

## Organising for a Sustainable Shift in the Underground Mining Industry: A Qualitative Case Study on the Building of Dynamic Capabilities

### Abstract

Following increased awareness of social and environmental challenges, the underground mining industry is currently entering a shift towards sustainable development. To adapt to the changes, original equipment manufacturers (OEM) supplying the underground mining companies are now rethinking their technology and offering configuration. An established research stream, dynamic capabilities, has grown in acceptance as enabling strategic change. In a single case study, this paper makes an attempt to understand how an incumbent OEM within underground mining can develop a foundation for new dynamic capabilities while implementing a new business model. The authors conclude that by creating an inter organisational unit as a stakeholder for the new business model, many of the incumbency related challenges can be overcome and the building of a foundation for dynamic capabilities can be facilitated.

Key words: Mining industry, dynamic capabilities, business model innovation, ambidexterity

### Authors:

Alexander Deimel (41396), MSc. in Business & Management

Therese Höijer (23154), MSc. in Business & Management

### Supervisor:

Henrik Glimstedt

Per Andersson

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## Glossary

**Ambidexterity:** One of the most accepted definitions is the one by Tushman and O'Reilly (1996); *“The ability to simultaneously pursue both incremental and discontinuous innovation and change results from hosting multiple contradictory structures, processes, and cultures within the same firm.”*

**Battery powered machines:** In this thesis they are considered as underground mining machines powered by electric batteries.

**Business Model:** *“A business model describes the rationale of how an organization creates, delivers, and captures value”* (Osterwalder and Pigneur, 2010).

**Dynamic capabilities:** One of the most accepted definitions is the one by Teece et al. (1997); *“We define dynamic capabilities as the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (...).”*

**Epiroc:** The focal company in this paper.

**Rocvolt:** The inter-organisational unit responsible for electrification within Epiroc.

**Mining Operators:** The companies responsible for operating mines - customers to the OEMs.

**Original Equipment Manufacturer (OEM):** In this thesis, used to denote a supplier of a machine that is used for mining

**Sustainable development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environmental Development, 1987, p. 41)

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# 1 Introduction

There are few that have missed the global debate that has been developing around social and environmental challenges. Through the Paris agreement, world leaders are coming together under the 17 Sustainable Development Goals (SDG) intended to address challenges like environmental pollution, poverty, health and education (Appendix 1). To address the identified environmental challenges and enable sustainable development, technology development is considered one of the major contributing factors (Foxon, 2010). In the corporate sector, the transition to sustainable development is currently challenging known truths on how to organize and business models must be reevaluated (Schaltegger, Hansen and Lüdeke-Freund, 2016). The industries responsible for the biggest shares of CO<sub>2</sub><sup>1</sup> pollution through fossil fuel emissions, are now pressured to reduce their impact. To reduce fossil fuel deployment, companies are both adopting new business models and investing in research and development of new technology. Experts believe that one of the major technological innovations that will have an impact in fossil fuel dependent industries will be electrification (Barkenbus, 2009). The automotive industry, still dependent on fossil fuel, is a well-known example with the electric vehicles gaining market share around the world (Munoz, 2019). Another industry that is heavily dependent on fossil fuel is the mining industry. By being a major environmental polluter in the world, the mining industry has become an important area of development for countries (Jenkins and Yakovleva, 2006).

## 1.1 Drivers in the Mining Industry

The mining industry is currently undergoing a transformation to keep up with legislation initiatives to reduce negative social and environmental impact (Epiroc, 2018). The aim is to reduce emissions and noise, as well as to improve the health and safety of the workers operating the mines. Changes in the mining industry have the ability to positively contribute to the SDGs, especially: “industry, innovation and infrastructure”, “responsible consumption and production”, “good health and well-being” and “life on land”. Regarding “responsible consumption and production”, also the indirect effects from the entire value chain of the material being mined must be considered. For example, customer of the mined material, such

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<sup>1</sup> Carbon dioxide

as Apple and BMW, have increased their interest in being able to track the origin of the material, so called material sourcing (Lars-Åke Lindahl, 2019).

Recent accidents made capital holders from a financing and risk management perspective increase their pressure on the mining companies to report in more detail about their operations. Large investors in the finance sector have joined forces in an initiative and written a letter to the 600 biggest mining companies in the world. The intention is to increase the reporting from the mining companies. Safety issues in some global mining operations create a big risk on the value of the investment. Additionally, there is an increasing interest to make green investments in the industry (Lars-Åke Lindahl, 2019). The mining operators are therefore incentivized to explore new ways of working socially and environmentally conscious. However, the industry is moving slow as the mining operators are in many countries not forced to change their operations yet. The technology is currently evolving and issues regarding for example shared standards need to be solved to motivate large investments by the suppliers of the machines.

Besides that, the move to electrification in mines is an interesting business case for underground mining. One of the biggest cost drivers in underground mining are the ventilation costs. Underground mines are inoperable without ventilation due to the heat and emissions from combustion engines. At the same time, underground mines are on average getting 30 meters deeper every year and are already now moving more weight in air for ventilation than actual rock (Åsa Gabrielsson, 2019). This development is therefore expected to continue to drive the costs for ventilation for the mining companies if nothing gets changed.

The mining industry is one of the biggest industries in Sweden and paramount for the country's export. Today, Sweden represents approximately 90% of the iron ore production in Europe (Lars-Åke Lindahl, 2019). Naturally from a historically big domestic market, Swedish original equipment manufacturers (OEMs) have a long heritage of developing high quality mining machines and are today among the biggest suppliers in the world. To stay relevant for the mining operators, the incumbent OEMs must now consider the social and environmental shift in society and act proactively to develop machines and solutions.

## 1.2 The Incumbent Firm and Technology Shift

Drastic changes tend to be big challenges for incumbents. Technology and market changes are the most common reasons for market leading companies to lose their leadership position (Bower and Christensen, 1995). Established companies typically do not possess the competencies to explore new technologies. Technology changes are usually connected to the departure from existing knowledge and shifting from profitable and proven technology to something new (Anderson and Tushman, 1990). Due to the specialized competences of employees, they usually focus on improving the established technology and therefore miss potential opportunities (Hall and Vredenburg, 2003). Even if new technology developments are recognized managers often fail to act on them, because they do not seem attractive compared to the established technology. Due to that and the rigid investment processes within big corporations, incumbents often fail to allocate resources to emerging technologies (Bower and Christensen, 1995).

Important to note is that even if a company manages to effectively explore a new technology, the shift to the new technology does not happen instantly but takes time. Therefore, incumbents have to be able to exploit existing assets and technology in a profitable way, while exploring the new. Hence, the incumbent must find a way to simultaneously manage efficiency and control while embracing innovation and autonomy. Literature written on the firm's ability to exploit and explore simultaneously, suggest the development of dynamic capabilities (O'Reilly and Tushman, 2008; O'Reilly and Tushman 2013). Dynamic capabilities can be seen as an extension of the resource-based-view, in the need to better explain how companies can keep their competitive advantage during technology and market changes (Teece, 1997). Teece (2007) has extended the theory and based it on the process of sensing, seizing and reconfiguring, aiming to look at how companies identify new opportunities, invest and act on them and adapt their routines and processes. An important step to seize new technology effectively is the adaption of the business model (Teece, 2018), especially in the face of sustainable development (Geissdoerfer et al, 2018).

## 1.3 Research Gap

Firstly, the fields of dynamic capabilities and business model innovation are still quite young and therefore in need of additional research (Schilke et al., 2018; Geissdoerfer et al., 2018). An



aspect that is posing a gap in existing literature is the implementation of new business models (Teece, 2018; Geissdoerfer et al., 2018). The case is especially relevant for incumbents in their development of new business models that require reconfiguration of existing resources (Teece, 2018). In case incumbents decide to diversify their business model in response to a changing environment, it is necessary to simultaneously exploit the old business model while exploring the new. Therefore, theories like dynamic capabilities and ambidexterity can add to our understanding when it comes to business model innovation within incumbents (Schaltegger et al., 2016). Secondly, the dynamic capabilities influence how well a company can innovate a new business model with existing resources, but also how the new business model affects the dynamic capabilities of the incumbent (Teece, 2018). The current literature does not elaborate on that. Therefore, the authors want to use the opportunity of researching business model implementation, to better understand how the new business model can affect the dynamic capabilities of an incumbent.

### 1.3.1 Research Purpose and Research Question

In order to contribute to the above presented research gaps, this study will investigate how Epiroc is able to build the foundation for dynamic capabilities in order to deal with technological changes in the mining industry. An empirical case study and dynamic capabilities as a theoretical lens will contribute to the understanding of (1) how a new business model gets implemented within an incumbent and (2) how the new business model contributes to the building of dynamic capabilities. The authors expect that this will contribute to the understanding of how the incumbent is able to simultaneously exploit and explore. Therefore, this paper will illuminate the following research question:

*How do incumbent OEMs build the foundation for dynamic capabilities to drive a sustainable industry shift?*

In order to answer this question in a structured way the following two sub research questions will be explored:

1. *What effect can the implementation of a new business model have on building new dynamic capabilities?*
2. *What can an incumbent do in order to effectively exploit the existing technology while exploring new technology?*

## 1.4 Delimitations

This study will be focused on building the foundation for dynamic capabilities to drive its transition to a sustainable way of operating. Therefore, the implementing of a new business model and other initiatives will be investigated. These can be understood as the foundation to build new capabilities. To allow an in depth understanding, the authors would like to stress that the focus is on the creation of new dynamic capabilities. This was done in order to address the research gap.

## 1.5 Research Outline

In better identifying the most important challenges and drivers that are changing the mining industry, the authors conducted an orientational study prior the main study (Flick, 2014). By doing so, an understanding of the context of the industry motivated a special interest in the underground mining industry. Expert and industry reports elaborated on why the incitements for technology adoption are high in the underground mining industry and highlighted some interesting early stage engagements.

In order to provide knowledge and answer the above research questions, the authors conducted an in-depth case study of Epiroc, an OEM in the underground mining industry. The systematic combining approach by Dubois and Gadde (2002) was followed to iterate the findings of the case company with the addition of new theory in order to get deeper in the analysis. The authors got a unique opportunity to get an in depth understanding and insight in the internal activities of sensing, seizing and reconfiguring to drive a sustainable shift in the industry. Primary data was collected by interviewing subject matter experts and Epiroc employees. The secondary data consisted of company reports, the company website, industry reports.

## 2 Literature Review and Analytical Framework

In order to understand how an incumbent organises for a technology change, the authors must develop a suitable analytical framework, to analyse the identified data in a value adding way. The analytical framework in this paper will be combined from the literature streams of dynamic capabilities, business model innovation and ambidexterity. Building the framework, each literature stream will be reviewed.

### 2.1 Dynamic Capabilities

As can be seen in the introduction the focus of this paper lies on a single case study concerning a technology shift an OEM in the mining industry is facing. The authors want to investigate how that OEM is planning for that shift and how resources and processes have been and will be adapted by building the foundation for dynamic capabilities. As already identified by Teece et al. (1997), theories to study the strategy process in competitive environments are competitive forces theories like Porter (1980) or the resource-based perspective (Wernerfelt, 1984; Prahalad and Hamel, 1990; Barney, 1991). Nevertheless, for the authors purposes, competitive forces theories put too much emphasis on the environment of the firm, rather than how resources and processes are adapted within the firm. The resource-based perspective on the other hand puts a high focus on the company's difficult to imitate resources through which a company can deliver superior quality or produce at lower cost. Nevertheless, less effort is put on the aspect of how companies can adapt their resources to the external environment. Other theories considered were within the stream of organisational change literature. Especially the sub streams of change enablers and change methods (Al-Haddad and Kotnour, 2015) seem to be suitable fields. Nevertheless, this literature typically delimits itself to the change process and therefore has little to no connection to the external environment and aspects like competitive advantage.

Dynamic capabilities are often seen as an extension of the resource-based view, which was officially introduced by Barney (1991) and further developed by Helfat and Peteraf (2003). When Teece et al. (1997) introduced the dynamic capabilities concept they wanted to shift the focus from the resources to the actions that help a company to change and adapt. Therefore, it is a suitable lens to analyse the actions that are supposed to help the focal company to adapt to the changing external market environment and will be the underlying concept for this paper. Additionally, two highly relevant concepts for the case study, business model and

organisational ambidexterity, are compatible with the dynamic capabilities literature. (Teece, 2018; O'Reilly and Tushman, 2008; O'Reilly and Tushman, 2013).

In order to get an understanding of the concept of dynamic capabilities, it is important to take a brief look at resources, competencies and capabilities and how these ideas are used in strategic management research (Mohamud and Sarpong, 2016). Resources are owned by an entity and can be classified into physical resources, intellectual resources and employees (Collis and Montgomery, 2008). Capabilities can be understood as the ability of a company to use its resources effectively, while competences can refer to actions that are successful and/or efficient (Drnevich and Kriauciunas, 2011). Dynamic capabilities are the routines and processes that shape and renew the resources (Romme et al., 2010) and competences (Ambrosini and Bowman, 2009) of a company.

Dynamic capabilities have to be built over time and therefore many authors agree that learning is an important part of the dynamic capabilities construct (Teece et al., 1997; Zott, 2003; Winter 2003; Eisenhart and Martin 2000). Zollo and Winter (2002) argue that learning is the source of dynamic capabilities through which a company can systematically modify its operating routines. In a longitudinal study, over a period of 20 years, Bingham et al. (2015) support the above assumption. Nevertheless, it is important to note that continuous learning is resource intensive and therefore is dependent on sufficient and available slack resources (Salge and Vera, 2013).

### 2.1.1 Current State of Literature

During an extensive literature review, Schilke et al. (2018) identified the three most commonly used definitions for dynamic capabilities. The most used one is *“We define dynamic capabilities as the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (...)”* by Teece et al. (1997). Followed by *“The firm’s processes that use resources—specifically the processes to integrate, reconfigure, gain and release resources—to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die”* (Eisenhart and Martin, 2000) and *“A dynamic*

*capability is the capacity of an organization to purposefully create, extend, or modify its resource base” (Helfat et al., 2007).*

Although, all three definitions are set up in different ways, two common themes can be identified, which will be considered throughout this paper. (1) The ability of the firm to change its competences and resources (2) to be able to adapt to the changing external environment. Searching for the term dynamic capabilities on Google Scholar shows that the usage of the term has been continuously increasing over the last 20 years (Schilke et al., 2018). Nevertheless, research by Di Stefano et al. (2010) shows that next to the commonalities there exists confusion about what constitutes dynamic capabilities. Di Stefano et al. (2010) assume that the reasons for this are related to the concept’s development path. More recent work supports the value of dynamic capabilities and has helped to fill conceptual holes, but due to the relatively young age of the concept, more research is needed to further develop the dynamic capabilities perspective (Schilke et al., 2018).

### 2.1.2 Context of Dynamic Capabilities

Dynamic capabilities are consistently mentioned in connection to change throughout the literature (Nedzinskas et al. 2013). Also considering the definitions above it can be seen that change is reflected as a common theme. Nevertheless, some authors question that change has to be a part of dynamic capabilities (Winter, 2003; Helfat and Peteraf, 2003; Arend and Bromiley, 2009). Arend and Bromiley (2009) argue that just because a company does not change, that does not mean that they don’t have the ability to change. Besides that, there have also been discussions concerning the link between dynamic capabilities and volatile environments. Zahra et al. (2006) are not excluding dynamic capabilities from less dynamic environments, but they argue that the value of dynamic capabilities could be greater in volatile environments. Therefore, external influences like technology and market changes typically trigger dynamic capabilities.

### 2.1.3 Organising Framework

In their extensive literature review Schilke et al. (2018) present one of the most recent and comprehensive frameworks in the dynamic capabilities literature. A brief summary of that

framework will be made as it will partly be incorporated in the analytical framework, but it also gives the reader orientational guidance when further reading through this paper.

**Antecedents.** Recent research has identified different relevant antecedents that can affect dynamic capabilities positively or negatively (Schilke et al., 2018). Organisational factors can for example be resource-richness of a firm (Giudici & Reinmoeller, 2012; Helfat & Peteraf, 2009) and organisational experience (Pisano 2002; Chen, Williams and Agarwal, 2012). Also, individual factors like human capital (Hsu & Wang, 2012), leadership (Kor & Mesko, 2013) and managerial cognition (Dunning & Lundan, 2010) can have impact on dynamic capabilities. The third relevant area of antecedents are environmental factors, which have already been discussed in 2.1.2.

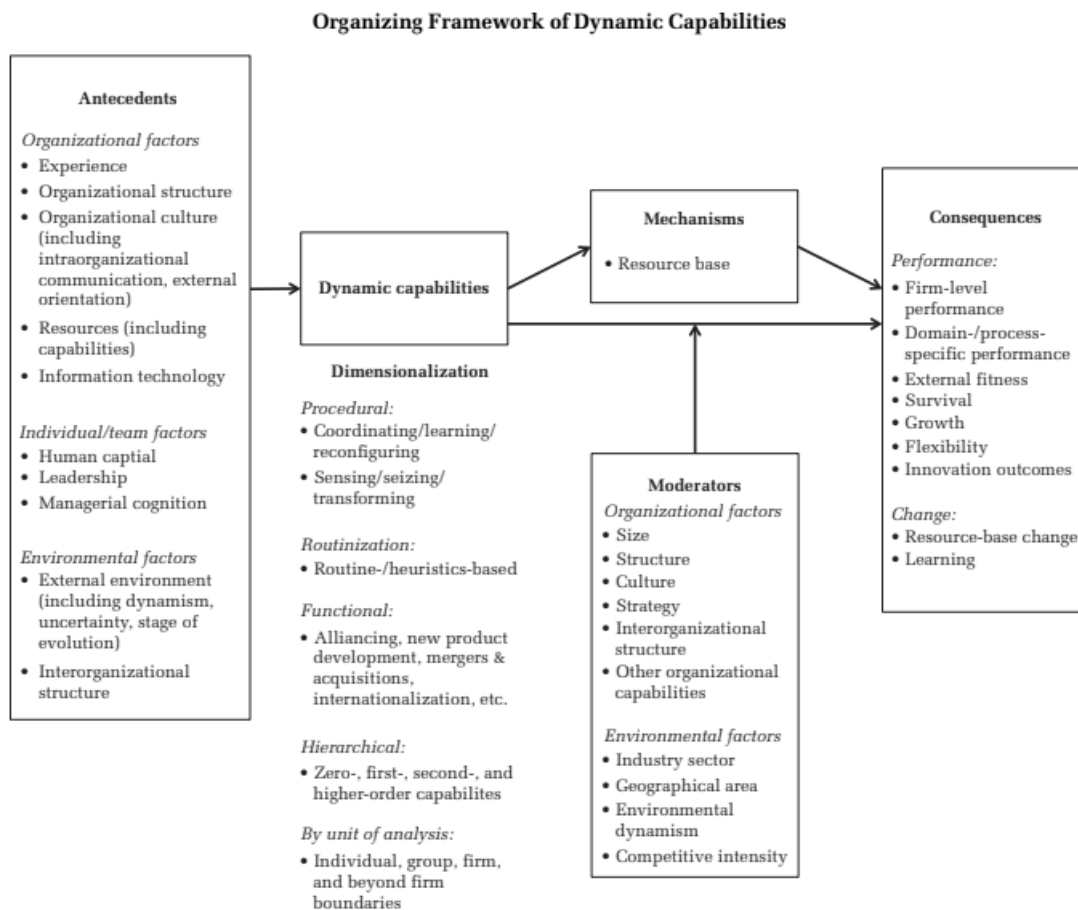


Figure 1 - Organising Framework of Dynamic Capabilities

Source: Schilke et al. 2018.

**Dimensionalization.** Schilke et al. (2018) state that due to the complexity of dynamic capabilities, analysing the concept among different dimensions has increased its richness and our understanding of what can be defined as dynamic capability. For example, the procedure

of dynamic capabilities. Teece et al.'s (1997) coordinating, learning and reconfiguring and Teece's (2007) sensing, seizing and transforming are the most recognised typologies. The latter one will be of central focus in this thesis. Another dimension is the degree of routinisation. Many authors have emphasized that routines are a main part of dynamic capabilities (Teece et al., 1997; Teece, 2007; Winter 2003; Helfat and Winter, 2011). Nevertheless, there are situations where routines seem less present, as for example in the entrepreneurial aspect of managerial decision making (Teece, 2007; Augier and Teece; 2008). Many studies classify dynamic capabilities also related to their position within the hierarchy of capabilities (Collis, 1994; Danneels, 2008; Winter, 2003; Zahra et al., 2006; Wang and Ahmed 2009). Winter (2003) wrote one of the most recognised articles on this topic. Her hierarchy of capabilities builds up from zero level capabilities at the bottom, to first-level capabilities and higher-level capabilities at the top. Zero-level capabilities refer to operational capabilities, being administration and basic governance. First level-capabilities, also called micro-foundations (Teece, 2007), are influencing and developing the zero-level capabilities. Higher level capabilities include tasks like new product development and expansion into new markets.

**Mechanisms, Moderators and Consequences.** Karimi and Walter (2015) have been looking at the way dynamic capabilities affect company performance. The mechanisms influencing the performance outcomes are changes in the resource base. Additionally, performance outcomes are also context dependent. Therefore, organisational and environmental factors can influence them. The reason many scholars became interested in dynamic capabilities was the possibility of explaining sustainable competitive advantage. Many studies have been looking at performance outcomes in terms of competitive advantage, financial performance and external fitness. Results have often been positive (Schilke et al., 2018).

#### 2.1.4 Dynamic Capabilities Procedure

As mentioned in the previous chapter, the procedure sensing, seizing and reconfiguring developed by Teece (2007) will be of central focus in this paper. The reasons why the authors choose this typology over the one developed by Teece et al. (1997) is, that stronger focus is put on the sensing and seizing. This will add more value to the analysis as the focal case illustrates the early stages of an incumbent moving into an emerging technology, where sensing and seizing are of utmost importance. Besides that, as already mentioned in the beginning of chapter 2, dynamic capabilities have been connected to business model and ambidexterity

theory (Teece, 2018; O'Reilly and Tushman, 2008) and in these works Teece's (2007) typology has been applied. As guidance, a short summary of Teece's (2007) sensing, seizing and transforming is presented below.

**Sensing.** In this step companies are keeping an eye on the technological developments and opportunities, but also the customer needs and behaviours. When opportunities are spotted the managers or entrepreneurs have to decide which market opportunity they will pursue by investing in the right technology and skills. Sensing typically requires investments in research and similar activities and “is very much a scanning, creation, learning, and interpretive activity” (Teece, 2007).

**Seizing.** Once a promising opportunity has been spotted and the company wants to position itself on the market, heavy investments in technology and capabilities are needed. It is substantial that the organisation is designed in a way, that it is able to effectively seize the opportunity. The set-up of the right business model can be equally important as the development of the technology. Additionally, in particular with non-continuous innovation, company culture and values have to be aligned in order to be successful. Often it is important to get rid of dysfunctional processes, that can interfere with seizing the opportunity. Especially, biases within the company like anti-innovation biases, including anti cannibalization biases, leading to problems with the right resource allocation can be critical.

**Reconfiguration.** Routines are necessary for bigger organisations to be successful in their daily business. Nevertheless, seizing new opportunities often implies changes within those routines, which can be challenging. Especially, big changes can be very costly and lead to increased concerns among the workforce. Teece (2007) therefore recommends this to be a semi-continuous process. Challenges can be silos within the organisation that interfere with integrated solutions, while too much centralization can lead to top management losing focus of the marketplace realities. Therefore, the main focus in the reconfiguration part is to achieve realignment of assets and processes.

#### 2.1.5 Dynamic Capabilities and Business Model Innovation

“A business model describes the rationale of how an organization creates, delivers, and captures value” (Osterwalder and Pigneur, 2010). The former will be the used definition



throughout this paper. In today's volatile environments it is not a question anymore if companies should innovate their business model (McGrath, 2013). A significant stream within the business model innovation literature confirms that business model innovation is essential for a company's survival, business performance and competitive advantage (Gambardella and McGahan, 2010; Teece, 2010; Bock et al., 2012; Casadesus-Masanell and Zhu, 2013). Dynamic capabilities are strongly interlinked with the business model and its innovation. The strength of a companies' dynamic capabilities can be an indicator for how good a company is at creating, delivering and capturing value, but also for the ability to innovate and develop the business model. At the same time the architecture of a business model affects organisational design and hence also the dynamic capabilities of a company (Teece, 2018). Before elaborating on these aspects, a brief introduction on the business model architecture will be presented as guidance below.

The business model canvas is a well-known tool developed to easily map out and understand the different components of a company's business model. Osterwalder and Pigneur (2010) separated the components of a business model into nine building blocks: (1) customer segments, (2) value proposition, (3) channels, (4) customer relationship, (5) revenue streams, (6) key resources, (7) key activities, (8) key partnerships and (9) cost structure. Blocks 1-5 describe how a company delivers and captures value, while 6-9 focus on how that value is created. In an extensive literature review Ramdani et al. (2019) identified the most important elements associated with business model innovation. The framework refers to previous literature (Johnson et al. 2008; Zott and Amit 2010) and focuses on areas where innovated business models can be explored. The focus areas are (1) the value proposition ("Why" the business model gets innovated), (2) operational value ("What" needs to be changed), (3) human capital ("Who" will execute the change) and (4) financial value ("How" value gets captured).

Due to various kinds of sustainability issues like growing inequality (Piketty and Saez, 2014) and increasing negative environmental impact (Rockström et al., 2009), an emergent subset of business model literature is focusing on sustainable business models (Geissdorfer et al., 2018). *"Sustainable business models seek to go beyond delivering economic value and include a consideration of other forms of value for a broader range of stakeholders."* (Bocken et al., 2013). This implies that the value proposition has to provide social or ecological value besides the economic value. Typically, also a closer relationship to the customers has to be established in order to take responsibility for the production and consumption system (Schaltegger et al.,

2016). Sustainable business model research took off in the beginning of the decade and therefore the field is still in need for more research. Relevant for this paper are especially the gaps around sustainable business model innovation and implementation, but also the use of organisational theories like dynamic capabilities and ambidexterity to explain business model innovation by incumbents (Geissdorfer et al., 2018; Schaltegger et al., 2016).

In order for a company to understand that the business model needs to be innovated, the company has to sense changes in its environment (Teece, 2018). One common reason are unmet customer needs. The company has to create a defensible business model in a way that it creates enough customer value to demand a price that covers the cost and allows to capture value in terms of profit. Thereby, the company will be able to further refine and develop the business model, its resource base and its capabilities. There are various mechanisms that can help to create a defensible business model, *“including patents or trade secrets to protect key knowledge assets, switching costs to promote customer lock-in, and rapid scaling to secure large market share and cost advantages before potential rivals can react”* (Teece, 2018). Looking at the history, it can also be seen that many drastic business model changes have been enabled or even demanded by technological changes (Armstrong, 2006; McGrath, 2013). Dependent on the strength of dynamic capabilities is the timeframe and amount of resources a company will need to be able to align its resources to the newly identified demands. Especially, drastic business model changes, involving new technology and/or reorganisation, are *“unlikely to succeed without major financial resources and steely commitment”* (Teece, 2018).

This leads to the next point of interest, the organisational aspect. The development and implementation of a new business model usually puts stress on the organisation (Leih et al., 2015). For innovation to be successfully implemented an organisation needs to be open to new ideas and act on them when needed. Typically, this requires flat hierarchies and decentralised authority (Foss, 2003). Teece (2012) also notes, that in early stage business models the degree of routinisation is lower and higher flexibility can be part of the dynamic capabilities then.

### 2.1.6 Dynamic Capabilities and Ambidexterity

Incumbent organisations that want to survive technological changes or drastic shifts in customer demands, have to be able to continue working with the existing assets and markets in a profitable way, while exploring new technologies and markets (Helfat & Raubitschek, 2000; Teece, 2006). In terms of business model innovation this relates to business model

diversification, meaning that the old business model stays in place, parallel to the new one being created and implemented (Geissdoerfer et al., 2018). This simultaneous exploiting of existing resources to ensure the company's survival and exploring of new technologies and markets (March 1991) is also referred to as ambidexterity (Duncan, 1976). Tushman and O'Reilly (1996) define ambidexterity as "*The ability to simultaneously pursue both incremental and discontinuous innovation and change results from hosting multiple contradictory structures, processes, and cultures within the same firm*", which will be the used definition throughout this paper.

As the definition above implies ambidexterity is typically challenging for organisations. Exploitation is about efficiency, keeping or increasing margins and not wasting any resources, while exploring is about searching, trying and finding new ways of making money (O'Reilly and Tushman, 2008). Exploring, the obtaining of new capabilities and new ways of making money involves learning from failure rather than avoiding it (Bingham, 2005). Therefore, if managers do not dare to challenge the status quo and accept failure, then decisions and actions will most often support exploitation due to positive signals from customers and also profitability (Benner and Tushman, 2003; Gupta et al. 2006). Therefore, in order to have better chances of succeeding managers need to be willing to invest in projects with a more long-term focus (Danneels, 2002) and an organisational structure that allows cross-organisational integration of new assets and ways of working has to be set-up (Helfat and Peteraf, 2003). Bower and Christensen (1995) argue that it is not viable to both exploit and explore within a single organisation and that companies that tried to do that ultimately failed. Reasons for that can be lacking responsibility to develop and sell the disruptive technology, but also missing the ability to think outside the box in terms of customer segments. Especially, when emerging markets around the new technology seem too small to be profitable for incumbents. Therefore, they suggest companies to create a separate organisational unit, but only if the "*disruptive technology has a lower profit margin than the mainstream business and must serve the unique needs of a new set of customers*" (Bower and Christensen, 1995). According to O'Reilly and Tushman (2013) dynamic capabilities are the most suitable theoretical lens to view how organisations actually manage ambidexterity.

## 2.2 Synthesis of Literature Review and Analytical Framework

In the following section research gaps based on the above presented literature will be presented. Followed by the synthesis of the literature review and the analytical framework.

### 2.2.1 Theoretical Gaps

Theoretical Gap 1: In their literature review Schilke et al. (2018) identified that strategic change can be related to many organisational functions. One field that has not received so much attention are the business model innovation capabilities of organisations (Mezger, 2014; Wirtz, Schilke and Ulrich, 2010). Also, Teece (2018) calls for more studies focusing on the understanding of business model innovation and implementation. Next to the traditional business model innovation literature, the emergent stream of sustainable business model innovation literature also depicts substantial research gaps (Geissdoerfer et al., 2018). In their literature review Geissdoerfer et al. (2018) state that the actual implementation of new business models within organisations is still unexplored (Chesbrough, 2007; Foss and Saebi, 2017; Boons and Lüdeke-Freund, 2013; Schaltegger et al., 2016). According to Schaltegger et al. (2016) organisational theories like dynamic capabilities and ambidexterity can add to our understanding when it comes to business model innovation within incumbents.

Theoretical Gap 2: Teece (2018) and O'Reilly and Tushman (2008), the authors that connect dynamic capabilities to the business model innovation and the ambidexterity literature, mainly focus on how dynamic capabilities can help to facilitate business model innovation and ambidexterity. Nevertheless, Teece (2018) also acknowledges that the business model design influences the dynamic capabilities of a firm, through its effects on the organisational structure. Nevertheless, elaborations on this topic have been fairly limited. Therefore, this paper will, with the help of an empirical single case study, elaborate on how business model innovation affects the organisations dynamic capabilities and design.

### 2.2.2 Analytical Framework

In the following paragraphs the analytical framework will be presented, which will help to ask the right questions and analyse the empirical data. This is necessary in order to answer the main research question, "How do incumbent OEMs build the foundation for dynamic capabilities to drive a sustainable industry shift?"

In the following paragraph a description of the visual analytical model (Figure 2) will be made. The antecedents will be the start point of the model, to understand the context and roots of the focal company. The authors expect this to be fundamental to understand, why the sustainable industry shift posed a challenge for the focal company. The next step will be to analyse the new business model. In the implementation of the new business model challenges are expected due to the tensions between the old and new approach. Ambidexterity literature will be an analytical tool to get an understanding of the challenges. Dynamic capabilities are the underlying concept of the framework to understand how the incumbent can build the foundation for sensing, seizing and reconfiguring through various initiatives.

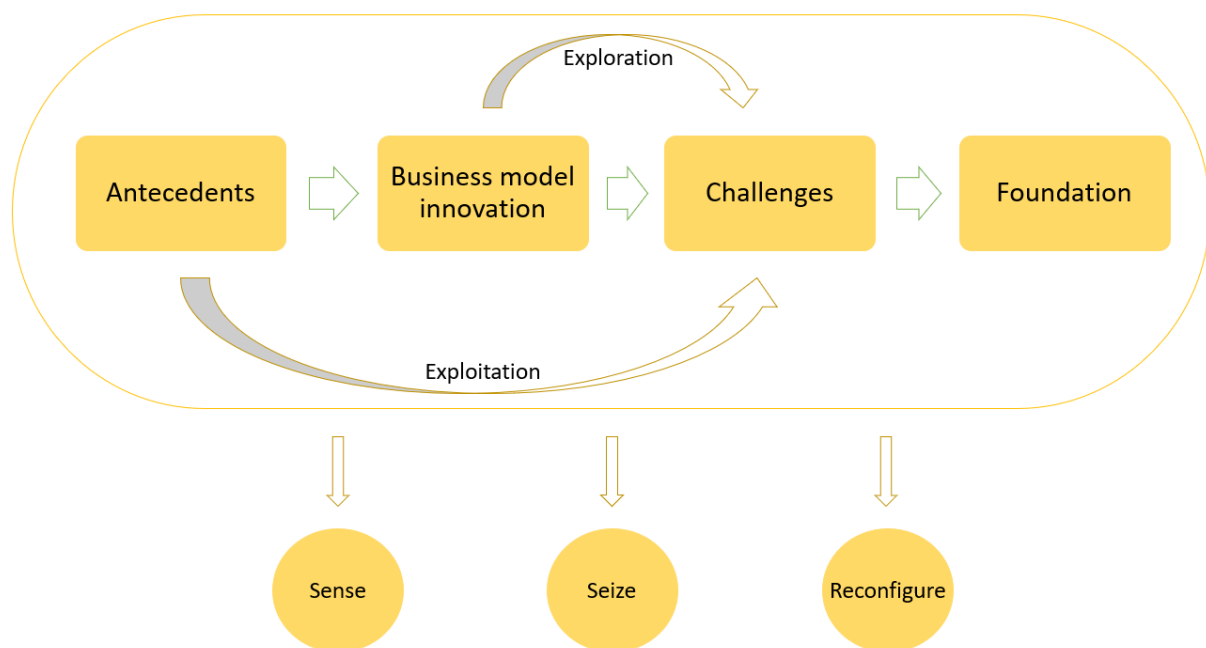


Figure 2 - Analytical Framework

In order to answer the sub question, “*What effect can the implementation of a new business model have on building new dynamic capabilities?*” the authors will use business model innovation literature to explore the aspects of the new business model. Dynamic capabilities will be the underlying concept to investigate how the four focus areas of business model innovation enable sensing, seizing and reconfiguring.

As the focal company is an incumbent and business model diversification occurs ambidexterity challenges will be expected, meaning that the company still has to exploit its existing business model and technology, while exploring the new. Thereby, the authors attempt to answer the

sub research question “*What can an incumbent do in order to effectively exploit the existing technology while exploring new technology?*”

Looking at the research questions and theoretical gaps, the authors are certain that the analytical framework will help to illuminate those. The combination of the above literature can help to understand how the company is able to build the foundation for dynamic capabilities, what effects the specific aspects of the business model have on the dynamic capabilities and how the company manages to simultaneously exploit and explore.

### 3 Methodology

In this section, the methodological approach intending to answer the research question through a single case study, is presented and argued for in order to ensure a rigorous qualitative study. First, a short introduction of the methodological fit will be argued. Second, the research design will be substantiated. Third, a description of the research process will be presented and fourth, the quality of the study will be critically evaluated.

#### 3.1 Methodological Fit

The uncertainty surrounding the underground mining industry considering the technical development made a qualitative research the obvious choice. The existence of multiple stakeholders in the development of capabilities to perform a new business model made a context-based approach the natural method for the study (Flick, 2019). To increase the understanding of the phenomenon (organising for sustainable development) and its context (underground mining industry), an in-depth study was selected (Dubois and Gadde, 2002). To further ensure the quality of the research and to develop converging lines of inquiry (Yin, 2014), a triangulation<sup>2</sup> approach including the triangulation of data, method, and investigator was used (Patton, 2002 in Yin, 2014). “*Triangulation refers to the use of different data collection techniques within one study in order to ensure that the data are telling you what you think they are telling you*” (Flick, 2019). Considering the nature of the single case study, any generalisation is on a theoretical rather than statistical level, addressing an important concern following the selection of this type of research (Yin, 2014).

#### 3.2 Research Design

The research design was based on the ‘Research Onion’ by Saunders, Lewis & Thornhill (2007) (Appendix 2) to ensure an effective while cohesive progression of the research methodology development (Saunders et al., 2007). The research onion should be looked upon from an outside-in perspective when building the research design, the relevant layers used for the research design of this study are therefore presented below starting from the outer layer (Saunders et al., 2007).

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<sup>2</sup> Triangulation: The convergence of data collected from different sources, to determine the consistency of a finding (Yin, 2014)

### 3.2.1 Research Philosophy

The research philosophy employed in the study was interpretivism. The research philosophy guided the authors in their research strategy, data interpretation and analysis.

Interpretivism was selected for two reasons: First, the focus of the study was to explore and increase the understanding about the early phase development of a new business model and its effects on the dynamic capabilities within the confines of the resources of an existing organisation. Interpretivism supported the authors aim to include the viewpoints of multiple stakeholders involved in this development (Flick, 2019). Second, interpretivism further allowed a rich, in-depth description of the context from experiences surrounding the phenomena of the dynamic capabilities development over generalisations (Eisenhardt and Graebner, 2007).

### 3.2.2 Research Approach

An abductive reasoning approach was used in the study and based on the theory of systematic combining presented by Dubois and Gadde (2002). The approach-built reflection into the process as the study progressed by having the authors move back and forth between the theoretical framework, the empirical world and the case analysis (Dubois and Gadde, 2002). Unlike the application of an inductive or deductive approach, the abductive approach enabled a critical review of the underlying assumptions and a nonlinear successive reorientation of the analytical framework when applied on the empirical world (Dubois and Gadde, 2002). The research process was thus circular and iterative with the objective to match theory and reality.

The choice of abductive reasoning is supported by the authors desire to contribute with theory development surrounding the early phase development of dynamic capabilities of an organisation in an industry that is experiencing a shift, rather than theory generation. The aim was to adapt the framework during the succession in order to achieve cross-fertilisation from combining theory with the insights and concepts from confronting it to the empirical world (Dubois and Gadde, 2002).

The abductive approach allowed a reiteration that was also reflected in the adaption of the interview guide in order to add new theories to build knowledge and elaborate the empirical findings in accordance to the systematic combining (Dubois and Gadde, 2002).



### 3.2.3 Research Choice

A multimethod approach was selected as the research approach where both primary and secondary data was collected through multiple data collection techniques. The primary data was collected through in-depth interviews with the studied company and an initial orientational study with subject matter experts from both the mining industry and related fields that are either influenced by or influencing a sustainable development. The secondary data was collected through the company website, company reports, and industry reports found online. The multiple sources of data allowed thickness and richness in cross-validation of the findings to build the knowledge of the authors and allow for methodological triangulation (Yin, 2004).

### 3.2.4 Research Strategy

A research strategy may be defined as “*a plan of how a researcher will go about answering her or his research question*” (Flick, 2019). In accordance with the research approach, the study is based on a case study (Dubois and Gadde, 2002). Despite some of the critique against case studies not being generalisable, they cannot be built on statistical inference and thus not critiqued as such (Dubois and Gadde, 2002). Using theory from Eisenhardt and Graebner (2007), Saunders et al. (2007) wrote: “*the case study strategy will be relevant if you wish to gain a rich understanding of the context of the research and the processes being enacted*”. As the aim of this study is to explore the development of capabilities within the complex confound of the mining industry, a case study is the deemed to be the most comprehensive alternative. Additionally, Harrison et al., (2017) recognize that the reputation of case studies as an effective method to study complex challenges and decisions in empirical settings has grown.

Epiroc was chosen as the case company for multiple reasons. First, the authors got access to the company through the company’s collaboration with the author’s university, Stockholm School of Economics (SSE). Epiroc partnered with SSE as a case company regarding their development of a new business model for electrification, the thesis was therefore a good fit with the company as a natural extension. Second, from the scope of the study, Epiroc was the ideal company to investigate as its challenges are representative for those faced by the OEMs within the underground mining industry. Epiroc is a leader in the sustainable development of the underground mining industry. Therefore, to study the early phases in the complexity of building the foundation for new capabilities regarding a new business model was particularly interesting (Yin, 2014). Additionally, at an early stage especially interesting initiatives by the

company were identified and considered a unique opportunity by the authors of how the foundation for dynamic capabilities is developed in relation to a sustainable industry shift. Furthermore, a case study is beneficial considering the context (underground mining industry) surrounding the development of the phenomenon (organizing for sustainable development) and its boundaries (ambidexterity) are not always apparent (Flick, 2019). The decision was therefore taken to conduct an in-depth single case study of Epiroc. The choice of an in-depth single case study was further strengthened by the request from scholars to further investigate “*how theories on the organizational level can explain the transformation of business models of established firms*” (Schaltegger et al., 2015).

The study was shaped as an “imbedded case study”, consisting of multiple units of analysis. In the study, the main unit of analysis was the organisational development within Epiroc. The main unit is complemented with subunits of analysis, these are also reflected in the sub questions to the main research question. The addition of subunits was made in order to allow a more extensive analysis of the research question (Yin, 2014).

In regard to time horizon of the data collection, the study was conducted following a cross-sectional time horizon, meaning it was done at a particular point in time (Saunders et al., 2012).

### 3.2.5 Data Collection and Data Analysis

The choice of the data collection and analysis is paramount for the validity and reliability of the study (Saunders et al., 2012). For this purpose, a multi method data gathering was used including both primary and secondary data. Primary data consisted of semi-structured interviews that were conducted with the studied case company and with industry experts. The secondary data was collected through company reports and presentations, the company website and industry reports found online.

#### 3.2.5.1 Orientational Study

An orientational study was made prior the main study in order to evaluate the state of the electrification within the industry for conducting a case study. The orientational study provided a broad understanding about the challenges facing the industry and better identify an area where a study could be a contribution (Flick, 2019). To perform an orientational study, two main

focus areas needed to be addressed before the main study was developed; First, get a better understanding of what is going on in the industry. There is a selection of secondary source data available regarding sustainable mining that were included in the study. However, due to the still very early phase of the transition, information was difficult to put in a context. Therefore, to address this challenge, the authors interviewed experts knowledgeable about areas affecting the electrification of the underground mining industry, these included experts from the mining industry, related industries affected by the electrification, and experts within sustainability (Appendix 3). Second, considering the in-depth study with the need to interview key personnel, and the sensitive early stage of the development, ensuring access to a case company was paramount. Furthermore, the company must also have managed to get somewhere in its development for the authors to be able to conduct analysis. From the introduction through SSE, the authors held multiple separate discussions with Lina Jorheden, the operational manager of the organisational unit responsible for the new business model development at Epiroc, to ensure access.

#### 3.2.5.2 Interview Sample

In total, the sample consisted of 18 interviews, 16 original interviews and 2 follow-up interviews, 1 follow up contact was also made per email (Appendix 3). 6 interviews were over Webex, 6 over Skype, 4 over phone, and 2 face-to-face. The reason for the Webex / Skype / phone-based interviews are that the case company is located in another city. All interviews but one was between 31 - 88 minutes long, the shorter one was 15 minutes due to an unexpected interruption. The sampling method used was theoretical sampling that is a form of 'purposive sampling' to ensure the centrality of the research question in the sampling considerations (Bryman and Bell, 2011). The theoretical sampling enabled theory development as the data was continuously collected, coded and analysed. The data collection was therefore controlled by the theory that emerged (Glaser and Strauss, 1967). The method allowed a more in-depth understanding of the research question unlike what a random sample would have provided and is therefore a more appropriate sampling strategy for qualitative research (Flick, 2019). The contribution should thus be considered more theoretical rather than generalisable (Bryman and Bell, 2011). The sampling strategy was to gain access to individuals in the organisation with insights in the development of the new capabilities following the new business model. The sample included individuals from the inter-organisational unit Rocvolt that was founded to be

an internal stakeholder for electrification, the management team and other involved key personnel.

The number of interviews were deemed sufficient for the purpose of this study for multiple reasons. First, the activities regarding the development of capabilities is currently at large concentrated within the inter-organisational unit. Second, the key personnel that was interviewed had deep knowledge from their previous roles within Epiroc that provided satisfactory material for analysing and identifying several areas of dynamic capabilities; Third, interviews were continued until sample saturation (Bryman and Bell, 2011).

### 3.2.5.3 Interview Design

The interview method that was applied to gather data were semi-structured interviews in order to let the interviewee share information in a conversation rather than in a more structured technique (Flick, 2019). An emphasis was placed on asking *how* or *why* questions in order to get the interviewee to elaborate to generate a more in-depth understanding of the phenomenon (Yin, 2011). The prepared interview guide allowed flexibility for the interviewee to steer the direction of the interview while the authors made sure the main areas were covered (Bryman and Bell, 2011).

An interview guide was prepared before each interview from the lens of the dynamic capabilities theory applied in the study (Example in Appendix 4). In alignment with the systematic combining approach applied in the study, the interview guide consisted of open-ended questions to ensure not to close off any alternative routes prematurely (Bryman and Bell, 2011; Dubois and Gadde, 2002). The interview guides were continuously updated with the succession of the study and more specific focus areas were identified and asked about, while ensuring flexibility for the respondent. Additionally, the interviewees expertise was taken into account in the development of their interview guide. Probes and follow-up questions were evaluated after each interview and altered accordingly to the abductive approach (Bryman and Bell, 2011). The interviewers used so called “ice breakers” in connection to the interviews in order to create a safe environment for the interviewees to express opinions.

The first round of interviews of the Epiroc personnel were coordinated with the assistance of the operational manager, Lina Jorheden, who had been assigned as our contact. After the first

interviews, all interviewees agreed to be contacted for potential follow-up questions and the authors therefore booked the follow-up interviews themselves. All participating interviewees from the orientational study were identified and booked by the authors. Each interviewee received an invitation with a short description about the study with the intended goal for the interview some time before the interview, this information was also repeated in the beginning of each interview to ensure informed consent (Flick, 2019) (Appendix 5). All interviews were recorded with permission of the interviewees (Flick, 2019).

#### 3.2.5.4 Data Processing

The interviews were recorded and the parts relevant for the study were transcribed to text (excluding initial ice breakers) (Flick, 2019). The computer assisted tool, Otranscribe, was used to make recordings play slower / faster as well as pause when transcribing. Secondary sources were read, and relevant paragraphs saved for later reference by being copied into a new document.

The authors coded and categorised the unstructured data and combined it with the information from the secondary sources document in order to generate themes. The Research Onion was triangulated with data alongside reiterations in order to ensure coherence (Yin, 2014). Both authors were participating in the transcribing and independently controlled, re-read the transcriptions and conducted interpretations by themselves prior discussing and the creation of combined themes. Both actions intended to achieve investigator triangulation (Yin, 2014).

### 3.3 Quality of Study

In light of the need for a research design to represent a logical set of statements, the quality of the design can be judged in accordance to logical tests (Yin, 2014). To ensure a high quality, great attentiveness has been placed in line with three quality measures for qualitative research; consistency, credibility, and transferability.

#### 3.3.1 Consistency

To ensure a trustworthy research process where the findings are consistent with the data collected (Merriam, 2009), safety measures were taken. The importance of keeping a clear

document chain for the quality of the research is nicely described by Birks and Mills (2011) who stated that “*procedural quality in research must not only be done, but also be seen to be done*”. Therefore, to achieve procedural quality, the steps of the research process were documented from the beginning and managed as operationally as possible (Mills and Birks, 2014; Yin, 2014). All interviewees received the same information beforehand and logs were kept for the interaction with interviewees (Bryman and Bell, 2011). All transcripts were also cross-checked with the audio file by both authors to ensure a correct transcription (Gibbs, 2007).

### 3.3.2 Credibility

McGinn (2012) defined credibility as “*...the extent to which a research account is believable and appropriate, with particular reference to the level of agreement between participants and the researcher*”. In order to ensure a believable and appropriate level of agreement between the researchers and the interviewees two things were especially taken into consideration. First, triangulation of data, method, and investigator increased the confidence in that the collected material is trustworthy and that any statements made by interviewees were appropriately represented as they were intended in the study (Yin, 2014). Second, all interviewees have had the opportunity to read the study before admission in order to ensure a correct representation of their statements in accordance to respondent validation (Bryman and Bell, 2011).

### 3.3.3 Transferability

Lincoln and Guba (1985) stated that “*the only generalization is that there is no generalization*”. A challenge for qualitative research is often its rootedness in contexts to enable expressiveness (Flick, 2019). In order to accommodate the challenge of appropriately enabling expressiveness, purposive sampling was employed in order to allow thick descriptions from the interviewees to gain deep insight into developing the foundation of dynamic capabilities. Considering that the study only covered parts of development of dynamic capabilities due to the early phase, thick descriptions might be deployed within the case as a database (Maxwell, 2012; Lincoln and Guba, 1985). Externally, the specific development of capabilities is unique for Epiroc. However, the authors identify the case as connected to time. The sustainable development shift is industry wide and more companies will meet similar challenges and must therefore themselves evaluate the potential to draw learnings from the capability build-up of Epiroc (Maxwell, 2012).

## 4 Empirical Findings

The empirical findings are structured into two main parts. First, the recent background of Epiroc to set the context of the company's development. The section will build around the development and end in the realisation of the need for a new business model by referring to received presentation material, interviews, orientational interviews and the website. Second, Epiroc's initial shift towards sustainability and the organisational development to accommodate the new technology. Therefore, the major initiatives brought up in the data collection will be presented. This section is built on the interviews and received company material.

### 4.1 Recent Background of Epiroc

In order to understand the development, one must first understand the context that Epiroc is operating in. The context is therefore presented in a narrative style below to increase understanding (Bryman and Bell, 2011). Epiroc is one of the world's largest OEMs within the mining, equipment and infrastructure industry and currently employs around 16,000 people worldwide. The company structure is decentralised consisting of seven divisions, one service division and six capital divisions operating independently with their own missions and budget. Epiroc has regional sales companies called customer centers (CCs) spread out globally as their machines operate in around 120 countries. The CCs are in charge of the customer contact and the service network. Having technicians on site to service machines in almost all mines in the world gives Epiroc the unique opportunity to keep "an ear to the ground". The development of the machines is managed within the product company (PC) and then sold to end customers through the CCs.

A noteworthy influence on Epiroc is the recent independence following the split from Atlas Copco in 2018. Before the split, Epiroc was one out of 5 business areas of Atlas Copco. Atlas Copco is famous worldwide for its good quality machines and drills. Quality that has been built for over 144 years. The culture within Epiroc is largely consensus driven and there is a need to get stakeholders aligned to get through, especially the middle management in charge of the resource allocation for projects must be convinced despite identified focus area from top management. The strategy has historically been to manage a close customer contact and build high quality machines without a lot of fixed costs. This strategy to keep to variable costs has been kept within Epiroc, for example, the company source the transmission and diesel engine

from suppliers and assemble internally. However, with the split some changes did happen. A strategic move of Epiroc was to further develop the close contact with the customers and consider itself a productivity partner for the mining, equipment and infrastructure industry rather than a supplier. The shift also incorporated a move to become more fast moving in the market compared to the history of the company:

*“Ok, we are an old company but we also have an opportunity to be kind of a start-up right now and we set the agenda for ourselves in a different way than we have done before when we were one out of five business areas.” - Lina Jorheden*

*“And in that I think Helena and her team (top management) must have done a lot of analysis of how our industry is changing and how we can match that. It was decided that we have to work differently, we cannot be that old traditional company. We are in a different world right now and we should be faster, we should be much more agile and really move from being maybe a service provider or even an equipment provider in the mining industry to be a solutions provider within the future of mining.” - Lina Jorheden*

The new strategic direction to become more of a start-up originates in the identified need from the top management to move faster in the market. The turn towards more frequent releases has also created the need to rethink the development process of the machines. The industry has historically competed on who delivered the best quality machines and the memory of a good machine to “*sound like an old tractor*” is still present within the company. Moving into a faster roll-out, the final touches of the design for some models are now created on site together with the customer:

*“But that is one of the big challenges with doing an R&D project or taking out a new machine in two years instead of five years. You have not been able to do all the homework before you release the product. You will have to do that in parallel kind of and we have not been working in that way before. So, it's a mindset to accept failures because we know it will create success in the future and accepting that we will have some tough times but focus on the long-term horizon.” - Lina Jorheden*



## 4.2 Epiroc's Electrification Journey

*“I think everyone agree that this is the right direction. In the future, all machines will be zero emission machines. The discussion is mainly about speed over the transition. But the transition will come, and it will come to a 100% and everyone agree on. I would say even the people who are found of tractors agree that diesel will die some time.” - Anders Lindkvist*

The start point for Epiroc to develop an electric platform was a reaction to the market tendencies to move towards electrification that was picked up in the sales company and external market studies. Epiroc has close relations and conversations with their biggest customers about their plans moving forward to ensure alignment. There are two main drivers behind the transition in the industry; First, legislation is increasingly tightening up the control over the mines in relation to emissions and the health of the workers and the surrounding; Second, a business case is created due to underground mines getting 30m deeper every year on average which increases one of the biggest cost drivers of mining operations: Ventilation. By getting rid of fossil fuels, the operating expenses (OPEX) of the mines can be reduced heavily. Furthermore, another contributing factor is that the price on batteries is declining.

The development of an electric platform started in 2010 and can be separated into three main phases, two technically related and one concerning the business model and the organisation. The first two, Generation 1 and Generation 2 are described briefly below and the third one, Rocvolt and Business Model Innovation, is described in the next subchapter.

### 4.2.1 Generation 1 - Are Electrified Underground Mining Machines Possible?

*“It was done as a test we see ok, it seems possible in theory to have a battery powered loader, ok let us try an build one and see if it is working.” - Anders Lindkvist*

Epiroc started to explore the move to electrification already back in 2010. One of the main driving forces behind the development, Erik Svedlund, started pushing for electrification internally after realising the potential. Epiroc developed Generation 1 electric machine together with an external supplier. Control system, battery and electric motor were sourced, and the machine design were modifications from the existing diesel machines. The use of an external supplier meant that Epiroc reduced the need for internal R&D to test the theory and speeded

up the development. The project was run together with the customer center in Canada as an own pilot project different from the normal R&D projects. Four different models were converted, however the coordination was low and they were mainly done as individual projects. Two out of the four different models were successful and eventually released to customers on a small scale. The battery machines were sold in a similar manner as the diesel machines. With a proof of concept in place, the next step was to scale up. Scaling up the battery powered machine development left the sandbox environment to gain strategic importance. This led Epiroc to develop Generation 2.

#### 4.2.2 Generation 2 - How Do We Operationalize Electrification?

*“In Generation 2 there we totally changed the thinking, it is not deciding about you know one prototype project and so on. Here it is actually about designing, doing a complete, massive transover of the total, all the machines in the company, going from diesel to electric. And how do you design a system that is not optimized for one machine but is optimized for the total fleet.” - Erik Svedlund*

With the theory confirmed in practice in Generation 1, a larger development to design battery powered machines from the beginning instead of redesigning the existing diesel machines started. The contract with the original external supplier was terminated due to competition and its inability to accommodate the higher demand from Epiroc. Building on the learnings from Generation 1, Epiroc’s top management took the strategic decision to develop the control system in-house and created strategic long-term partnership agreements with two suppliers for the battery and the electrical motor. The internal R&D department took a much more active role and drove technology development together with the new partners, which required new capabilities:

*“We needed new capabilities for that. We needed first of all the technical capabilities, but also being more entrepreneurial. It put the team into one room and the mission of what should we do about electrification, battery and driveline development and come up with roadmaps.” - Anders Hedqvist*

The machines were now updated in the design to be battery driven from the beginning. A modular design of the batteries was developed to reduce the need for individual designs for

each machine type and gain scalability in the production. The serial production of batteries started in 2016 and was developed within the R&D in the underground division alongside the diesel engine. R&D build the development within the existing processes but a focus on increasing speed in every step, which has been challenging for an organisation with deeply embedded routines and many quality measures.

### 4.3 Rocvolt and Business Model Innovation

*"There is a major challenge in changing the business model, there is a major challenge in changing the technology, we do not have competence really to manage this day 1." - Lina Jorheden*

With more coordination after the initial trial in Generation 1 each machine development was intended to be more cost efficient. However, the development of new machines is resource intensive and resources of engineering hours are limited and must be shared with the diesel development. Additionally, the mining industry is conservative to a certain extent and the big adoption of electric powered batteries is slow. A learning for the company was that even if the battery powered machine make sense from a total cost of ownership (TCO) the higher upfront investment of the battery machine is not weighted together with the lower OPEX and thus perceived more expensive. Therefore, Epiroc had challenges to effectively scale-up their electric machine business which is necessary for economic reasons within the processes of the offering.

People within the organisation were still questioning if it is already the time to transition to this new technology and if it is a better solution than the combustion engine at this point. Top management and people working with electrification understood that in the future all machines will be zero emission. An external study confirmed that going full electrification is the right direction and that there is a significant market potential. Nevertheless, the organisational and commercialisation challenges had to be solved first.

#### 4.3.1 A New Organisational Unit Was Born

*“We are coming from very mature products and that is the top of the S-curve and the ones that rule there is the management team. Mature products and the capabilities you need in that kind of role is or management team is "Keep the margins, don't waste money on crap, you know keep the top-line and keep the bottom-line and be strict.” – Kent Rubensson*

It became obvious that this new entrepreneurial way of thinking could not be done within the existing structure. The structure in the form of well-established routines, processes and mission statements, around the diesel machine would win against the new battery driveline. Therefore, in order to grow it had to be broken out and have its own stakeholder. Besides that, Epiroc is a company that takes pride in its high decentralised and efficient divisional structure. Nevertheless, this structure makes it difficult to implement initiatives like digitalisation, electrification and automation for example, because the divisions have to reach an agreement. Solutions had to be found through thinking differently and changing the business model to enable new initiatives.

There were two individuals from the market side, Erik Svedlund and Fredrik Martinsson, that started to develop and push for a new business model internally. As Erik Svedlund and Fredrik Martinsson have been driving the electrification topic within Epiroc they were also the ones initiating the setup of a new organisational unit. While thinking about the many possibilities of how to commercialize Generation 2 they simultaneously exchanged ideas on how this new unit could look like. Besides that, they had been in contact with the divisional heads from the R&D and aftermarket division, Anders Hedqvist and Kent Rubensson. Looking at high level challenges like working with a completely new technology and changing the entire mining industry, they concluded that this needs to be an organisational unit of its own. The idea was to create a cross functional and cross divisional unit in order to grow electrification within Epiroc. With a concept and the support from an external expert report, Erik Svedlund and Fredrik Martinsson went straight to the top management to ask for approval. The president and the group management were open to their idea and Erik and Fredrik were asked to set-up the new unit.

*“There are many times that we could have said that, if we do not continue to push for Rocvolt... None would bother to ask. Now it is off course, it has happened, but during the way it has been hard.” – Fredrik Martinsson*

In order for Rocvolt to be able to deal with the challenges above, it was decided that it should be an agile, start-up like unit within Epiroc, not focusing on the manufacturing. Entrepreneurial skills and tools seemed suitable to deal with this technology shift as the knowledge needed to be developed partly from experiences outside the established organisations core competence. The management acknowledged that it is important that Rocvolt can move and fail fast. Therefore, Rocvolt was set up to be a high-performing team and together with support from human resources a program was developed to train Rocvolt to be able to solve its own conflicts and perform on a high level. The team members should be able to seek new types of solutions and be creative to find ways for Rocvolt to move forward. It was also decided that the management of Rocvolt should be divided into three parties. Erik Svedlund’s role is to develop the business in terms of battery applications. Fredrik Martinsson’s role is to take these ideas and transform them into products and solutions. Additionally, Lina Jordheden was hired as an operations manager to take care of Rocvolt as an organisation, ensure that the team is performing and to take care of financial aspects.

Rocvolt’s mission is to enable the growth of electrification. Rocvolt’s core product is the battery. Therefore, their only focus is the battery business, while Epiroc’s core are rockdrills and the machines around that. On a high-level Rocvolt is perceived to be aligned with Epiroc’s strategy. Sustainability, looking at the SDGs 7<sup>3</sup>, 9<sup>4</sup> and 12<sup>5</sup> for example, are a significant part of Epiroc’s strategy and therefore top management is supporting Rocvolt. Due to the limited number of resources Rocvolt’s focus is not to execute but to support and work together with project managers in Epiroc, who’s projects are aligned with Epiroc’s mission. Therefore, one of the main tasks of Rocvolt is to collaborate and communicate with peers in the organisation to build ways of working around electrification.

Rocvolt does not have a budget beyond its own operating costs. It is a cross functional set up between the underground R&D and aftermarket division in a 50/50 share. Rocvolt is therefore

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<sup>3</sup> Affordable and Clean Energy

<sup>4</sup> Industry, Innovation and Infrastructure

<sup>5</sup> Responsible Consumption and Production

dependent on the resources from these two divisions or funds coming from top management. It is governed in that way, that the costs for Rocvolt and its revenues are split equally 50/50 between these two divisions. Thereby, friction between the two divisions is tried to be reduced. Due to the resource dependency and financial set up between the underground and aftermarket division, Rocvolt is managed by a steering committee. It is a board that is set up 50% by members of the underground division and 50% members of the aftermarket division. The members are the division presidents and division controllers. If the Rocvolt team has any suggestions, and it goes beyond Rocvolt's budget or is a strategic decision then it gets brought up in monthly or sometimes semi-monthly meetings. Thereby the steering committee is deciding the direction Rocvolt is taking. Due to the structure of the committee the members, especially the divisional presidents are sitting on two chairs and must manage both Rocvolt's but also their own divisions' interests, to find solutions that fit all stakeholders.

#### 4.3.1.1 The Work of Rocvolt

*"We are also kind of internally marketing us as the electrification group. I mean, there are so many people outside of Rocvolt working with electrification in Epiroc, but we become kind of the easy point of contact for anyone." - Lina Jorheden*

Rocvolt is taking the position as the electrification group within Epiroc and is responsible for taking actions related to electrification. The placing of Rocvolt between two divisions enable a holistic perspective from Epiroc's point of view:

*"I think one thing that is very good, is that Rocvolt is two different divisions. I mean, there is aftermarket and underground in one. So, I think that is good because that give holistic perspective of their business and it also helps to see different perspectives. It is easy to say that you should do it, I mean always in underground we have to look at the aftermarket perspective... But sometimes when different presidents are measured it is not that easy, but that, that is actually a very good thing about Rocvolt because in that small organization it is all taken into one, holistic approach for the business." - Annelie Mård*

The primary motivation for Rocvolt is to speed up the electrification in the company and combine interests of the underground and the aftermarket division into Rocvolt mission. The Rocvolt unit is intended to adapt as they go and not have a lot of structures and processes that

risk slowing down the operation. By being placed between two divisions without any ownership of resources, Rocvolt must continuously motivate their resource requests. At this stage in the development, a resource that is especially requested are engineering hours, which are limited and Rocvolt does not have budgeted hours. Therefore, in their interactions with the steering committee, Rocvolt team members do the preparatory work for resource requests to facilitate a decision. Even though the steering committee is positive towards a project, the consensus driven culture still demands a lot of anchoring with middle management. In some cases when decisions on go aheads are delayed in the steering committee or by the culture, Rocvolt must find a way in the organisation. One example of one division wanting to do a project and the other one was hesitant:

*“In the end, the division that wanted to do it said to us "do a case, bring it up to Helena", which is then reporting to the CEO and is our business area president "and see if you can get the money from another pocket" so to say. And we did and we got that money. So, we did kind of stepped with one divisions agreement, we stepped around and went two levels above our level, above our division president to our big boss basically. And we got funding for a new project which was much more than any we have ever calculated, it is one of the bigger projects.” - Lina Jorheden*

Rocvolt also works close with the rest of the organisation to free up resources and ensure the electrification perspective is taken into account. One of the main tasks of Rocvolt is to increase the knowledge internally at Epiroc about electrification to ensure individuals understand the impact each decision will have. They are therefore engaging in conversations throughout Epiroc to facilitate understanding. By driving the electrification within the organisation, Rocvolt is also having an impact on the culture within Epiroc:

*“What the electrification journey has done in terms of R&D spirit, is very much a revitalisation of the team, because this is paradigm shift in or industry and our product and many people are very proud and passionate about that journey and being in this company for 25 years, I never seen this enthusiasm and passion for a development.” - Anders Hedqvist*

### 4.3.2 A New Business Model Configuration

Effectively scaling up the electric machines business was hindered by two factors. First, although the TCO for combustion engine and electric machines was already equivalent in 2010, the high cost of the batteries dramatically shifted the costs for the customers from OPEX to capital expenses. Second, the true benefit of a battery powered machine would only come if the complete mine was converted into electric, however the portfolio of machines in a mine needs to include machines by other suppliers too.

*“We could also see that we want to change the mining industry and our machines are only part of a fleet in a mine. So, can we support the mines in a quicker transformation to electrification?” – Anders Hedqvist*

The first hindrance also created an internal challenge for Epiroc. They make most of their profits in their aftermarket business, when servicing and maintaining the machines. Nevertheless, with the decreased complexity of an electric powertrain, the lower need for maintenance affects the aftermarket division’s main source of revenue. The motivation for pushing the battery machine as a main priority was therefore not strong within any division in Epiroc even though there was agreement on the importance of electrification.

*“It is when you change your technology as drastically as this, then it is a golden opportunity to adapt the business model.” – Fredrik Martinsson*

When Fredrik started in his new role as Head of Marketing, Products and Services at Rocvolt, it was one of his first tasks to set up the new business model. During the development Fredrik was working closely together with Erik in his new role as Head of Marketing, Business Development. They were challenging themselves by trying to think outside the box and focusing on how they can maximise the value for the batteries, by working in sprints<sup>6</sup> together with the customers and also the steering committee.

When working together with the customers a lot of valuable feedback could be obtained. Concerns from the customers were, as already mentioned, the increased investment costs for electric machines due to the batteries, but also how many batteries need to be bought for a

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<sup>6</sup> A sprint consist of testing, feedback, improving, testing.



certain fleet. Other issues the customers brought up, were training of staff to take care of the battery system and the technological improvement of battery technology. They asked why they should already invest now, if the battery capacity increases and costs reduce every year. Already in 2015, when customers used Epiroc's electric machines, they were asking if there is a possibility to rent or lease the batteries. Besides that, Erik and Fredrik also sensed that many other OEMs are struggling with electrification and that there is a huge possibility to grow outside the traditional customer segments.

*“The customer needs and problems to solve was like a puzzle that were built over many years. I think of information like stars in a sky, one star is just a star, but many stars form a picture. You need to meet many customers, in many countries to get the information needed and you need to connect that to how the business is run today.” – Fredrik Martinsson*

The outcome of the development was a circular business model by offering batteries-as-a-service (BaaS). To shortly outline the business model before going into the specifics, Rocvolt wants to sell their modular battery technology solution dependent on the usage, to its existing mining customers and also other OEMs. Due to the high wear of equipment within mining operations, the batteries will only be used for a couple of years in the machines and then enter their second life in energy storage, to stabilize the mines grids. When the capacity of the battery gets too low for this application the batteries will be used to fight the issue of energy poverty<sup>7</sup>. At the end of the battery's life, the batteries will be taken back to the supplier to recycle the valuable metals within the battery cells.

Going into the business model the value proposition is “Instant seamless technology leap to Zero Emissions”. Epiroc will do that through being a full-service partner, offering a financing solution for the batteries and guaranteeing uptime & availability through proactive planning and fleet communication. The customer relationship will focus on enabling zero emission mining. Therefore, the focus is on helping the customers with converting their own fleet by providing new electric Epiroc machines or also convert existing Epiroc or competitor machines. Additionally, the solution can stabilize the grid of the customers' mines. Customer segments will be the traditional mine operators, but also other OEM's who can use the batteries

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<sup>7</sup> Energy poverty: It refers to the situation of large numbers of people in developing countries and some people in developed countries whose well-being is negatively affected by very low consumption of energy, use of dirty or polluting fuels, and excessive time spent collecting fuel to meet basic needs.

for industrial applications. Many other OEM's within the underground mining industry but also outside have machines with similar size and performance requirements. Therefore, the batteries can be used to electrify other machines too. Additionally, local communities, non-governmental organisations and companies supporting these communities will be a new customer group. Rocvolt makes it clear that they want to stay a niche player, because that is where their strengths lie. To bring the solution to the customers, Rocvolt will use Epiroc's existing sales network, which operates in 120 countries around the world. As briefly described above, revenues will be generated through providing the batteries to customers and charging them depending on the usage. With the addition of the 2nd and 3rd life the revenue per battery is tried to be increased, before the end of the battery's life.

Key partners for the development will be ABB who provide the electrical engine and the driveline and Northvolt who produce the battery packs and are also taking care of the recycling. Key activities for Rocvolt will be to take care of the battery management, apply the existing know how and ensure correct infrastructure within the mines. Additionally, taking care of the supply chain and ensuring that the technology reaches the remote places where many mines are located. Key assets for Rocvolt are the intellectual property around the battery system, the batteries, the financing solution for the batteries and the service network Epiroc has around the world. Major costs for Rocvolt will be the investment in the batteries, because they will be manufactured by Northvolt and owned by Rocvolt or Epiroc. Additionally, ensuring the uptime and availability of batteries will be a cost, because maintenance, parts and new batteries need to be constantly provided.

*“You need to see the vision, you need to understand why and because there is so many people that has different specialist competencies that are much more specialized than me or other so they need to know the background where we going. I will give you an example, when you design something for as a service, we are going to be responsible for the total cost of ownership of that product for the total lifecycle, including recycling. So when you chose the glue you use to glue the cells of the battery pack, are you going to choose a glue that is going to be permanent forever or are you going to think about the recycling at the end of life. But if you do not know that we are going to be responsible you do not take that into consideration.” - Erik Svedlund*

#### 4.4 Project Volta - Sharing the information

*Electrification is quite a big thing and it is a big technology leap for Epiroc. We did see knowledge missing in both internally and also, off course, even more in our CCs, our local Epiroc offices around the world. So, trying to get the information out and making sure that everyone are up to speed and share the information... And really try to make this transition into zero emission as smooth as possible. - Daniel Jonsson*

To successfully implement the new business model and battery machines, the Rocvolt team has put together an educational training for the customer centers globally named Project Volta. The organising for electrification will bring three major changes challenging the CCs. First, they are no longer selling a machine with a service package, nor are they leasing it, they are selling the usage. Second, Epiroc will now be the full solutions provider. Thereby, any earlier friction between Epiroc and the combustion engine supplier regarding service disagreement is removed; Easier maintenance performed in the field and more technically advanced service is done in workshops. Third, the development will happen within the existing sales network of Epiroc meaning that it will still be the same people when it comes to sales, support, logistics, chargers and governance. The Rocvolt team is not going to be able to fly over and fix any problems that might come up, it must be scalable and solved on site by the CCs.

Project Volta is built to address the three challenges described above. The development of the program started with virtual meetings with the CCs to understand their needs and challenges. The CCs are invited on site to a weeklong training, prioritized by which country has a market ready for electrification. The training consists of a Rocvolt presentation and introducing the basic battery systems and safety. Furthermore, a mix of e-learnings, technical specifications, workshops, presentations and Q&As.

The trainings with more countries at the same time intend to create a network between the sales companies making them less dependent on information from Rocvolt or the factory. In the beginning of the training, the countries get to present their markets readiness for electrification, different CCs can then connect with each other to discuss similar upcoming challenges with the business model without going through Rocvolt.

*“We ensure that the first companies now that have sold this equipment, that they have strong network between each other as well. That is an important part. Also, because it is new technology and we know that there will be a lot of questions and it is much better that there is a strong network between for example the service person in Canada and Australia then with an expert in Sweden. They should be part of it of course, but to have hands on information and that they know that they can always call each other is very powerful.” - Lina Jorheden*

The countries have their Project Volta. It is an umbrella of tools including also e-learnings and a Project Volta information database has also been created. Here all relevant information that is not too sensitive is uploaded. The idea is to upload all questions and answers that come in from customer centers to Rocvolt.

Roll outs of normal machines are usually done as the machine reaches the market with training for a limited number of individuals and functions within the CCs. Because of this technology change of the machines Rocvolt sees the need to do the training earlier than usual and bring all functions in the CCs onboard. Therefore, Project Volta is designed to be cross-functional and bring more individuals from different functions in the CCs together. Designing Project Volta, the project manager looked from the perspective of electrification:

*“I tried to think of this in “what do I need in order to succeed with electrification as a whole”. Not only for my aftermarket or capital, but as a whole for the company.” - Fredrik Martinsson*

## 4.5 Conversion Project - How Rocvolt Drives Deployment of Electric Machines

A specific example for how Rocvolt works to increase the number of electrical machines out in the field are Conversion Projects. Epiroc is facing a challenge concerning one of their bestselling machines in the world. It is a 10-ton loader with around 1000+ units out in the field worldwide. Due to national regulations on the emissions of combustion engines constant, often yearly, upgrades on the engines have to be executed. Due to the amount of resources needed and other important projects running, Epiroc is not able to provide the required emission regulations. The underground department is working on the development of a fully electric 10-ton loader, nevertheless, the product will not be on the market until 2023.

*“So that means that we leave the market open for our competitors, for 5 years. That is not good for the company. So, then we have given the very infected question, that what can we do differently here to close this gap quicker.” – Fredrik Martinsson*

Rocvolt had the idea to convert existing machines out in the field into electric machines. Nevertheless, this kind of project does not fit well within the R&D department's processes and it would have been necessary to delay other projects in order to develop the conversion kit. Therefore, Rocvolt started to search the resources somewhere else. One option was Epiroc's R&D department in China, but they also did not have sufficient resources. Then, Rocvolt started to look if the needed R&D competencies could be contracted externally. They found a suitable partner, that fulfilled the cost requirements and also could be managed from a risk perspective. Rocvolt then pitched the suggestion to go with an external contractor to Helena Hedblom, Senior Executive Vice President, Mining and Infrastructure.

*“So, Helena goes around and she meets customers in Australia, Canada, in Europe and so on. And they are frustrated that they cannot find our version of a 10-ton loader, so she sees that need.” – Lina Jorheden*

Therefore, she approved Rocvolt's suggestion. Epiroc normally, tries to do projects inhouse, as long as the competencies are existing, but with this decision Helena Hedblom also challenges the R&D department. The project is sponsored and managed by the aftermarket division, because it is them that do the conversion in the field. After about half-life of a diesel engine machine, a major overhaul has to be done and that presents an opportunity, where instead of overhauling the combustion engine and drivetrain, it gets replaced by an electric powertrain. The converted machine is a minimum viable product (MVP), but it allows Epiroc to fill the gap in their product portfolio and solve the customers' needs, while driving electrification in the industry. Additionally, through working with an external contractor and using the existing processes of the market facing units, Rocvolt is not burdening the R&D with an additional project, but gives them the opportunity to effectively work on the development of the final version of the 10-ton loader and other large development projects. Through building this MVP product straight at the customer, the customer can be included in the development of the final product. The R&D development project of the final 10-ton loader will run over several years and there is of course the risk that the final product does not suit the customer needs. Through bringing the product to the customer so early Rocvolt is also obtaining revenues which can help

fund other projects and they secure the market for the launch of the final 10-ton loader and other electrified machines. Nevertheless, there are also concerns in Epiroc, especially within R&D that the conversion project will cannibalise on the final version of the 10-ton loader. This naturally creates friction within the company.

## 5 Analysis

This thesis aims to explore how Epiroc develops the foundation for dynamic capabilities at an early phase to drive a sustainable development shift. In order to address this, the empirical findings presented in chapter 4 will be systematically structured and analysed in the order of the research questions presented in chapter 2. These are:

5.1 the sub-question: *What effect can the implementation of a new business model have on building new dynamic capabilities?*

5.2 the sub-question: *What can an incumbent do in order to effectively exploit the existing technology while exploring new technology?*

5.3 the main question: *How do incumbent OEMs build the foundation for dynamic capabilities to drive a sustainable industry shift?*

### 5.1 Business Model Innovation as An Enabler for Dynamic Capabilities

In this section the authors aim to answer the research question: “*What effect can the implementation of a new business model have on the dynamic capabilities?*” Therefore, a closer look will be taken at the specific aspects of the new business model (Ramdani et al., 2019). It will be analysed to understand the development of dynamic capabilities within the incumbent.

#### 5.1.1 The “Why, What, Who and How” of the new business model

**Value Proposition.** The major change is that the battery will be put at the center, instead of the machines and rockdrills. The reason for that are the before mentioned customer needs around electrification. Through the change the initial investment, will be equivalent to a combustion engine machine and then the costs for the usage of the battery are OPEX similar to the ones of diesel. Through Epiroc having the ownership of the battery, they are responsible to ensure that they are up- and running. This makes it more attractive for the customer, because Epiroc will take care of the maintenance and will also provide new batteries when the batteries reach the end of their life or better battery technology is on the market. Thereby, customers are also less

worried about waiting for the right time to invest, because Epiroc ensures that batteries will be updated to the highest technological standard.

Additionally, putting the battery at the center and designing it in a modular way, enables Epiroc to include other OEMs as target customers. Thereby, the chances to effectively scale-up are increased. Through that, the battery volume can be scaled up efficiently and electrification within the entire mining industry can be sped-up. The modular design allows Epiroc to separate the sale of the machine and the battery. Therefore, the battery can also be used to stabilize the mine's grid and eventually reduce energy poverty in local communities close to the mines. By adding the 2nd and 3rd life to the battery, Epiroc solves the problem arising from the combination of keeping ownership of the batteries with the short usage time in the mining environment. Instead of being stuck with the investment they can prolong the life cycle and create additional revenue streams. Additionally, the perceived customer value shifts from Epiroc being "just" a high-quality machine provider to being a full service provider for electrification. Furthermore, electrifying the fleet, reducing energy poverty and recycling the batteries, makes Epiroc an attractive partner because it effectively contributes to the sustainability of the mining and similar operations. The electrification of the mining industry will drastically reduce CO<sub>2</sub> emissions and the energy demand for ventilation. Thereby, also the working environment of miners will be healthier and safer. Additionally, in the 3rd application the batteries will be used to fight the issue of energy poverty, which will have positive effects for local communities.

**Operational Value.** Key assets for the business model are the intellectual property around the battery system, which ensures Epiroc a limited, but substantial competitive advantage. Besides that, the batteries themselves will be a key asset, because they will be in the ownership of an Epiroc entity. This poses a difference to the traditional business model and also to Epiroc's strategy, which is to be asset light. That is also the reason why the battery life is tried to be extended as much as possible, to maximize the single profit on each battery. An additional key asset is Epiroc's extensive sales and service network around the world. The CCs are responsible for selling, delivering and maintaining the battery solution at the customer sites. Due to the responsibility of ensuring up and runtime, Epiroc has to conduct predictive maintenance and provide new battery units. Therefore, Epiroc has to ensure data supply from the batteries to increase the service efficiency. At the end of life, Epiroc has to bring back the batteries from the customers, to a recycling facility. The batteries and electric engine will be provided by



suppliers. In order to ensure constant supply of batteries a single battery manufacturer has been selected, who ensures to be able to recycle the batteries responsibly. Nevertheless, this also makes Epiroc dependent on that single supplier, which could lead to challenges going forward.

**Human Capital.** The fact that Epiroc, has also been sourcing and assembling the components in the traditional business model, makes this shift to the new technology easier, because they do not have employees specialized in building combustion engines or transmissions. Nevertheless, the above developments pose challenges to Epiroc as an organisation. Employees must be educated on the new business model and the new technology. Besides a change in those rather clear structures and processes, employees within Epiroc also must change their mindset. Offering this technology as a service, requires them to think differently compared to when it was just about selling the machine and then receiving additional revenue through maintenance. With offering the batteries for a fixed pay-per-use price, it is up to Epiroc to ensure that everything works and maintaining them effectively at lowest possible cost. It is basically, in Epiroc's hands to make this profitable. Additionally, employees have to understand to design the battery system in a way that it can be effectively monitored, maintained and recycled to be suitable for a circular business model.

**Financial Value.** Major changes have also occurred in the financial aspects of the business model. Revenue streams from the traditional business model will be the sales of the machines and providing spare parts and maintenance, although less due to the decreased complexity of the electrical engine. The new business model will generate revenues through charging the customers for the use of the battery. Thereby, completely new revenue streams are created, by replacing the diesel in the machines and adding the 2nd and 3rd application of the battery. The traditional revenues from the machine will go as usual to the underground division, while the new revenues from the battery business will be split 50/50 between underground and aftermarket, where they will recover and add to the losses in maintenance. On the cost side additionally costs will occur for the maintenance of the battery system, which will be included into the pay-per use agreement and as already mentioned the investment in the batteries, due to Epiroc's asset light strategy this which will pose a strategic challenge going forward.

### 5.1.2 Business Model Effects on Dynamic Capabilities

Putting the battery at the center, helps to solve customer concerns, which will create more interest from the customer side. When Epiroc just looked at existing customers, the expansion

of the battery business moved very slow. Nevertheless, the modular design, which is suitable for many industry applications opens up completely new opportunities. Thereby, Epiroc senses the electrification not only within the mining industry but also exogenous industries. Using information from various sources can give them valuable insights for their own development. By developing modular and standardized battery packs they can enlarge their customer base, which allows Epiroc to seize the battery business in a more effective way due to the following four reasons; First, by introducing a 2nd and 3rd application for the batteries they are able to offer the batteries-as-a-service. Without Epiroc would not be able to generate enough revenue to keep the battery ownership. Second, they can speed up the transition to zero emission mines, by affecting not only their own but also other suppliers' fleets, which in turn increases the value for Epiroc's machines. Third, increasing the possible target customers, will help to speed up the sales, which will continuously reduce internal resistance against the new business model, by proving its effectiveness. Fourth, the modular system makes it easier for Rocvolt to train the CCs on a single system, rather than many different ones, which makes the transition to new skills and routines smoother. The effects of the business model on the sustainable development of the mining industry lead to new sense of excitement and revitalisation of the culture within Epiroc.

Through keeping control over the batteries and being in a closer relationship with customers Epiroc will receive more data on user needs, which will allow them to continually adapt processes and behaviours. Additionally, moving into industry applications so aggressively with this technology, might enable Epiroc to secure first mover advantage, which can give them a competitive edge going forward. Being a full-service provider around electrification, through providing infrastructure like chargers for example for their battery systems, might lead to high switching costs, for customers, which will make them more likely to choose Epiroc's system for all their machines and applications.

The combination of the traditional and new business model might not make the shift too drastic, which will help to reduce enormous anxiety within Epiroc. In general, the new business model can enable other divisions and departments to adapt new ways of thinking. Looking at themselves more as a full solution provider instead of a product provider. Thereby, a semi-continuous culture change can happen through similar initiatives starting throughout the organisation. One main challenge internally, was the shift in revenues, especially for the aftermarket division. The business model effectively helps to compensate these changes and

creates additional revenue streams in the substitution of diesel and the 2nd and 3rd life of the battery. This creates an incentive internally to support the new technology.

### 5.1.3 Conclusion

In order to answer the research question “*What effect does the implementation of a new business model have on the dynamic capabilities?*” the table below shows how the different aspects of the business model innovation build dynamic capabilities. As already described by Teece (2007; 2018) the business model is a mean to effectively seize new opportunities. The authors analysed that this is also the case here because it allows to solve customer needs, scale up effectively, increase the value of the batteries and solve cultural challenges. Nevertheless, it can also be seen that the business model helps to build sensing and reconfiguration capabilities. It allows Epiroc to be more open towards new opportunities, receive more data from their customers and also tap into information from exogenous industries. In terms of reconfiguration, the business model enables the organisation to adapt its routines and processes in a smoother way, but also has the power to influence other parts of the organisation with this new way of thinking.

	Value Proposition	Operational Value	Human Capital	Financial Value
<b>Sense</b>	<ul style="list-style-type: none"> <li>- Opens up Epiroc to many new opportunities</li> <li>- They can learn from partners and customers coming from other industries</li> </ul>	<ul style="list-style-type: none"> <li>- Epiroc can receive more data on customer needs</li> </ul>		
<b>Seize</b>	<ul style="list-style-type: none"> <li>- Excitement and revitalization of the culture due to the sustainability focus of the business model</li> <li>- 2nd and 3rd application enable Epiroc to keep ownership of the batteries</li> <li>- Solving the specific customer needs helps to seize the new technology</li> <li>- Bigger potential customer base will make it easier to scale up and increase the value for Epiroc's electric machines</li> </ul>	<ul style="list-style-type: none"> <li>- Fast scaling can help them to create a first mover advantage</li> <li>- The full potential of the batteries can be seized by adopting the lifecycle approach</li> </ul>	<ul style="list-style-type: none"> <li>- The combination of the traditional business model and the new is not as drastic as a complete shift to a new business model and therefore reduce the effort to create commitment</li> </ul>	<ul style="list-style-type: none"> <li>- The newly created revenue streams by the business model can help to create commitment within the organization</li> </ul>
<b>Reconfigure</b>	<ul style="list-style-type: none"> <li>- Modular design of the battery decreases the amount of training needed</li> </ul>	<ul style="list-style-type: none"> <li>- More data from their users allows them to adapt processes and routines proactively</li> </ul>	<ul style="list-style-type: none"> <li>- The new business model leads to a new way of thinking in the company, which can lead to other departments and divisions going in the same direction</li> </ul>	

Table 1 - Overview Business Model Innovation

## 5.2 Balancing Exploiting and Exploring

In this section the authors aim to answer the second research question: “*What can an incumbent do in order to effectively exploit the existing technology while exploring new technology?*”

Through identified cases from the company, the analysis will look deeper into what activities the company engages in, to exploit the existing technology while developing the new. The section will be divided into three parts; Rocvolt, in terms of the set up as an cross-functional team within the organisation (Bower and Christensen, 1995) and two of their major initiatives the Conversion Project and Project Volta in terms of exploring and exploiting opportunities arising from customer need (O’Reilly and Tushman, 2008).

### 5.2.1 Rocvolt - An Internal Stakeholder

Rocvolt was created in order to safeguard the development of the new technology and the business model. The small inter-organisation is responsible to lead the building of the capabilities required to implement the new business model described in 5.1. This is possible by operating outside the existing processes and creating a culture that learns by failing fast to ensure moving forward.

The placing of Rocvolt between the two divisions, underground and aftermarket, enables Rocvolt to align processes and motivate technological investments for the new business. Being placed cross-functionally, Rocvolt is set-up to develop the business model following their goals using a holistic perspective. Through Rocvolt gathering and presenting decision material to the steering committee in monthly or semi-monthly meetings they are responsible for sensing the electrification developments in their own but also adjacent industries. By having Rocvolt as a stakeholder, the uncertainty over responsibilities between the divisions in the development of battery machines is reduced and the development can be more efficient. Within Rocvolt, there is a shared responsibility to stay responsive and agile in order to scan new possibilities that could contribute to the team moving towards its goal. A benefit coming from keeping the unit small is that the unit is more flexible and can adapt different approaches to move forward towards their goal of implementing the new business model.

Through marketing itself as the electrification unit, Rocvolt is an easy point of contact to support electrification initiatives and share learnings to enhance knowledge build up in the

organisation. Through collaborating and seeking communication with other divisions in Epiroc, Rocvolt helps to support the building of processes, to align the culture and the way to think about electrification in a more long-term, lifecycle manner. By putting Erik and Fredrik as managers of Rocvolt, but relieving them from any administrative tasks, they can use to their experience and network to drive Rocvolt's strategy within Epiroc.

In order to drive the strategy, Rocvolt must work together with the steering committee. Sitting on two chairs, they have an important role in aligning between Rocvolt and the line organisation for resources. When resource allocation is stopped by conflicting interests in the organisation, the Rocvolt team leverages its ties to the top management to go outside of the formal hierarchy to find the resources. The fact that Rocvolt is aligned with Epiroc's strategy on a high level allow them access to management support, which increases their chances of receiving resources for their projects. Keeping a close relationship and alignment with top management helps Rocvolt to maintain momentum. Top management is also an important key stakeholder for Rocvolt in order to set the direction internally.

### 5.2.2 Focused on the Goal, Flexible on the How

The Conversion project is an example of how Epiroc effectively seizes electrification in the mining industry. Here the close connection and strategic alignment with top management helped them to receive resources, which were not available internally. Rocvolt went with external contractors, which underlines that they are focused on the goal, but are more flexible on the how. By converting the machine out in the field, Rocvolt shortened the launch of their most used product as an electric version from four years to one year. By launching it as an MVP and including customers in the development out in the field, Rocvolt can actively sense the customers' needs and reiterate to the R&D department with the development of the final product. Besides that, working with external R&D capabilities allows the internal R&D department to more effectively work on the major electrification projects and include the learnings from these initial tests.

Through these initial products, the service units out in the field, will get incremental learnings concerning how they must change their own processes in order to efficiently maintain the electric machines. Additionally, through testing it out in the field, also the customers get a better understanding of the benefits that electrification can bring within their mines. This will

reduce stress on the CCs' sales process when the final product hits the market, because some customers already had their initial experiences. The increased demand from the customer side will confirm that this is the right way to go, which will help to change the behaviour and way of thinking concerning the new technology in the main organisation. Doing the conversion during the otherwise major overhaul of the combustion engine shows how Rocvolt is combining the new technology with existing processes. Thereby, Epiroc can drive the electrification out in the field, without drastically changing routines in the organisation, but rather continuously adapt them.

### 5.2.3 Preparing the Organisation for the Shift

Considering the human capital challenges identified in the business model Rocvolt saw a need to proactively train the CCs on the new battery machines. The training facilitates a smooth transition and reduces the pressure on the PC that normally manages all trainings. With the training, the CCs will better explore the demand in their respective market and leverage existing customer relationships. Project Volta is a structured way of effectively communicating the new development to all the CCs.

Rocvolt will use the same sales and service network as for the diesel engine to execute the new business model. Therefore, the training combines the existing knowledge about the Epiroc machines and the already existing customer relationships, with everything the CCs need to know about the new technology and business model. Through having the training earlier than usual, Rocvolt ensures that the CC teams have enough time to adapt their processes and behavior before they start selling in their respective markets. By inviting cross functional teams to the trainings Rocvolt can ensure that the CCs also receive a more holistic perspective on the new business model. With the CCs being part of Epiroc's market intelligence this helps to ensure that the local teams are looking out for the right signals in their markets and are able to react to early requests or questions by customers. During the trainings the CCs also start formulating their strategies on how to go to market with the new technology.

One of Project Volta's aims is to reduce the information asymmetry to minimize uncertainties as hindrances for CCs to act. The Q&A database is an essential tool for that because it enables all CCs with the same question to find the information quicker to reduce the dependence and pressure on the line organisation and Rocvolt. Another tool is to create networks between the

CCs in the weeklong trainings. By being out in the field and experiencing challenges first-hand they are better equipped to help each other than the PC in Sweden would be. This again reduces the stress on the PC, but also ensures effective problem-solving for the customer.

	Rocvolt	Conversion Project	Project Volta
<b>Sense</b>	- Rocvolt is responsible for sensing developments and opportunities and presenting them to the divisions and top management	- By converting existing machines of customers can enable Rocvolt to try out early ideas and learn from the customers	- Giving the CCs a holistic view at an early stage allows them to sense signals and react to customer requests in their local markets
<b>Seize</b>	- The set up allows Rocvolt to try and fail fast to build learnings - Rocvolt align the culture in the underground and the aftermarket division - Through high level alignment with Epiroc's strategy Rocvolt receives top management support and resources - Erik and Fredrik use their experience and network to drive Rocvolt's strategy within Epiroc	- By converting the existing machines in the field, Rocvolt can be able to fill the gap in their portfolio and reduce the pressure on the R&D department - The sales teams of the CCs will be in a better position when the final product hit the market as the customers already have experienced the solution - Through increasing customer demand, Rocvolt can internally motivate resource allocation and create commitment - Rocvolt breaks hierarchies and dependence on the resources in the divisions by top management supporting them to go with an external partner	- Through the training Rocvolt can communicate in a structured way and create commitment in the CCs around why electrification is important - Making the Project Volta virtual enhances the CCs to independently build capabilities - CCs starting to develop the strategies in the training, allows Rocvolt to support how the individual CCs effectively approach their markets - By building a network among the CCs, project Volta builds the foundation for effective learning and problem solving
<b>Reconfigure</b>	- By marketing itself as the electrification unit, Rocvolt interact across the divisions to support and influence the process development	- Rocvolt can use the learnings to support the R&D internally in reconfiguring the processes for new development projects - By using the existing processes for the roll out, the service units can experience a smoother transition instead of a drastic change.	- The proactive training ease the implementation as the CCs are given time to update their processes

Table 2 - Overview Initiatives

### 5.2.4 Conclusion

In order to answer the question “*What can an incumbent do in order to effectively exploit the existing technology while exploring new technology?*” the authors combine the dynamic capabilities identified above with the ambidexterity literature.

By creating Rocvolt, a separate unit was given the mission to explore electrification. Rather than trying to do it within the existing structures, a team was formed, that puts the battery at the centre of their strategy. Thereby, Rocvolt operates to build dynamic capabilities around the technology development from learning by experience. Instead of focusing on being resource efficient and maintain a good manufacturing flow, it is their task to explore new opportunities, try out what works and what does not and learn from that. Rocvolt is aligned with top and

divisional management and have their support. However, once decisions are made it is up to Rocvolt to find ways to seize these new opportunities, often dependent on aligning with the existing structure. Therefore, they need to collaborate and communicate in order to slowly build an organisation that is besides exploiting, within an efficient divisional structure, also able to free up resources to explore new opportunities. This shows that Rocvolt is not really spun-out of the organisation, but by placing it between two existing units, Rocvolt's aim is to facilitate ambidexterity within Epiroc. A reason for this is that Rocvolt's business model must function in combination with the traditional business model of Epiroc.

Through their own research but also with support from the market facing units Epiroc realised that the market is showing more and more interest in electrification. Nevertheless, the exploiting structures, lack of slack resources and remaining scepticism retard the ability to explore, which affects the speed of bringing products to the market. In this case the strong mission and being outside the existing processes enables Rocvolt to find new approaches. With external resources they are able to build a product that might not be as developed as Epiroc's products usually are but is good enough to satisfy the customers' needs of a zero-emission mining machine. Then by training the market facing units in a structured way, they ensure that the product gets rolled out to the market quickly, to further explore the new technology. (Appendix 6) In the authors view, this represents quite an interesting situation. Due to the inability of the main organisation to become ambidextrous fast enough, Rocvolt found a way to skip that middle part and create alignment between top management, Rocvolt and the market facing units. It is of course a risky move and is challenging the structures and employees within Epiroc. Nevertheless, it will create demand on the market side, which the PC will probably not be able to resist. Thereby, Rocvolt might create positive local feedback that forces the PC to invest more resource in exploring this new technology. Additionally, Rocvolt's mission is focusing on creating a more sustainable mining industry, which is something many people can identify with.



### 5.3 Building the right Dynamic Capabilities for Sustainable Development

This section will bring section 5.1 and 5.2 together in order to answer the main research question: *How do incumbent OEMs build the foundation for dynamic capabilities to drive a sustainable industry shift?*

The authors analysed the effect the development of a new business model has on the dynamic capabilities. Through combining the model of Teece (2007) with theory from business model innovation and ambidexterity, the authors are able to confirm that the organisation at an early phase is engaging in activities to develop dynamic capabilities for the purpose of sensing, seizing and reconfiguration to drive a sustainability shift.

Applying business model diversification, the incumbent organisation faces the challenge of ambidexterity to develop a new business model within the confounds of an existing organisation. To build the right capabilities which effects materialize in the longer term, the incumbent must give room for the organisation to pursue new opportunities and act on the market signals. To seize, the incumbent can protect identified opportunities in the infancy stage by creating a dedicated inter organisational unit with ownership over the new business model. The new business model allows Epiroc to build the processes and routines to better seize more opportunities within mining and related industries. Therefore it enables them to sense a wider array of information, increase the value for each battery, effectively scale up and allow a smoother implementation of new technology in the organisation. Externally, at the early stage, the inter-organisational unit develops the offering with the customer to create a pull from the market side. By leveraging the close ties through the CCs development is done together with existing customers. Therefore, the incumbent has access to sense their needs and the adoption of Epiroc's battery technology. Taking a holistic perspective, the inter-organisational unit also engages in activities and processes within the organisation to create alignment in the form of informal and formal information sharing meetings and participation in electrification projects. The alignment of processes at an early stage consists of educating the organisation and acting as a vessel to effectively push for necessary culture realignment within the company. To do this, it is paramount for the inter-organisational unit to access resources in three ways; First, leverage existing personal ties with the organisation and seek to work in a collaborative manner

with the main organisation; Second, build a close relationship with immediate management for support; Third, build close relationship with top management to go outside the hierarchies.

To summarize, the incumbent organisation is building the foundation for dynamic capabilities by developing a new business model, creating organisational alignment and increasing market adoption managed by an inter-organisational unit. By doing this, Epiroc can address the ambidexterity and incumbency related challenge during a sustainable development shift.

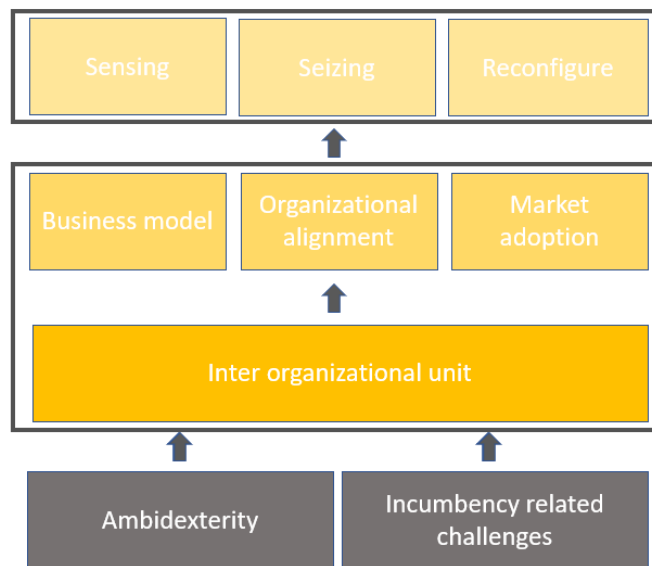


Figure 3 - High Level Overview of Sustainable Shift of Incumbent

## 6 Discussion

In this paper, the authors combined the related theories of dynamic capabilities, business model innovation and ambidexterity. Dynamic capabilities have confirmed to be a valuable lens to observe how companies react and change in accordance with changes in their environments. Zahra et al. (2006) acknowledge that dynamic capabilities can be triggered by drastic technology and market changes, meaning that companies do not necessarily possess them all the way. This is highly relevant in many industries facing sustainable development challenges. The case study in this paper presents an example, where a company coming from a rather stable industry is faced with environmental changes. In order to understand this early phase development of dynamic capabilities, business model innovation and ambidexterity were used as supporting theories. The business model is seen as an important mean to seize opportunities in the market (Teece 2007; 2018), but in relation to this paper the concept has served as a valuable tool to understand how dynamic capabilities can be triggered in all three dimensions of seizing, sensing and reconfiguring. It gave a conceptual understanding of how specific changes in the business model architecture, directly relate to the development of dynamic capabilities. Besides that, an important factor, influencing the dynamic capabilities are the antecedents of a company. In the focal case the company represented an incumbent coming from mature products, which posed certain challenges in developing suitable dynamic capabilities. Ambidexterity literature presented a valuable analytical tool, as there is a strong focus on how incumbents deal with exploring and exploiting simultaneously. Thereby, the challenges of the incumbent were understood better and how organisational and commercial actions enabled dynamic capabilities and ambidexterity.

Looking at the above, this case study presented a unique opportunity to combine the three streams of literature. If one of them would have not been included into the theoretical framework, it would have been difficult for the authors to illuminate all relevant factors. In line with Teece (2018) and Bower and Christensen (1995) it was an important step to put the new technology and business model within a separate unit. Besides that, the case study confirmed that dynamic capabilities cannot be built in a certain moment in time, but continuous learning and development of routines are essential (Zollo and Winter, 2002). The authors notice that no relevant discrepancies between the theory and empirical world could be identified. This could be connected to the early stage of the development.

## 7 Conclusion

Dynamic capabilities are an important asset for organisations as they can effectively enable strategic change. In the work of Teece (2007), an important dimensionalization is made in sensing, seizing and reconfiguring. In this paper, the authors have aimed to study what activities an incumbent engages in, to build the foundation for the development of new dynamic capabilities. To an incumbent facing a sustainable development shift and choosing to develop a diversified business model strategy, ambidexterity poses as a specific challenge. In this paper, an inter-organisational unit drives the sustainable development shift by engaging in activities to build the foundation for the creation of new dynamic capabilities for the organisation. Two examples that could be highlighted at an early stage are Project Volta and the Conversion Project, which exemplify the inter-organisational units work to create alignment throughout the organisation.

### 7.1 Theoretical Contributions

This study attempts to motivate the bringing together of three research streams to explore a phenomenon. Dynamic capabilities have previously been researched together with business model innovation (Teece, 2018) and ambidexterity (O'Reilly and Tushman, 2008) individually. Through combining the research streams a better understanding could be built, of how a new business model can be implemented and how it can influence the dynamic capabilities.

### 7.2 Managerial Implications

The findings of this research can be interesting for incumbents that are facing challenges concerning building dynamic capabilities for sustainable development. Especially, C-level executives or other senior managers could learn from the actions Epiroc has taken. By using dynamic capabilities in combination with business model and ambidexterity literature, the authors could create an understanding of how incumbents can build the foundation for the right dynamic capabilities to simultaneously exploit and explore in the face of a drastic sustainability shift. Four main learnings could be identified: (1) The development needs to be supported by top management in order to ensure support, that helps to grow the initiative within the organisation. (2) If the sustainable shift involves a new technology, fundamentally different from the traditional method, it has to be placed within a separate organisational unit. This

ensures that there is an internal stakeholder, with its own mission, that safeguards the new technology within the organisation. (3) In order to unleash the full potential of the new technology the business model has to be adapted, in order to overcome organisational and commercialisation challenges. (4) In case the new technology is meeting resistance within the organisation, which is slowing down the development, efforts can be redirected towards creating a pull from the market by working with the local offices and the customers.

### 7.3 Limitations

The authors identified three limitations in this paper. First, the focal company is in an early stage of the development of the new business model and the dynamic capabilities. Therefore, the authors are forced to draw implications from the empirical data, but cannot ex-post confirm the actual existence of these dynamic capabilities. Second, the chosen method is a single case study approach and although the authors tried to ensure transferability of the research, further qualitative research is needed in different geographical and industry contexts. Third, due to the emphasis of the study on the actions of Rocvolt, only people involved or connected to this sub-unit have been interviewed. In order to get an even broader and more nuanced understanding, people of other parts of the organisation could have been interviewed.

### 7.4 Future Research

This study has attempted to combine the three research areas of business model innovation, dynamic capabilities and ambidexterity to understand how incumbents build the dynamic capabilities driving a sustainable development shift. Dynamic capabilities have previously been researched within both business model innovation (Teece, 2018), and ambidexterity (O'Reilly and Tushman, 2013), however, more research on how these three perspectives together can give a deeper understanding of a phenomena is needed. Furthermore, the focal study has been a single case study within a specific context. More in-depth research from different geographical or industry contexts is needed to strengthen the findings. This study was conducted at an early stage, it is therefore of interest get a further understanding on the implications from a longer-term perspective to identify how the dynamic capabilities build up from learnings over time.

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## 9 Appendices

### Appendix 1

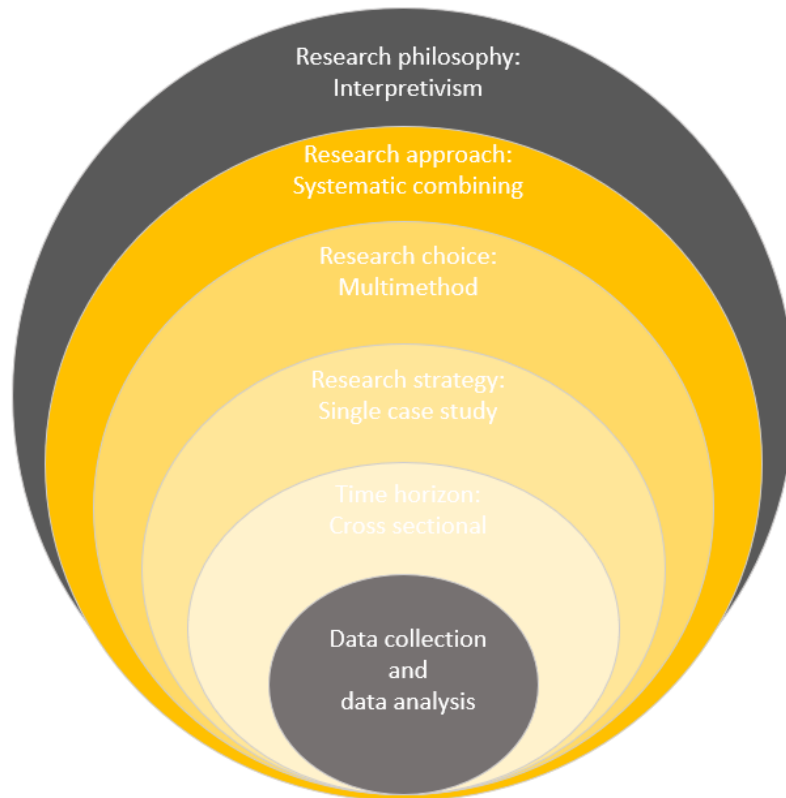
#### Sustainable Development Goals



### Appendix 2

#### Research Onion





Source: Sounders et al. 2007.

### Appendix 3

List of interviewees – Orientational Study, Follow up and Main Study

Orientational Study Interviews						
	Interviewee	Role	Company	Date	Duration	Channel
1	Olle Olsson	Research Fellow	Swedish Environment Institute	10.10.2019	41:01	Skype
2	Ranjula Bali Swain	Visiting Professor	SSE Institute for Research	10.10.2019	36:56	Skype
4	Anders Lewald	Senior Advisor	Swedish Energy Agency	15.10.2019	15:07	Skype
3	Per Wettergren	Project Manager, E-Mobility	Vattenfall	17.10.2019	32:01	Skype
5	Lars-Åke Lindahl	Coordination EU issues	Svemin	24.10.2019	44:58	Face-to-face
6	Jenny Greberg	Research and Innovation	Svemin	24.10.2019	36:10	Skype

Follow-up contact					
	Interviewee	Role	Company	Date	Channel
1	Erik Svedlund	Head of Marketing, Business development	Epiroc	18.11.2019	Email

Main Study Interviews						
	Interviewee	Role	Company	Date	Duration	Channel
1	Åsa Gabrielsson	General Manager, URE	Epiroc	2.10.2019	47:04	Skype
2	Lina Jorheden	Operations Manager, Rocvolt	Epiroc	25.10.2019	1:14:26	Face-to-face
3	Anders Hedqvist	VP R&D Underground	Epiroc	30.10.2019	46:46	Phone
4	Anders Hedqvist	VP R&D Underground	Epiroc	18.11.2019	36:55	Phone
5	Ander Lindkvist	Technology Development, Underground	Epiroc	30.10.2019	42:17	Phone
6	Fredrik Martinsson	Head of Marketing, Products and Services	Epiroc	31.10.2019	1:28:30	Webex
7	Fredrik Martinsson	Head of Marketing, Products and Services	Epiroc	11.11.2019	1:06:06	Webex
8	Erik Svedlund	Head of Marketing, Business development	Epiroc	01.11.2019	1:07:26	Webex
9	Anneli Mård	VP HR Underground	Epiroc	04.11.2019	44:39	Phone
10	Kent Rubensson	VP Technical, Mining and Rock Excavation Service division	Epiroc	04.11.2019	46:16	Webex
11	Daniel P. Jonsson	Lead data and analytic	Epiroc	15.11.2019	43:41	Webex
12	Jimmy Kristoffersson	Project leader Rocvolt Governance	Epiroc	21.11.2019	31:03	Webex

## Appendix 4

Interview guide example

### Intro

Our names are Alexander Deimel and Therese Höijer and we are two MSc. Students at SSE passionate about the development of sustainable business models within manufacturing. This thesis focuses on the processes and routines within Epiroc and how these has been altered in the development for the sustainable business. We are especially interested in looking into the activities of Rocvolt from an organizational perspective. In brief, the purpose of our research is to map the development of processes and to understand the interrelations with stakeholders and their ability to drive the development of the offering to Epiroc's customers. We are aspiring to generate insights in the internal organizing for change in the context of sustainability and go to market strategies within sustainable mining. The goal with the interview is to get perspective on how Rocvolt and the rest of the organization work together in developing the processes and offering. We will go through questions today related to this development and very much would like to get your perspective on it. Is it ok if we record the interview for the purpose of this thesis? Quotes might be presented in the final report and you will have the possibility to check them beforehand.

Initial working research question earlier identified:

*How can a subunit of an incumbent OEM develop dynamic capabilities to enable the shift to a sustainable business model?*

### **Sensing**

1. Concerning the goal, you have within Epiroc and the shift towards sustainable mining - How do search and gather information about the outside world?
  - a. On what level?
  - b. In what format? (relationship, role, formal meetings, coffee?)
2. Who is actually gathering the information first-hand, is it Rocvolt or Epiroc?
  - a. Why do you do it in that way?
3. How do you deal with uncertainties about the outside world?
4. How much information do you share with external parties?
5. How do regulations, standards and business ethics affect you? (development and the design of your offering)
6. Do different stakeholder groups affect you? (example, unions, investors or executive board)
7. How do you evaluate information in order to move to the next phase?
  - a. Who and how is signed-off in the end?

### **Seizing**

1. How do you make investment decisions?
  - a. Did you have to develop new budgeting processes for this purpose?

- b. How do you safeguard from having decision-biases (especially looking at your role as an incumbent)?
2. How do you ensure that projects (cross functional) are aligned and executed within Epiroc?
3. Do you feel that there has been a change within the organizational culture within Epiroc?
  - a. How open are you with this development?
  - b. Did you have to hire people with new skill sets?
  - c. How do you create commitment among employees?
  - d. How can people share their opinion and how is it taken into consideration within organization?
4. How do you manage the balance between procuring technology externally and developing it internally?
5. How do you work with customers to implement the new solution?
  - a. Have you shifted your business model?
  - b. Are there financing issues?
6. What kind of challenges are you dealing with?
  - a. Do you have any processes in place to overcome them?

### **Managing threats and reconfiguration**

1. Have there been any routines and processes within the organisation that became dysfunctional?
  - a. What were the major changes?
  - b. Have there been any silos or organisational boundaries you had to break?
2. Does the old and new complement within the organisation? If yes, how did you make that happen?
3. Any changes concerning decision rights, teamwork, task responsibilities or performance-based rewards?
  - a. How was the cross functional team configured?
  - b. Payroll? Who is belonging where?
4. How do integrate and ensure internal learning and knowledge sharing?
  - a. Concerning technology, intellectual property

### **Appendix 5**

#### Interview email invitation example

Hi,

We hope this finds you well.

Our names are Alexander Deimel and Therese Højjer and we are two MSc. Students at SSE passionate about the development of sustainable business models within manufacturing. Because of our interest and the interesting activities at Epiroc, we decided to write our master thesis as a

case study at Epiroc about the organizing for a sustainable development in the industry. We are especially interested in looking into the activities of Rocvolt from an organisational perspective. In brief, the purpose of our research is to map the development of processes and to understand the interrelations with stakeholders and their ability to drive the development of the offering to Epiroc's customers. We are aspiring to generate insights in the internal organizing for change in the context of sustainability and go to market strategies within sustainable mining. The goal with the interview is to get perspective on how Rocvolt and the rest of the organisation work together in developing the processes and offering.

As part of our empirical research, we are conducting expert interviews with key people within Epiroc and are very grateful for the chance to interview you over Skype to talk about the development.

Best,  
Therese and Alex

**Appendix 6**  
Conceptual overview of Rocvolt activities

