of change of the inter-connectedness of product components. Therefore, an increase in involvement of socio-technical systems in innovations might lead to entire system innovations or transitions (Boons et al., 2013). Another aspect to note is the extend of the radicalness of the innovations. Radical innovations – an innovation novel to the firm, industry, country, or world – is often targeted at niche markets that are less attractive for large established firms (Markides and Geroski, 2005). Since sustainable developments pose large challenges, sustainable innovation is often defined by radicalness, going beyond the standard product and process innovations (Charter et al., 2008). The theory on sustainable innovation is relevant to understating how leadership dynamics change over time as organizations grow and influence business model experimentation to foster a commitment to sustainable innovation. The theory highlights the importance of innovative approaches, particularly those relevant for new business models, in addressing both economic and sustainability challenges at higher system levels.

2.1.3 Sustainable innovation in the energy sector

Sustainability in the energy sector is of importance as organizations in this sector seek to tackle challenges of climate change while facilitating the transition to a low-carbon economy. Schiederig et al., (2012) argue that the integration of environmental considerations into the innovation process is key to facilitate sustainable innovation. Within sustainable innovation in the energy sector, the role of collaboration is crucial as knowledge sharing between stakeholders fosters sustainable innovation (Molina-Murill & Canizares, 2019). The green energy sector, encompassing renewable energy sources such as solar, wind, and hydro power, require ongoing innovation to enhance the energy efficiency to facilitate this transition to a low-carbon economy. Several studies argue that systemic changes in the energy sector need to facilitate this, such as policy reforms and collaboration among stakeholders (Fichter & Lorek, 2018). Furthermore, Pallares-Barber et al. (2019) argues that financial support and funding, partnerships, and knowledge sharing influence sustainable innovation in the energy sector. The theory emphasizes the importance of sustainable in the energy sector that illustrates the need for ongoing innovation to facilitate the transition to a net-zero economy.

2.2 Leadership dynamics in startups

While previous literature on innovation leadership has predominantly focused on individual leaders (Anderson et al., 2014; Hughes et al., 2018; Hogan and Kaiser, 2005), this chapter explores the concept of collective leadership and its impact on sustainable innovation, considering leadership as a shared or distributed phenomenon that emerges through interactive processes (Langley et al., 2012). By exploring different forms of collective leadership and their contribution to team effectiveness and sustainable innovation through business model experimentation, the literature provides insights in the complex dynamics of leadership in driving organizational growth. Additionally, by integrating Greiner's (1989) model of organizational growth, the interplay between leadership evolution and revolution phases is investigated. Greiner's (1989) model of organizational growth provides a framework that illustrates the interplay between leadership dynamics, organizational growth, and sustainable innovation. This helps to identify the phases and challenges organizations face during organizational growth, demonstrating the context in which leadership and sustainable innovation interact.

2.2.1 Collective leadership

Leadership is central to innovation (Anders et al., 2014; Hughes et al., 2018), however, traditional research has focused on individual leaders, rather than how collectives of leadership contribute to innovation (ibid). Yet recent literature suggests that multiple individuals can satisfy leadership and team needs, and many firms have different leaders in different situations (Morgeson et al., 2010), especially during changes, transitions, growth, and innovation phases (Denis et al., 2021). I therefore focus on leadership as a collective phenomenon that is shared or distributed among different people and which is constructed in interaction (Langley et al., 2012).

Various literature streams have focused on plural forms in team leadership. For instance, leadership can be shared in teams, pooled at the top of organizations, spread through and across boundaries over periods, and can be produced and developed through interactions (Langley et al., 2012). Shared or plural leadership in teams often arises out of the motivation of individual organizational members that set aside opportunistic behavior, allowing leadership to be accessible to a broader group of individuals within an organization (Langley et al., 2012).

Thus, the shared influence of multiple leaders within organizational settings, plural leadership can take different forms.

I focus on collective leadership forms that can be shared in teams, therefore viewing leadership in the following way. First, when working in teams, leadership is oriented around team need satisfaction which should enhance team effectiveness. The individuals or groups that take responsibility to satisfy the need of the team is seen as fulfilling the team leadership role. Thus, team leadership is centrally oriented encompassing the satisfaction of the needs of teams (Morgeson et al., 2010).

Certain conditions within an organization need to be in place to smoothly transfer leadership functions between team members (Burke et al., 2003). Diaz-Saenz (2011) argues that formally appointed leaders can enable the transformation of followers into leaders, while Pearce and Sims (2002) suggest that vertical leadership – having a formal leader of a team – and shared leadership – distributed leadership emergent within team dynamics – work complementary, thus seeing both formally appointed leaders and distributed team leadership within an organization engaging parallel.

Leadership in such teams can thus stem from different sources. A model by Morgeson et al. (2010) aims to conceptualize the sources of leadership along two structural dimensions: the locus of leadership and formality of leadership.

		Formality of Leadership	
		Formal	Informal
Locus of Leadership	Internal	Team leader Project manager	Shared Emergent
	External	Sponsor Coach Team advisor	Mentor Champion Executive coordinator

Figure 1. Sources of Leadership in teams (Morgeson et al., 2010).

The interaction between these dimensions generates four factors of team leadership. The dimensions of the locus of leadership illustrates whether the leadership role is fulfilled by someone who is a member of a team and thus is actively engaged within the team's task cycle (internal) or whether the leadership role is fulfilled by someone who is outside the team's daily activities and not actively participating (external). In turn, the formality of leadership

dimension illustrates if there is a formalized way in which there is responsibility for team performance within an organization (formal), or if there is no formal and no direct responsibility for a team's performance and leadership (informal) (Morgenson et al., 2010).

In this thesis, I therefore view leadership as a functional role that can be occupied by one or more persons stemming from different sources. While the source of team leadership often varies, they arise from the aim to satisfy team needs with the goal to enhance the effectiveness of a team. In this, leadership is the vehicle that satisfies these needs, regardless of the source, thus I take a collective and team-centric leadership perspective. This entails that I will look at how different sources of leadership in relation to the leadership team contribute to fulfilling the teams overarching goal of achieving sustainable innovation through experimenting with business models and how this is done.

2.2.2 Leadership during organizational growth

Greiner (1998) developed a model in which the evolution and revolution of companies reveals how different elements interact to shape the development of an organization over time. First, the age of an organization affects leadership as management problems and principles are rooted in time, while managerial attitudes become institutionalized. This leads to higher predictability of employees' behaviour; however, this behaviour also becomes harder to change (Greiner, 1998). While the passage of time affects development, the size of an organization changes as number of employees increases. New functions emerge and coordination and communication issues aggravate. During the development process of a firm, organizations will experience quieter *evolution* periods, ones in which only modest adjustments are necessary for maintaining growth. Yet, stable evolution is not indefinitely sustainable or linear. In times of rapid changes, turbulence, and experimentation organizations face periods of *revolution*. Traditional leadership practices are brought under scrutiny and organizations see a change of leadership forms. Organization that inadequately change their practices are often unable to grow or continue. Leadership thus changes in the organization and is adapted to the period of evolutionary growth. At last, the speed of the evolution and revolution phases in a firm is closely correlated with the environment and industry the organization operates in. Evolutionary periods can be long in slow-growing industries while in fast-growing industries this period can be relatively short (Greiner, 1998).

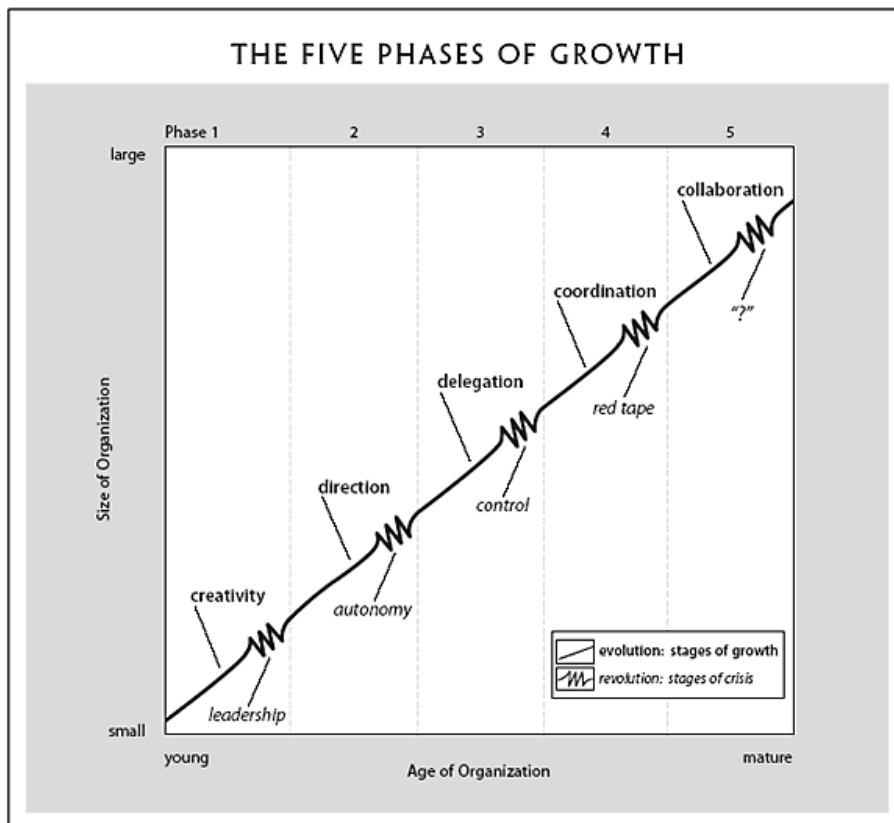


Figure 2. Five phases of organizational growth. From Greiner, L. E. (1989)

The periods of evolution and revolution occur in five different phases of growth. These five phases have a dominant leadership style that is most occurring in the evolution phase of the organization, while the revolutionary period is defined by a leadership problem that needs to be solved for an organization to continue its growth (Greiner, 1998). Over the phases of growth, Greiner (1998) argues that each growth phase is a result of the preceding phase, and therefore a cause of the next phase. During the first phase, *creativity*, the organization is developing a product and market, and thus starts developing their business model. Founders are entrepreneurially oriented and have a focusing on the technical side of things, putting less effort into leadership duties. The creativity activities are key for the organization to start; however, they often lead to the first problems as the organization grows. A *crisis of leadership* will occur as first revolution, as leadership and managerial duties are to be confronted. Finding a strong leader who can pull the organization together is of importance. Greiner (1998) suggests that organizations who survive this first phase will continue with leadership in a more *directive* form that, in a more efficient manner, channels employees' energy into growth. Leadership and communication become more formal. This, however, could lead to a *crisis of autonomy*. Organizations often move towards an increase of *delegation*; however, it is often

seen that leaders who had a directive role find it hard to give up the responsibility, thus centralized methods keep being present. During the delegation evolution face, greater responsibility is handed to employees. The next growth phase stems from this, seeing an increase in decentralized organizational structures which sees higher responsibility given to more people within the organization. Yet, the freedom that this brings poses the next problem as it breeds a parochial attitude, resulting an organization to go into a *crisis of control* (Greiner, 1998). Higher managers strive to gain more control of their organization again, seeking a more centralized leadership approach. Due to the new organizational structure, this often proves to be difficult, thus seeing organization find new solutions of coordination techniques. This next phase of *coordination* sees the implementation of more formal systems to aim for greater coordination. By introducing new systems and programs, a lack of confidence appears within an organization, seeing the new systems exceeding their usefulness. This leads to next problem, a *red tape crisis*. Organizations become too complex to be led through formal programs and forms, starting the next revolution. To overcome the red-tape crisis, organizations see a spontaneity in leadership and management actions and forms in the fifth phase, emphasizing *collaboration*. The fifth phase builds on flexibility in leadership forms, having more focus on solving problems through team action and simplified formal control systems. Furthermore, experimentation within the organization is often encouraged. The theory and framework proposed by Greiner (1989) provides insights into the dynamics of leadership and organizational growth. The theory argues that leadership practices need to adapt to challenges and critical moments at different stages as the organizations grows. By understanding these different phases of evolution and revolution, the research can further explore how leadership dynamics change over time as an organization grows and how these changes influence business model experimentation while fostering the commitment towards sustainable innovation.

2.3 Business models' centrality to leadership as organizations grow

Leaders often tend to overlook development stages in the fast growth periods of a startup (Chesbrough, 2010). The problems as well as practices leaders face are however rooted in time, not lasting throughout an entire lifespan of an organization. Leadership therefore has a key influence on the business model of a young organization that is set to grow. A business model of a company provides a framework that steers and directs the operations, and

leadership is essential in executing this business model while driving the innovation for growth (Teece, 2010). Business models need to be adapted due to changing market conditions, customers' needs, and emerging trends and require effective leadership to ensure that the business model remains relevant and sustainable over time, while maintaining a competitive advantage (George and Bock, 2011).

2.3.1 The concept of a business model

A business model can be seen as a structure which describes how an organization proposes their value to new and existing customers (value proposition), how the organization organizes itself in order to create this value (value creation), which key resources, activities and partners the organization will use for this and under which precedencies (value delivery), and at last how the organization retains value for the organization (value capture). Thus, the business model captures how companies succeed with value creation, delivery, and capture. (Schaltegger et al., 2016; Jørgensen & Pedersen, 2018). The value proposition reflects how a company intends to create its value. It therefore displays how the organization intends to help customers solve a problem, and therefore fulfill their needs. A value proposition should accordingly integrate what an organization has to offer as well as the duty that the customers would like done (Jørgensen & Pedersen, 2018).

Thus objectively, a business model is a set of interdependent structured operational relationships between a customer, the firm, its suppliers, partners, complementors and other stakeholders (Doz & Kosonen, 2010). The relationships and interactions consisting between the actors are often embedded in tacit action routines. From leadership perspective, a business model can also be seen as a subjective representation of these mechanisms. From a subjective perspective the business model represents how a firm relates to its environment, standing as a cognitive structure that sets boundaries, creates, and captures value, and how the firm organizes its governance and internal structure (Doz & Kosonen, 2010).

Startups bring new sustainable technologies and innovation to a market by following an initially developed business model (McDonald & Eisenhardt, 2020). The value of this technology is often fully gauged and reach its full potential when it is developed or adapted in some way. The innovation can successfully enter the market through an already existing and familiar business model, but these business models do not always fit the market or innovation, and therefore do not reach the full potential of the market opportunity (Chesbrough and

Rosenbloom, 2002). To enter the market, firms need to vary with their business model in order to capture value from the innovation. Not being able to vary with a business model could lead to a lower value captured.

In the concept of business models, effective leadership plays an important role in adapting and executing business model changes, for example to market conditions, emerging trends, and enabling the organization to maintain sustainable innovation. This is important for startups focusing on sustainable technologies, as adapting the business model to capture value from sustainable innovations is crucial to maximize market opportunities.

2.3.2 Business model experimentation

Across industries and countries, firms innovate their business model to become more sustainable. This consists of innovations in products and services, but also in processes and entire business models. Experimentation is a key function of sustainability transitions and has been recognized as a key factor in transaction research (Bocken et al., 2019). The challenge of innovating and designing a business model can be described as business model experimentation (Jorgensen and Pedersen, 2018). To succeed in business model innovation for firms to become more sustainable, companies need to experiment. When performed under controlled conditions, business model experimentation can reduce the risk of an innovation by seeing what works and what not (Jorgensen and Pedersen, 2018). The purpose is therefore to test certain assumptions while building legitimacy across internal and external stakeholder groups through the joint collection and circulation of information flows. This should be done while having low recourse and visibility to others while maintaining a low-cost method to implement the testing (Bocken et al., 2019). A common notion in entrepreneurship is that young firms should fail fast to quickly learn from failures in a cost-effective way (Cannon and Edmondson, 2005). Jorgensen and Pedersen (2018) argue that trial and error, thus failing, is a good strategy for business model experimentation, however only when performed in a controlled way.

With the current capabilities of technology and software, managers can nowadays base consequential decisions on ran experiments that are scientifically proven (Davenport, 2009). Formalized testing provides new types of understanding of what things actually work and can be best utilized in the strategy execution phase. According to Davenport (2009), testing is most reliable in case many moderately similar settings can be observed, in which desired outcomes

are measurable and defined, and if a logical hypothesis has been formulated with regards how the effects will influence a firm.

Bocken et al. (2019) argue that there are three important aspects to consider when experimenting with sustainable innovation towards sustainable business models. These key issues are construct clarity, boundary setting, and uncertainty about outcomes. When construct clarity occurs, the innovation optimizes only specific elements of the business model such as the value proposition, value creation, value delivery, and value capture instead of creating an impact across all systems (Richardson, 2008; Bocken et al., 2019). In turn, when no boundaries are set, there is difficulty in assessing the impact of sustainable innovations within the business model as there is no fixed frame of reference on the context in which these innovations take place. Consequently, when the first two key issues arise, there will be uncertainty about the outcomes of the sustainable innovations. Since it is hard to assess the impact the new sustainable innovations will have on the developed sustainable business model, actual outcomes are hard to predict which could lead to undesired rebound effects (Bocken et al., 2019). The intensity of these rebound effects depend on which boundaries are set up before. Davenport (2009) argues that leaders can implement experimentation by first defining the experiment and testing processes over all levels of the organization in order to establish what constitutes a valid test. Firms that desire testing to be an effective and reliable element of their decision-making process are in need of an infrastructure to facilitate that, going further than just the test-and-learn capability. This infrastructure should include managerial training that brings the level of knowledge up for all managers on randomized tests, test-and-learn software that enables firms to test and experiment, learning capture that allows firms to guide future initiatives and share knowledge by the substantial amount of learning that is done through testing and experimenting, regular revisiting of experiments to try and determine if a test has become obsolete, and creating a core resource group in order to have a central coordination point which allows for sufficient and rigorous testing.

Leaders and other individuals in an organization that are involved in the sustainable innovation of business models need to critically audit drawn up system boundaries when thinking about their processes and activities. This requires the firm to critically evaluate and clarify the construct of their business model and see how this aligns with stakeholders. This can be done by making a model around the ecology of a business model (Bocken et al., 2019). Moreover, as business model innovation is a multifaceted process, leaders need to enable ways in which involved actors work integrative together while periodically assessing the development within

factors of value created, effectiveness, and fairness (Bocken et al., 2019). Furthermore, considering the process of time, leaders are required to find the right balance in relation to the timing of activities concerning the development of the business model. The boundary work that is required should find ways of accommodating different time perceptions between different actors (Bocken et al., 2019). A model by Bocken et al. (2019) displays how organizations go from an existing to new sustainable business model through experimentation.

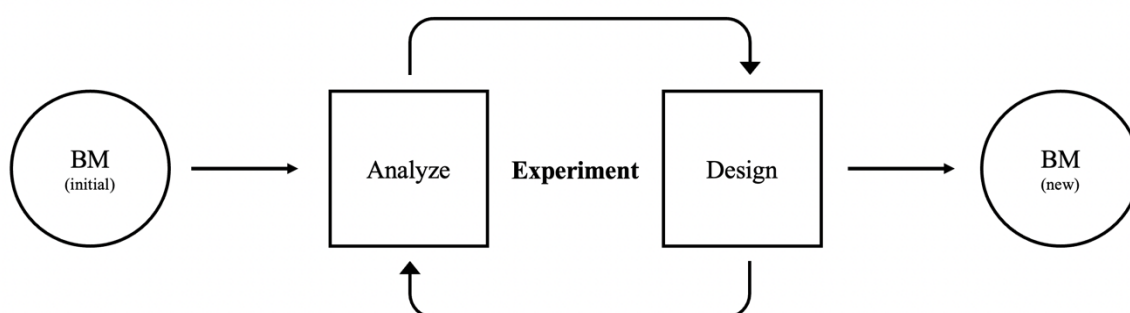


Figure 3. Adapted from Bocken (2019)

Experimentation of business models can lead to minor changes or more drastic shifts with the business model, however, not all sustainable innovations need to be radically changed and deviated from existing business models in order to work (Jorgensen and Pedersen, 2018). While the innovations that are radical seem like they should make a high impact, the greatest effect towards a sustainable business model comes from improvements of existing operations or diffusions of already implemented (sustainable) innovations (Jorgensen and Pedersen, 2018). Leadership thus plays an essential role in fostering sustainable innovation in the energy sector. By enabling business model experimentation, leaders facilitate the adaption of business models that incorporate sustainable innovations, enabling business models for long-term sustainable innovations.

2.4 Theoretical framework

Built on the literature review, the existing theory can be used to present a theoretical framework that provides a conceptual foundation for the further research in this study. The conceptual framework is built on sustainable innovation, leadership, and business model experimentation. Specifically, the framework is built on the premise that different leadership

dynamics are present in organizations developing sustainable innovations (Langley et al., 2012), with different sources of leadership present at times in an organization (Morgeson et al., 2010). Further, organizational growth likely influences the leadership dynamics in an organization (Greiner, 1989) that lead to business model experimentation by the leaders (Bocken et al., 2019; Chesbrough and Rosenbloom, 2002). At last, the assumption is set that leadership dynamics affected by organizational growth that leads up to business model experimentation fosters a commitment of sustainable innovation in organizations.

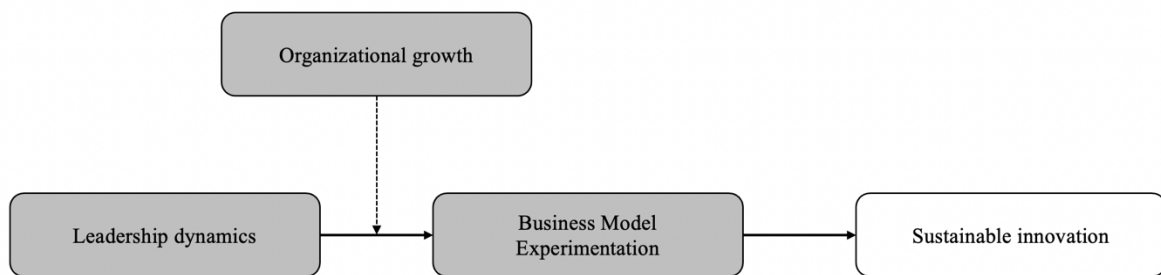


Figure 4. Theoretical Framework

This research therefore aims to examine the relationship between leadership dynamics and business model experimentation for sustainable innovation. As research to date on the relation between these factors is scarce, this thesis will explore the interrelation between leadership and business model experimentation as the startups experience organizational growth, while fostering a commitment to sustainable innovation.

3. Methodology

The methodology section of the thesis will specify how the research question is answered and empirical research is executed. The first section will describe the chosen research philosophy and approach, followed by the research design in the second part. The third part explains how the data is collected and the tools to analyze the collected data will be described in the fourth section. The fifth section discusses the quality of the data, followed by ethical consideration in the final section.

3.1 Research philosophy and approach

To establish what this thesis is investigating and how the theory is understood to contribute to the research, it is imperative to relate it to a research philosophy (Johnson and Clark, 2006). The foundation of the research philosophy affects all sections of the research process (Hesse-Biber, 2016). This study aims to investigate how leadership influences business model experimentation during organizational growth and how that in turn has its effect on sustainable innovation.

And inductive research approach will be adapted to identify the themes and patterns to explore the phenomenon of different contexts of leadership for business model experimentation and sustainable innovation (Saunders et al., 2012). The paper will contribute to theory building by generating untested conclusions and forming a conceptual model. This is done by conducting in-depth interviews with persons that contribute to leadership in their respective firms. By considering leadership as a collaborative process, the organization can be seen as a collective process of continuing social enactment, thus not assuming only managers take on the task of leadership.

Taking a social-construct view, the subjective data represents constructed realities of interviewees, allowing for individual as well as shared realities to be present. The difference between the views of the social actors that act as leaders implies that an emphatic view is adopted to understand the role of leadership in business model experimentation and sustainable innovation, The research approach and process is therefore perceived as having an interpretivist stance (Saunders et al., 2012).

According to Edmondson & McManus (2007), there can be three different states of prior knowledge on specific research questions: mature, intermediate, and nascent. Their framework suggests that a nascent prior research and theory state has an open-ended inquiry about an interest or observed phenomenon, with typically new constructs and only a few formal measures. An intermediate state of prior theory and research suggests that the research question proposes relationship between established and new constructs, which implies that there are normally one or several new measures and/or constructs. A mature state of theory and research has focused questions and/or hypotheses relating existing constructs, this therefore often relies heavily on existing construct and measurer (Edmondson & McManus, 2007). Since the nature of this paper is qualitative and the research questions are an open-ended exploration about the phenomenon, a nascent theory research is imposed. The data collected by in-depth interviews of collaborative leaders will be interpreted for meaning to look for patterns that suggest certain theories.

3.2 Research design

In line with this being a nascent field of research, I use a qualitative and inductive research design. As argued, an interpretive philosophy is common when using such a qualitative and inductive research approach. The data collection will be done via in-depth interviews which are non-standardized. This allows for procedures and questions to emerge during the process that is both interactive as well as naturalistic. A non-probability sampling technique is used to have a sample using a subjective method.

By conducting in-depth interviews with open questions, a deeper insight about the topic can be achieved. The research strategy will follow a case study design that explores the context of leadership affecting business model experimentation and sustainable innovation by contrasting and comparing firms. Since both high and low performing firms are analyzed, a multiple cases study is used. This aims to establish if the effect of leadership on business model experimentation and sustainable innovation can be replicated over firm the different firms, thus observing if there are differences between the certain factors.

The research strategy behind the thesis is built from Eisenhardt (1989) framework on how to build theory from case studies. With the thesis having an inductive approach working on building a theory through explorative research, this method seems well fit. As Eisenhardt (1989) argues, selecting cases is a fundamentally important aspect of building a theory from

case studies. Multiple levels of analysis of the case studies will be performed via a within-case and cross-case analysis (Eisenhardt, 1989). With the within-case analysis, the descriptive write-ups will be made for each interview, followed by the cross-case analysis in which patterns are found between the different case companies and interviewees (Eisenhardt, 1989). Cases are chosen in which the process of interest is transparently observable (Pettigrew, 1988).

3.2.1 Timeline of the research

The research is conducted over a period of three months in the fall of 2022. Due to the limited time available to conduct the research, some limitations might arise as will be discussed in the limitations section.

3.2.2 Sector and case selection

To find relevant findings on leadership and its inter-relatedness with business models in the context of sustainable innovation this thesis focuses on Norwegian SMEs that are operating within the energy sector. The growth of the energy and renewables market is expected to become even greater (Heineke et al., 2022b) and is therefore a relevant sector to look at.

To determine relevant case companies several databases and proxies were used. First a data base by Innovation Norway was used to find companies engaging in environment innovation after receiving advice from a representative at Innovation Norway. Specifically, it was recommended to focus on companies that had received funding through the "Miljøteknologiordningen" program, which provides funding to companies that offer sustainable solutions to environmental problems (Innovation Norway, 2022). With eco-innovation as proxy, the Innovation Norway database to identified relevant SMEs operating within the energy sector, to ensure comprehensive coverage of potential case companies. Second, a data base by the European Innovation Council (EIC) which showed companies their received funding from EIC as they demonstrate potential for sustainable innovation (European Innovation Council, 2022). Furthermore, companies out of Norwegian energy and renewables related clusters were gathered for further review. This gave an extensive list of companies within the energy sector. By cross-checking the companies, the most relevant companies were initially gathered.

The list of companies was thereafter narrowed down by years, ranging from 2015 to 2019. To obtain the most relevant data, firms were selected based on similarities in product offering and growth numbers. Growth numbers were determined by looking at the number of employees

and financial data obtained through the company's website and through the data website proff.no. Sethibe & Steyn (2016) find that growth factors that best measure performance are profitability and sales growth, while (Delmar et al., 2003) finds that number of employees is another important factor of growth. This thesis will follow these research streams and measure growth in terms of profits and growth in number of employees. First, SMEs are chosen based on when they started (sustainably) innovating, from that point on growth will be measured by looking at EIC data taking profit and employees in consideration. The selection process eventually concluded 14 potential SMEs in the Norwegian energy sector. Due to availability reasons and the research timeline four companies were chosen for the research, which can be described in the following.

Company A, founded in 2017, aims to produce semiconductors to facilitate the transition towards renewable energy sources in their sector. With a current workforce of 11 employees, they operate in a market with relatively few established players and have shown a steady increase in income.

Similarly, Company B was also founded in 2017 with a focus on providing an innovative and environmentally friendly solution to the market. Their "state of the art" construction has the potential to disrupt the current market solutions and contribute to the EU's renewables ambition. Although they have had a slow increase in sales revenue, the company has shown considerable growth in the last financial year. They currently employ nine people.

Company C, established in 2016, has ten employees and has already disrupted current market solutions with their prototype. They are in the launch phase and ready to industrialize their product, showing steady growth in sales revenue.

Lastly, Company D was established in 2018 with a focus on producing semiconductors for the renewable energy sector. The company is currently in the funding phase, with a current workforce of one employee. Due to a lack of funding, the company had to reduce their activity, but they aim to receive trust from investors to take their product further. Although the company has only shown growth in its first year, it was included to gain a deeper understanding of leadership during critical phases of the innovation process, as they work towards securing funding for their sustainable innovation.

In sum, the four case companies examined all focus on developing technical sustainable innovations within the Norwegian energy sector. To verify findings, information that was

retrieved from other sources was cross-checked, such as annual reports, and found consistent patterns across the case companies. These companies all started with one to three founders, each of whom held central leadership roles. Upon assessing their development over time, it can be observed that several of the companies now have around ten full-time employees, which indicates that they fall under the definition of SMEs.

The selected companies have developed similar sustainable innovation products within the Norwegian energy sector, and some of them are close to industrializing their innovations. To protect the anonymity of the case companies and the fact that there are only a limited number of other companies that develop similar products in this industry, there will not be any revealing details presented about the companies in this case study.

3.3 Data collection

With the nascent theory research approach the primary data source will consist of semi-structured interviews, which is in line with Edmundson and McManus (2007) recommended techniques of data collection. With semi-structured interviews, part of the interview process will be structured with some key-questions and themes, while other areas of the interview will go more in-depth varying from interview to interview, fitting the exploratory research (Saunders et al., 2012; Cooper and Schindler, 2008). As there is a general research theme among multiple theses, there is an organizational context used for all interviews while the in-depth question will focus on specifics about the research question. Semi-structured interviews will furthermore allow for opportunities for the interviewees to build and elaborate on their answer, developing the interpretivist epistemology with the approach to understand the meaning behind different phenomena (Saunders et al., 2012).

3.3.1 Interview outset

Once the four chosen SMEs were identified, a more specific focus on themes and concepts was developed. In collaboration with the other research teams within the DIG RaCE: LEAD IN project that are working on similar research encompassing leadership forms, an initial interview guide was developed. This interview guide consisted of an overarching section of questions about leadership, followed by a specific section tailored to the specifics of the research, in this case business models and experimentation with these business models. To increase credibility and remove leading questions and biased conceptions, the interview guide

was approved by all members in LEAD IN as well as by the supervisors. After testing the interview length, the interviews were scheduled for 45 minutes with room for flexibility and adaptability based on interview circumstances. First, questions about leadership were asked, followed by the influence on sustainable innovation. Business model experimentation questions conveyed both sustainable innovation and leadership aspects, diving deeper into the construct behind this. The entire interview guide can be found in appendix 1.

3.3.2 Sampling

Data collection is done through non-probability sampling, following a purposive sampling group (Saunders et al., 2012). While this sampling technique does not allow for proof on statistical grounds, it can still be used to generalize outcomes. The sample size consists of four Norwegian SMEs in the energy sector in which a total of eight interviews are conducted. Within the firms the employees who take on leadership responsibilities were sought after for an interview. This was done to discover the role of leadership throughout the organization. Often, the first leader was the CEO who thereafter was able to give us contacts of other people within the firm whom we found potentially relevant.

/	Company	Role
Informant 1	A	CEO
Informant 2	B	CEO / Founder
Informant 3	C	Managing Director
Informant 4	C	Founder
Informant 5	A	CCO
Informant 6	D	CEO
Informant 7	B	Concept inventor / Founder
Informant 8	E	Chair of Board

The informants were all chosen based on leadership roles, formal or informal, within the companies. To get comprehensive data, employees who actively performed leadership duties

needed to be interviewed. Therefore, the first interviewee per company was asked to identify other employees within the company who perform these formal or informal leadership roles. This method aimed to rule out only interviewing people who have formal leadership roles, thus discovering where the collective leadership plays a role.

To validate the data, enough interviews need to be conducted to create data saturation and interviews should be conducted until no added value is brought to the research (Eisenhardt, 2021; Saunders et al., 2012).

3.3.3 Data collection of primary data

Prior to the interviews, the informants were sent a consent form via email as well as the interview guide. Hereby their consent of using their shared information was retrieved that explained their rights, as well as giving the respondents the option to prepare for the interview. At the start of each interview, the respondents were reminded of their rights and asked for their consent to record the interview.

The interviews were conducted on Microsoft Teams and were recorded – when consent was given – to re-listen to the information given. Moreover, this enabled full attention during the interview itself with less focus on note taking. During and after the interviews we took notes to memorize and leverage the key take-aways and insights from the interviews.

3.3.4 Data collection of secondary data

In addition, secondary data was collected through annual reports as well as other available documents, reports, and (financial) statements, about the companies. The secondary data was used throughout the process of collecting all the data. Secondary data was used to set requirements to see how a company grows, giving indication of relevant company size and funding stages.

3.4 Data analysis

3.4.1 Preparing data

Data analysis, being an ongoing process throughout the data collection and analysis phase, was undertaken to find important themes, patterns, and findings (Saunders et al., 2016). After

data collection through in-depth interviews, these interviews were analyzed by first transcribing the data, a process that was done soon after completing the interviews in order to be most accurate and capture important aspects such as expressions, pauses and other types of non-verbal communication (Saunders et al., 2016). The transcribing process was done in the language of the interview, whereafter the interview was translated to English in case the interview was in another language.

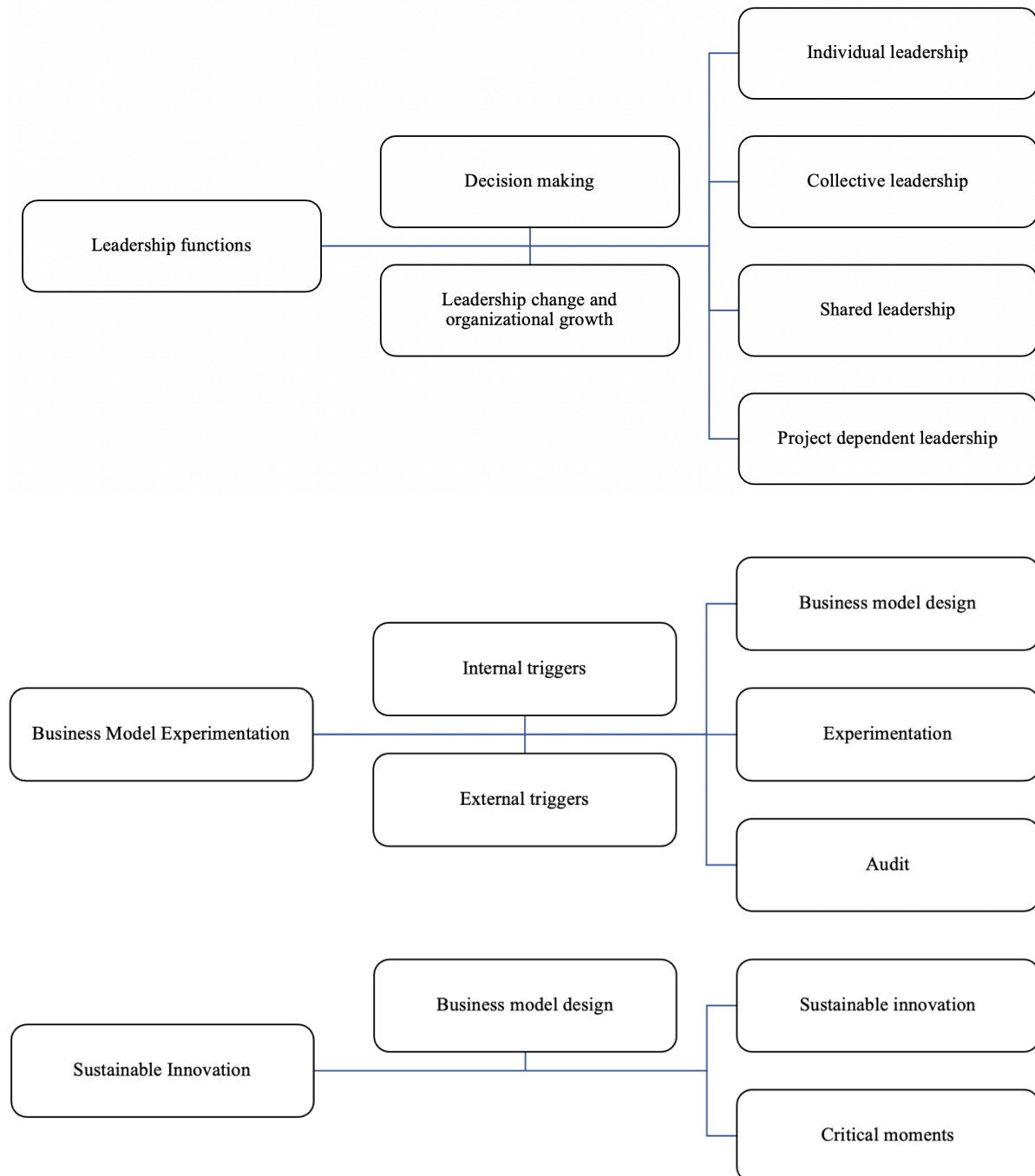
3.4.2 Analyzing interviews and coding data

First the data of the interviews was categorized using codes, allowing for data to be assigned to simple (raw-data based) analytical categories. During this initial coding, codes arise from utilizing terms that emerged in the data itself and consisted of both an internal aspect that allowed for codes to be meaningful to data and an external aspect that required a code to be meaningful to other categories (Saunders et al., 2012). While the specific codes arise from a data driven perspective, the Eisenhardt (1989) framework is considered to analyze the data based on a case framework (Eisenhardt, 1989) Units of data were thereafter assigned to different categorical labels in the qualitative coding tool Atlas.ti.

After categorizing data, the data was further analyzed by looking for key themes, patterns, and relationships. The codes were compared and placed into broader categories making it more manageable. During this process, some new codes and categories arose to further explore patterns in order to move towards the generation of an explanation of the research question (Miles and Huberman, 1994). In the process of analyzing the data, I took a step back and reanalyzed the data through focused coding, which allowed me to use initially discovered codes as broader labels of categories together with codes that are used most frequently or are most important. (Charmaz, 2006). By the continuous comparison of data and codes an analysis developed that consisted of a high level of abstraction. The reanalyzing of data as well as the constant comparison that comes with this allowed me to check for similarities, stimulate the process of data analysis and contribute to the consistency. After the coding in Atlas.ti the data was organized there, which allowed me to view code groups and find relevant connections (Miles and Huberman, 1994). In total there were 18 codes divided over six code groups.

The initial coding consisted of finding broader analytical categories, which were related to the three fields of this study: Sustainable innovation, business model experimentation, and collective leadership. Several patterns were found in this, in business model experimentation

we can see that there are internal and external triggers that lead to this, while leadership forms show different types of structures such as collective leadership, leadership that is shared but also factors such as the change and expansion of leadership.



3.5 Research and Data Quality

Several aspects ensure the research quality of the project. Due to the nature of qualitative research, a lack of standardization might be present, which leads to some concerns about

reliability (Saunders et al., 2012). Moreover, biases can occur that can influence reliability. Saunders et al. (2012) suggest there are three types of biases that can arise: interviewer bias, response bias and participation bias. Interview bias relates to the tone and/or non-verbal actions of the interviewer that could influence the response by the interviewees on the questions asked. This can partially be prevented by excluding own beliefs and frame of reference when conducting the interview. It can also occur due to a lacking credibility by the interviewee and a limited amount of valuable information given, two aspects that are harder to control. Response bias relates to the perceptions of interviewees about the interviewer. The nature of this bias does not necessarily come from a perception related to the interviewer, but rather about the in-depth unstructured exploration of certain themes. A confidentiality agreement can partially remove this bias, making the interviewee more comfortable in sharing certain factors, therefore increasing reliability. Participation bias means that participants have a reduced willingness to partake in interviews due to, for example, time-consuming requirements (Saunders et al., 2012). By sampling the right firms and people and clear communication, this bias can be controlled for.

Since the assumptions that are explored with semi-structured interviews are complex and dynamic, the findings and data from the interviews are not always intended to be repeatable (Marshall and Rossman, 2006). Instead, semi-structured interviews allow for flexibility in exploring the complexity of the research question. Reliability is thus not achieved through repeatability, but rather through the realistic assumptions that arise by the interviews which can therefore be used to replicate findings (Saunders et al., 2012).

It is often argued that due to the lack of statistical validation with qualitative research, generalizability cannot always be reached with the smaller sample of cases. However, by linking this thesis to existing theory, it can be argued that the cases have a broader theoretical significance (Marshall and Rossman, 2006; Yin, 2009). While with the exploratory research the goal is to develop a theory, existing theoretical propositions can be used in order to create a relationship between existing theories and new findings and theory (Bryman, 1988; Saunders et al., 2012)

Validity is achieved with a well-developed interview guide which consist of questions that probe meanings and explore responses from different angles (Saunders et al., 2012).

Below the quality of the research is assessed according to the above-mentioned factors based on the dependability, credibility, transferability, and conformability of this study encompassing the important quality requirements for a qualitative study.

3.5.1 Dependability

To reach dependability in the study, the stability of the findings over a period needs to be evaluated, a process comparable to reliability (Saunders et al., 2019). The interpretation when conducting the interviews influences the interview as the research relies on the interpretation of one's realities during the time of the interviews, which could be subjective and conditional to change (Saunders et al., 2019). To create dependability for the study, a detailed methodology before the data collection was created in order to receive feedback from the supervisor as well as the other teams within LEAD-IN. As the interviews were conducted with another team present, there was the option to have at least one person as observer and critical note taker, keep a record of changes made throughout the interviews. All in all, the aim with the research and data collection was to cover all parts of the research process and therefore create a reliable account of the study that can be evaluated by others (Lincoln & Guba, 1982). To ensure dependability, a record of changes was made which allowed for an audit trail. Hereby, the goal was to create a trustworthy and dependable research that can be replicated.

3.5.2 Credibility

Credibility is closely aligned with creating internal validity. This is necessary to establish a correlation between the realities that were presented as a researcher during the time of the interview with the constructed realities of that of the respondents (Saunders et al., 2016; Sinkovics & Ghauri, 2008). A basis of trust needs to be built up for this, combined with sufficient data that is collected. To ensure the credibility, prior research established a foundation of knowledge for me as researcher that was open for new inputs based on the constructed realities of the informants. As multiple informants from the same firm were interviewed, credibility is strengthened.

By providing a safe environment during the interviews I aimed to ensure the respondents that there were no right or wrong answers, thus giving them more freedom what to say. Moreover, by ensuring confidentiality the respondents could speak freely with the knowledge the answers would not lead back to them. The interviews were conducted over Microsoft Teams. While

Teams provided a digital platform that makes it more difficult to assess non-verbal communication, it allowed for a single research instrument to be used.

Participant errors pose a potential threat to credibility. This refers to any factors that could negatively affect the way in which the informants perform or act during the study (Saunders et al., 2016). To minimize this, the participants received the interview guide beforehand, allowing them to prepare for the interview. Moreover, by aiming to provide a safe and comfortable interview environment I aimed to minimize the risk on participant bias. Potential errors in data analysis by the researcher such as biases or misinterpretation were reduced by establishing a clear research and data analysis structure that was built on continuous feedback.

3.5.3 Transferability

Similar to external validity, transferability looks at the generalizability of the findings. However, transferability specifically looks at the applications of the findings in situations, times, and other settings (Saunders et al., 2016). While the research can provide significance in a broader research context, the findings are specific to a smaller and specific section of an industry. The transferability to a wider context is therefore not fully possible, however, could be generalizable to similar contexts. This is supported by the detailed context provided in the study on the research design, allowing for a replication of the contexts.

3.5.4 Confirmability

By looking how the data identifies the objectivity of the study, the confirmability can be concluded (Saunders et al., 2016). During the study, a clear research design was made and adopted and feedback was provided as a continues process. Furthermore, the responses by the informants were confidential aiming to get as open and honest answers as possible. While all biases cannot be ruled out, the structure and foundation provided a solid method to avoid the personal opinions and conceptions to disrupt the study.

3.6 Ethics

To avoid unethical conduct throughout the process of the research, ethics must be considered and planned for (Saunders et al., 2016). The research has been entirely conducted according to ethical guidelines by the Norwegian School of Economics (NHH). First, in order to assure confidentiality of the interview respondents, the names of the interviewees are replaced with

pseudonyms to avoid negative consequences of participation. Furthermore, revealing information about the respective companies is adjusted in the citations. Regardless of these confidentiality measures, it cannot be entirely ruled out that individuals can be identified. The research has also been subject to high level of objectivity and integrity to maintain quality and reliability of the study, while biases can occur, these are ruled out as much as possible. At last, all collected data was shared with the supervisors and some data was shared with other DiG RaCE LEAD IN members to facilitate learning and create a more complex understanding of the data. All data will be deleted after the research project comes to an end. All data measures are according and approved by the Norwegian Center for Research Data (NSD).

3.7 Limitations

Several limitations of the study are worth noting. As the timeframe of the study is limited while performing a qualitative study, the analysis of the data cannot be done with a longitudinal study. This limits the amount of times data can be analysed followed by new interviews to gain new insights. Furthermore, a limited number of case companies could be selected, mainly due to the time limitations. A limited number of case companies resulted in a limited number of available formal and informal leaders to interview within these companies. While the data obtained is still of enough quality, the study would have advanced from more informants.

4. Results

In this section the main findings and results of the research are displayed. Overall, the findings derived from the data analysis show how leadership dynamics shift from being individually oriented to becoming a more collective function in the process of experimenting with business models in different phases – that arise through internal and external triggers in the first years of firms – nurturing the commitment towards sustainable innovation and organizational growth. The contextual model presented in the theory section is used as a springboard to illustrate how leadership dynamics are present through the process of business model experimentation for sustainable innovations. Furthermore, figure 5 builds a framework based on existing research that is used to construe the findings. The framework is built on sustainable innovation, leadership, and business model experimentation. Specifically, the framework is built on Morgeson et al. (2010) sources of leadership, incorporating the internal and external aspects of the locus of leadership, as well as the formality or informality of the function of leadership in organizations. Second, the model incorporates Greiner's (1998) model of growth, specifically for a high growth sector such as the energy sector. Including stages of evolution and revolution illustrates the changing function of leadership while the size of an organization grows as time passes over different phases of the organizational growth.

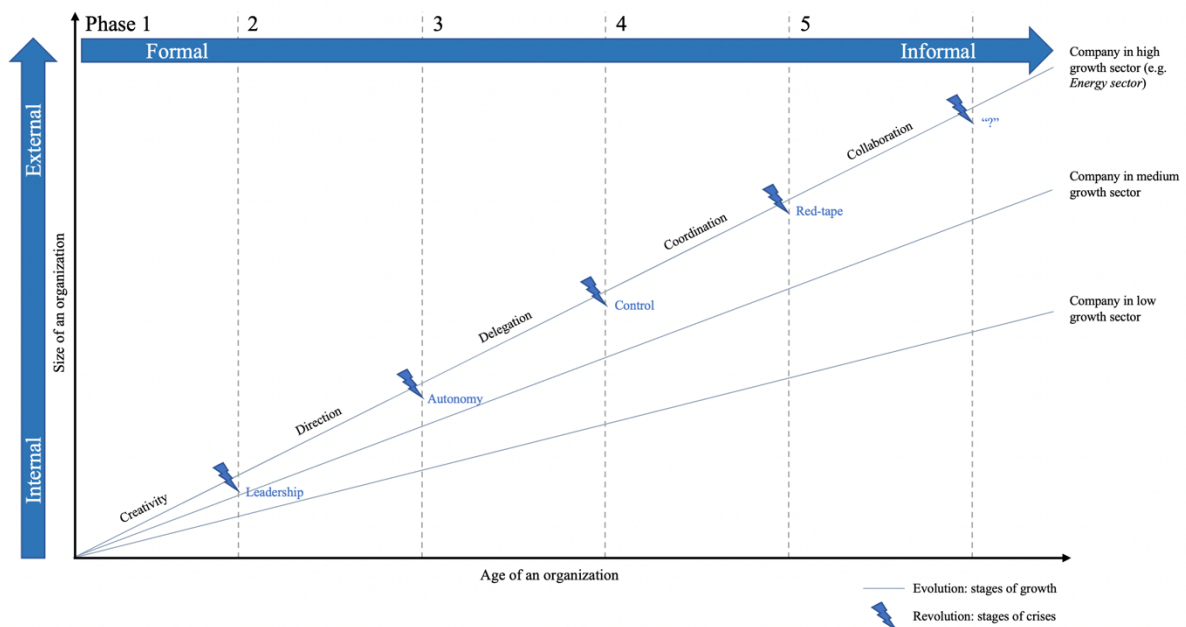


Figure 5. The changing function of leadership during organizational growth

Built on this theoretical framework, the findings can examine the relationship between the formality and informality of leadership as the organization grows over different phases.

Furthermore, the framework provides a foundation to explore how business model experimentation affects the dynamics of leadership in organizations focusing on sustainable innovation. Interestingly, the results show that startups in the Norwegian energy sector experience evolution and revolution in a similar order, however in three distinguishable phases contrary to the five phases as defined by Greiner (1989). The results are thus presented in three rather than five different phases of growth in sustainable innovation management: (1) the founders' phase, (2) the formalized leadership and role-based management phase, and (3) the collective leadership transformation phase, which will be shown in the following figures.

First, the findings delve deeper into the phases by discussing and illustrating the different leadership dynamics in the different phases of the firm, and how these functions develop as the startups grow in size over time. Notably, the findings show that leadership dynamics change over time as the firms experience critical moments and experiment with their business model. Alternately to following a linear path with evolution and revolution, the startups temporarily move back to previous phases in an agile manner, seeing the next phase after collaboration as a new process starting at creativity. This is explained in the next set of results which will present how the experimentation with business models influence leadership in a transition between phases.

Interpretations are stemming from illustrative quotations acquired through primary data. Each set of findings will be exemplified using a part of the contextual model, displaying how the function of leadership shifts in the three phases. The findings will be concluded after each phase and summarized in the last section.

4.1 The changing function of leadership as organizations grow

4.1.1 Evolution of creativity in the founders' phase.

During the first phase, the founders' phase, the organization is developing a product and market, and thus starts developing their business model. Founders are entrepreneurially oriented and have a focus on the technical side of things, putting less effort into leadership duties. The creativity activities are key for the organization to start; however, they often lead to first problems as the organization grows, as founders need to take on a wide variety of management tasks next to innovating their product or service. The first set of findings will

show how leadership dynamics in the first phase, and how several factors influence leadership as the company starts.

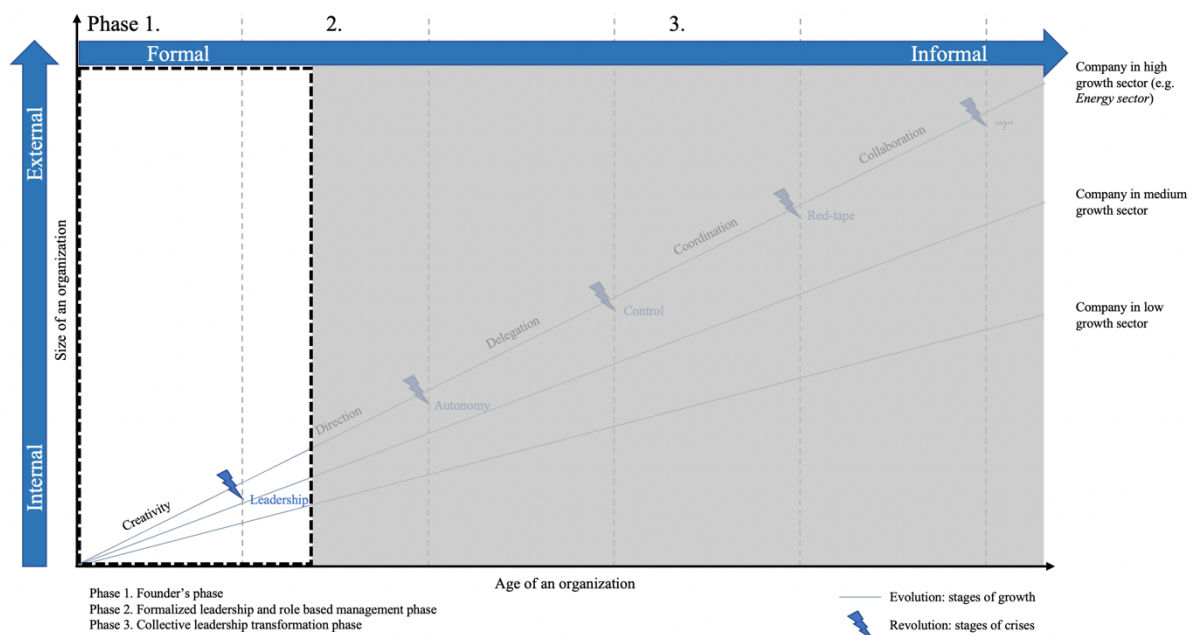


Figure 6. Leadership in the founder's phase

The analysis reveals interesting insights into the dynamics of leadership and innovation within the early phases of organizational development. Notably, the findings revealed that during the initial phases of the firm, the founders tend to prioritize the development and growth of their innovation, often neglected leadership dedicating less attention to managerial tasks. The innovation itself is considered paramount, with the founders believing that for the organization to thrive, the innovation must be developed. This highlights the commitment and passion of the founders towards their idea, which provides them as key drivers behind the development of the organization in early stages.

“So, it has been a very much let's say, situation-based management is that what you call it, so it's, it happens to be myself that is the inventor and also then standing as a private individual, you might say, and then you want to form the company to drive the invention further and to make the innovation so to speak” (Informant 1)

Leadership is typically characterized by the existence of one or more focal individuals in the firm. Leadership is fulfilled by individual forms of leadership in which the founder, CEO or a certain person has the clear lead of the firm, project, or process. As teams are still small, leadership is taken on by the founder or CEO while it also dispersed over the other people that

enter the firm early. This decentralized leadership approach reflects the flexibility and adaptability required in growing an organization with a small team.

“Both me and the board are of the opinion that it is best to lead that by myself”
(Informant 1)

Interestingly, the presence of multiple founders in a startup introduces a distinct dynamic. Leadership is distributed among multiple founders of the same firm, resulting in more than one person having influence on leadership functions. While decision making and other leadership activities are not clearly defined in a firm as such, a degree of formality does need to be applied for a partnership to function. Involvement of co-founders or partners thus play a significant role in shaping the leadership landscape during the first phase of the firm.

“Joined the company with a partner [...] we were two people to really start developing the firm” (Informant 4)

As the organization progresses in the first phase the importance of finding a suitable leader becomes evident. The focus of the organization shifts from the innovation towards the need for effective leadership to guide the organization towards growth. During the transition, leaders engage different sources of leadership, such as getting co-owners or investors on board who are willing to take an active role in the firm or take a role in the board. The focus is predominantly on getting the company started, which means the leaders' focus is on getting investors on-board.

“We managed to get the first investor [...] that made an investment that made it possible to work in the company” (Informant 1)

Overall, these findings extend assumptions about the relationship between leadership and sustainable innovation in the first phase of startups. While the innovation remains a central focus for leaders, the findings highlight the evolving role of leadership and the growing recognition of its significance in shaping the organization over the first phase. The findings show an interplay between creativity in developing the initial innovation and the emerging importance of effective leadership structures within the first phases to support sustainable development.

4.1.2 Formalized leadership and role-based management influenced by autonomy and control.

After a formal leader is appointed, the findings about this phase will show that start-ups indeed follow a more directive form of leadership, creating more formalized functions. A desire for autonomy, however, will lead to new delegation roles, shifting more towards collective leadership. Nonetheless, control thereafter appears necessary as critical moments require a more formalized function.

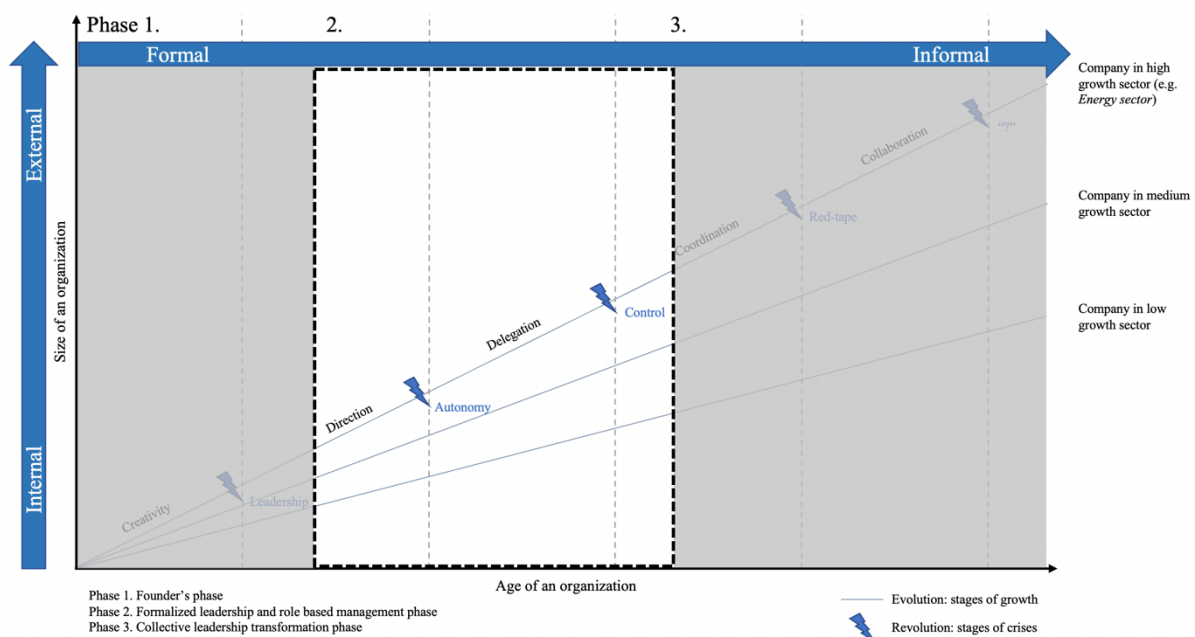


Figure 7. Leadership in formalized leadership and role-based management phase

As the startup expands and new employees join during the second phase of growth, leadership within the organization disperses beyond the founding team. The pace of leadership expansion is not equal for all startups and varies due to factors such as funding availability. The findings show that startups face challenges in securing investment to move their operations forward. To further facilitate this growth, the hiring of additional personnel is seen as essential, reflecting a strategic pursuit for growth in the organizations.

“It is tough for a startup to get in position to get funding and to progress the company. [...] we were eventually also able to hire more people [...] to support the activity.”
(Informant 1)

When leaders in the firms start conceptualizing and developing an actual product that is made ready for launch, leadership in firms changes. Internal and external developments lead to a shift in the processes of firms, with new areas of expertise and importance. Simultaneously, new situations lead to the occurrence of critical moments and the function of leadership often growing into a formalized process to establish a solid foundation for the firm. Decision making is typically done by the CEO, board, or other top management functions while smaller departments or teams start to form, and leadership thus shifts from an individual to formalized function.

Leaders are still working on business model development and are narrowing down their business model design towards validation of assumptions. Concurrently, leaders are looking for employees who fit in their current development leading up towards the innovation launch. With the right funding in place, new employees are hired in the second phase to construct further development for the next phase.

“So since then, we have kind of, I would say, developed the business plan, we have attracted people to start working on the task, and we have also raised money to finance our operation. So, now we are a very narrow, focused company at the moment.”
(Informant 3)

The findings also uncover an interplay between business model development and the recruitment of employees during this phase. Leaders in the startups actively seek individuals who fit the trajectory and culture of the organization, and with adequate funding in place, the leaders strategically hire new employees to advance the organization’s progress. As the identity of the organization takes more shape, founders and early and early employees play a pivotal role in shaping the firms values and direction. Leadership in the organization maintains a formalized structure during this phase, as the employees navigate various tasks.

“[...] when we had the core team together, the first five of us, we sat down, and we had a good process on our values, vision, and mission. We spend a lot of time [...] discuss how we would do things.” (Informant 2)

With small teams, leaders tend to give extended ownership of projects and situations to a greater majority of people in the firm during the second phase. Different projects and tasks see different ownership and leadership; however, decision making is still formalized, and the final process ends at designated leaders. High performance by employees is desired and is intended

to arise by giving freedom and ownership to employees. Nevertheless, the findings show that the structure and direction of decision-making processes remain formalized, with designated leadership having ultimate authority.

“We were [at the time] a small company [...] we were discussing all kinds of things and I had full freedom to do whatever I wanted to do in my daily work, but overall, the direction [of the firm] was of course governed” (Informant 4)

This set of results illustrated the growth of a startup over time as the desire for growth increases, and displays the interplay of autonomy, formalization, and collective decision-making, holding important implications for startups navigating the challenges of leadership during growth. Startups start hiring their first employees which see modest dispersion of leadership in the organization. However, as the organizations are still relatively small, the employees take on a wide variety of tasks. As the company grows further, and the hiring process increases in pace, the first indications of leadership moving towards a collective approach appear. Nonetheless, leadership stays formalized in this phase, and proceeds with a structured approach.

4.1.3 Transformation towards a collective leadership approach

After a certain time in the formalized leadership and role-based management phase with a formalized and relatively structured leadership function, the continuous hiring process and therefore size of the organization starts to grow to precipitate a more collective leadership approach within the organization. Leadership becomes more dispersed as collaboration increases, and innovation gets elevated as input enhances.

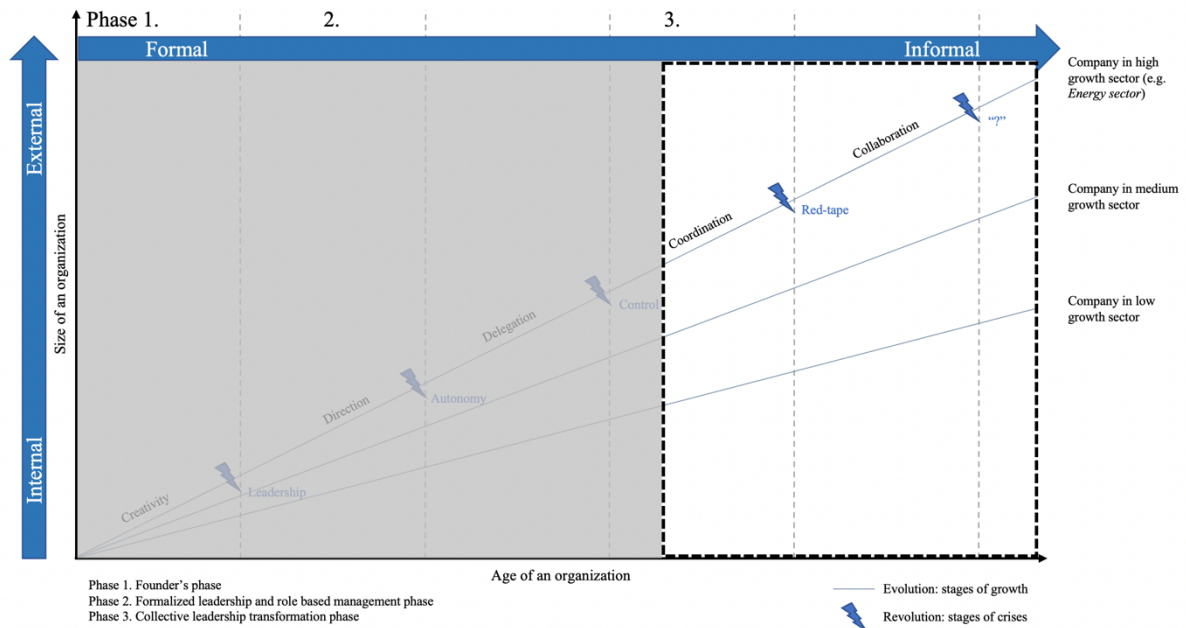


Figure 8. Leadership in collective leadership transformation phase

When leaders have conceptualized their ideas, developed a sufficient foundation for their firm and start growing in number of employees, leadership develops into new forms. With new departments and teams in action and more employees in the firm, leadership takes a broader role. Not only do multiple people take on leadership, but this leadership also shifts between different situations.

People that are in the firm since the second phase who often have maintained a certain leadership role, recognize the need for employees who are able take on ownership. The findings show that leaders hire new employees partially based on competence on functioning in a firm with a collective leadership approach.

“So, it is really the team [which] is the key thing here, to get a good team together. That is what investors are going for, they are not going for the idea [but] they are going for the team.” (Informant 2)

With more employees joining the firm, more people are involved in the business processes. While initially leadership and ownership of tasks were divided over the few employees in the firm – who often have top-management functions – the leadership in the third phase is divided collectively but remains formalized due to the small size of the team. With more people joining firms, leadership seems to grow with the size of the firm. The leadership and ownership

dynamics spreads' out over the different employees and does not remain in only top management, therefore conveying towards a more collective approach.

“I think [leadership], it is a collective effort. Everyone has its role and all of us are doing our best. [...] all contributions are important in reaching the goals of the company.” (Informant 1)

The growth of collective leadership seems to rise as more people join the firm through the coordination between teams and functions. Teams are smaller in size – relative to the entire firm – and therefore initially make it easier to disperse leadership. Certain projects and situations therefore allow for different types of collective leadership built through coordination, creating situations in which all employees are involved and others with only the employees directly involved in the project.

“From a process point of view, three [employees] are located abroad being the manager in their country and part of the management team. We get some suggestions from the project [team], the designer and elements like that. Then we bring it to the product development meeting where we discuss the proposal. [...] if we say it is worth to pursue than they identify key people, whatever element of innovation we're talking about to drive it forward. Then we have a design review and that is very democratic, [...] we can allow everybody in the company to report the design review.” (Informant 5)

While more people take on ownership in the firm, the decision-making structure within firms – during normal business processes and situations – experiences a shift. In certain situations, the decision making also becomes more collaborative and democratic, with more people getting involved. Input comes from multiple different angles and decision making is not always only done by top-management or the CEO.

“Things are heavily discussed among management, sales and marketing, supply chain and everyone that is involved in differences on that. Of course, the board which consists of many experienced people and also large owners are directly involved in how to approach things” (Informant 1)

The results here have shown that firms continue to grow, therefore creating the first teams. With the right coordination in the firm, leadership shifts from a directive form to a more

collaborative approach, which ultimately leads to collective leadership in different scenarios. New – more informal – leadership roles appear as certain decision-making processes simultaneously disperse over these employees. The next section will illustrate how critical moments will influence the role of leadership and how these influential moments result in leadership going back to earlier forms in an agile way.

4.2 Shifting back to formal leadership in critical phases

In all three phases of the firms, major changes as well as developments lead to critical moments for the firms and the accompanying leadership. Critical moments can be the internal and external triggers that occur in experimentation phases. Nonetheless, critical moments could also arise during major upturns and downturns for the firms, or during important decision-making situations. These critical moments can thus be positive and negative, however always influence certain leadership dynamics within the firm.

As the firms move through the phases, leadership changes as described before. Generally, leadership moves from a more individual approach towards more formalized and thereafter to certain collective leadership dynamics. Remarkably, during critical moments, however, a shift back to a formalized leadership approach is visible, thus going backwards from collective leadership. The still relatively young firms are highly flexible and agile, and therefore adapt rapidly to critical moments, shifting decision making and other leadership dynamics towards a structured and formal setting.

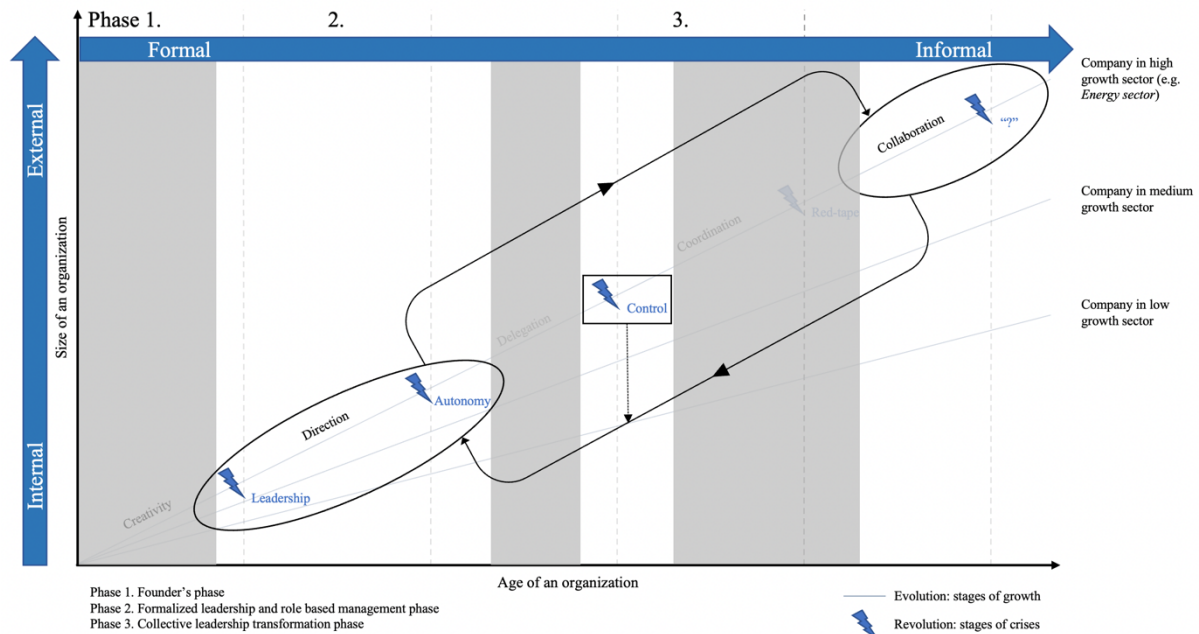


Figure 9. Shift in leadership dynamics during critical moments and business model experimentation

During critical moments, leadership thus moves as a process back to a structured setting with higher level of leadership direction. As startups are still highly prone to defaulting, top management implements more hierarchy to prevent failure.

“[We] had to stick together as a team obviously, very beneficial that we are few, [which allows for easy] communication and short decision making. Pretty simple in terms of the hierarchy, very tight leadership group, but I think so that builds some coherence.” (Informant 5)

During critical moments, the influence of external investors and the board also take a larger role. These parties put on more pressure and try to take a more active role in decision making by influencing the management team. While the leadership within the firm becomes more structured, the final decision making could pose more challenges with extra steps to be taken.

“My board didn't see kind of the full consequences of what was happening, which we saw a couple of years later. So that was a very decisive moment for a company which at that time, it didn't fully understand the concepts consequences of what we actually set up.” (Informant 4)

With critical downturn in later phases, the teams have grown in the firms. The people who take on leadership functions feel the need to keep teams motivated. During downturns or other critical moments in earlier phases, it can often lead to firms defaulting or failing. Therefore, the right leadership practices need to be in place for the firms to survive.

“I think the downturn is really to see that what we believed was the finding investment dates or finding decision points for projects where our technology our crucial part of the projects, the decision process and dragging out in time. Okay, that is that is kind of the kind of the motivation challenge from time to time, to see projects dragging out. So both the both for the management and also of course for the team to kind of keep the motivation high when you see that projects are not being sanctioned as planned.”
(Informant 3)

4.3 The interplay between leadership dynamics, organizational growth, and business model experimentation

4.3.1 Leadership influencing organizational growth and business model experimentation

An important aspect of this change of leadership is how this relates to experimentation with new business models. Experimentation requires the startups to be highly flexible and adaptable. During periods of experimentation, leadership sometimes first shifts towards a more collective approach as the phases of the firm progress to allow for greater input and collaboration from the employees. However, once important decisions need to be made, or the new business model needs to be implemented, a structured approach is needed to implement the changes effectively, thus seeing leadership shifting back to a more formalized setting. This allows for greater clarity and direction in the decision-making process, providing an organization to move forward with a greater deal of purpose and efficiency. A difference between the conceptual model can thus be observed. Notably, the leadership function shifts from an informal and external approach built on collaboration in a collective leadership setting back to a formal and directive leadership approach, which is desired to have a greater form of control to steer the organization through critical moments and experimentation.

Leadership influences experimentation of business models in two different stages: (1) experimentation and adaptation of the business model in the first phase, between the first and second phase and in the early stage of the second phase, and (2) experimentation and adaptation of the business model in the later part of the second phase, between the second and third phase and in the third phase. As leaders in the organization develop a business model, the leaders start experimenting as a result of triggers that initiate the process. These triggers can be categorized in internal triggers – triggers that arise from internal competence such as knowledge and disruptive ideas – and external triggers – triggers that arise outside of the organization such as market developments and customer demands – both occurring for a firm. Within the first stage, both internal and external triggers are noticeable, while in the second stage the experimentation is generally influenced by solely external triggers.

The process of experimentation in the first and second phase of business model evolution is broad, and the dynamics of leadership within the organization have a large influence on the experimentation process. Leaders have a crucial role in this phase as they actively develop the business model while simultaneously strive to effectively position their innovation in the market. The experimentation efforts revolve mostly about scouting for optimal approaches to leverage innovation, rather than on extensive business model expansion or transformation. Given the composition of the organization, which primarily consists of founders, CEOs, and the management team, the dynamics of leadership significantly shape the decision-making process for experimentation. Moreover, financial limitations further emphasize the influence of leadership dynamics on the experimentation process. Leaders are required to be cautious in the decision-making process while engaging in experimentation to drive growth and innovation.

“I would describe it as a continuous process. It's a decision that it's not like you wake up in the morning say we must do this. I haven't seen it before, but now I see it. It's a continuous and ongoing process with a lot of information on different areas and angles. And slowly a picture is changing, and you see a pattern and you see opportunities and you understand more, and you discuss this you could try out some things with other people and you get some feedback as this is this is how it evolves.”

(Informant 4)

The development and design of the business model is intrinsically linked with the design of the organizational structure. Foundational aspects of the organization are developed and

considered simultaneously to the business model. This consists of determining leadership roles that are present, positions of authority, and methods for enhancing organizational growth. This is an ongoing process as experimentation entails engagement with various phases of evolution and revolution over time, aligning with Greiner's model of growth (1989). Leadership dynamics play a crucial role in shaping the relation between business model development, organizational growth, and the experimentation process, as decisions made by leaders have direct impact on the structure of the organization. Furthermore, the ongoing nature of experimentation shows the significance of leadership dynamics. As business models adapt and evolve, leaders must make necessary adjustments that foster experimentation. This correlation between leadership and experimentation contributes to the refinement of organizational growth. Leadership dynamics change as formal leaders start sharing leadership roles.

“What many founders fail to do is to [...] the ability to give away more shares than you think you should. You always have a great expectation for your share. But then again, if you're not willing to give away more than 50% of the company, in a seed round, you won't get the money. Nobody wants to invest in a company whether the founders have full control. That's a key thing and that's a psychology we had to overcome. And I think.. we agreed on it. It had to do with that we had tried for some time we have worked on it.” (Informant 2)

In the early stages of organizational development, the dynamics of leadership play an important role in shaping the process. During this phase, leadership dynamics follow the same flow as established in the figure 5. As the business model evolves in the first creativity phase, leadership dynamics shift from a directive form towards delegation and coordination. This shift is further dispersed among individuals that are located in various (geographical) areas of the organization. These transformations of leadership dynamics facilitate the exploration of new ideas, thus enabling startups to facilitate sustainable innovation.

“We have a business model that [...] we can basically grow organically in terms of where we have specific projects [...] we can then dedicate a local project manager that can guide locally how to build this.” (Informant 5)

During the transition from phase two to phase three, the business model becomes more defined. This, however, does not discontinue business model experimentation. Contrary, startups with an established business model continue to experiment in order to exploit their

innovation and nurse the sustainable innovation process. Leadership dynamics are key in facilitating these experimentation efforts, and navigate the organization down different roads, including the adaptation of the business model to external triggers, design business model extensions, or experiment with business models for large transformations that align with internal capabilities and external demands.

“I think that will take place in the future; we will challenge our business model. And we will try to twist our offering from the traditional delivery of technology model to a more service-based business model where we maybe own and operate the infrastructure and just offer services to the end client. I'm not saying that we will do it, but that is certainly one potential business model that we will need to evaluate if that is more favorable for our customers and for ourselves.” (Informant 3)

Leadership dynamics also play a crucial role between the transition from phase two to phase three. In shaping the process of the experimentation with the business model, leaders identify and respond to triggers. The emphasis at this stage shifts towards external triggers, driven by new market opportunities, evolving demand, and customer feedback. The leaders are in charge of the strategic decision making and also aim to cultivate an organizational culture that drives experimentation for sustainable innovation. By leveraging the leadership dynamics, leaders aim to adapt, explore, and exploit new business model opportunities that will ultimately to sustainable growth and innovation. While the dynamics of leadership stay comparable, they further influence the business model experimentation process.

“As far as the main innovation, so I came to you know, the table was decked to put it like that, but having said that, of course, we have a lot of processes that goes towards improving, you know, the offering, which is a continuous effort.” (Informant 5)

4.3.2 Leadership dynamics are as a process affected by business model experimentation

The process of experimentation, that largely happens in the collective leadership through collaboration phase, a key factor is observed. When making key decisions that happen during experimentation, startups adapt a new leadership function quickly. Due to their relatively small size, they are flexible and move to a more structured leadership approach. Therefore, the function of leadership is shifting from collaborative back to structure and delegation, moving back through the phases.

“It needs a firmer or more structure involvement by the management team [...] during such [larger] decision” (Informant 3)

Experimentation with business models thus shifts the function of leadership. Experimentation starts in earlier phases by internal and external triggers, followed by mostly external triggers in latter stages. Leadership is crucial in the process but needs to adapt to effectively steer the organization through the process. When leaders experiment in the first phases, the current leadership style in the organization is structured, which helps organizations to efficiently move through the process. In the end of the second and in the third phase, the collaborative approach results in two aspects. First, more dispersed leadership and freedom sees more innovative ideas being brought to the table, which leads to more experimentation with the business model and innovations. This, however, results in organizations desiring more control once more, thus going back to a structured approach. In consequence, experimentation and business model adaption consequently can be seen as a new process. A process that starts at new creative ideas by new employees, moving through the phases of delegation, coordination, towards collaboration and collective leadership. Being agile while already having employees and a business model foundation, means that it is likely that firms will move through these stages faster, or potentially spend relatively less time in certain phases.

“So we try to have a lean and transparent organization with kind of structure but not overly structured because we will need to kind of base our performance, which is very much culture driven, and it's driven by strong individuals that are given freedom to develop and to think by themselves. But I think, we of course need to have certain decision authority metrics, etc. in place” (Informant 3)

4.4 Summary of findings

The findings illustrate the influence of leadership dynamic on the process of business model experimentation during growth for sustainable innovation. Startups experience rapid adaptation of leadership functions during key-decision making processes. The flexibility and adaptability as well as relatively small team size enables startups to transition from a collaborative leadership approach to a more structured and delegated approach as experimentation progresses. The function of leadership thus shifts accordingly, moving back and forth between phases as the organization evolves. Leadership is critical throughout the experimentation process as it must adapt to effectively steer the organization through its

complexity. In the first phases, in which experimentation is triggered by both internal and external factors, leadership sees a structured style that enables efficient growth. As experimentation advances due to leadership dynamics, the notion of leadership itself changes as a more collaborative approach emerges, portrayed by dispersed and informal leadership with increased freedom for employees, aiming to foster innovative ideas and enable further business model experimentation for sustainable innovation. This collaborative phase, combined with the increasing complexity of business model experimentation, eventually leads to a desire for increase control, proposing a return to a formalized and structured leadership approach. The process of leadership and business model experimentation can be seen as a dynamic cycle. New creative ideas are shaped and progressed through phases of delegation, coordination, collaboration, and collective leadership in the organization leading to the initiation of experimentation throughout the phases due to the leadership dynamics, ultimately cycling back as the organization desires control.

5. Discussion

The intention of this thesis is to contribute to and extend the current literature regarding leadership and sustainable innovation (Carrillo-Hermosilla et al., 2010) by exploring how leadership changes over time (Greiner, 1998), as a startup experiments with its business model (Bocken et al., 2019; Jørgensen & Pedersen, 2018). The study shows how leadership changes from an individualistic form with a founder as the centrality to leadership, to a formalized structured form of leadership with role-based management, to eventually encompass collective leadership as the firm grows.

Through qualitative data collection with semi-structured interviews, combined with rigorous data analysis, several compelling findings have formed. The contribution of these findings is presented in the framework below.

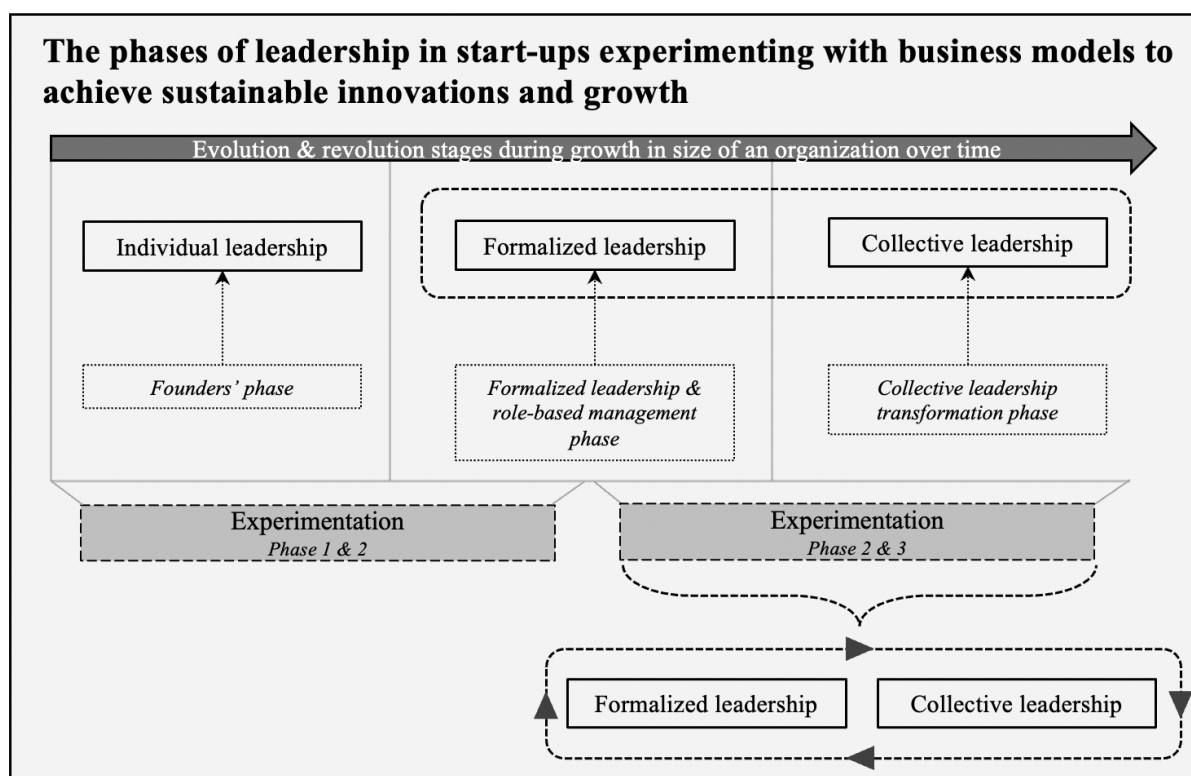


Figure 10. The phases of leadership in start-ups experimenting with business models to achieve sustainable innovations and growth.

The evolution and revolution stages were identified within three different phases: (1) individual leadership, (2) formalized leadership, (3) collective leadership. These reflect on the three phases of leadership in startups: the founders' phase, the formalized leadership & role-based management phase, and the collective leadership transformation phase. As the

organizations grow in size over time, input and contribution to experimentation evolves from the process of leadership. This leads to a shift in leadership function. As the model illustrates, leadership goes back as a process from formalized leadership to steer the organization through the complexity of the experimentation until it reaches a point in which it can facilitate collective leadership again. This will lead to new evolution and revolution stages for the startups that need to be further explored.

5.1 Theoretical implications

This study has contributed how leadership develops to enable sustainable innovation (Hughes et al., 2018) as well as the literature on collective leadership (Denis et al., 2012) in a sustainable innovation context. Research is limited on collective forms of leadership and its correlation with the experimentation of business models as a firm grows in size over time. Overall, the research contributes to this field of research by providing new findings and insights into the changes in how collective leadership is enacted during business model experimentation in startups with a focus on sustainable innovation.

As Morgeson et al. (2010) researched, the formality of leadership can differ between formal and informal leadership. The findings show that as startups develop and grow over time the formality of leadership changes from formal to informal as a structured form of leadership changes into a shared and collective leadership function. The findings add to the existing literature by suggesting that the number of employees in the organization influences the change of leadership in a faster way than illustrated before. Even with a low number of employees in the organization, leadership can shift from an individual to a collective approach with only small teams in place spreading through the organization and its boundaries (Langley et al., 2012) even in early stages.

Further, the phases of growth in an organization are often defined as five separate ones. As Greiner (1998) showed, leadership changes in five phases to a collaborative approach. Yet, the findings showed that leadership in startups within the energy sectors take three broader phases rather than five. Were Greiner (1998) showed five phases of evolution, the findings concluded three phases of leadership development in broader form, illustrating how leadership dynamics shifts over phases rather than over specific functions.

The findings further add to Greiner's (1998) model by developing and adopting it to a leadership and sustainable innovation context. Greiner (1998) argues that leadership evolves from a structured to collaborative approach as the size of the organization grows over time. The findings first go one step further, showing that leadership thereafter moves to a collaborative function. Furthermore, the findings notably show how the process of business model experimentation brings startups back to earlier phases, taking on an increased formalized and structured leadership function to steer the startup through the complexity of experimentation.

5.2 Practical implications

The findings of this research explore the function of leadership in startups focusing on sustainable innovations in the Norwegian energy sector. As an overall practical implication of this study, business model experimentation is acknowledged as critical factor that influences the function of leadership in an organization. As Greiner (1998) argues, leadership changes over time as the firm goes through stages of evolution and revolution. The formality of leadership shifts as new employees join the organization (Morgeson et al., 2010) and organizations can go from formalized leadership to a collective approach as leadership spreads through the organization (Langley et al., 2012). Practical implications on the influence of business model experimentation on the function of leadership within startups in the energy sector, however, is scarce. This research is an early contribution to the centrality of business model experimentation on leadership dynamics in achieving sustainable innovation.

The traditional understanding of leadership development often relies on models that propose a linear progression through distinct phases. The findings of this research exhibit a different pattern of leadership development, providing three phases of leadership in the first stages of a startup, which diverges from Greiner's (1998) five stages of evolution and revolution. By understanding the specific phases of leadership development relevant to their contexts, startups can proactively anticipate and address leadership challenges at each stage. The understanding that this provides can guide leaders to better anticipate and navigate through the different stages of leadership, thus more effectively ensuring a smooth transition from structured to collaborative approaches, fostering sustainable innovation needed to lead the transition to net-zero in the energy sector. The implications of these phases extend beyond merely understanding the direction of leadership.

To effectively leverage leadership capabilities, the startups will need to align their leadership strategies and development initiative. By recognizing and adapting to these phases, the startups enable themselves to enhance leadership practices and optimize an approach to sustainable innovation. This alternative perspective challenges the current assumptions about the linear progression of leadership development, contributing to the current literature by providing insights in the unique leadership dynamics within startups in the energy sector.

Second, a flexible organizational structure can accommodate the evolving nature of leadership. Traditional hierarchical structures may hinder the emergence of collective leadership and sustainable innovation. An openness by startups to adapting new leadership approaches and structures while the organization grows, can facilitate the emergence of informal and shared leadership roles. This flexibility can foster a culture of innovation and sustainability as diverse skills and perspective can more effectively be leveraged. If engagement at all levels increases, the contribution to the collective leadership function grows, allowing for more empowered employees that in turn are more likely to embrace collective leadership and thus contribute to sustainable innovation.

At last, the findings of the research suggests that startups that are engaged in business model experimentation may need to temporarily shift towards increase formalization and structured leadership to successfully navigate through the complexity that is provided by the process. Experimentation with business models goes paired with uncertainties, risks, and the need for focused efforts to test hypotheses and assumptions. Startups will require a more deliberate and controlled approach, often moving to temporary formal leadership structures or the appointment of specific leaders during phases of experimentation. By adopting a strategic approach to business model experimentation, startups can effectively manage complexity and align resources, which are needed in a high growth sector such as the energy sector. In addition to providing a framework to set objectives, a structured leadership approach assists startups in maintaining clarity when testing various aspects of their business model. Once the experimentation phase is completed, the startups can transition back into a more collaborative and shared leadership approach, allowing for agility, adaptability, and innovation as the organization integrates the insights gained. Leaders should foster an environment that encourages creativity and embraces failure as an opportunity for growth to further develop sustainable innovation in the energy sector. The resulting culture of experimentation can further facilitate the adoption of a flexible organizations structure, enabling the organization to respond effectively to changing market dynamics and drive sustainable innovation.

5.3 Strength and limitations

The research on collective leadership during business model experimentation, and the implications this has for sustainable innovation in startups has several strengths and limitations.

The research contributes to existing literature by addressing a gap in research on collective forms of leadership and its correlation with business model experimentation, specifically in the context of startups within the Norwegian energy sector. The findings present provide new insights and empirical evidence that enhances the understanding of the changing nature of leadership and its impact on sustainable innovation. Additionally, the research builds on theoretical perspectives from established scholars. Building upon and extending theories provides a solid theoretical foundation for the findings and implications. Furthermore, by conducting a multiple-case study, the methodology of the research allows for a comprehensive analysis of the research area, providing a better understanding of the complex dynamics of business model experimentation in relation to the dynamics of leadership in startups.

Although the research provided several strengths, limitations are also present and important to consider. First, the research focused specifically on startups within the energy sector in Norway. This could limit the generalizability of the study, making it harder to generalize the findings over other industries or locations. Replicating the research in other contexts could provide validation of the findings, extending the applicability or the results. Moreover, data collection and analysis are exposed to subjective measures which could lead to biases and limitations accordingly. At last, the research focusses on the correlation between leadership development and business model experimentation within startups. Regardless of the value that this brings, future research can explore broader organizational or ecosystem factors that influence leadership dynamics and sustainable innovation, therefore building a more holistic perspective of the research area.

5.4 Future research

Future research in this area should concentrate on several important areas. First, longitudinal studies that follow startups over an extended period would contribute with valuable insights into the dynamics of collective leadership and its correlation with business model experimentation over phases that are in this research unexplored. Investigating how leadership

evolves over longer phases and adapts throughout different experimentation processes can provide long-term implications for sustainable innovation. Further, exploring contextual factors that affect the transition from formal to informal leadership and the effectiveness of collective leadership in startups would enhance our understanding of this research area. Additionally, research should focus on the evaluation of development interventions specifically for startups that engage in sustainable innovation and business model experimentation. Comparative case studies across different industries can establish variations and commonalities in the dynamics of experimentation and its correlation with collective leadership. Other research streams can explore how startups can effectively capture and leverage knowledge that is obtained through the experimentation process to enhance sustainable innovation. Addressing these different research areas will contribute to advancing knowledge and providing evidence-based guidance for leadership practices in startups, benefiting sustainable innovation for startups.

6. Conclusion

The research has explored the changing role of leadership of phases during growth of Norwegian start-ups in the energy sector, and the affect this has on business model experimentation to foster a commitment to sustainable innovation. Based on an inductive analysis, the findings revealed that leadership changes over time as companies grow in size over time. The pace of change is affected by factors related to business model experimentation such as models for funding and hiring strategies and sees firms developing over three phases of growth. As leadership moves from an individual approach to a formalized structured approach, leadership dynamics change to facilitate sustainable innovation. As the firm continues to grow and adopt a collective leadership approach, experimentation with business models increases. The experimentation creates a shift in leadership roles, becoming more formalized in a new process. The research contributes to existing literature on leadership by exploring the relationship between leadership, between business model experimentation and growth of sustainable innovation start-ups. Future research in this area can improve the understanding of this relationship and discover patterns over longer phases of organizational growth.

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7. Appendix

7.1 RaCE consent form

Consent form- participation in research project at NHH

Background and purpose

This research project is part of the RaCE program at SNF and NHH. The purpose is to investigate how Norwegian companies respond to technology-driven change. The main focus is to understand how leadership can be developed to support sustainable innovation, particularly looking at business model experimentation and emotion regulation.

What does participation in the study involve?

The interview will take roughly 45 minutes. If you approve, we will record the interview on audio file and transcribe it afterwards. The audio file will be deleted after transcription, and the transcribed version of the interview will be anonymized.

What happens to the information about you?

All personal information will be treated confidentially, and the information stored with the transcribed version of the interview will not contain a name - but a dedicated code. Names and any contact information, as well as this form, will be kept separate from interview data. Only the project group at NHH / SNF will be able to access the anonymized interviews.

Your company will be anonymized. The project is scheduled to end in December 2022.

Voluntary participation

It is voluntary to participate in the research project, and you can withdraw your consent at any time without giving any reason. If you withdraw, all information about you, and your interview, will be deleted. If you have any questions about the project, you may contact Synnøve Nesse (synnove.nesse@snf.no) for any questions regarding this research.

On behalf of SFN / NHH, NSD - Norwegian Center for Research Data AS has assessed that the processing of personal data in this project is in accordance with the privacy regulations.

Your rights

As long as you can be identified in the data material, you have the right to - access which personal information is registered about you

- to have personal information about you corrected
- to have personal information about you deleted

- to receive a copy of your personal information (data portability), and - to send a complaint about the processing of your personal data.

What entitles us to process personal information about you?

We process information about you based on your consent.

Consent to participate in the study

Please reply to the email that you received the consent form from to accept your participation in this study.

(Signed by the informant, date)

7.2 Interview guide

Interview guide

The aim with this interview is to understand how business model experimentation may influence the process of succeeding with sustainable innovations in the Norwegian Energy sector.

We define business model experimentation as the design and innovation of a (new) business model. I hope to be able to ask you questions about your role, other leaders in and around your company and critical points in the sustainable innovation process and ask how you dealt with those situations and how and if business model experimentation may be connected to achieving successful sustainable innovation in your company.

For the purpose of this interview, I would like to address that you have received a consent form prior to taking part in this interview, which states your rights to voluntary participation. Before we begin the interview, I would like to ask for your consent to record and transcribe your answers and use this in our master thesis for the purpose of generating theory about how leadership can be developed to support sustainable innovation.

The findings from the study will be part of a larger project concerning leadership and sustainable innovation led by our supervisors, researcher/consultant Synnøve Nesse (SNF/AFF) and consultant Anne Line Grepne (AFF) through DIG/SNF, which is part of the research project RaCE (Radical Technology-Driven Change in Established Firms and LEAD IN (Innovating Leadership to Innovate in Organizations)).

First, we see leadership as something that can stem from the CEO, the board of directors, other formal leaders in the firm, or informal leaders or teams in the firm, or even an advisor or more – or an investor. Can you state your own role and relationship with the others in the firm before we start?

Questions about leadership and sustainable innovation:

1. Can you describe the process in your firm leading to a new sustainable innovation. a. How does leadership change over time in the process of a new innovation?
2. Looking back at your company's ups and downs over the years, can you describe any critical moments or events during this time that you would consider as particularly positive or negative for your company?
3. Who were influential during these critical moments?
 1. Any individual that specifically comes to mind? Did the informal roles change over time?
 2. How would you say it was a collective effort?

Business model experimentation:

4. How do you experiment with your business model?
 - c. Can you describe the process (e.g. who decides on experimentation)

5. How does the function of leadership differ in business model experimentation over time? (e.g. experimentation in the first phases of the firm vs when scaling or after slight growth)

Other:

6. Is there anything else you would like to add to the topic of leadership and sustainable innovation?

7.3 Additional quotes

Code group	Code	Quotation
Business model experimentation	Audit	<p><i>R5: «Because of course, we can't you know, as a business afford that to happen again, basically, unless it's something really dramatic, but it also so So something we could have done better on that part, basically, on our you know, dimensioning in the setup to some degrees, some elements of how do we follow up and supervise the local construction company»</i></p>
	Business model design	<p><i>R4: “So what I think what we managed through those years was to support industry and understanding on the technical side, how things could work. What were the opportunities and the possibilities with that technology as it was today? How would things look like how would it how much will it cost? And so on so on»</i></p>
	Critical moments	<p><i>R3: “I think that the most struggling moments are when we see that projects in the renewable sector are moving to the right, according to the time axis there. There are easy to see delays, especially when you are kind of bringing in new technology into a market. There are a lot of hurdles that</i></p>

		<i>needs to be passed. That tends to take time.»</i>
	Experimentation	<i>R5: “So it's, but there are incremental steps. You know, we look at different ways of placing this there's different ways of using [innovation]. We play around with architecture. In terms of [innovation] that we're bringing these elements like that. Different attachment methods that we're looking at.»</i>
	External triggers	<i>R6: “The market dictates certain things sometimes. I mean, so far, we've been able to be in front of that curveball. I can see that there could be regulations for instance, coming up»</i>
	Internal triggers	<i>R8: It's probably more internal [triggers] all the time</i>
Leadership factors	Decision making	<i>R3: “I think I am trying to let small decisions run by himself by the team or it's when there is important strategic decision to be taken»</i>
	Ineffective leadership	<i>R1: “At some point this is a classic fault often made by entrepreneurs and innovators that they do not see their deficiencies or, or once the company becomes, let's say enter another phase where we have more aesthetic product. It's more maybe perhaps more internationalization. It's more sales and marketing driven, for instance, then it's</i>

		<i>very important to to be aware of the... any new situation in that area and then the company is, it could be better led by others with another skill set»</i>
	Internal communication	<i>R8: “Right now... we don't actually have scheduled meetings. Maybe we should have that. I do have that in another company where I also have a similar role, but we're talking about.. we're talking ad-hoc-based, but we're talking at least once every week. I think we certainly do, on average. I spoke to him yesterday, I spoke to him last week. I talk to him.. At least.. Let's say on average once a week.»</i>
	Leadership change	<i>“Oh, it's pretty steady, the most important owners has been with us for a long time and also board members. And we are a growing organization. So if there are any new elements, it's often the new employees or, but it could also be ideas from consultants or other external sources and when it comes to energy, it's very important what administration's in government also decide if you have new legislation for instance, then you quickly need to adapt to that new situation»</i>
	Leadership growth	<i>“So but eventually it was... we manage then to get the first investor, who was an old high school friend of myself that</i>

		<i>made the investment that made it possible to work in the company, and he also joined the company and then later there was some important investment rounds, essentially old colleagues from Rec and that quickly understood the technical challenge and the potential of the innovation»</i>
	Organizational growth	<i>“So it was... but as you probably know and heard, it is a very tough phase for a startup to get in position to get the funding and to progress the company but we managed to do that and had several investment rounds and we're eventually also able to hire more people, more engineers to support the activity.»</i>
Collective leadership	Collective leadership	<i>“You know, it's these things are heavily discussed among management and sales and marketing and supply chain and everyone that is involved in in differences on that and of course the board which consists of many experienced people and also large owners also are directly involved in how to approach these things»</i>
	Shared leadership	<i>“So the thing was that both me and partners that I ended up with, we were just two people. We weren't so we were hired in and employed in a company that was already set up so we didn't do</i>

		<i>anything on the setting up of the company as such, other than kind of filling it with things and making it running»</i>
Individual leadership	Individual leadership	<i>“I have always when I work alone as an inventor I always filed the patent by myself. Then I tried to sell the idea to get a royalty fee.»</i>
Sustainable innovation	Sustainable innovation	<i>“At the same time we had a very incremental innovation in that in that space»</i>
Formalized leadership	Project dependent leadership	<i>“Yeah, it is. It's structured, I would say but, but I took on the position as the CEO in 2019, early 2019.»</i>
	Structured leadership	<i>“It needs a firmer or a more structured involvement by the management team and all employees in such decisions (larger decision).»</i>