



SCHOOL OF  
ECONOMICS AND  
MANAGEMENT

# SMEs in Times of Crisis

---

An Analysis of Medtech SMEs' Strategic Responses to the  
COVID-19 Pandemic

by

Alina Tater  
Marc Leon Willemsen

June 2021

Master's Program in International Strategic Management

Supervisor: Pauline Mattsson

# Abstract

The COVID-19 crisis has disrupted industries across the globe and has forced organizations to respond. One example is the medical technology (medtech) sector in which small and medium-sized enterprises (SMEs) were impacted and had to respond strategically. Previous literature on crisis management is still immature in respect to strategic responses to this unique crisis. Therefore, the purpose of this thesis is to analyze how medtech SMEs have responded to the COVID-19 pandemic.

The study employs a multiple-case study, for which five semi-structured interviews with medtech SME top-managers were conducted. A cross-case analysis allowed to confirm the common strategic responses retrenchment, persevering, innovating, and exit, but also expand them by two other responses, namely collaboration and financing. The researchers developed a crisis management framework consisting of the three phases, pre-crisis, crisis, and post-crisis that also integrates the strategic responses. The findings further reveal that medtech SMEs do not use the responses in isolation but rather in combination. By practicing the certain strategic responses, medtech SMEs were able to grow and develop their business throughout the crisis.

The results of this study add to previous research on strategic responses in the field of crisis management. Further, it provides valuable practical implications for managers. It presents ways to respond strategically to crises, and provides learnings that may serve their companies to prepare for future global crises.

Keywords: Crisis Management, Strategic Responses, SME, COVID-19, Medtech

# Acknowledgment

Writing the acknowledgment is always a part of the thesis, which makes you think about what you have done, much more about what is now really over. Some people would say it is an emotional page. We would say they are right. This one-year master's program has been an intense and joyful journey, culminating with our master's thesis. In other words, our academic path has come to an end (for now). We look forward to our next steps and what the future holds for us.

First of all, we would like to express our greatest gratitude to our supervisor, Pauline Mattsson. Dear Pauline, thank you so much for your valuable feedback, guidance, and always motivating and warm words during the whole process.

Second, a tremendous thank you goes to Givi Kokaia and María Fernanda Bocángel from Kunskapspartner, as well as Petter Hartman from Medical Valley Alliance, who supported us, gave us thought-provoking input, and helped us to get in touch with the selected case companies. At this point, a special thanks goes to you, Givi, because from the first second on, you have worked with us in an unbelievable sympathetic way and have put us on the right track in the beginning.

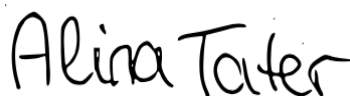
We would also like to take this opportunity to thank the five top-managers who took the time for an interview and to answer our questions.

Third, we would like to thank our fellow students, our friends who made this special year a unique experience that we will remember for a lifetime. The exchange with all of you was inspiring and motivating at the same time. We want to thank you from the bottom of our hearts.

Fourth, a special thanks to Lund University and all our professors, who, despite the COVID-19 situation, have taught us excellently and have developed us personally and professionally.

Fifth, we would like to thank our families, not only for the support during the last year but also for where we are now, this would not have been possible without you. Thank you so much. We love you.

In the background of our thesis, lastly, we would like to thank all the doctors, nurses, and all the people who are fighting against the COVID-19 virus in the front line every day. Their work cannot be appreciated enough.



Alina Tater



Marc Leon Willemsen

# Table of Contents

<b>1 INTRODUCTION .....</b>	<b>1</b>
1.1 Topic Background and Relevance .....	1
1.2 Research Question and Purpose.....	3
1.3 Outline of the Thesis.....	5
<b>2 LITERATURE REVIEW .....</b>	<b>6</b>
2.1 Crisis in general .....	6
2.2 Crisis Management .....	8
2.2.1 An Overview of Crisis Management .....	8
2.2.2 Pre-Crisis Phase .....	9
2.2.2.1 Theoretical Background Pre-Crisis Phase .....	9
2.2.2.2 Influencing Factors on Pre-Crisis Management .....	12
2.2.3 Crisis Phase.....	13
2.2.3.1 Theoretical Background Crisis Phase .....	13
2.2.3.2 Dynamic Capabilities.....	14
2.2.3.3 Strategic Responses to Crises .....	15
2.2.4 Post-Crisis Phase.....	20
2.3 Concluding Remarks.....	23
<b>3 METHODOLOGY .....</b>	<b>24</b>
3.1 Research Design and Approach.....	24
3.2 Choice of Case Companies .....	26
3.3 Data Collection .....	28
3.4 Data Analysis.....	30

3.5	Validity and Reliability .....	32
3.6	Ethical Considerations .....	34
<b>4</b>	<b>EMPIRICAL RESULTS.....</b>	<b>36</b>
4.1	Description of the Cases .....	37
4.1.1	Overview of the Medtech Sector .....	37
4.1.2	Medtech SME 1 .....	39
4.1.3	Medtech SME 2 .....	39
4.1.4	Medtech SME 3 .....	40
4.1.5	Medtech SME 4 .....	40
4.1.6	Medtech SME 5 .....	40
4.2	Pre-Crisis Phase .....	41
4.2.1	Proactive and Reactive Crisis Management .....	41
4.2.2	Age.....	42
4.2.3	Company Size .....	42
4.2.4	Financial Resources .....	43
4.3	Crisis Phase.....	43
4.3.1	Impact of the COVID-19 Crisis on the Organizations and Sector.....	43
4.3.2	Strategic Responses .....	45
4.4	Post-Crisis Phase.....	51
4.4.1	Key Learnings.....	51
4.4.2	Future of Work.....	52
4.5	Empirical Framework .....	52
<b>5</b>	<b>DISCUSSIONS AND ANALYSIS.....</b>	<b>56</b>
5.1	Crisis Preparation.....	56
5.2	Crisis Phase.....	58

5.3 Crisis Learnings .....	61
<b>6 CONCLUSION .....</b>	<b>63</b>
6.1 Theoretical Implications .....	64
6.2 Practical Implications.....	65
6.3 Limitations and Future Research .....	66
<b>REFERENCES.....</b>	<b>67</b>
<b>APPENDIX A .....</b>	<b>81</b>
<b>APPENDIX B .....</b>	<b>82</b>
<b>APPENDIX C .....</b>	<b>84</b>

# List of Tables

<b>Table 1:</b> Overview of the Selected Cases.....	28
<b>Table 2:</b> Overview of Conducted Interviews .....	30
<b>Table 3:</b> Predefined Template for Data Analysis (based on Literature Review).....	32

# List of Figures

<b>Figure 1: Framework of the Three Phases of Crisis Management including the Strategic Responses (created by authors).....</b>	<b>55</b>
---	-----------



# 1 Introduction

*“The corona virus has definitely given SMEs a window of opportunity where they need to rethink-redefine-re-do their strategies for survival.” (Sharma, 2020, p.20)*

## 1.1 Topic Background and Relevance

In recent years, the world experienced several crises which, to mention a few examples, include the global economic and financial crisis in 2007-2008, natural disasters like Hurricane Katarina in 2005 or Irma in 2017 (Doern, Williams & Vorley, 2019), terrorist attacks like 9/11 in 2001 which followed an economic downturn, Fukushima in 2011, the migration crisis in 2015, the Brexit dispute and the climate crisis (Wenzel, Stanske & Liebermann, 2020). As the examples demonstrate, a crisis is an negative-oriented and unexpected event (Pearson & Clair, 1998; Weick, 1988). Often their outcomes are disastrous on several levels, including the individual, societal, economic, and natural levels (Pearson & Clair, 1998; Wenzel, Stanske & Liebermann, 2020). Their harmful impacts may include collapses of firms or entire industries (Wenzel, Stanske & Liebermann, 2020) which in consequence means that a crisis can pose a threat to the existence and development of an organization (Chong, 2004; Guo, Yang, Huang & Guo, 2020; Kuckertz, Brändle, Gaudig, Hinderer, Morales Reyes, Prochotta, Steinbrink & Berger, 2020).

The most recent example is the COVID-19 crisis (Guo et al. 2020; Wenzel, Stanske & Liebermann, 2020) which can be seen as one of the world's most challenging global health crises so far (Nangia & Mohsin, 2020). On a global scale, societies and economies across all sectors have been impacted by this unpredictable and highly significant event (Kuckertz et al. 2020). The global development of the crisis, which required immediate countermeasures, had instant harm on local economies and

the global economy as a whole (Waldkirch, 2021). The damage caused may last far into the future and may also negatively impact global economic growth (Guo et al. 2020).

The medical technology (medtech) sector is one exemplary industry that has strongly been impacted by the COVID-19 crisis (West, Cheong, Boone & Moat, 2020). West et al. (2020) state that supply chains have been disrupted, product life cycles have changed, and clinical trials have been delayed or could not be performed. Further, they mention that the crisis has initiated major temporary and permanent changes within medtech companies, affecting processes, activities, and business models. At the same time, West et al. (2020) also point out that the digital inertia of the industry has once again been accelerated. In other words, digitization and innovation strategies are increasingly shaping the medtech sector (Fang, Chen, Chiu, Lin & Su, 2020; Javaid, Haleem, Vaishya, Bahl, Suman & Vaish, 2020), which has been further intensified by the COVID-19 crisis (West et al. 2020). Therefore, it can be pointed out that the COVID-19 crisis has changed the medtech industry in several ways, and “the healthcare ecosystem, including the medical device industry, will never look quite the same again” (West et al. 2020, p.56).

Moving from an industry perspective to the company level, it has to be stated that the COVID-19 crisis has had a formative impact on small and medium-sized enterprises (SMEs) worldwide (Gourinchas, Kalemli-Özcan, Penciakova & Sander, 2020; Guo et al. 2020; Juergensen, Guimón & Narula, 2020; Kuckertz et al. 2020). In general, SMEs are a key driver of technological innovation, and their existence provides social stability (O'Regan, Ghobadian & Gallear, 2006). However, due to several size-related characteristics, SMEs are particularly vulnerable to crises (Guo et al. 2020; Herbane, 2010; Kuckertz et al. 2020; Runyan, 2006; Smallbone, Deakins, Battisti & Kitching, 2012). Reasons for this may include a limited product line, a very narrow customer base, or limited internal resources (Smallbone et al. 2012). However, at the same time, SMEs are also highly flexible and adaptable and may easily be able to adjust resource inputs, prices, products, or processes (Kuckertz et al. 2020; Smallbone et al. 2012). In that context, the question arises of how those companies have responded strategically to the COVID-19 crisis.

Crisis management strategies in general and in particular the responses towards the COVID-19 crisis are highly relevant for academia and management. The importance of crisis management cannot be overemphasized enough (Crandall, Parnell & Spillan, 2010; Fink, 1986; Mitroff,

Shrivastava & Udvardia, 1987; Myers, 1993; Pearson & Clair, 1998), and thus makes the field of organizational strategic responses to crises very relevant to analyze (Cui, Wang & Ping, 2016; Mayr, Mitter & Aichmayr, 2016; Thornhill & Amit, 2003). Guo et al. (2020) reinforce this by stressing that strategically responding to a crisis is a highly important field to pay attention to. A gap in crisis management literature has also been identified by Wenzel, Stanske and Liebermann (2020), who call for further studies, in particular in the field of strategic responses to a crisis.

The COVID-19 crisis and its consequences have created an unique situation for medtech SMEs, but where the specific field of crisis management is still immature. Thus this study is one of the first ones that enters this specific field of research on crisis management from a strategic perspective in the context of the COVID-19 crisis for this specific sector. By studying Nordic medtech SMEs, this study also picks up the request for further research of this specific COVID-19 crisis in different countries to gain an overarching picture of the field under study (Kraus, Clauss, Breier, Gast, Zardini & Tiberius, 2020). It will enrich the body of research on crisis management by addressing a particular crisis, the COVID-19 crisis, and also by looking into a specific sector, the medtech sector. From this, specific strategic responses may be derived.

## 1.2 Research Question and Purpose

“When a crisis occurs, it usually arrives as a barrage of urgent, unexpected and unpleasant events, allowing little time to organize or plan appropriate responses” (Nathan, 2000, p.12). In other words, organizations have only a short time window to respond to a crisis as unique as the COVID-19 crisis (Albers & Rundshagen, 2020; Wenzel, Stanske & Liebermann, 2020). Further, compared to crises in the past, increasingly emerging technologies lead to new business opportunities and possibilities for firms when responding to today’s crisis events (Gkeredakis, Lifshitz-Assaf & Barrett, 2021; Guo et al. 2020).

Therefore, the purpose of this thesis is to create an understanding of the strategic responses of medtech SMEs to the COVID-19 crisis and analyze how they have responded strategically to the crisis. In that context, this study first aims to understand the immediate impact of the pandemic on the medtech industry and the SMEs in particular. The following will identify the specific strategic

responses which will be presented in a framework. Previous literature often differentiates crisis management into three phases: pre-crisis, crisis and post-crisis (Crandall, Parnell & Spillan, 2010). For the purpose of this study, those individual phases will be analyzed regarding medtech SMEs within the COVID-19 crisis. The main focus will be on the crisis phase. For this, the analysis will be based on the four strategic responses retrenchment, persevering, innovating, and exit, identified by Wenzel, Stanske and Liebermann (2020). By this, the study aims to generate results that have key implications for medtech SMEs and which also may be generalized and transferred to future crisis situations. The purpose of this study also includes providing guidance for SMEs on how to encounter unexpected crisis events. Based on this purpose, the thesis examines the following research question:

*How have medtech SMEs responded strategically to the COVID-19 crisis?*

To address this research question, a qualitative abductive research approach was chosen, and a multiple-case study will be conducted. The focus of the individual cases will be on medtech SMEs that offer a ‘convergence product’ (Bamber & Gereffi, 2013). In other words, the study investigates medtech SMEs that deliver a product or service, as well as supporting software and/or app for a smartphone and therefore represents cases with a digitized business model.

This thesis aims to contribute to the field of research in crisis management in several ways. First, this study will contribute to the emerging literature on crisis management with respect to COVID-19 by identifying strategic responses to crises and synthesizing them based on theoretical and empirical results into one framework. Second, the uniqueness of the COVID-19 crisis and its global scale, which stands in contrast to previous crises, leads to a highly relevant field to study for academia and business. It allows to derive practical learnings from a global crisis that may prepare for future global crises. Third, the findings will help managers of SMEs to make decisions regarding their strategies in times of future crisis events, whereby the goal of the strategic responses is to not only survive the crisis but also capture opportunities that a crisis entails.

## 1.3 Outline of the Thesis

This thesis is subdivided into six chapters. Following the introduction, the literature review in chapter two first creates an understanding of the crisis event itself and consequently focuses on crisis management within the three crisis phases, pre-crisis, crisis, and post-crisis. Chapter three covers the underlying research methodology of this thesis, thus elaborates on the research design, choice of case companies, data collection, data analysis and also considers validity and reliability issues as well as ethical considerations. Chapter four introduces the selected cases and subsequently presents the findings of the empirical study. The fifth chapter continues with the analysis and discussion of the findings and puts them into relation to the previous literature review. Lastly, chapter six concludes the thesis and presents theoretical and practical implications, points out limitations, and draws attention to future areas of research.

## 2 Literature Review

In any academic study, a crucial element is to review existing literature from the field under study (Webster & Watson, 2002). Further, Webster and Watson (2002) underline that such a review will provide the foundation for a study and consequently will enrich the existing body of knowledge. To align with that, the following review aims to establish a solid foundation of the existing literature in the field of crisis management. To provide a common understanding, the first section of the literature review will elaborate on several crisis definitions and crisis categories. Subsequently, the main focus will be on crisis management. The synthesis of several crisis management frameworks in prior literature allowed to identify three underlining phases of crisis management, namely pre-crisis, crisis, and post-crisis, which will serve as the organizing structure of this crisis management literature.

### 2.1 Crisis in general

In order to approach the broad field of crisis management, it is essential to establish a common understanding of the term crisis. Over the years, several researchers have offered several definitions. In broad terms, a crisis is an negative-oriented and unexpected event that may come with negative consequences (Pearson & Clair, 1998; Weick, 1988) and can lead to the demise of any company (Chong, 2004). There are three key elements in the various definitions of a crisis that stand out. First, it includes the surprise aspect, meaning that the appearance of the crisis is unexpected (Pearson & Clair, 1998; Pearson & Mitroff, 1993). Second, it recognizes the urgent need to respond quickly, and third, it recognizes that high-priority goals are threatened (Hermann, 1963).

A well-established definition for an organizational crisis has been presented by Pearson and Clair (1998, p.60), who consolidated the main elements of an organizational crisis and synthesized the following definition:

An organizational crisis is a low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decisions must be made swiftly.

A more recent definition stems from Coombs (2014, p.3):

A crisis is the perception of an unpredictable event that threatens important expectancies of stakeholders and can seriously impact an organization's performance and generate negative outcomes.

Overall, James, Wooten and Dushek (2011) highlight the three elements: rarity of the event, significance of the event, and impact on stakeholders, as highly important and as the key characteristics for a crisis.

Some authors further distinguish between disaster and crisis (Coombs, 2014; Quarantelli, 2005). Quarantelli (2005) characterizes disasters as sudden events that cause disruption, require immediate new actions to handle the event, and pose a great risk to companies and societies. Coombs (2014) adds to this by saying that disasters have an impact on a larger scale and require responses from governments from several countries. At the same time, he says that disasters and crises are interconnected as disasters can turn into an organizational crisis when the event affects the business operations.

Another essential element in the context of crisis is the classification of crises. A number of events can lead to a crisis, and many researchers defined several categories of crises (Mont, Curtis & Voytenko Palgan, 2021). Marcus and Goodman (1991) built a framework of three categories: Accidents, product safety and health incidents, and scandals. Pearson and Mitroff (1993) identified seven types of crises: economic attacks, environmental accidents, occupational health diseases, psycho events, damage to reputation, informational attacks, and breaks. Myers' (1993) framework focuses on three crisis types, namely natural, environmental, and man-made disasters. Another

approach has been shown by Mitroff, Shrivastava and Udwadia (1987), who created a crisis management matrix by mapping different types of crisis (internal, external and technical/economic, people/social/organizational). In summary, the categorization of crises is diverse. It shows that organizations can be impacted by many different types of crises which can be seen as an indicator of how vulnerable organizations are (Pearson & Clair, 1998). To mitigate the threat of a crisis, companies have to practice crisis management (Pearson & Clair, 1998) which will be presented in the next section.

## 2.2 Crisis Management

Every crisis can pose a threat to the existence of an organization (Chong, 2004), and any business can become a victim of a crisis (Spillan & Hough, 2003). For this reason, it is essential that companies practice timely and effective crisis management (Pearson & Clair, 1998). To address this topic, this chapter will first provide an overview of crisis management and consequently dive into the three individual phases of pre-crisis, crisis, and post-crisis.

### 2.2.1 An Overview of Crisis Management

For companies to survive and grow in times of crises, it is essential to respond with timely and effective crisis management (Pearson & Clair, 1998). However, effective crisis management is a difficult strategic topic because crises as events are unpredictable and may never occur (Mitroff, Shrivastava & Udwadia, 1987). According to Crandall, Parnell and Spillan (2010), this often leads to a lack of motivation in companies to plan for a crisis. Nonetheless, Spillan and Crandall (2002) underline that crisis management should be a crucial part of every company's planning process as the importance of crisis management cannot be overemphasized enough (Crandall, Parnell & Spillan, 2010; Fink, 1986; Mitroff, Shrivastava & Udwadia, 1987; Myers, 1993; Pearson & Clair, 1998). This necessity can be underlined by Mitroff, Shrivastava and Udwadia (1987, p.291), who state that "it is no longer a question of whether a major disaster will strike any organization, but only a matter of when, how, what form will it take, and who and how many will be affected?".



The goal of crisis management is to make the impact of sudden events during the lifetime of an organization as little as possible (Spillan & Hough, 2003) and can be defined:

as a systematic process by which an organization attempts to predict or identify potential crises that an organization may encounter, take precautions to prevent the crises, or minimize the effects of the crises (Wilson, 1992 cited in Preble, 1997, p.777).

Over the years, a number of different crisis management frameworks have emerged, which aim to help analyze the timeline of a crisis with the goal to gain a more holistic understanding of the crisis itself (Crandall, Parnell & Spillan, 2010). This is essential, as the life of a crisis consists of several phases, namely its beginning, its main phase, and its aftermath (Crandall, Parnell & Spillan, 2010). Synthesizing the work of previous literature on crisis management frameworks (Fink, 1986; Myers, 1993; Pearson & Mitroff, 1993; Richardson, 1994; Smith, 1990), it becomes evident that all frameworks consist of three to five stages that can be allocated into three underlining phases. These are the time period before the crisis (pre-crisis), the time during the crisis (crisis), and lastly, the time after the crisis (post-crisis) (Crandall, Parnell & Spillan, 2010). In the following, those three phases serve as the underlying structure and will be further elaborated.

## 2.2.2 Pre-Crisis Phase

### 2.2.2.1 Theoretical Background Pre-Crisis Phase

The pre-crisis phase is the first phase in crisis management and, in general, focuses on employing preventive measures (Crandall, Parnell & Spillan, 2010). Richardson (1994) calls it the ‘precrisis/ disaster phase’ in which threats that may lead to a crisis are addressed. Myers (1993) defines this first phase as the ‘normal operations’ stage where operations are still running according to plan, but certain crisis preparation takes place for the case of an unexpected event. Similar is the classification by Fink (1986), who describes it as the ‘prodromal crisis stage’ and, in addition to the other authors, also mentions potential warning signs, which, if heard, may help to prevent a crisis. The power of warning signs is also reflected in the framework by Pearson and Mitroff (1993), in which the authors differentiate between the ‘signal detection’ stage and a ‘preparation/ prevention’ stage.

Overall, effective crisis management in the pre-crisis phase can be proactive or reactive (Mitroff, Shrivastava & Udvardia, 1987; Spillan & Crandall, 2002). In other words, managers can either prepare for a crisis as well as possible, which would reflect the proactive approach, or they trust in their abilities when the crisis event occurs, thus practicing a reactive approach (Spillan & Crandall, 2002). In that context, Mitroff, Shrivastava and Udvardia (1987, p.285) highlight that “[t]he less vulnerable an organization thinks it is, the fewer crises it prepares for; as a result, the more vulnerable it becomes”. To demonstrate this point, Mitroff, Shrivastava and Udvardia (1987) mention the tragic accident of NASA's Space Shuttle Challenger in 1986, which exemplifies how the organization became vulnerable to accidents due to failures on several levels within the organization. Further, the authors point out that the ignorance of early alarm signals was the underlying reason for the crisis to happen.

An organization cannot protect itself from every crisis, however, Mitroff, Shrivastava and Udvardia (1987) identified several activities which are helpful when preventing and preparing for a crisis. Their work, identified safety policies, maintenance procedures, environmental-impact audits, emergency planning, and worker training. They point out that it allows a company to cope with a crisis in a more effective way. From a strategic management perspective, there are three activities that are essential in a pre-crisis phase, namely crisis management teams, the consideration of worst-case scenarios, and the creation of a crisis management plan (Hickman & Crandall, 1997).

Crisis management teams are an essential part of effective crisis management, which has been confirmed by a number of authors (Fink, 1986; Hickman & Crandall, 1997; Pearson & Clair, 1998; Spillan & Crandall, 2002). The purpose of such teams is twofold. On the one hand, it includes the planning process for any potential crisis before it occurs, and on the other hand, the team is responsible for managing the crisis when it occurs (Spillan & Crandall, 2002). In line with that, Pearson & Clair (1998) state that companies with a crisis management team are more concerned about a possible crisis. For this reason, crisis management teams have become an essential part of the management process (Spillan & Crandall, 2002). Further, Spillan & Crandall (2002) identify two major reasons that underline the importance of crisis management teams. First, they mention that a crisis-management culture which will be created by implementing crisis management teams,

and by doing so, the top-management underlines the necessity of crisis management practices. This type of culture will increase the awareness for potential crises within the entire organization (Pauchant, Mitroff & Shrivastava, 1989; Pearson & Clair, 1998; Pearson & Mitroff, 1993). Pearson and Mitroff (1993) add on that by saying that crisis management teams ensure the practice of the specific roles for a crisis scenario which once more strengthens the system and the crisis culture of the company. Second, the creation of management teams comes with experiences that entail valuable lessons learned (Penrose, 2000).

Once a crisis management team has been established, a crisis preparation plan must be developed (Fink, 1986). After a crisis management plan has been created, it regularly needs to be tested and updated (Hickman & Crandall, 1997). Further, Hickman and Crandall (1997) state that it is essential to run through trial crisis situations, which necessity is supported by a survey that showed that half of the crisis management plans failed substantially or even completely when they were tested for the very first time. However, it is important to recognize that crisis management cannot provide a predefined plan that can be followed in case of a possible crisis (Hickman & Crandall, 1997). It is rather about preparing the organization to think creatively to make the best possible decision in case of a crisis (Pearson & Mitroff, 1993). Nevertheless, research also points out that external crises are harder to prepare for because they are mostly outside the business and do not fit common patterns (Mitroff, Shrivastava & Udwadia, 1987).

Taking a holistic perspective, it becomes clear that the pre-crisis phase consists of several rather formal measures to prepare an organization for a crisis. However, in contrast to large organizations, small businesses do not put much focus on crisis management and only become concerned when a crisis actually occurs (Spillan & Hough, 2003). Further, Herbane (2013) adds on that by underlining that managers in SMEs focus less on crisis planning. This is in line with Runyan (2006), who supports that by saying that SMEs focus less on crisis management and that they are less prepared in case of a crisis. A study by Hong, Huang and Li (2012) also shows that the lack of formal processes has been described as one of the main weaknesses of SMEs in a crisis.

Resulting from this, and the work of other authors like Eggers (2020) and Madrid-Guijarro, García-Pérez-de-Lema and Van Auken (2016), influencing factors of SMEs pre-crisis management have

been derived. These three major factors are age, size, and financial resources and will be discussed in the following section.

#### 2.2.2.2 Influencing Factors on Pre-Crisis Management

The way companies prepare for and consequently respond to a crisis depends not only on the previously described formal crisis management measures but also on several other factors, namely age, size, and financial resources, which will be discussed in the following.

**Age.** The first influencing factor to mention is age, which, however, causes different opinions among researchers (e.g. Simón-Moya, Revuelto-Taboada & Ribeiro-Soriano, 2016; Thornhill & Amit, 2003). According to Thornhill and Amit (2003), especially young SMEs are confronted with a higher risk of failure, even more so in a crisis. In their work, they state that two of the main reasons for this are the lack of experience and the deficit of the efficient matching and use of their own resources, as well as their own abilities. However, they also mentioned that when young firms can overcome this phase, young SMEs can develop essential skills for the future and create competitive advantages to leave the young age as an SME. In contrast, Simón-Moya, Revuelto-Taboada and Ribeiro-Soriano (2016) argue that, especially in a crisis, the likelihood of survival of a young SME is higher because of the opportunity costs. They state that the rough economic situation in terms of lack of workplaces and security social benefits leads to the fact that the owner and people within the company are willing to survive the crisis with their business. In other words, during a crisis, the opportunity costs are lower by surviving as a young company, compared to searching for new jobs or closing down the SME (Simón-Moya, Revuelto-Taboada & Ribeiro-Soriano, 2016). Furthermore, according to Cowling, Lui and Zhang (2018), younger SMEs are better prepared compared to established SMEs because they are used to a fast and innovative working environment.

**Size.** To add to the previous factor, another crucial factor is the size of the SME to survive changing environments (Thornhill & Amit, 2003). Thornhill and Amit (2003) found out that small SMEs have to deal with a lack of resources when they face an uncertain situation, such as a crisis, whereas bigger SMEs are able to align more resources to critical firm tasks. Geroski, Mata and Portugal (2010, p.526) support that by saying that “[...] changes in firm size have a strong and robust impact upon survival”. In general, SMEs are more flexible and can adapt to a crisis situation faster,

compared to large companies (Juergensen, Guimón & Narula, 2020). Additionally, SMEs usually have a private ownership structure and little hierarchy, which increases their adaptability and flexibility during a crisis (Juergensen, Guimón & Narula, 2020).

**Financial Resources.** The third identified factor which influences the pre-crisis management of SMEs is financial resources. In other words, it means how SMEs receive financing before/during a crisis (Gourinchas et al. 2020). Based on the fact that SMEs typically are not listed companies, they have only two options to receive funding, namely through bank loans or/and trade credit, according to Carbo-Valverde, Rodriguez-Fernandez and Udell (2016). Those credits or loans are not guaranteed, especially when the economic situation is tense (OECD, 2018). Another opportunity to deal with the need for additional money to prepare for the crisis is to bring in or ask investors or business angels (OECD, 2018).

Although it does not exclusively relate to financial resources but rather to resources in general, it still must be stated that SMEs usually have minimal resources and often depend on external sources, which increases their vulnerability to crises (Barron, Hultén & Hudson, 2012; Mayr, Mitter & Aichmayr, 2016). This further leads to a higher dependency on external institutions, such as government or local authorities (Runyan, 2006). However, in contrast, Jin (2010) argues that SMEs are more aware of crisis preparation because their resources are limited in case of a crisis scenario. Further, according to Thornhill and Amit (2003, p.505), especially small firms face a great risk of failure because of a “lack of valuable resources and capabilities”.

## 2.2.3 Crisis Phase

### 2.2.3.1 Theoretical Background Crisis Phase

The second phase is the phase in which the crisis actually takes place. Richardson (1994) describes it as the ‘crisis impact/ rescue phase’ and Pearson and Mitroff (1993) as the ‘containment/ damage limitation’ stage. Both state that this phase is primarily all about bringing the crisis under control and mitigating the effects of the crisis on the organization and its stakeholder in order to keep the damage at a level as low as possible. Myers (1993) and Fink (1986) looked at this phase in a more detailed way by differentiating between two stages within this phase. The first stage in this crisis

phase, which Myers (1993) labels ‘emergency response’, is an immediate reaction to the crisis and the moment when a crisis gets noticed by the outside world (Fink, 1986). This stage is followed by the ‘chronic crisis stage’, which is still significant but where the situation starts to calm down (Fink, 1986). Myers (1993) describes it as the ‘interim processing’ stage, which includes temporary measures that are necessary before operations return back to normal.

#### 2.2.3.2 Dynamic Capabilities

Firms have strategically responded to several crises in the last decades, with COVID-19 as the most recent example (Kuckertz et al. 2020; Wenzel, Stanske & Liebermann, 2020). A study by Irvine and Anderson (2004) shows that the responses to crises of small firms in rural areas have been highly flexible, which goes in hand with Smallbone et al. (2012), who point out that SMEs are highly flexible and adaptable. In this context, dynamic capabilities play an essential role, as Guo et al. (2020) identified them to be critical in the crisis responses of organizations. Dynamic capabilities are companies’ internal specific competencies to deal with changing environments (Teece, 2007, 2018; Teece, Pisano & Shuen, 1997). Further, dynamic capabilities help to stay competitive in the market in changing times (Teece, 2007, 2018; Teece, Pisano & Shuen, 1997). Thus, if a company quickly responds to a changing business environment, innovates products flexibly, and restructures internal and external resources, a competitive advantage will be maintained or created (Teece, Pisano & Shuen, 1997). This is in line with Eisenhardt and Martin (2000) and Lin and Wu (2014), who declare dynamic capabilities as a crucial tool to create a competitive advantage in changing times, such as a crisis. Three dynamic capabilities are most relevant (Ballesteros, Useem & Wry, 2017; Teece, 2018), namely, sensing, seizing, and transforming (Teece, 2007, 2018).

**Sensing.** The capability sensing identifies new opportunities by analyzing the changing environment (Teece, 2018). In addition, Ballesteros, Useem and Wry (2017), Lampel, Shamsie and Shapira (2009), and Teece, Pisano and Shuen (1997) underscore that this capability allows companies to understand the situation at an early stage. Müller (1985) supports this by saying that a prepared strategic response is impossible without anticipation for the next situation.

**Seizing.** Seizing questions the current business model compared to the changing environment (Teece, 2007, 2018). Based on the competition in the market, the action of competitors, and the

situation of their own intellectual property, the business model within the strategy has to be changed or refined (Teece, 2018). Furthermore, seizing can identify new business potentials in a crisis (Ballesteros, Useem & Wry, 2017; Easterby-Smith, Lyles & Peteraf, 2009).

**Transforming.** Transforming focuses on the realignment of the capabilities and, if necessary, on investments in additional capabilities (Teece, 2018). Additionally, this capability also includes how effective and efficient the firm can reconfigure external and internal resources to face the crisis (Makkonen, Pohjola, Olkkonen & Koponen, 2014).

Taking a holistic perspective, the sensing and seizing process is continuous, whereas the transforming process takes place periodically, if appropriate (Teece, 2018). Further, Teece (2018) highlights that adapting and implementing a new business model is one of the most crucial features that a firm can have, in the highly developed technology world. Guo et al. (2020, p.4) summarizes it by saying that “dynamic capabilities are critical for firms’ public crisis responses”.

#### 2.2.3.3 Strategic Responses to Crises

Key elements of this study are strategic responses to crisis events. In that context, a recent paper by Wenzel, Stanske and Liebermann (2020) has synthesized several key articles from that field of research and presents four underlying strategic crisis responses. The four responses consider different time dimensions and include retrenchment (short-run response), persevering (medium-run response), innovating (long-run response), and exit (any-time response). This study will use those four proposed strategic responses as a foundation for the analysis.

**Retrenchment.** Retrenchment can be seen as one of the most common strategic responses to crisis events (Bruton, Ahlstrom & Wan, 2003). According to Pearce and Robbins (1993, p.614), a retrenchment response includes “reductions in costs, assets, products, product lines and overhead”. This leads to positive and also negative consequences (Kraus et al. 2020). On the positive side, Bibeault (1998), Hall (1980), and Hofer (1980) state that when a company faces a decline in performance, retrenchment is an effective strategic response for a turnaround. Wenzel, Stanske and Liebermann (2020) add that it is an opportunity to renew the business strategy. By this, retrenchment has been identified to play an important role in the long-term recovery of a firm (Wenzel, Stanske & Liebermann, 2020). It goes in line with Thorgren and Williams (2020), who

identified deferred investments, layoffs, and reduced labor costs and expenses as an immediate retrenchment response of SMEs that expect a negative long-term impact that may result from a crisis. Further, retrenchment in crises increases the company's chances of survival in severe crises (Hofer, 1980; Pearce & Robbins, 1993; Robbins & Pearce, 1992).

On the negative side, retrenchment can also promote underperformance (Barker & Duhaime, 1997; Barker & Mone, 1994). Moreover, researchers argue that retrenchment is significantly more harmful compared to strategic long-term costs (Boyne & Meier, 2009; Castrogiovanni & Bruton, 2000). In other words, according to the authors, retrenchment is not always a strategic response that helps the situation because no benefit will arise from it. This is in line with Rico and Puig (2019), who point out that retrenchment should not be a general strategic response to a crisis, and the company should instead focus on stakeholder relationships and the elimination of unnecessary expenses. Figueiredo, Feldmann and Rawley (2019) found out that downsizing during a crisis can harm or destroy possible synergy effects. Considering the time dimension, retrenchment might be unavoidable as an immediate strategic response to the crisis and is effective in the short run, but in the long run, this response can eliminate a company's resources and values, and in a worst-case scenario, it can destroy the business, and this questions its viability in the long-term (Chadwick, Hunter & Walston, 2004; Ndofor, Vanevenhoven & Barker, 2013). Wenzel, Stanske and Liebermann (2020) therefore suggest that when recovering from a crisis, retrenchment may be the first response but ideally not the last.

**Persevering.** The second strategic response to crises is persevering which means that the company continues its business activities (Kraus et al. 2020; Wenzel, Stanske & Liebermann, 2020). In other words, the status quo of the business remains the same as before the crisis (Wenzel, 2015). Wenzel, Stanske and Liebermann (2020) declare persevering as a strategic response that is suitable in the medium run. In other words, they point out that managers should not react too early but at the same time underscore that this strategic response is not sustainable for crises of longer duration. According to Pacheco-de-Almeida (2010) and Stieglitz, Knudsen and Becker (2016), persevering is an effective strategy to face a crisis because multiple strategic adjustments reduce the beneficial effect of strategic renewals. Chakrabarti (2015) supports this with his study about manufacturing firms during the economic crisis in Asia in 1997 by stating that, particularly in a crisis, it is a higher



risk to reconfigure resources and assets. Further, Chakrabarti (2015) states that a strategic renewal with a lack of resources is dangerous. Instead, his work underscores the essential part of external institutions by providing capital and information for the companies in a crisis situation. This is in line with Albers and Rundshagen's (2020) study, titled 'European airlines' strategic responses to the COVID-19 pandemic (January-May, 2020)', which highlights that the government acted as a lender. This led to an enabling of the continuation of the business and a persevering strategic response, among others (Albers & Rundshagen, 2020). In addition, De Carolis, Yang, Deeds and Nelling (2009) underscore the importance of having the core competencies in the firm during a crisis.

**Innovating.** According to Wenzel, Stanske and Liebermann (2020), innovating as a strategic response is another way to respond to a crisis. This is in line with several authors, who point out that a crisis is a chance to renew the business strategy, explore new markets as well as product opportunities (Helfat, 1997; Reymen Andries, Berends, Mauer, Stephan & Burg, 2015; Ucaktürk, Bekmezci & Ucaktürk, 2011). Clauss, Abebe, Tangpong and Hock (2019) add on this by saying that business model innovation is promoted by changing environments, such as a crisis. Carmeli and Schaubroeck (2008) state that when an SME faces a crisis, it can be seen as a kick-off for organizational innovation and to establish a more successful business in the future.

According to Kuckertz et al. (2020), on the one hand, small businesses are particularly effective at responding to a crisis with innovation by quickly aligning their resources. On the other hand, growth, and innovation lead to higher risk (Kuckertz et al. 2020). This is in line with Dowell, Shackell, and Stuart (2011), who point out that during a crisis, particularly smaller companies were able to react faster and consequently performed better compared to big firms with an established governance structure. Further, their study highlights the importance of a powerful CEO to respond quickly to a crisis. In contrast, Gartenberg and Pierce (2017) argue that a crisis can lead to rushed behavior of executives, which can result in errors or even fraud. In other words, Gartenberg and Pierce (2017) value an established corporate governance structure to respond strategically to a crisis. Helfat (1997) highlights that a disadvantageous situation in a crisis can lead to a new solution, as shown by the U.S. petroleum industry during the oil crisis in the mid-1970s. Ucaktürk, Bekmezci and Ucaktürk (2011, p.89) support innovating as a strategic response by saying:

“Therefore, business model innovation is the best and the most valid way to cope with the crisis and recession periods to increase market share and to profit”. Also, Mayr, Mitter and Aichmayr (2016) describe innovation as one of the most essential elements for a sustainable turnaround of SMEs in a crisis.

Considering the time dimension, innovation can be categorized as a long-term response, as innovative activities during a crisis are unavoidable for companies to survive in the long run (Wenzel, Stanske & Liebermann, 2020). An example for this long-term innovative response can be provided by the study by Albers and Rundshagen (2020), which found out that some European airlines changed their business model by reconfiguring their aircrafts for cargo activities.

In the context of innovation, it is also essential to draw attention to the concept of bricolage. The term bricolage has first been coined by Lévi-Strauss (1966) and means to use available resources and combine them in new ways to address problems and pursue opportunities. This concept has been studied by Baker and Nelson (2005), who researched of 29 firms that were limited in their resources. The study shows that firms employed entrepreneurial bricolage by creating “something from nothing” (Baker & Nelson, 2005, p.357). Cunha and Cunha (2007, p.52) add to that by stating that bricolage means using “existing resources for new purposes” to address a problem.

The concept of bricolage has been adopted by entrepreneurs and means to use available resources in order to encourage change and create opportunities (Baker & Nelson, 2005; Martinelli, Tagliazucchi & Marchi, 2018). It has become especially relevant when organizations need to respond to an unexpected event (Alonso, Bressan, Kok, Sakellarios, Koresis, O’Shea, Buitrago Solis & Santoni, 2021). Thus, bricoleurs demonstrate that a crisis can be seen as an initiator for new opportunities (Brünjes & Revilla-Diez, 2013) for innovation and new products and also services (Brem, Nylund & Viardot, 2020; Irvine & Anderson, 2004). In order to respond to a crisis and solve new problems, bricolage can be used to identify and pursue new opportunities and directions for the organization (Kuckertz et al. 2020).

Bricolage is further a key element in the concept of resilience (Alonso et al. 2021) which is also highly relevant in crisis management (Doern, Williams & Vorley, 2019). Williams, Gruber, Sutcliffe, Shepherd & Zhao (2017) point out that past research has shown that when organizations

have to respond to a crisis, the quality “critically depends on the capacity to enhance improvisation, coordination, flexibility, and endurance - qualities that we typically associate with resilience” (Comfort, Boin, Demchak & Demchak, 2010, p.11). Literature has, in general, used resilience to describe an organization’s ability to react to disturbances in its environment and to recover from it without severe effects on its functioning or its stability (Linnenluecke, 2017).

**Exit.** Exit as a strategic response is the closure of the business (Argyres, Bigelow & Nickerson, 2015; Burgelman, 1996). This step is necessary when all other steps, namely retrenchment, persevering, and innovating, have failed (Kraus et al. 2020; Wenzel, Stanske & Liebermann, 2020). Argyres, Bigelow and Nickerson (2015) argue that also an ‘innovation shock’, caused by unexpectedly high demand for a new, innovative product, can lead to an exit as a strategic response. Further, business exits are able to create capacities for new projects (Carnahan, 2017) or, in other words, can be a starting point for a new firm (Ren, Hu & Cui, 2018). Sometimes exit is the best option for a company, especially in crises, that a manager should always consider, to rule out further damage (Porter, 1976). According to Oh and Oetzel (2011), who investigated European multinational companies (MNC) found out that an exit is more likely when the firm faces a terrorist attack or technological disaster compared to a natural disaster. In addition, Oh and Oetzel (2011) highlight that an exit is also less likely when the host government takes action and support in case of a natural disaster or a terrorist attack. This is in line with Albers and Rundshagen (2020), who also identified the government’s action in times of a crisis as an essential factor for the survival of firms. Whereas Albers and Rundshagen (2020) focused more on the internal aspect (government as a lender), Oh and Oetzel (2011) looked at the external factor (government as an overall crisis manager for the country). Managers in a crisis situation try to avoid exits because it is negatively related to failure (Xia, Dawley, Jiang, Ma & Boal, 2016). Elfenbein and Knott (2015, p.973) underscore this by saying, “[m]arket exit is one of the most overt strategic actions CEOs can take, [...]”. Further, it is against managers’ positive attitude to keep the company alive in a crisis (Porter, 1976). Based on that, the right time for an exit as a strategic response is often delayed (Elfenbein & Knott, 2015). Wenzel, Stanske and Liebermann (2020, p.V13) conclude it by saying that exits “may not necessarily be the end of the road”, rather they underscores the new opportunities this creates.

It can be summarized that organizations can choose between several different responses to crisis events, namely retrenchment, persevering, innovating, and exit. However, what also becomes clear is that different strategic responses to crises are appropriate at different points in time. This means that at some points in time pursuing, a certain strategic response might be “too early” or “too late” and implementing it would be ineffective (Wenzel, Stanske & Liebermann, 2020, p.V14). In that context, Wenzel, Stanske and Liebermann (2020) point towards the term ‘windows of opportunity’ discussed by Tyre and Orlikowski (1994).

#### 2.2.4 Post-Crisis Phase

The third phase is the post-crisis phase, in which the company returns to its normal operational activities (Fink, 1986; Myers, 1993) and which also is about regaining trust from the organization's stakeholders (Coombs, 2014).

The post-crisis phase can be divided into two stages, namely recovery, and learning (Pearson & Mitroff, 1993). According to Pearson and Mitroff (1993), the recovery stage may include short-term and long-term recovery programs and considers two key questions. First, “What are the minimal procedures and operations that we need to recover and conduct normal business?” (Pearson & Mitroff, 1993, p.53). Second, “What are the key activities and tasks that we must perform to serve our most important customers?” (Pearson & Mitroff, 1993, pp.53–54).

After the recovery stage has been completed, it follows the learning stage, which is the last stage in the post-crisis phase of crisis management (Pearson & Mitroff, 1993). As the crisis management process follows a cycle, this is consequently the last stage before the pre-crisis phase starts again (Pearson & Mitroff, 1993). This aligns with Penrose (2000), who states that after every crisis, the preparation for the next crisis starts. The learning stage underlines the importance of reflecting and assessing the organization's learnings from the crisis (Pearson & Mitroff, 1993). This necessity has once more been underlined by Pearson and Clair (1998) as a key element in crisis management. According to Penrose (2000), the evaluation of the crisis plan, especially the assessment of how the company handled the crisis, is one of the most crucial elements and thus makes this stage such an important one within the process of crisis management. The author highlights three goals that

should be accomplished during this stage. First, the performance of the team should be assessed to identify and address errors. Second, mental support should be given to the crisis team itself, and any related personnel should receive mental support and lastly, the crisis plan needs to be reflected on and revised.

Although the importance of this learning stage cannot be overstated (Penrose, 2000), a study indicates that not all organizations conduct this stage (Pearson & Mitroff, 1993). Pearson and Mitroff (1993, p.54) found that many organizations disregarded this stage as they assume that it will “only reopen old wounds”. However, the authors state that almost the opposite was found in organizations that embraced this last stage. They point out that, as recommended, the companies used it to integrate their learnings and experiences into their crisis management process. On the one hand, they analyzed the elements that helped them perform well, and on the other hand, they carefully examined the factors that limited their performance and where they have to improve (Pearson & Mitroff, 1993). In addition to that, the authors explain that these organizations did not try to blame anyone else for the crisis and any failures. They rather focused on improving their capabilities and addressing current issues (Pearson & Mitroff, 1993).

Crisis events usually cannot be predicted, and therefore, the insights that can be gained from such an unexpected event are not foreseeable (Meyer, 1982). Sudden interruptions shed light on weaknesses and unrealized potentials within an organization that offers an excellent opportunity for learning (Christianson, Farkas, Sutcliffe & Weick, 2009). Thus, the learning takes place in the form of an emergent process during which valuable lessons are discovered (Lampel, Shamsie & Shapira, 2009). This is also underlined by research that shows that incorporating experiences helps organizations to learn (Haunschild & Sullivan, 2002). Lampel, Shamsie and Shapira (2009) identified that very similar rare events can lead to very different learnings for an organization. In other words, the authors state that an event can have two characteristics that influence learning. First, it is the potential impact that the event has on the organization, and second, the relevance the event may potentially have for the organization. Both factors strongly influence the following learning process (Lampel, Shamsie & Shapira, 2009). In general, it can be stated that while events that strongly impact an organization trigger a high motivation to learn, events that only have a

minor impact lead to a lower willingness to learn, and experiences are rarely transferred into lessons learned (Lampel, Shamsie & Shapira, 2009).

Lampel, Shamsie and Shapira (2009) defined four types of learning that result from rare events. First, the authors mention 'transformative rare events', which are events that have a high impact and a high potential relevance for the organization, thus lead to transformative learning. Christianson et al. (2009) add on this by mentioning that those events can make companies reconsider their identity as it shows them what they are capable of doing. The authors present an example of such a transformative case, where a collapsed roof broke up previous structural patterns and thus had a transformative effect on the organization and its strategy. The second one is 'reinterpretative rare events', which still have a high level of relevance for the organization but only a low impact (Lampel, Shamsie & Shapira, 2009). Those kinds of events can provide valuable lessons learned (Haunschild & Sullivan, 2002). Further, the learning may not only address problems but also raises opportunities (Lampel, Shamsie & Shapira, 2009), as exemplified by Starbuck (2009), who recalls how a new business opportunity, namely a 24/7 service has been created by an unexpected request. Third, there are 'focusing rare events' that have a high impact but where the relevance is assumed to be little or only selective (Lampel, Shamsie & Shapira, 2009). Therefore, the learning resulting from this event is relatively narrow and only focuses on specific problems (Lampel, Shamsie & Shapira, 2009). Overall, the authors state in the context of focused learning that when an event has a negative impact, the learning is concentrated on the prediction of consequences, while when the event has a positive impact, the learning is focusing on replication. Fourth and lastly to mention are 'transitory rare events' where both characteristics, the impact, and the relevance are low, thus the learning from those events is assumed to be transitory and therefore comes with limited incentives to learn (Lampel, Shamsie & Shapira, 2009). This is exemplified by Kaufman (2008), who refers to the limited learning from the several financial crises by pointing out that after the markets recovered, organizations did not see the need in understanding the crisis but rather as a phase which they had to get through.

## 2.3 Concluding Remarks

The reviewed literature outlines the body of knowledge that exists in the context of crisis management for SMEs. Synthesizing several frameworks of crisis management within the literature allowed to identify three underlying phases, namely pre-crisis, crisis and post-crisis. Within each phase, further elements have been identified. The main focus is the strategic responses within the crisis phase. Following the structure of Wenzel, Stanske and Liebermann (2020), four strategic responses have been highlighted, namely retrenchment, persevering, innovating, and exit.

Overall, the literature review once more underlines the identified research gap, namely the lack of crisis management literature and, in particular, the strategic responses of medtech SMEs to the extraordinary COVID-19 crisis. The COVID-19 crisis and all its consequences have created a unique situation for medtech SMEs. However, research in that particular field of crisis management that looks into how those SMEs implemented the different strategic responses is still immature. To address this research gap, the literature review provided a theoretical overview of the crisis management process, including strategic responses, and thus serves as a foundation that will further be explored in the empirical part of this study.

# 3 Methodology

The aim of this chapter is to outline the methodology which has been chosen to address the research question and to fulfill the purpose of this thesis. The starting section will elaborate on the research design and approach adopted by this study. Following, the selection of case companies will be explained and motivated. The next section will explain the data collection method. Afterward, the data analysis process will be discussed, which explains how the collected data will be turned into findings that address the defined research question. Following the sections which discuss the research process, a section will be dedicated to reflect on the validity and reliability of the selected methodology to evaluate the quality of the empirical study. Lastly, ethical considerations which apply to this thesis will be brought up.

## 3.1 Research Design and Approach

The research design can be seen as a plan that presents how the research question will be addressed, as pointed out by Saunders, Lewis and Thornhill (2016). Further in their work, the authors add that in order to derive the appropriate and adequate research design, it is of great importance to clearly understand the research question. Following this advice, the first step for the researcher of this study is to recall the research question that was defined in accordance with the research purpose, which is to create an understanding of how medtech SMEs responded strategically to the COVID-19 crisis.

Previous research lacks to address strategic responses of medtech SMEs specifically to the COVID-19 crisis in the research field of crisis management and thus requires further exploration. In order to address the research question adequately, the thesis follows Creswell and Creswell (2018), who point out that a qualitative research design is deemed to be most appropriate when the



research question requires an explorative approach. Saunders, Lewis and Thornhill (2016) strengthen that point by underlining that an exploratory study is most suitable to clearly understand a phenomenon. Morse (1991) similarly expresses the need to explore and consequently develop theory as key characteristics of qualitative research, which in combination with other qualitative research design characteristics once more support the research design choice to address the research question at hand.

Reflecting on the chosen qualitative research design, it is typically associated with an inductive approach which allows the researcher to generate theory by “drawing generalizable inference out of observations” (Bryman & Bell, 2011, p.13). However, this research approach exclusively focuses on collected data and disregards existing literature that may provide a certain direction or have some implications that would be valuable to consider (Saunders, Lewis & Thornhill, 2016). This inductive approach has therefore been considered to be inadequate. In contrast, a deductive approach does neither seem to be applicable. It is characterized by testing existing theory (Saunders, Lewis & Thornhill, 2016) which means that it does not allow to identify further strategies. For this study’s purpose and to appropriately address the research question, a combination of both, thus the abductive approach appears to be the most valuable choice. This approach allows the researcher to collect empirical data to explore a specific phenomenon and to develop theory or modify an existing one, and consequently, it allows to test this theory by collecting further data (Saunders, Lewis & Thornhill, 2016). Combining elements of the inductive and deductive approach offers a higher degree of flexibility and has therefore been deemed most appropriate for the research at hand.

This study chose to apply a multiple-case study research design to produce an in-depth understanding of the several strategic responses of medtech SMEs to the COVID-19 crisis. A multiple-case design has several advantages over a single case design as they are less vulnerable, provide several analytical benefits, and conclusions and findings are more defensible (Yin, 2009). Eisenhardt and Graebner (2007, p.27) highlight that conducting a multiple-case study allows to generate “more robust, generalizable, and testable theory than single-case research”. In general, multiple-case studies are also helpful to discover events and describe them (Yin, 2009), such as

the COVID-19 crisis. Based on that, the researchers of this thesis explicitly choose a multiple-case study as the applied research method.

While a multiple-case study has several strengths, it is also important to reflect on its limitations. Compared to a single-case study, Yin (2009) underlines that a multiple-case study requires a lot more resources than a single-case study. Furthermore, some case studies are criticized for inadequate scientific precision (Crowe, Cresswell, Robertson, Huby, Avery & Sheikh, 2011; Yin, 2009). According to Crowe et al. (2011), another weak spot of multiple-case studies is the risk of inadequate case selections, resulting from a lack of theoretical assumptions. To mitigate this risk, the authors of this study provide full transparency of their selected cases, which leads to the following subsection, the case selection and choice of case companies.

## 3.2 Choice of Case Companies

After outlining and motivating the choice of conducting a multiple-case study, the focus of this section is on presenting how the cases have been selected. The selection of the case companies is based on a “judgemental sampling” (Collis & Hussey, 2014, p.132). Following Saunders, Lewis and Thornhill (2016, p.296), the “non-probability sampling technique”, which is a self-selection sampling, is applied. It means that the researchers select the cases beforehand (Collis & Hussey, 2014; Saunders, Lewis & Thornhill, 2016). This procedure has also been followed in this thesis.

Further, it is relevant to classify the cases by criteria or categories in order to find the most appropriate cases to address the research question (Collis & Hussey, 2014; Yin, 2009). This is in line with Yin’s (2009) two-stage screening approach for selecting the cases. First, an overview of the possible cases is made, which includes all the medtech SMEs in the Nordic market. This data is generated through desk research and the official database of Medicon Valley Alliances. Second, defined categories allowed to further narrow down the selection of cases, which is a crucial step in the preparation process to find the most appropriate cases for the study (Yin, 2009). In the following, the categories are defined by referring to existing literature.

According to Bamber and Gereffi (2013), medtech companies are divided into six categories based on the product they produce, namely (1) ‘Disposables or high-volume commodities’ which are characterized by mostly single-used, and low-tech products (e.g. surgical gloves or needles); (2) ‘Surgical and medical instruments’ are multi-used products that are used in various surgeries (e.g. dental drills); (3) ‘Therapeutic devices’ help support various therapies, in the form of implants and non-implants (e.g. pacemakers); (4) ‘Capital equipment’ is characterized by high cost and is an investment for a long-term period. These high-tech products run, among others, diagnosis, monitoring, and imaging processes (e.g. magnetic resonance imaging equipment or computer tomography). Due to the technological development in the sector (McCaffery, Donnelly, Dorling & Wilkie, 2004; McHugh, McCaffery & Casey, 2012; Vlčková, 2019), two additional product categories are growing (Bamber & Gereffi, 2013). Bamber and Gereffi (2013) name (5) ‘integrated solutions’ which are a combination of several services that may include medical devices, training, and consulting; and lastly, (6) ‘convergence products’, which are medical devices that use additional software or applications for monitoring and/or diagnosis functions. An overview of all product categories and the individual SMEs can be found in Appendix A.

Based on previous research and the identification of trends in the field of digitalization and innovation, the last category, “convergence products” (Bamber & Gereffi, 2013, p.11), has been defined as the selection criterion for the selected medtech SMEs. In other words, this thesis investigates medtech SMEs that deliver a product or service, as well as supporting software and/or an app for a smartphone. Choosing this as the selection criterion can be supported by McHugh, McCaffery and Casey (2012), who state that mobile applications and the use of mobile devices in combination with medical devices are growing exponentially. McCaffery et al. (2004) also identified software opportunities as becoming an essential factor in the industry that once more strengthens the defined selection criteria.

This categorization was made to make the results more comparable and was considered most adequate to answer the research question (Yin, 2009). Accordingly, the selected cases for the study meet the following criteria: a) medtech SMEs in the Nordic market and b) produce or offer convergence products. Based on these criteria, five final cases have been selected, which are presented in Table 1.

*Table 1: Overview of the Selected Cases*

Company	Reference	Product(s)	Founding year (Age in years)	Number of Employees (Size)
Medtech SME 1	Manager 1 (M1)	App Software System	2016 (5)	8
Medtech SME 2	Manager 2 (M2)	Consultancy Design Research Software Development Product Development	2016 (5)	45
Medtech SME 3	Manager 3 (M3)	App Software	2018 (2)	8
Medtech SME 4	Manager 4 (M4)	Platform Software	2016 (5)	11
Medtech SME 5	Manager 5 (M5)	App Software	2016 (5)	3

### 3.3 Data Collection

For the purpose of data collection, this study employs semi-structured interviews. Semi-structured interviews are a common type of qualitative interviewing (Bryman & Bell, 2011) and combine aspects of structured and unstructured in-depth interviews (Saunders, Lewis & Thornhill, 2016). Typical for semi-structured interviews, an interview guide provides a certain degree of structure. It ensures that all relevant topics and questions will be covered but at the same time allows flexibility within the interview process during which the order of questions may be adjusted and questions may be added or omitted (Bryman & Bell, 2011). As the interviews aim to explore different strategic responses of medtech SMEs to the COVID-19 crisis, semi-structured interviews are an adequate type to generate valuable data to address the research purpose.

All conducted interviews are expert interviews. Nagel and Meuser (2009, p.18) define an expert as someone who “has knowledge [...] which is not accessible to anybody in the field of action

under study”. Experts in the context of this study are top-managers of the selected case companies. Due to several constraining factors like the reachability and lack of time on the side of the top-managers, potential interview partners have been selected and contacted via email right at the beginning of the research process to ensure that sufficient interview partners would agree to an interview. In addition to that, the researchers joined an industry webinar, that was called ‘MVA Medtech Network Meeting - Digital Transformation in Medtech’. As one of the selected case companies was present during this webinar the researchers’ participation led to one further interview partner. Tables 1 and 2 summarize a more detailed overview of all interview partners and their relevant data.

To prepare for the interviews, a semi-structured interview guide was designed and can be found in Appendix B. It contained open-end questions and was structured to cover three crisis management phases in this study, whereby specific questions and themes will be investigated in these blocks (Easterby-Smith, Jaspersen, Thorpe & Valizade, 2021). The first block deals with the pre-crisis phase and investigates how the company prepares for crisis events and to what extent they were prepared for the COVID-19 crisis. Following, the crisis event block covers critical questions that point towards the strategic responses of the organizations to the COVID-19 crisis. Questions of how the business was impacted and how the organization's strategy changed due to the crisis were asked. The last block of the interview serves as a post-crisis outlook that draws attention to how the pandemic will impact the future strategy of the company and also asks for key lessons learned for the company from the crisis. Following Collis and Hussey’s (2014) advice, after every block, summary questions were asked to make sure that all answers were understood correctly. The interview guide provided a certain frame for the interview. However, depending on the respondent, in some cases, it was necessary to leave certain questions out or follow-up on questions in order to clarify or further explore certain statements of the interviewee. Providing the respondents with a certain leeway for individual answers allowed them to gain the most profound possible insights, as this led to highly relevant but unexpected aspects, the researchers did not consider beforehand.

In total, five interviews were conducted, which lasted between 20 and 45 minutes, leads to an average of 31 minutes per interview. All interviews took place via GoogleMeet due to the COVID-19 safety measures and the companies’ diverse geographic location. During all interviews, both

researchers were present. Given the previous approval of the interview partners, all interviews were audio-recorded and transcribed afterward. Along with other advantages, transcribing allows the researchers to entirely concentrate on the interviews to afterward thoroughly analyze what the interview partners have said (Heritage, 1984).

**Table 2:** *Overview of Conducted Interviews*

<b>ID</b>	<b>Company Name</b>	<b>Position of Interviewee</b>	<b>Date of Interview</b>	<b>Medium</b>	<b>Interview Duration</b>
M1	Medtech SME 1	CEO	23 April 2021	GoogleMeet	45 minutes
M2	Medtech SME 2	Managing Director	23 April 2021	GoogleMeet	33 minutes
M3	Medtech SME 3	CEO	26 April 2021	GoogleMeet	24 minutes
M4	Medtech SME 4	CEO	28 April 2021	GoogleMeet	20 minutes
M5	Medtech SME 5	CEO	05 May 2021	GoogleMeet	34 minutes

### 3.4 Data Analysis

Data analysis is a highly important part of every qualitative research (Creswell & Creswell, 2018; King & Brooks, 2017; Yin, 2009). During the data analysis, several activities continue “hand-in-hand” (Creswell & Creswell, 2018, p.195). First, in order to prepare the data for analysis, the collected interview data were recorded and transcribed verbatim. For an improved reading experience, word doublings, hesitation sounds, and conversation fillers were not transcribed. In return, punctuation was added without changing the meaning of what has been said. In addition to that, remarks in brackets serve the purpose of clarification as well as anonymization.

Another crucial measure is the coding and structuring of the data (Creswell & Creswell, 2018; King & Brooks, 2017), for which the researchers used the data analysis software MAXQDA. Different approaches to analyze the data can be used, such as the Grounded Theory Method or the Narrative Analysis (Saunders, Lewis & Thornhill, 2016). For this study, the template analysis by

King (2012) has been applied. The template analysis provides some structure but at the same time allows enough flexibility when analyzing the data (King, 2012; King & Brooks, 2017).

The applied template for this study (Table 3) was developed throughout the literature review process and served as guidance for the data analysis. However, to follow King's (2012) steps, this predefined template will further be developed throughout the coding and analyzing process and can thus not be seen as final at this stage. For this, the researchers of this study got familiar with the raw data by transcribing the interviews. Further, throughout several proofreadings, each of the researchers obtained a clear understanding of the raw data. In addition, thoughts about categories, clusters, and codes were considered that allowed further adjustments of the template.

As mentioned above, on the one hand, one of the most significant benefits of the template analysis is the high flexibility and the fact that the researchers can create a template that best suits the analysis of the data (King, 2012; King & Brooks, 2017). On the other hand, the template analysis also comes with weaknesses and limitations (King & Brooks, 2017). The template can be very unstructured and can miss the aim of the research purpose (King, 2012; King & Brooks, 2017). Further, the authors mention that self-created categories and codes can miss the study's topic. In addition to that, the generic nature of the approach can lead to difficulty in terms of justifications (King & Brooks, 2017). To avoid those weaknesses, the researchers created the template structure similar to the structure of the literature review. Further, the researchers performed several checks by questioning themselves and each other during the analysis process to ensure that the template remained structured.

**Table 3: Predefined Template for Data Analysis (based on Literature Review)**

Phases	Categories	Codes
Pre-Crisis	Characteristics	Age
		Size
		Financial Resources
	Crisis-Preparation	Proactive
		Reactive
Crisis-Event	Strategic Responses	Retrenchment
		Persevering
		Innovating
		Exit
Post-Crisis	Recovery	[...]
	Learning	[...]

### 3.5 Validity and Reliability

In every study, validity and reliability are crucial elements for the research design (Bryman & Bell, 2015; Creswell & Creswell, 2018; Yin, 2009). Bryman and Bell (2015) state that various research designs lead to different weightings of importance for validity and reliability. Based on the fact that this study is a multiple-case study, the focus is on case study research in particular. Yin (2009) classifies four tests to ensure validity and reliability, namely construct validity, internal validity,



external validity, and reliability. To add to this, internal validity is only applicable for causal studies; consequently, internal validity is not of relevance for the present case study (Yin, 2009).

**Construct validity.** Construct validity must ensure that the chosen operational measures are collecting and measuring what they are supposed to (Bryman & Bell, 2015). Further, Yin (2009) highlights that failure to identify adequate operational measures leads to a subjective interpretation of the data. The author further mentions that explaining key terms and concepts of the study is necessary to provide the reader with an understanding. In this study, construct validity might be connected to defining key terms like crisis and key concepts of crisis management. The literature review provides the reader with core information about the concepts of crisis management, including the three phases pre-crisis, crisis event, and post-crisis and gives an overview of the strategic responses to crises. Based on that, the reader can judge whether the selected concepts are appropriate to answer the research question.

**External validity.** External validity tests the “replication logic” (Yin, 2009, p.44) of a study. In other words, the question arises whether the obtained results can be generalized (Bryman & Bell, 2015). According to Yin (2009), it is questionable how generalizable case studies are and therefore external validity is not the major focus of a study. In contrast, in a quantitative study, external validity is of utmost importance (Bryman & Bell, 2015). Still, the researchers of this study ensure external validity by following specific Creswell and Creswell’s (2018) validity strategies, namely, triangulation (investigating various data sources to support case study’s findings), usage of rich, thick description (providing a detailed description and examples), and clarifying biases (mentioning of background information). To be more precise, to incorporate triangulation, besides the interviews with top-managers of the companies, the researchers talked to industry experts, read internal information through websites and internal documents. In addition, market reports have been reviewed, and one industry webinar, as mentioned above, has been visited. To ensure external validity through rich description, the cases were described in greater detail to the participant, and examples have been provided. Lastly, for the purpose of full transparency, the researchers mentioned in the interviews that they are master students of Lund University, and in addition, they mentioned that Kunskapspartner and Medicon Valley Alliance helped them to get in touch with the medtech SMEs.

**Reliability.** Reliability should ensure that the study with the same setting can be repeated (Bryman & Bell, 2015). Further, following the description of earlier researchers, it should allow generating similar results and conclusions (Yin, 2009). Yin (2009, p.45) highlights that “[t]he goal of reliability is to minimize the errors and biases in a study”. The researchers of this study followed all steps to ensure high reliability. This chapter has explained the approach of the case study to enable other researchers to reconstruct this multiple-case study. In addition to that, the questionnaire is provided in Appendix B. Nevertheless, the researchers of this study were aware that the COVID-19 pandemic created a unique situation for research that is more or less impossible to reconstruct. In this case, future crises can be used to create a similar research setting. In addition to that, the reliability of the results may be weakened if the participants were biased and not honest with their responses. Furthermore, to follow Creswell and Creswell’s (2018) qualitative reliability approach, the qualitative data, in this case, the interview transcripts, was checked for any type of mistakes, a constant exchange between the researchers was ensured, and codes were cross-checked to employ an intercoder agreement for higher reliability.

### 3.6 Ethical Considerations

Ethical considerations in business research are essential and important to consider, as mentioned by Bryman and Bell (2015). The authors identified four ethical considerations which should be accounted for in the study. Therefore, this section addresses those ethical considerations and presents measures to avoid them.

The first ethical principle is the concern of harming the participant (Bryman & Bell, 2015). It is crucial to exclude any potential harm to the participant, including mental, physical harm, and reputation damage (Bell & Bryman, 2007; Bryman & Bell, 2015). To prevent this, the participants have been treated sensitively at all times. Furthermore, the participants also have been informed that their names and companies will be anonymized; only the position of the participants will be published in case of permission. In addition, the participant had the possibility to withdraw from the interview at any time, not answer questions, or retract statements. After each interview, the transcript has been sent to the participant by email to allow her or him to check any critical

statements and also to check the transcript for accuracy to ensure that everything has been captured correctly. The second ethical principle concerns the lack of informed consent (Bryman & Bell, 2015). To avoid this risk, the participants have been informed about the study and the purpose of the study. This explanation has been given before each interview. In addition, overview information has been provided in the initial email, requesting an interview. The researchers tried to be as accurate as possible to avoid a lack of informed consent. Thirdly, Bryman and Bell (2015) mention invasion of privacy as an ethical concern. To counteract this concern, the participant always had the opportunity to not answer to any question. As mentioned above, in addition, he or she had the opportunity to withdraw from the interview at any time. Further, the transcript has been sent to the participant after the interview to note privacy violations. Lastly, the fourth ethical concern is deception (Bryman & Bell, 2015). To prevent this concern, the researchers were aware of accurate reporting of the study and were also focused on presenting the study for what it is.

## 4 Empirical Results

The aim of this chapter is twofold. The first part introduces the cases which have been selected for this thesis. Afterward, it presents the empirical findings, which have been gained through five semi-structured interviews with medtech SME top-managers and also through publicly available company data. The findings section reflects the same main structure that has also been used in the literature review, namely, it is structured according to the three phases pre-crisis, crisis, and post-crisis.

The collected data was analyzed with the help of the template approach whereby predefined categories and codes were used (as presented in section 3.4, Table 3) and new categories and codes added throughout the analysis process to fully capture all the respondents' statements. To be more specific, two new codes were created for the crisis phases, namely 'Collaborations' and 'Financing', which describe two further strategic responses. In addition to that also a new category, 'Impact of COVID-19', that includes the codes 'Mindset', 'Digitalization', and 'Clinical trials', was created within the crisis phase. Regarding the post-crisis phase, the researchers expanded the template by specifying the category 'Learning' with the codes 'Key Learnings' and 'Future of Work'. The extended template is provided in Appendix C.

This chapter is important to address the presented research question, which looks into how medtech SMEs have responded strategically to the COVID-19 crisis. However, it is essential to underline that the sole purpose of this chapter is to present the findings which have been collected throughout the empirical research. The goal of the next chapter will then be to put those findings into the context of previous literature, discuss them, and derive the contributions of this study.

## 4.1 Description of the Cases

This subsection presents the five cases which have been chosen for the purpose of this study. The description of the medtech SMEs follows a consistent scheme. First, the business model will be presented, followed by the founding year and age of the medtech SMEs, the number of employees, and lastly, how the COVID-19 crisis impacted the respective organization. To bring the medtech SMEs into a bigger picture and context, the subsection starts with an industry overview of the medtech sector. The industry overview provides information and data about the medtech sector in general, and in addition to that, the role of SMEs in this sector will be highlighted.

### 4.1.1 Overview of the Medtech Sector

A universal definition of medtech does not exist, neither in academia nor in the business world (Vlckova & Thakur-Weigold, 2019). According to Medtech Europe (2020, p.4), medical technologies are “products, services or solutions used to save and improve people’s lives”. They can be divided into three main categories, namely medical devices, in vitro diagnostics, and digital health (Medtech Europe, 2020). Following other studies, this thesis includes digital health into the medical device category. The World Health Organization (2021, n.p.) defines medical devices which can “solve a health problem and improve quality of life”. Further, according to the European Union (1993, p.No L 169/3), a medical device is

any instrument, apparatus, appliance, material, or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings [...].

In other words, medtech companies are firms that provide or produce applications, software, or physical products such as “x-ray equipment, orthodontic implants, stents, minimally invasive surgery products, pacemakers, equipment for physically disabled, hemodialysis as well as disposables” (Swedish Medtech, 2021, n.p.). The purpose of the devices is to help with diagnosis, prevention, and/or monitoring and also to improve health care in general (European Union, 1993; Medtech Europe, 2020; Swedish Medtech, 2021; World Health Organization, 2021).

The global medtech market includes approximately 500.000 products (Medtech Europe, 2020; Vlčková, 2019), and the average yearly market growth rate of approximately 5.5% leads to the estimate that the global revenue will surpass 600 billion U.S. dollars by 2025 (Fortune Business Insights, 2021; Statista, 2021). For comparison, the European market includes 32.000 medtech companies, of which 95% are SMEs, representing 27% of the world market in 2018 with around 120 billion U.S. dollars (Medtech Europe, 2020). Therefore, it is the second-largest market after the U.S. market, with around 43% market share (Fortune Business Insights, 2021; Medtech Europe, 2020).

The medtech industry is characterized by three unique factors (Vlckova & Thakur-Weigold, 2019), which are described in the following. First, Vlckova and Thakur-Weigold (2019) point out that the medtech market for medical devices is highly regulated. Therefore, high safety requirements and the conformity of patents make the production and creation extremely complex (Kramer, Xu & Kesselheim, 2012; Vlckova & Thakur-Weigold, 2019). Second, according to several authors (Cohen & Neubert, 2017; Donzé & Imer, 2020; Vlčková, 2019), the medtech industry is driven by innovation. This is in line with the European Patent Office (2018) that showed in their Annual Report that the industry had the highest number of patents, which serves as an indicator for innovation. Third, the fact that medtech companies have private consumers, as well as public, national customers, puts them in an extraordinary situation, and they consequently must pay attention to perfect quality (Vlckova & Thakur-Weigold, 2019). In addition, in some cases, there are distribution plans between hospitals and medtech companies, and continuous availability of the products has to be ensured (Vlckova & Thakur-Weigold, 2019).

SMEs have a dominant role in the medtech industry, accounting for 95% of the European medtech companies (Medtech Europe, 2020). According to Vlckova (2019) and Medtech Europe (2020), medtech SMEs are highly innovative to ensure their competitiveness. Zakery and Seremi (2020) support that by saying that especially small businesses focus on disruptive innovation rather than incremental innovation, and an increase in their product differentiation. Further, the study of Brown, Dixon, Eatock, Meenan and Young (2008) underscores that medtech SMEs are more likely to launch radical new products compared to larger companies.

In contrast, Heiß (2018) points out that SMEs face difficulties in terms of lengthy approval processes and clinical trials, representing a major cost and time factor. Consequently, these regulations and standards represent an entry barrier for SMEs in the medtech industry (Heiß, 2018; Vlčková, 2019). Another obstacle in the industry, particularly for SMEs, is to find the right distribution channels and partners (Barnes, Chakrabarti & Palihawadana, 2006). This is supported by Vlckova and Thakur-Weigold (2019), who mention that some public customers (e.g. hospitals) have distribution plans. Dümmler, Hofrichter and Biedermann (2014) sum it up by mentioning that the high regulations, standards, and fewer resources on the side of the SMEs, can negatively impact medtech SMEs.

#### 4.1.2 Medtech SME 1

Medtech SME 1 is selling an app/system for motion analysis. Further, the system works cloud-based and uses algorithms. By using the app/system, during a walk or a run, the app/system can recognize movement patterns of the patient, can analyze them, and, based on that, can provide training programs. Customers/patients and physiotherapists, or professionals can work with the data to prevent chronic incorrect movement patterns. The app/system is available in the Google Play Store as well as the App Store. Medtech SME 1 was founded in 2016 and employs eight people at the moment. The company's initial intention was to sell their product only via a B2B channel. This business model, however, changed in the context of the COVID-19 crisis.

#### 4.1.3 Medtech SME 2

Medtech SME 2 is an agency that focuses on digital health product development. This firm provides an integrated model of design and research in combination with software development. Furthermore, medtech SME 2 also acts as a consultancy firm for regulatory and quality topics within the medtech sector. Their main goal is to create solutions for a better life. The peculiarity is that medtech SME 2 acts as a partner for other medtech firms to develop their product to the next (digital) stage and also to launch the product. Medtech SME 2 was founded in 2016 and has

45 employees. In the context of the COVID-19 crisis, several projects had to be set on pause or were delayed.

#### 4.1.4 Medtech SME 3

Medtech SME 3 offers a tool for chronic pain patients. The tool should reach patients in hospitals and rehab programs as well as patients who are at home. The patient has to fill in the tool with data of his or her day that includes activities he or she did. By using machine learning and artificial intelligence, the tool is able to provide analysis and data to suggest helpful measures for the patient. Medtech SME 3 was founded in 2018 and has 8 employees. The company was about to start several clinical studies and landed agreements with four hospitals, three in the U.S. and one in Lund. However, in the context of the COVID-19 crisis, all clinics closed down, and as a consequence, the clinical trials were put on hold and severely delayed, some more than a year.

#### 4.1.5 Medtech SME 4

Medtech SME 4 offers a cloud-based platform for data collections, statistics, graphical data presentation, and collaboration. It is a software as a service (SaaS) company. This service can be used for several sorts of raw data in every field, but their main focus is on medical research and clinical studies. Medtech SME 4 was founded in 2016 and employs 11 people. Before the crisis, the company was eager to grow and expand its network to reach new customers, but in the context of the COVID-19 crisis, this was no longer possible.

#### 4.1.6 Medtech SME 5

Medtech SME 5 offers an app that helps children with eating challenges. With a gamification approach, the children (and the parents) are able to earn points for a superhero by taking a picture when they are eating something. In other words, the child is motivated to eat something to earn points for his or her superhero. With the earned points, the child is able to play with his or her superhero challenges within the app. The app is available in the App Store. Medtech SME 5 was founded in 2016 and employs 3 people. The medtech SME wanted to conduct a clinical study to



gain scientific acceptance for their app. However, in the context of the COVID-19 crisis, everything was put on hold, and the clinical study was set on hold.

## 4.2 Pre-Crisis Phase

This section presents the results of the pre-crisis phase and thus provides insights on how the medtech SMEs prepared for the crisis. Overall, it stands out that none of the companies were prepared for the COVID-19 crisis and predominantly practiced reactive crisis management. The interviews also allow identifying three key factors which influence the companies' pre-crisis management. These are age, size, and financial resources.

### 4.2.1 Proactive and Reactive Crisis Management

The interviews reveal that none of the medtech SMEs was prepared for the COVID-19 crisis. This aligns with the findings that all five medtech SMEs have practiced a reactive crisis management approach. According to the managers, the companies were not able to implement proactive crisis management plans as multinational companies do. Medtech SME 1, 3, 4, and 5 state that they were really unprepared when the crisis hit. In contrast to that, medtech SME 2 has already been more established, which relates to the finding that they tried to act “proactively as much as possible” by discussing plans on what they want to do in terms of employees, investments, and next steps, according to M2. Further, M2 underscores this by saying:

*So, the way that we managed crises prior to the pandemic is really that we have a core leadership team that meets on a weekly basis and one of the key elements that is discussed there is resource management.*

Overall, those findings show that all five medtech SMEs practiced a very reactive crisis management approach. The interviews further reveal that this reactive approach has been influenced by three factors, which are age, company size, and financial resources. How these

factors specifically influenced the pre-crisis management of the medtech SMEs will be discussed in the following, where each factor is presented individually.

#### 4.2.2 Age

One influencing factor is the age of the company. Medtech SME 1, 3, 4 and 5 are all young SMEs, and the managers revealed that they were instead focused on starting and scaling up their companies. M3 supports this by saying:

*I must admit that we didn't prepare at all for any crisis. We had existed for like six months at the time, so we were fully engaged by starting up the organization and finding the right people and writing up our business model and knowing what to do and how to do it. So we were totally unprepared about things like that.*

Similarly, M1 recalls that his company was just struggling to bring their first product to the market and therefore was not yet thinking about any type of crisis management. Further, he adds that his company focuses on a short-term perspective, which does not include a crisis forecast. M4 and M5 also stated that it was not possible to prepare for a crisis given the early age of their companies. M5 brings it to the point by saying that “[i]n the startup company we do not have those kinds of things. It's more, you know, directly hand to mouth”.

#### 4.2.3 Company Size

Another factor that influences the pre-crisis management approach is the company size. All interviewed SMEs are relatively small. The findings show that in contrast to larger companies, this relatively small size leads to lacking pre-crisis management mechanisms.

To show an example, M2 points out:

*We're still fairly small. So, we have nothing systematically proactively looking at different cases of what could happen, like different scenarios. Big companies of course have this. They have whole teams just, [...] when for example an earthquake happens.*

Similar to this, M1 recalls that:

*[...] As a really small company, we're not really dealing with crisis situations, as larger companies are doing. So, no specific work on crisis management, I would say.*

#### 4.2.4 Financial Resources

A third factor that stands out throughout the interviews is the importance of having a solid financial background. In other words, all managers underline that a healthy financial environment is a good form of preparing for a crisis. M2 and M4 describe that both companies had a strong financial background or some sort of funding which helped them when entering the crisis phase. In contrast, medtech SME 1 has a constant financial shortage which made their situation far more difficult. M1 explains that already in the pre-crisis phase, before the COVID-19 crisis, there was already a lot of “uncertainty in the market”, which made it difficult to attract money. In other words, it was rather difficult to convince investors and business angels to invest money in a medtech SME. Overall, M4 summarizes the factor financial resources in a pre-crisis phase by saying: “The best way we could prepare at that stage was to just have a strong funding. And we have... my main focus has been to have as low financial risk as possible.”

### 4.3 Crisis Phase

This section presents the findings from the crisis phase. It starts with the impact of the COVID-19 crisis on the organizations and consequently presents the executed strategic responses, which demonstrate which strategic responses the medtech SMEs executed to respond to the COVID-19 crisis.

#### 4.3.1 Impact of the COVID-19 Crisis on the Organizations and Sector

The COVID-19 crisis had a substantial impact on the organizations but also on the medtech sector itself. The focus of this study is on the strategic responses of medtech SMEs during the crisis.

However, to gain a better contextual understanding of what led to those responses, this subsection presents three key impact areas of COVID-19 on the medtech SMEs and the industry, which have been identified throughout the interviews. This section starts with digitalization, merges into mindset shift, and lastly, looks at the impact on clinical studies.

**Digitalization.** In the context of the COVID-19 crisis, one major factor that stands out is digitalization. All managers underline that the crisis has accelerated the process of digitization within the medtech sector. M2 also highlights that the government has started to invest more in digital tools in that sector. M2 and M3 add on this that the crisis underscored the need for a digital revolution within the medtech sector. M2 said:

*[...] this COVID crisis really accelerated the need and understanding of how to utilize digital in the sector. [...]. Suddenly, what maybe would've been five, ten years of time needed to really, you know, transition to those new tools and new ways of working was conducted into one year because people had to do it.*

M3 summarized it by describing the COVID-19 crisis as “a giant project to digitize the world”.

This accelerated digitalization consequently led to a shift in the mindset of the people regarding digital medtech products, as the interviewees report. Those findings will be presented next.

**Mindset shift.** According to all managers, the COVID-19 crisis has changed the mindset of the people regarding digital health products. M1 states that during the pandemic, people increasingly realize the actual possibilities of digital products and how they can improve their lives. This consequently leads to a higher acceptance rate of digital products and digital solutions, which provides a great opportunity for the digital medtech SMEs. M1 explains that it is simply not efficient and useful anymore to go to a doctor’s appointment when an online session can cover it as well. Also, in terms of diagnoses, he highlights that more and more people are using digital tools for that or at least combining both, namely digital health products and physiotherapists, for example. M2 describes that people have realized that a digital health product is no longer an additional tool or ‘gimmick’, but that they are something that can really improve someone’s life. M3 summarized it by saying: “It's quite popular to work with e-health and digital treatments. [...],

I think that its acceptance has become much faster and many more people understand the importance of those digital tools.” To support this summary, M2 also states:

*COVID accelerated digital and what has always been an issue within the healthcare industry is of course that digital tools have always been something that are nice, nice to have, but this COVID crisis, really accelerated the need and understanding of how to utilize digital in the sector.*

**Clinical trials.** A third area that the COVID-19 crisis had a significant impact on are clinical trials, which is reported by all managers. Clinical trials are necessary for the scientific evidence of medtech products. The main problem was that a lot of planned or running clinical studies of the medtech SMEs were stopped or postponed due to the crisis. In other words, the medtech SMEs were not able to launch their products in time. M3 underscores that by saying:

*It has affected our business. Our plan was to run clinical trials, to prove that the tool works. We had just landed agreements with four hospitals, three in the U.S. and one here in Lund but all of them closed down.*

Another statement from M5 supports this by pointing out: “And when it comes to these clinical studies, now there's a huge backlog. But when that backlog is away, I think we can start approaching that area again.”

### 4.3.2 Strategic Responses

Following the impact COVID-19 had, a major component of the findings within the crisis phases are the strategic responses of the medtech SMEs to the COVID-19 crisis. Therefore, the following subsection presents the strategic responses that were identified throughout the interviews. It includes the four responses: retrenchment, persevering, innovation, exit, according to Wenzel, Stanske and Liebermann (2020), that were already presented in the literature review. In addition to that, it includes the two responses: collaboration and financing, which have been defined through the empirical research.

**Retrenchment.** The interviews reveal that a common strategic response to the COVID-19 crisis is retrenchment. M1 and M2 both underline the necessity of cutting costs. M1 recalls: “We had to, well, reduce everything, both the number of employees and the board members. [...] we had to reduce to try to stay in the market.” He further outlines that due to the fact that the company was no longer able to afford to employ people permanently, they instead started to work with temporary consultants.

Indirect cost-cutting, by essentially cutting new hires was also the key issue for M2 who remembers:

*We cut costs where we could. Everything that were no must-haves was cut. No new hires. We made plans for how to save, you know, potential layoffs as the worst case and then we did what we could across the organization to ensure that new projects came our way.*

Instead of any major cost-cutting measures, M3 and M4 report rather the contrary. They explain that the company actually recruited people as they were still in the process of starting the business. However, taking a forward-looking perspective, M3 also explains that if the company’s revenue streams are further delayed, “[...] we’ll have to lay off people because we can’t pay their salaries. And that is, of course, something that we are preparing heavily for now to prevent of course”.

**Persevering.** Throughout all interviews, one other overall strategic response that can be identified is persevering. All companies, at least to some extent, continued their business operations in response to the COVID-19 crisis. M1 points out that their company had to implement certain strategic changes as they moved from only B2B to B2B plus B2C. However, this shows, and has also been stressed by the manager, that the company did not give up their B2B track, meaning that they kept their initial strategy and therefore is an indicator for a persevering response in that respect. He also positively looks into the future and reassures:

*We can see the light in the tunnel and hopefully soon, it will be passed. But we will stay on track with our products we have now and with the business model we have now.*

A strong persevering crisis response can be found in medtech SME 2, where the crisis helped the company to focus even more on their initial strategy. In other words, their strategy has become more refined and the scope of their business much clearer, which also strengthened their market position. The manager explains that the organization did not lay off any employees and kept what they had. He explains, it was a risky decision but also underlines that due to the fact that COVID-19 accelerated digitalization, this persevering response was successful for the company as he summarizes: “2020 ended up being a strong [...] business driver for us, both growing new projects, new initiatives, new investments, even new hires. So as a business part, it was positive for us.” Also, the manager of medtech SME 3 and 4 underlined that they followed their plans and did not change their products. M3 explains, “[...] we had a plan or still have a plan and we are believing in it. [...] So [...] we follow the plan. Naive maybe, but optimistic”. Similarly, M4 remarks that instead of being frustrated about limited market opportunities in times of the crisis, the company focused “[...] on what we can control ourselves in terms of product and business model”.

**Innovation.** Across almost all medtech SMEs, it stands out that they have become in some way innovative during the COVID-19 crisis. M3 points out, “When you end up in a crisis, you start thinking and you get some brilliant ideas, and you get some really bad ideas as well, but you get a lot of ideas.” Several managers reveal that the pandemic has a formative effect on their business model. M1 states: “The pandemic has impacted us. Our business model has been formed during the pandemic and made our company turn from only B2B to both, B2B and B2C.” He adds on that by saying: “And we will stay with that [...] So, our business model has evolved in that sense.” He further explains that in the beginning, the company’s intention was not to focus on the consumer market, however, this has changed due to COVID-19 as they realized that it would be easier to explain the product to consumers who can try out the product and understand it. For this reason, they shifted their target market. He summarizes the situation by pointing out:

*[...] we had to give up track on trying to see a market for our products. We turned instead to the consumer market because it's much faster to reach and we were not hindered by any certification and so on.*

In addition to the business model which evolved, the company also developed new products, which would not have been the case in the absence of the pandemic. A similar transition of the company throughout the pandemic can be noticed in medtech SME 4, as the manager illustrates:

*[...] we basically took the decision that we will use the pandemic to really develop our product, develop our business model and come out on the other end of the pandemic, as a mature, more mature company.*

She further underlines that a strong focus was on “[...] boost[ing] the development department” for which also new employees have been recruited during that time. In order to allow a boost in the development department during the pandemic, she also explains that other activities like building the marketing department were paused.

A similar case applies to medtech SME 5. M5 outlines that the company was eager to turn their product into a medical product, which, however, would require certain clinical studies. Everything was set up, and the clinical study was supposed to start. However, COVID-19 hit, suddenly everything was shut down, and the study has been put on hold. This event redirected the business of the company as they took their core idea of becoming a medical device in a different direction. Therefore, at the moment, they remain a pure consumer product. M5 adds to this:

*The gist of the whole thing is that, of course, there's other things that we can do for families with small children and food. And this is now a second version that we're building. [...] Perhaps, we would have done that anyway, but, at a later stage, because we were so focused on becoming a medical device, but right now, it's a pure consumer product.*

Nonetheless, as soon as medical studies take place again, M5 stresses that the company will be ready to extend its product to a medical device further.

In a broader innovative context, it may also be mentioned that due to the COVID-19 crisis, some medtech SMEs got into focus to help the fight against the pandemic. M4, for example, mentions that their product was selected to help COVID-research. He said: “[...] shortly after the start, we got the contract for supporting COVID-research. We are one of the five biggest national research



projects in Norway. They are using our platform for COVID-research”. This example shows how the platform of the SME has been used in an innovative way to serve another purpose.

Overall, throughout the interviews, it became clear that COVID-19 favored innovation in various ways like the business model, product development, or even providing new business opportunities. M4 brings it to the point:

*We have improved and developed the product more. Because of COVID, the use of the product in the COVID crisis has been beyond what we thought was the boundaries of the usage.*

**Exit.** None of the five medtech SMEs uses exit as a strategic response to the crisis. However, medtech SME 2 realized during the crisis that instead of doing a broad range of projects that also includes ad hoc projects, they instead only focus on projects which are in their field of expertise. In other words, M2 mentioned that due to COVID-19, they “exited” some project fields. He summarizes the situation as follows:

*I guess, it is just focused on our strategy more than it was originally. [...] We did many different types of projects before and during the crisis. [...] but I think for us, the crisis helped us to focus on where we are and [...] where we will move within the next three to four years. What are the areas we will not invest in? We will not do the types of activities and projects which are not in our DNA. [...] our focus has just become much more stringent now than it was before, where we also did different ad hoc projects within the supply chain within other areas, which is not relevant for where we want to move as an organization.*

**Collaborations.** Another strategic response that can be identified throughout the interview is collaborations. In the case of medtech SME 1, the manager explains that due to the pandemic, the company started collaborations that they would not have started in the absence of the crisis. One example he mentions is a collaboration with a running coach community which allowed the company to develop new products which might not have been developed otherwise. Personal relations are essential for companies in an early stage, and in combination with the crisis, the importance of collaborations has been underlined by M4, who remarks:

*I think what has changed in people's minds is that collaborations are really important. Yeah. I think some of those boundaries have been broken down and that's good for us because that is what our business model is about. [...] If I invite you for a research collaboration, you are exposed to our platform and you may also want to use it for your other projects. And you invite new collaborators.*

The manager further explains that the COVID-19 crisis confirmed the organization that their plan of not having their own sales organization throughout Europe or abroad but rather collaborating with strategic partners.

Also, M3 points towards the importance of collaboration by recalling that as soon as the clinical trials for their tool stopped, the company instead reached out to patient organizations who are private persons but still relevant patients and would thus deliver valuable input. M3 remembers that collaborating with those patient organizations was very helpful for evaluating the tool from a clinical perspective on the one side and from a user experience perspective on the other side.

**Financing.** Financing is another element that has been brought up by several interviewees. M3 states that her company is applying for EU grants and National grants and, at the same time, is meeting investors. Also, M5 reports that the company gained financial support from one new investor and the previous investors. Those investments are not huge amounts but do prove the concept of the organization and serve as “bridge” (M5).

Overall the interviews reveal that the financial situation in times of the pandemic is challenging and also time-consuming. M3 summarizes the situation by saying:

*I mean, I would prefer to go out there, do business with clinics etc. Now, I have to focus my time on [...] the survival side rather than on the expansion side and that's the bit annoying.*

## 4.4 Post-Crisis Phase

This section presents the post-crisis phase, where the findings include key learnings of the medtech SMEs regarding their companies' performance throughout the crisis and reflections on the future of work. The managers were asked to see this phase more like an outlook because, at the time of the interviews, the pandemic was not yet over.

### 4.4.1 Key Learnings

Two key learnings stand out by interviewing the managers. First, things can change quickly, and therefore a company should be able to adapt fast. Second, all managers pointed out that it is important to have the opportunity to reduce cost fast if necessary but also already have implemented a lean organizational structure within their company.

**Fast adaptability.** M1 and M5 highlight that events like the COVID-19 crisis show how quickly things can change and that a fast adaptation to the situation was key to succeed in the crisis. Retrospectively it is essential to have a mentality to adapt quickly if it is needed for the company. In other words, M5 supports this by mentioning that a CEO should always look for new opportunities when a crisis like the current COVID-19 pandemic hits the company.

**Fast cost-cutting and lean organizational structures.** Adding on the previous learning, it has further been mentioned that the company should always be able to reduce costs quickly. For example, M1 explains that his company has started to work with consultants with short-term contracts (weekly/monthly), which would allow him to cut costs rapidly, by ending contracts in a timely manner, if necessary. The same interview partner also mentioned that long-term contracts for young and small companies are dangerous when it comes to a crisis. This is one of his key learnings that he will focus on even more in the future. Like fast cost-cutting, M4 clearly states that a lean organization can prepare a company for the next crisis.

In that context, one of the key learnings that all managers mention is that having a solid financial background is crucial. M4 brings it to the point:

*I think the lesson learned for all companies is that when a crisis hits you should really have strong financials. It can be extremely hard to raise money throughout the crisis, during a crisis.*

With this key learning of being in a robust financial situation, a line can be drawn back to the element of financial resources, which has been discussed as one of the influential factors on pre-crisis management for SMEs.

#### 4.4.2 Future of Work

All managers agreed on the fact that the future of work will look different compared to the time before the COVID-19 crisis. This means that working from home is an option, and also less traveling will be required because the work can also be done efficiently in a digital setting. M3 also mentions that it is highly attractive for small companies and employees as they have become more flexible regarding their locations. M1 and M3 highlights that collaborations can be possible theoretically worldwide. M2 supports that by saying:

*[...] we don't go back into it as it was, that you have to have a face-to-face, three hour meeting on the other side of the world or somewhere else. It's not true that you can't get things done [digitally]. That's a wrong assumption we made pre-COVID, you can get things done.*

### 4.5 Empirical Framework

In order to summarize the findings of the empirical research, which expand the previous literature of the field under study, the researchers have developed a framework which is presented in Figure 1. While a more in-depth discussion of the findings in the context of the previous literature will be done in the following chapter of this thesis, this section summarizes the findings and provides an understanding of the framework.

Overall, the framework represents the three crisis management phases, pre-crisis, crisis event, and post-crisis, showing their interconnections. Starting with the pre-crisis phase at the top, it can be differentiated between proactive and reactive crisis management. The findings of this study show that all five medtech SMEs have practiced reactive crisis management. This approach to crisis management has been influenced by three factors, namely age, size, and financial resources. In most cases, the findings reveal that the companies were simply too young, too small, or did not have substantial enough financial resources to implement formal crisis management measures, which would have allowed them to practice a proactive crisis management approach. Nonetheless, although all SMEs lacked crisis preparation measures, meaning they practiced a reactive approach, they have been successful in their responses to the crisis, leading to the crisis phase part of the framework.

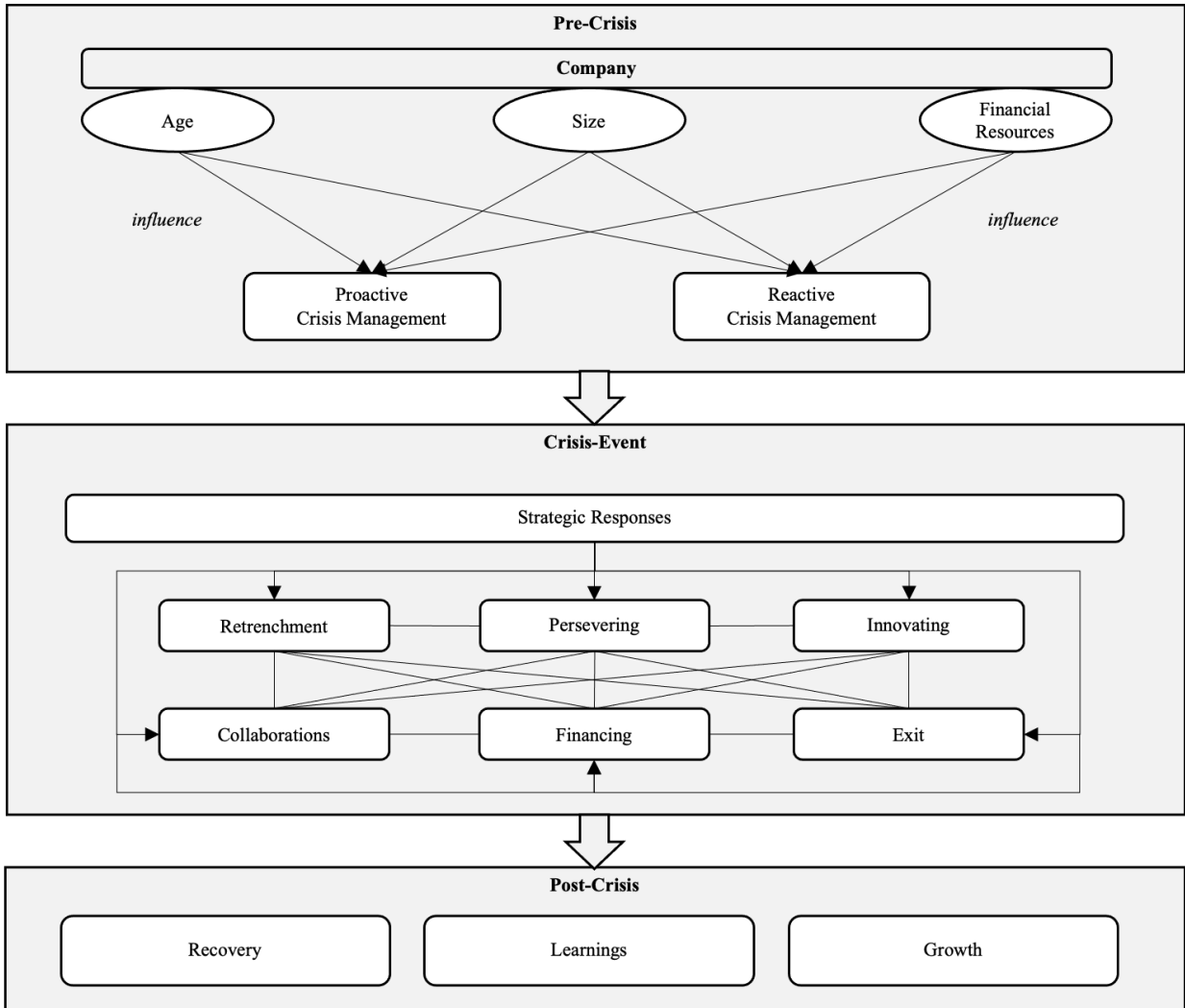
Within the crisis phase, the findings reveal that the medtech SMEs have responded in several different ways to the COVID-19 crisis. More specifically, they mostly followed Wenzel, Stanske and Liebermann's (2020) strategic responses, persevering, innovating, retrenchment or exit. However, the researcher also identified two additional responses, namely collaborations and financing. All six responses are presented in the framework. Important to mention is that the responses must not be seen in isolation, which is demonstrated by the lines connecting all responses with each other. This visualization is based on the findings, which show that most companies practice several responses at the same time or after each other, depending on the point of time of the crisis. To exemplify this, right after the crisis hit, most of the analyzed companies made use of the retrenchment response and implemented certain cost-cutting measures. However, as time passed by, they shifted over to another response, which in many cases was innovation. The manager reported that they used the pandemic to innovate their business model and developed new products. Also, a combination of two strategies at the same time can be observed. One company, for example, started a collaboration which led to the development of a new product and thus also reflects the innovation response.

Another aspect that stands out in the findings is that even the influencing factors presented in the pre-crisis phase show an impact on the strategic responses. This can be exemplified in two cases. The first company had powerful financial resources in the beginning. Although they still did not

practice proactive crisis management, this strong financial position allowed them to practice the persevering response, as no major cost-cutting was necessary. Another company that also reported substantial financial resources at the beginning of the crisis consequently was able to respond in a very innovative way and did not have to focus too much on a retrenchment response.

In summary, these findings show that companies can shift from one strategic response to another during the crisis or even practice several responses at the same time. Further, these can even be influenced by the factors from the pre-crisis phase.

Lastly, the framework presents the pre-crisis phase, which includes three main elements: recovery, learnings, and growth. The major findings stem from the field of learning. Most managers report that fast adaptability to changing situations, the possibility for fast cost-cutting, and lean organizational structures have proven to be key elements when responding to a crisis. Focusing on these aspects will better prepare them for the next crisis. It shows that all companies are eager to learn from the crisis and turn it into an opportunity to develop themselves. The element of recovery can also be found in the analyzed medtech SMEs, as all of them in some way have to recover from the crisis. However, all of them turned the crisis into an opportunity to grow, which is the third element mentioned in the framework.



**Figure 1:** Framework of the Three Phases of Crisis Management including the Strategic Responses (created by authors)

## 5 Discussions and Analysis

The previous chapter presented the findings of the empirical study as well as the resulting framework. Building on this, the purpose of this chapter is to discuss the presented findings and relate them to existing literature. The goal of this discussion is to provide a more holistic perspective to the topic under study and the proposed research question, which is how medtech SMEs have responded strategically to the COVID-19 crisis. The chapter is subdivided into the three sections crisis preparation, crisis phase, and crisis learnings.

### 5.1 Crisis Preparation

The pre-crisis phase is an important part of crisis management, and it can be differentiated between proactive and reactive crisis management (Mitroff, Shrivastava & Udwadia, 1987; Spillan & Crandall, 2002). In order to prepare for a crisis, the literature recommends that companies implement formal crisis management measures like crisis management teams or a crisis preparation plan to respond to a crisis successfully (Hickman & Crandall, 1997). However, the literature also states that SMEs only pay little attention to crisis management (Spillan & Hough, 2003) which has been confirmed by the results of this study. It shows that none of the five medtech SMEs had any preparation measures in place. All of them practiced the reactive crisis management approach, which is influenced by the three in the framework presented factors, namely age, size, and financial resources.

Starting with the factor age, all presented companies are young SMEs and, in some cases, the managers were still in the process of starting and scaling up their organizations and were trying to bring their first products to the market. Their young age did not allow them to prepare themselves in any way for the crisis, which is why they only had a short-term perspective on their business operations. This explains the reactive crisis management approach. Second, to mention is the factor



size. Going in hand with the factor age, the size of the presented companies is relatively small, which may explain why no proactive crisis management mechanisms were in place. The companies rather acted ad hoc and in an unprepared way. This behavior has also been presented in the literature, which states that due to its flexibility, smaller companies can better and faster adapt to crisis situations (Juergensen, Guimón & Narula, 2020). Further, literature states that in contrast to larger organizations, small businesses most of the time only become concerned when the crisis actually occurs (Spillan & Hough, 2003). The findings of the study, which show that small companies do not have the means for any form of crisis preparation, thus once more strengthen existing literature in this field.

One other aspect which, throughout the study, turns out to be of great importance is to have a solid financial background. Strong funding has been identified as a key factor in the pre-crisis phase, however previous crisis management literature, in the direct context of strategic responses, is lacking to emphasize this. Companies with a healthy financial situation were in a much more manageable situation when the crisis started. As the results show, it also influenced their strategic responses, as it, for example, allowed them to focus on innovation activities instead of retrenchment measures.

Overall the results of this study partly align with the previously presented theory but are also partly contradictory. The findings confirm the dominating lack of formal crisis management mechanisms or any other form of crisis preparation in SMEs, especially when the companies are still very young and small (Hong, Huang & Li, 2012). This, however, makes them very flexible and allows them to react fast to changing environments, such as a crisis. The flexibility and adaptiveness of the firm was a key success factor to respond quickly. This also explains why all companies have been very successful throughout the crisis by practicing a reactive approach. To some extent, this contradicts with the theory (Fink, 1986; Hickman & Crandall, 1997), which stresses the importance of crisis management plans and teams in order for companies to successfully survive a crisis. From this fact, it can be concluded that formal crisis management measures may be useful to prepare for a crisis but are not always essential, referring solely to SMEs as only this type of companies was studied. The cases show that all SMEs had a strong response to the crisis and grew through it without any form of preparation.

## 5.2 Crisis Phase

At the heart of crisis management is the actual crisis phase, which requires specific strategic responses of the companies to address the crisis and mitigate its impact.

Taking a holistic perspective, the findings reveal that the analyzed SMEs have responded in several different ways. However, two types of responses dominate and can mostly be found in combination: the rather short-term response retrenchment and the more long-term oriented response innovation. Drawing a line back to the studies presented in the literature, the authors Myers (1993) and Fink (1986) differentiate between two response stages within the crisis phase. First, Myers (1993) points out the ‘emergency response’, which can be seen as the immediate reaction to the crisis. When the situation starts to calm down, the ‘chronic crisis stage’, defined by Fink (1986), sets in. In the following, the empirical findings will be related to those two response stages.

**Strategic short-term response.** The findings reveal that an immediate short-term response of all medtech SMEs was retrenchment, which can, according to the literature, be declared as an emergency response. To a great extent, costs were cut down, mainly by reducing the number of employees or at least by cutting new hires and everything else that were non-essentials for the company. This allowed the companies to survive in the short-term right after the crisis hit. This data is broadly consistent with the major trends in the literature, which describes layoffs and reduced labor expenses as an immediate retrenchment response of SMEs that are impacted by a crisis (Thorgren & Williams, 2020).

Besides retrenchment as a strategic response, another strategic response also became apparent. Financing was identified as another short-term response in a crisis. Besides cost-cutting, the managers had to find new ways of financing their organizations. In other words, the search for new money to continue the business or to collect money for innovation during the crisis can be a short-term activity for top-managers. This aspect was repetitively mentioned throughout the interviews and in this way expands the strategic responses which have been presented in the literature, where financing did not gain much attention as a form of strategic response.

**Strategic long-term response.** Following this short-term response, the findings reveal that innovation is also a dominating response in the analyzed medtech SMEs. This rather long-term oriented strategic response can be related to the chronic crisis stage as it has been defined by (Fink, 1986). The findings underline that the pandemic strongly impacted the companies' business model, which in some cases evolved throughout the crisis. Overall, the results show that the COVID-19 crisis clearly redirected the business of the medtech SMEs, which aligns with previous literature. Literature states that a crisis can be seen as a chance to renew the business strategy and develop new products (Ucaktürk, Bekmezci & Ucaktürk, 2011). This also relates to the finding that new products were developed which would not have been developed in the same way in the absence of the pandemic. Helfat (1997) supports this by outlining that disadvantageous situations in times of a crisis often trigger new solutions. Bringing it to the point, innovation is the key element to survive a crisis in the long-run (Wenzel, Stanske & Liebermann, 2020). This has also been confirmed by the findings from the empirical study, as all companies succeeded throughout the crisis by becoming innovative with their business models or product. Another repetitively mentioned strategic long-term response throughout the interviews which is lacking in the literature is collaborations. The pandemic has shown the value and importance of strategic partnerships. One mentioned benefit was, for example, the creation of a new product, only due to the created partnership.

Overall, the results show that the COVID-19 crisis triggered several strategic responses of medtech SMEs. However, the companies do not just decide on one single strategic response but instead, use of a combination of several to address the crisis.

**The concept of bricolage and strategic responses.** Further, a line can be drawn to the concept of bricolage which means to create something from nothing (Baker & Nelson, 2005). The results of this study reveal that some of the medtech SMEs were selected for COVID-Research and thus used their product for another purpose than originally intended for. However, this was only a temporary measure and can be related to the 'interim processing', the second period in the crisis response phase, which has been labeled by Myers (1993) and includes temporary measures before operations will return back to normal. Due to the pandemic, some medtech SMEs could no longer deliver their product the way they planned. Following the concept of bricolage, it can be stated

that those companies used their existing resources, modified their product, and thus created a new product to pursue new opportunities.

**Dynamic capabilities and strategic responses.** Taking a broad perspective on the crisis responses of SMEs, literature stresses the elements of flexibility and adaptability (Juergensen, Guimón & Narula, 2020; Smallbone et al. 2012). Further, it points towards the dynamic capabilities, which play an essential role in the crisis responses of organizations (Guo et al. 2020). It has been pointed out that the three dynamic capabilities sensing, seizing, and transforming, are specific competencies that an organization possesses and which help them to deal with changing environments, as in this case of the COVID-19 crisis (Teece, 2007, 2018; Teece, Pisano & Shuen, 1997). Looking at the dynamic capabilities one by one, they can directly be applied to the individual case companies from this study.

First of all, sensing allows companies to identify opportunities in a changing environment, which in the case of the study is the COVID-19 crisis. Second of all, seizing implies that companies question their current business model in the context of the changing environment and consequently adapt and refine it. This study shows that most SMEs adjusted their business model and products in response to the crisis. Lastly, transforming means the reconfiguration of external and internal resources, which is partly also applicable in the presented cases.

**Digital business model and strategic responses.** The results of this study also shed light on the digital opportunities, which have been created throughout the crisis. Digitalization and digital opportunities in crisis management are lacking in the literature (Guo et al. 2020). Because of the medtech SMEs' digital business models, they were able to innovate their business model very fast and which allowed them to change their direction immediately. This action once again opened new opportunities, which might have remained hidden without the crisis.

The findings also reveal that the digital business model was one underlying reason why the medtech companies were not that negatively affected by the COVID-19 crisis. It also allowed them to easily transition to a digital work environment and continue their business. In some way, it can be stated that this digital business model prepared them for the crisis as it made them more independent, which has been reported by the interviewees. Referring to the findings that present

the impact of the COVID-19 crisis, it has been stated that the pandemic accelerated digitalization within the medtech sector. Putting the digital business model into that context, another conclusion could be drawn, namely that a digital business model compensates for the lack of traditional crisis management measures like crisis management teams and plans. Digital business models or at least digital elements within the business model have therefore become an even more important element in terms of crisis preparation.

### 5.3 Crisis Learnings

A key element in crisis management is learning and reflecting, which is part of the post-crisis phase. Literature stresses the importance of this learning stage and, at the same time, points out that it is often neglected (Lampel, Shamsie & Shapira, 2009). As the pandemic was still ongoing at the time of this study, the interview results focus more on learnings during the crisis and provide an outlook towards the time after the crisis.

All managers that were interviewed reflected on the crisis and derived certain learnings from the crisis for their organization. This is highly supported by existing literature which states that it is of great importance to, on the one hand, look at the elements that helped the organization get through the crisis but on the other hand also to identify factors that limited the performance of the companies (Lampel, Shamsie & Shapira, 2009). The learnings rotate around three elements that will be discussed in the following.

The first key learning is that one can never take the status quo for granted, and things can change very quickly. Companies need to be able to adapt quickly to changes as this is a key to succeed in times of changes like a crisis. Second of all, it is highly recommended to implement a lean organization and to be able to cut costs quickly. For this, the findings reveal that short-term contracts and flexible costs are an essential element. A third aspect, which is important, is strong financials which influence not only the approach to crisis management but also the strategic responses the company may choose.

Putting those findings in the context of the literature, the learning can be categorized as learnings from 'reinterpretative rare events' (Lampel, Shamsie & Shapira, 2009) as the relevance of the crisis was high but the impact relatively low. All companies grew throughout the crisis and developed their business further.

## 6 Conclusion

The purpose of this thesis has been to create an understanding of the strategic responses of medtech SMEs to the COVID-19 crisis and in which way they have been implemented. Therefore, the following research question has been formulated:

*How have medtech SMEs responded strategically to the COVID-19 crisis?*

In order to adequately address this research question, this study employed a multiple-case study that analyzed how the COVID-19 crisis impacted five different medtech SMEs and how those responded to it. By combining previous literature with the results of the empirical study, a framework has been developed. It has been structured according to the three different phases of crisis management, namely pre-crisis, crisis, and post-crisis, and includes the key elements within these phases. A major focus has been placed on the strategic responses to the crisis presented by Wenzel, Stanske and Liebermann (2020).

The findings within the pre-crisis phase reveal that all medtech SMEs have practiced a reactive crisis management approach which is influenced by the three factors age, size, and financial resources. Following, this study shows that within the crisis phase six different strategic responses of medtech SMEs to the COVID-19 crisis can be identified. However, it also presents that a combination of three different strategic responses dominates in relation to the time dimension. In the beginning, the short-term response retrenchment dominates, and later a shift to the long-term responses innovation and collaboration can be noticed. The study also presents three key learnings from the COVID-19 crisis for SMEs, namely the ability to adapt quickly to changes, the importance of implementing lean organizational structures and options for fast cost-cutting, and lastly, to have substantial financial resources. In that context, the importance of digital elements within the business model has to be mentioned, as it stands out that even without formal crisis management measures in place, the companies successfully responded to the COVID-19 crisis by capitalizing on their digital business models.

The results further reveal that the medtech industry has been strongly disrupted by the COVID-19 crisis and accelerated the digitalization of the sector. This provided several opportunities which have been captured by the medtech SMEs through their innovative responses. Therefore, the researchers want to conclude this study with the famous words of Winston Churchill, who said: “Never let a good crisis go to waste.”

## 6.1 Theoretical Implications

The study provide important implications for academic literature. It addresses the identified research gap in crisis management literature that lacks to analyze strategic responses to crisis events that are as specific as the novel COVID-19 crisis. The theoretical contributions follow Wenzel, Stanske and Liebermann (2020), who call for further studies in crisis management, and in particular, the field of strategic responses to a crisis.

More specifically, the authors of this study integrate their findings into the four strategic responses to crisis events which have been presented by Wenzel, Stanske and Liebermann (2020). This research, on the one hand, supports the proposed strategic responses but also advances it by two further responses to crises. In addition, it draws attention to the common practice of companies who tend to combine responses rather than apply them in isolation. A framework has been developed which serves the understanding of how medtech SMEs responded strategically to the COVID-19 pandemic.

Further, this thesis is unique by analyzing five exemplary SMEs within the medtech industry. So far, there have been no previous publications that address the field of crisis management in the context of the COVID-19 crisis for this specific sector. This study also picks up the request for further research of this specific COVID-19 crisis in different countries and industries to gain an overarching picture of the field under study (Kraus et al. 2020).

Overall, this thesis confirms knowledge regarding strategic responses which has previously been established and was applied in different contexts and industries (e.g. Albers & Rundshagen, 2020;



Kraus et al. 2020) as it addresses a particular crisis, the COVID-19 crisis, and also looks into a specific sector, the medtech sector.

## 6.2 Practical Implications

The aim of this study is also to derive practical implications for managers. Overall, this research provides valuable insights on crisis management in SMEs. First, the results of this study show that also in the absence of formal crisis management mechanisms, SMEs can succeed in a crisis by practicing a reactive approach. However, the study indicates that managers should focus on a strong financial background of the SME, flexible costs models, and digital enhancement in their business model, which prepares them well in case of a crisis.

Second, in case of a crisis, managers may implement one or a combination of several of the six identified strategic responses. The findings show that a combination of different strategic responses is the most successful way to address a crisis. Further, a crisis creates a great opportunity for innovating the product or business model. The study suggests that managers of SMEs need to be innovative in a crisis and also be open to collaborations. This can lead to synergy effects and help both parties of the collaborations.

The managers should analyze the changing environment in terms of opportunities and threats and focus on market opportunities. To exemplify, the COVID-19 crisis accelerated the digital transformation and consequently the digital medtech sector.

Third, during and especially in the aftermath of a crisis, managers need to reflect on the performance of the company and focus on the next steps, which may include recovery or growth. Another crucial element that must not be underestimated is key learnings. It makes the organization more robust and can be valuable for the next crisis situation.

## 6.3 Limitations and Future Research

The aim of this last subchapter is to present several limitations of this study and also to point out areas for future research. First to mention is the methodological approach of this study. A qualitative multiple case study was carefully chosen as the study design. However, it cannot confirm causal relationships as a quantitative study could do. This could lead to future research in the context of the success rate of strategic responses in several crisis cases. It might be interesting for managers how successful some strategic responses are and which combination/sequence of strategic responses is the most fruitful way in a crisis. It might also be interesting for a qualitative study to determine the importance of the characteristics of the SMEs to succeed in a crisis.

Two other significant limitations include time constraints and generalizability. The results are based on the specific COVID-19 crisis. Because of the uniqueness of the crisis and the historical impact, it may be difficult to transfer the results to future crisis situations. In addition to that, the interview respondents may be biased and present a subjective picture of the facts. Further, this study only investigated medtech SMEs with a digital business model, which leads to another field of future research. Promising insights may result from an investigation of low-digital SMEs and how they respond strategically to the COVID-19 crisis. Similarities and differences may be derived and extend the framework of strategic responses.

Moreover, the COVID-19 crisis shows how much impact a crisis can have on the global economy. This study was conducted in the midst of the COVID-19 crisis. The crisis is evolving quickly, and the responses are presumably dynamic, which is why the results in this study can only be seen as a snapshot in time which includes empirically collected data up until 05 May 2021. It therefore only provides preliminary findings and does not allow to draw conclusions on the long-term success of the implemented strategic responses. It remains of interest to investigate how the SMEs recover in the long-term after the crisis. Overall, the unique COVID-19 situation remains valuable to study and call for further research to contribute to the field of crisis management.

# References

- Albers, S., & Rundshagen, V. (2020). European Airlines' Strategic Responses to the COVID-19 Pandemic (January-May, 2020), *Journal of Air Transport Management*, vol. 87, no. 101863, pp.1–7
- Alonso, A. D., Bressan, A., Kok, S. K., Sakellarios, N., Koresis, A., O'Shea, M., Buitrago Solis, M. A., & Santoni, L. J. (2021). Facing and Responding to the COVID-19 Threat – An Empirical Examination of MSMEs, *European Business Review*, vol. ahead-of-print, no. ahead-of-print, Available Online: <https://www.emerald.com/insight/content/doi/10.1108/EBR-09-2020-0231/full/html> [Accessed 11 April 2021]
- Argyres, N., Bigelow, L., & Nickerson, J. A. (2015). Dominant Designs, Innovation Shocks, and the Follower's Dilemma, *Strategic Management Journal*, vol. 36, no. 2, pp.216–234
- Baker, T., & Nelson, R. E. (2005). Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage, *Administrative Science Quarterly*, vol. 50, no. 3, pp.329–366
- Ballesteros, L., Useem, M., & Wry, T. (2017). Masters of Disasters? An Empirical Analysis of How Societies Benefit from Corporate Disaster Aid, *Academy of Management Journal*, vol. 60, no. 5, pp.1682–1708
- Bamber, P., & Gereffi, G. (2013). *Costa Rica in the Medical Devices Global Value Chain: Opportunities for Upgrading*, Duke Center on Globalization, Governance & Competitiveness
- Barker, V. L., & Duhaime, I. M. (1997). Strategic Change in the Turnaround Process: Theory and Empirical Evidence, *Strategic Management Journal*, vol. 18, no. 1, pp.13–38
- Barker, V. L., & Mone, M. A. (1994). Retrenchment: Cause of Turnaround or Consequence of Decline?, *Strategic Management Journal*, vol. 15, no. 5, pp.395–405

- Barnes, B. R., Chakrabarti, R., & Palihawadana, D. (2006). Investigating the Export Marketing Activity of SMEs Operating in International Healthcare Markets, *Journal of Medical Marketing*, vol. 6, no. 3, pp.209–221
- Barron, A., Hultén, P., & Hudson, S. (2012). The Financial Crisis and the Gathering of Political Intelligence: A Cross-Country Comparison of SMEs in France, Sweden and the UK, *International Small Business Journal: Researching Entrepreneurship*, vol. 30, no. 4, pp.345–366
- Bell, E., & Bryman, A. (2007). The Ethics of Management Research: An Exploratory Content Analysis, *British Journal of Management*, vol. 18, no. 1, pp.63–77
- Bibeault, D. B. (1998). *Corporate Turnaround: How Managers Turn Losers Into Winners!*, Washington D.C.: Beard Books
- Boyne, G. A., & Meier, K. J. (2009). Environmental Change, Human Resources and Organizational Turnaround, *Journal of Management Studies*, vol. 46, no. 5, pp.835–863
- Brem, A., Nylund, P., & Viardot, E. (2020). The Impact of the 2008 Financial Crisis on Innovation: A Dominant Design Perspective, *Journal of Business Research*, vol. 110, pp.360–369
- Brown, A., Dixon, D., Eatock, J., Meenan, B. J., & Young, T. (2008). A Survey of Success Factors in New Product Development in the Medical Devices Industry, 2008 IEEE International Engineering Management Conference, pp.1–5, Available online: <https://ieeexplore.ieee.org/document/4617987?arnumber=4617987>, [Accessed 26 April 2021]
- Brünjes, J., & Revilla-Diez, J. (2013). ‘Recession Push’ and ‘Prosperity Pull’ Entrepreneurship in a Rural Developing Context, *Entrepreneurship & Regional Development*, vol. 25, no. 3–4, pp.251–271
- Bruton, G. D., Ahlstrom, D., & Wan, J. C. C. (2003). Turnaround in East Asian Firms: Evidence from Ethnic Overseas Chinese Communities, *Strategic Management Journal*, vol. 24, no. 6, pp.519–540
- Bryman, A., & Bell, E. (2011). *Business Research Methods*, 3rd edn, Cambridge, New York, NY: Oxford University Press
- Bryman, A., & Bell, E. (2015). *Business Research Methods*, 4th edn, Cambridge, New York, NY: Oxford University Press

- Burgelman, R. A. (1996). A Process Model of Strategic Business Exit: Implications for an Evolutionary Perspective on Strategy, *Strategic Management Journal*, vol. 17, pp.193–214
- Carbó-Valverde, S., Rodríguez-Fernández, F., & Udell, G. F. (2016). Trade Credit, the Financial Crisis, and SME Access to Finance, *Journal of Money, Credit and Banking*, vol. 48, no. 1, pp.113–143
- Carmeli, A., & Schaubroeck, J. (2008). Organisational Crisis-Preparedness: The Importance of Learning from Failures, *Long Range Planning*, vol. 41, no. 2, pp.177–196
- Carnahan, S. (2017). Blocked But Not Tackled: Who Found New Firms When Rivals Dissolve?: Blocked But Not Tackled, *Strategic Management Journal*, vol. 38, no. 11, pp.2189–2212
- Castrogiovanni, G. J., & Bruton, G. D. (2000). Business Turnaround Processes Following Acquisitions, *Journal of Business Research*, vol. 48, no. 1, pp.25–34
- Chadwick, C., Hunter, L. W., & Walston, S. L. (2004). Effects of Downsizing Practices on the Performance of Hospitals, *Strategic Management Journal*, vol. 25, no. 5, pp.405–427
- Chakrabarti, A. (2015). Organizational Adaptation in an Economic Shock: The Role of Growth Reconfiguration, *Strategic Management Journal*, vol. 36, no. 11, pp.1717–1738
- Chong, J. K. S. (2004). Six Steps to Better Crisis Management, *Journal of Business Strategy*, vol. 25, no. 2, pp.43–46
- Christianson, M. K., Farkas, M. T., Sutcliffe, K. M., & Weick, K. E. (2009). Learning Through Rare Events: Significant Interruptions at the Baltimore & Ohio Railroad Museum, *Organization Science*, vol. 20, no. 5, pp.846–860
- Clauss, T., Abebe, M., Tangpong, C., & Hock, M. (2019). Strategic Agility, Business Model Innovation, and Firm Performance: An Empirical Investigation, *IEEE Transactions on Engineering Management*, pp.1–18, Available Online: <https://ieeexplore.ieee.org/document/8726152/> [Accessed 13 April 2021]
- Cohen, B. & Neubert, M. (2017). Price-Setting Strategies for Product Innovations in the Medtech Industry, in 10th Annual Conference of the EuroMed Academy of Business, pp.459–473 Available online: [https://www.researchgate.net/publication/320298521\\_PRICE-SETTING\\_STRATEGIES\\_FOR\\_PRODUCT\\_INNOVATIONS\\_IN\\_THE\\_MEDTECH\\_INDUSTRY](https://www.researchgate.net/publication/320298521_PRICE-SETTING_STRATEGIES_FOR_PRODUCT_INNOVATIONS_IN_THE_MEDTECH_INDUSTRY), [Accessed 23 April 2021]

- Collis, J., & Hussey, R. (2014). *Business Research: A Practical Guide for Undergraduate & Postgraduate Students*, 4th edn, Houndmills, Basingstoke, Hampshire, New York, NY: Palgrave Macmillan
- Comfort, L. K., Boin, A., Demchak, C. C., & Demchak, C. C. (2010). *Designing Resilience: Preparing for Extreme Events*, Pittsburgh: University of Pittsburgh Press
- Coombs, W. T. (2014). *Ongoing Crisis Communication: Planning, Managing, and Responding*, London: SAGE
- Cowling, M., Liu, W., & Zhang, N. (2018). Did Firm Age, Experience, and Access to Finance Count? SME Performance after the Global Financial Crisis, *Journal of Evolutionary Economics*, vol. 28, no. 1, pp.77–100
- Crandall, W., Parnell, J. A., & Spillan, J. E. (2010). *Crisis Management in the New Strategy Landscape*, London: SAGE
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th edn, International Student Edition., London: SAGE
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The Case Study Approach, *BMC Medical Research Methodology*, vol. 11, no. 100, pp.1–9
- Cui, T., Wang, D., & Ping, J. W. (2016). The Exploration of Crisis Management Strategies: Looking Back and Ahead, *Frontiers of Business Research in China*, vol. 10, no. 2, pp.220–244
- Cunha, M. P. e, & Cunha, J. V. da. (2007). Bricolage in Organizations: Concept and Forms, in M. A. Rahim (ed.), *Current Topics in Management: Volume 12 (1st edn)*, New York: Routledge, pp.51–72
- De Carolis, D. M., Yang, Y., Deeds, D. L., & Nelling, E. (2009). Weathering the Storm: The Benefit of Resources to High-Technology Ventures Navigating Adverse Events: Navigating Adverse Events, *Strategic Entrepreneurship Journal*, vol. 3, no. 2, pp.147–160
- Doern, R., Williams, N., & Vorley, T. (2019). Special Issue on Entrepreneurship and Crises: Business as Usual? An Introduction and Review of the Literature, *Entrepreneurship & Regional Development*, vol. 31, no. 5–6, pp.400–412
- Donzé, P.-Y., & Imer, R. (2020). Innovation in the Global Medtech Industry: An Empirical Analysis of Patent Applications, 1960–2014, *Osaka Economic Papers*, vol. 69, no. 4, pp.18–42

- Dowell, G. W. S., Shackell, M. B., & Stuart, N. V. (2011). Boards, CEOs, and Surviving a Financial Crisis: Evidence from the Internet Shakeout, *Strategic Management Journal*, vol. 32, no. 10, pp.1025–1045
- Dümmler, P., Hofrichter, B. & Biedermann, P. (2014). The Swiss Medical Technology Industry 2014: The Dawn of a New Era, *Medical Cluster of the Innovation Promotion Agency of the Swiss Confederation*, Zurich: medical cluster, Available Online: <https://docplayer.net/7436432-The-swiss-medical-technology-industry-2014-the-dawn-of-a-new-era.html> [Accessed 30 March 2021]
- Easterby-Smith, M., Jaspersen, L. J., Thorpe, R., & Valizade, D. (2021). Management and Business Research, 7th edn, London: SAGE
- Easterby-Smith, M., Lyles, M. A., & Peteraf, M. A. (2009). Dynamic Capabilities: Current Debates and Future Directions, *British Journal of Management*, vol. 20, pp.1–8
- Eggers, F. (2020). Masters of Disasters? Challenges and Opportunities for SMEs in Times of Crisis, *Journal of Business Research*, vol. 116, pp.199–208
- Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building From Cases: Opportunities And Challenges, *Academy of Management Journal*, vol. 50, no. 1, pp.25–32
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic Capabilities: What Are They?, *Strategic Management Journal*, vol. 21, no. 10–11, pp.1105–1121
- Elfenbein, D. W., & Knott, A. M. (2015). Time to Exit: Rational, Behavioral, and Organizational Delays: Rational, Behavioral, and Organizational Exit Delays, *Strategic Management Journal*, vol. 36, no. 7, pp.957–975
- European Patent Office, E. P. (2018). Annual Report 2018, Available Online: <https://www.epo.org/about-us/annual-reports-statistics/annual-report/2018.html> [Accessed 30 March 2021]
- European Union. (1993). Council Directive 93/42/EEC of 14 June 1993 Concerning Medical Devices, vol. OJ L, no. 169, Available Online: <http://data.europa.eu/eli/dir/1993/42/oj/eng> [Accessed 25 March 2021]
- Fang, I.-C., Chen, P.-T., Chiu, H.-H., Lin, C.-L., & Su, F.-C. (2020). Establishing the Digital Transformation Strategies for the Med-Tech Enterprises Based on the AIA-NRM Approach, *Applied Sciences*, vol. 10, no. 21:7574, pp.1–21

- Figueiredo, R. J. P., Feldman, E. R., & Rawley, E. (2019). The Costs of Refocusing: Evidence from Hedge Fund Closures during the Financial Crisis, *Strategic Management Journal*, vol. 40, no. 8, pp.1268–1290
- Fink, S. (1986). *Crisis Management: Planning for the Inevitable*, New York, NY: American Management Association
- Fortune Business Insights. (2021). Medical Devices Market Size, Share, Trends Analysis Report 2018-2025, Available Online: <https://www.fortunebusinessinsights.com/industry-reports/medical-devices-market-100085> [Accessed 23 March 2021]
- Gartenberg, C., & Pierce, L. (2017). Subprime Governance: Agency Costs in Vertically Integrated Banks and the 2008 Mortgage Crisis: Agency Costs in Vertically Integrated Banks and the 2008 Mortgage Crisis, *Strategic Management Journal*, vol. 38, no. 2, pp.300–321
- Geroski, P. A., Mata, J., & Portugal, P. (2010). Founding Conditions and the Survival of New Firms, *Strategic Management Journal*, vol. 31, no. 5, pp.510–529
- Gkeredakis, M., Lifshitz-Assaf, H., & Barrett, M. (2021). Crisis as Opportunity, Disruption and Exposure: Exploring Emergent Responses to Crisis through Digital Technology, *Information and Organization*, vol. 31, no. 1
- Gourinchas, P.-O., Kalemli-Özcan, Şebnem, Penciakova, V., & Sander, N. (2020). COVID-19 and SME Failures, *NBER Working Paper Series*, working paper, no. 27877, Cambridge, MA: National Bureau of Economic Research, Available online: <http://www.nber.org/papers/w27877.pdf> [Accessed 3 May 2021]
- Guo, H., Yang, Z., Huang, R., & Guo, A. (2020). The Digitalization and Public Crisis Responses of Small and Medium Enterprises: Implications from a COVID-19 Survey, *Frontiers of Business Research in China*, vol. 14, no. 19, pp. 1–25
- Hall, W. K. (1980). Survival Strategies in a Hostile Environment, *Harvard Business Review*, vol. 58, no. 5, pp.75–85
- Haunschild, P. R., & Sullivan, B. N. (2002). Learning from Complexity: Effects of Prior Accidents and Incidents on Airlines' Learning, *Administrative Science Quarterly*, vol. 47, no. 4, pp.609–643
- Heiß, G. (2018). Investigating Sme's Strategic Approach in the Context of Internationalization and Organizational Capabilities in the German Medtech Industry, *International Journal of Sales, Retailing & Marketing*, vol. 7, no. 2, pp.50–62



- Helfat, C. E. (1997). Know-How and Asset Complementarity and Dynamic Capability Accumulation: The Case of R&D, *Strategic Management Journal*, vol. 18, no. 5, pp.339–360
- Herbane, B. (2010). Small Business Research: Time for a Crisis-Based View, *International Small Business Journal*, vol. 28, no. 1, pp.43–64
- Heritage, J. (1984). Garfinkel and Ethnomethodology, Cambridge, Massachusetts, USA: Polity Press
- Hermann, C. F. (1963). Some Consequences of Crisis Which Limit the Viability of Organizations, *Administrative Science Quarterly*, vol. 8, no. 1, pp.61–82
- Hickman, J. R., & Crandall, W. (1997). Before Disaster Hits: A Multifaceted Approach To Crisis Management, *Business Horizons*, vol. 40, no. 2, pp.75–79
- Hofer, C. W. (1980). Turnaround Strategies, *Journal of Business Strategy*, vol. 1, no. 1, pp.19–31
- Hong, P., Huang, C., & Li, B. (2012). Crisis Management for SMEs: Insights from a Multiple-Case Study, *International Journal of Business Excellence*, vol. 5, no. 5, pp.535–553
- Irvine, W., & Anderson, A. R. (2004). Small Tourist Firms in Rural Areas: Agility, Vulnerability and Survival in the Face of Crisis, *International Journal of Entrepreneurial Behavior & Research*, vol. 10, no. 4, pp.229–246
- James, E. H., Wooten, L. P., & Dushek, K. (2011). Crisis Management: Informing a New Leadership Research Agenda, *Academy of Management Annals*, vol. 5, no. 1, pp.455–493
- Javaid, M., Haleem, A., Vaishya, R., Bahl, S., Suman, R., & Vaish, A. (2020). Industry 4.0 Technologies and Their Applications in Fighting COVID-19 Pandemic, *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, vol. 14, no. 4, pp.419–422
- Jin, Y. (2010). The Interplay of Organization Type, Organization Size, and Practitioner Role on Perceived Crisis Preparedness: A Cognitive Appraisal Approach, *Journal of Contingencies and Crisis Management*, vol. 18, no. 1, pp.49–54
- Juergensen, J., Guimón, J., & Narula, R. (2020). European SMEs amidst the COVID-19 Crisis: Assessing Impact and Policy Responses, *Journal of Industrial and Business Economics*, vol. 47, no. 3, pp.499–510

- Kaufman, H. (2008). How the Credit Crisis Will Change the Way America Does Business, *Wall Street Journal*, 6 December, Available Online: <https://www.wsj.com/articles/SB122852289752684407> [Accessed 25 April 2021]
- King, N. (2012). Doing Template Analysis, in G. Symon & C. Cassell (eds), *Qualitative Organizational Research: Core Methods and Current Challenges*, London: SAGE, pp.426–450
- King, N., & Brooks, J. M. (2017). *Template Analysis for Business and Management Students*, London: SAGE
- Kramer, D. B., Xu, S., & Kesselheim, A. S. (2012). How Does Medical Device Regulation Perform in the United States and the European Union? A Systematic Review, *PLOS Medicine*, vol. 9, no. 7, p.e1001276
- Kraus, S., Clauss, T., Breier, M., Gast, J., Zardini, A., & Tiberius, V. (2020). The Economics of COVID-19: Initial Empirical Evidence on How Family Firms in Five European Countries Cope with the Corona Crisis, *International Journal of Entrepreneurial Behavior & Research*, vol. 26, no. 5, pp.1067–1092
- Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Morales Reyes, C. A., Prochotta, A., Steinbrink, K. M., & Berger, E. S. C. (2020). Startups in Times of Crisis – A Rapid Response to the COVID-19 Pandemic, *Journal of Business Venturing Insights*, vol. 13, e00169
- Lampel, J., Shamsie, J., & Shapira, Z. (2009). Experiencing the Improbable: Rare Events and Organizational Learning, *Organization Science*, vol. 20, no. 5, pp.835–845
- Lévi-Strauss, C. (1966). *The Savage Mind*, Chicago: University of Chicago Press
- Lin, Y., & Wu, L.-Y. (2014). Exploring the Role of Dynamic Capabilities in Firm Performance under the Resource-Based View Framework, *Journal of Business Research*, vol. 67, no. 3, pp.407–413
- Linnenluecke, M. K. (2017). Resilience in Business and Management Research: A Review of Influential Publications and a Research Agenda: Resilience in Business and Management Research, *International Journal of Management Reviews*, vol. 19, no. 1, pp.4–30
- Madrid-Guijarro, A., García-Pérez-de-Lema, D., & Van Auken, H. (2016). Financing Constraints and SME Innovation during Economic Crises, *Academia Revista Latinoamericana de Administración*, vol. 29, no. 1, pp.84–106

- Makkonen, H., Pohjola, M., Olkkonen, R., & Koponen, A. (2014). Dynamic Capabilities and Firm Performance in a Financial Crisis, *Journal of Business Research*, vol. 67, no. 1, pp.2707–2719
- Martinelli, E., Tagliazucchi, G., & Marchi, G. (2018). The Resilient Retail Entrepreneur: Dynamic Capabilities for Facing Natural Disasters, *International Journal of Entrepreneurial Behavior & Research*, vol. 24, no. 7, pp.1222–1243
- Mayr, S., Mitter, C., & Aichmayr, A. (2016). Corporate Crisis and Sustainable Reorganization: Evidence from Bankrupt Austrian SMEs, *Journal of Small Business Management*, vol. 55, no. 1, pp.108–127
- McCaffery, F., Donnelly, P., Dorling, A., & Wilkie, F. G. (2004). A Software Process Development, Assessment and Improvement Framework, for the Medical Device Industry, in 4th International SPICE Conference on Process Assessment and Improvement, pp 100–109, Available online: <https://ulir.ul.ie/handle/10344/2153> [Accessed 27 March 2021]
- McHugh, M., McCaffery, F. & Casey, V. (2012). Changes to the International Regulatory Environment, *Journal of Medical Devices*, vol. 6, no. 2 (021004), pp.1–4
- Medtech Europe. (2020). MedTech Europe’s Facts and Figures 2020, Available Online: <https://www.medtecheurope.org/resource-library/medtech-europes-facts-and-figures-2020/> [Accessed 30 March 2021]
- Meyer, A. D. (1982). Adapting to Environmental Jolts, *Administrative Science Quarterly*, vol. 27, no. 4, pp.515–537
- Mitroff, I. I., Shrivastava, P., & Udwadia, F. E. (1987). Effective Crisis Management, *Academy of Management Perspectives*, vol. 1, no. 4, pp.283–292
- Mont, O., Curtis, S. K., & Voytenko Palgan, Y. (2021). Organisational Response Strategies to COVID-19 in the Sharing Economy, *Sustainable Production and Consumption*, vol. 28, pp.52–70
- Morse, J. M. (1991). Approaches to Qualitative-Quantitative Methodological Triangulation, *Nursing Research*, vol. 40, no. 2, pp.120–123
- Müller, R. (1985). Corporate Crisis Management, *Long Range Planning*, vol. 18, no. 5, pp.38–48
- Myers, K. N. (1993). Total Contingency Planning for Disasters: Managing Risk ... Minimizing Loss ... Ensuring Business Continuity, New York: Wiley

- Nagel, U., & Meuser, M. (2009). The Expert Interview and Changes in Knowledge Production, in A. Bogner, B. Littig, & W. Menz (eds), *Interviewing Experts*, New York: Palgrave Macmillan, pp.17–42
- Nangia, M., & Mohsin, Dr. F. (2020). Revisiting Talent Management Practices in a Pandemic Driven VUCA Environment - A Qualitative Investigation in the Indian IT Industry, *Journal of critical reviews*, vol. 7, no. 7, pp.937–942
- Nathan, M. (2000). The Paradoxical Nature of Crisis, *Review of Business*, vol. 21, no. 3/4, pp.12–16
- Ndofor, H. A., Vanevenhoven, J., & Barker, V. L. (2013). Software Firm Turnarounds in the 1990s: An Analysis of Reversing Decline in a Growing, Dynamic Industry: Research Notes and Commentaries, *Strategic Management Journal*, vol. 34, no. 9, pp.1123–1133
- OECD. (2018). Fostering Markets for SME Finance: Matching Business and Investor Needs, OECD SME and Entrepreneurship Papers, Vol. 6, Available Online: [https://www.oecd-ilibrary.org/economics/fostering-markets-for-sme-finance\\_0bd38639-en](https://www.oecd-ilibrary.org/economics/fostering-markets-for-sme-finance_0bd38639-en) [Accessed 2 May 2021]
- Oh, C. H., & Oetzel, J. (2011). Multinationals' Response to Major Disasters: How Does Subsidiary Investment Vary in Response to the Type of Disaster and the Quality of Country Governance?, *Strategic Management Journal*, vol. 32, no. 6, pp.658–681
- O'Regan, N., Ghobadian, A., & Galleary, D. (2006). In Search of the Drivers of High Growth in Manufacturing SMEs, *Technovation*, vol. 26, no. 1, pp.30–41
- Pacheco-de-Almeida, G. (2010). Erosion, Time Compression, and Self-Displacement of Leaders in Hypercompetitive Environments, *Strategic Management Journal*, vol. 31, no. 13, pp.1498–1526
- Pauchant, T. C., Mitroff, I., & Shrivastava, P. (1989). Crisis, Disaster, Catastrophe: Are You Ready?, *Security Management*, vol. 33, no. 2, pp.101–108
- Pearce, J. A., & Robbins, K. (1993). Toward Improved Theory and Research on Business Turnaround, *Journal of Management*, vol. 19, no. 3, pp.613–636
- Pearson, C. M., & Clair, J. A. (1998). Reframing Crisis Management, *Academy of Management Review*, vol. 23, no. 1, pp.59–76
- Pearson, C. M., & Mitroff, I. I. (1993). From Crisis Prone to Crisis Prepared: A Framework for Crisis Management, *Academy of Management Perspectives*, vol. 7, no. 1, pp.48–59

- Penrose, J. M. (2000). The Role of Perception in Crisis Planning, *Public Relations Review*, vol. 26, no. 2, pp.155–171
- Porter, M. E. (1976). Please Note Location of Nearest Exit: Exit Barriers and Planning, *California Management Review*, vol. 19, no. 2, pp.21–33
- Preble, J. F. (1997). Integrating the Crisis Management Perspective into the Strategic Management Process, *Journal of Management Studies*, vol. 34, no. 5, pp.769–791
- Quarantelli, E. L. (2005). Catastrophes Are Different from Disasters: Some Implications for Crisis Planning and Managing Drawn From Katrina, working paper, Disaster Research Center, University of Delaware, Newark
- Ren, C. R., Hu, Y., & Cui, T. H. (2018). Responses to Rival Exit: Product Variety, Market Expansion, and Preexisting Market Structure, *Strategic Management Journal*, vol. 40, no. 2, pp.253–276
- Reymen, I. M. M. J., Andries, P., Berends, H., Mauer, R., Stephan, U., & Burg, E. van. (2015). Understanding Dynamics of Strategic Decision Making in Venture Creation: A Process Study of Effectuation and Causation, *Strategic Entrepreneurship Journal*, vol. 9, no. 4, pp.351–379
- Richardson, B. (1994). Socio-technical Disasters: Profile and Prevalence, *Disaster Prevention and Management: An International Journal*, vol. 3, no. 4, pp.41–69
- Rico, M., & Puig, F. (2019). Successful Turnarounds in Bankrupt Firms? Assessing Retrenchment in the Most Severe Form of Crisis, *BRQ Business Research Quarterly*, vol. 22, no. 4, pp.1–14
- Robbins, D. K. & Pearce, J. A. (1992). Turnaround: Retrenchment and Recovery, *Strategic Management Journal*, vol. 13, no. 4, pp.287–309
- Runyan, R. C. (2006). Small Business in the Face of Crisis: Identifying Barriers to Recovery from a Natural Disaster, *Journal of Contingencies and Crisis Management*, vol. 14, no. 1, pp.12–26
- Saunders, M. N. K., Lewis, P., & Thornhill, A. (2016). Research Methods for Business Students, 7th edn, New York: Pearson Education
- Sharma, N. (2020). COVID-19: Challenges and Opportunities for Small and Medium Enterprises (SMEs), SSRN, pp.1–29 Available Online: <https://www.ssrn.com/abstract=3650473> [Accessed 3 May 2021]

- Simón-Moya, V., Revuelto-Taboada, L., & Ribeiro-Soriano, D. (2016). Influence of Economic Crisis on New SME Survival: Reality or Fiction?, *Entrepreneurship & Regional Development*, vol. 28, no. 1–2, pp.157–176
- Smallbone, D., Deakins, D., Battisti, M., & Kitching, J. (2012). Small Business Responses to a Major Economic Downturn: Empirical Perspectives from New Zealand and the United Kingdom, *International Small Business Journal: Researching Entrepreneurship*, vol. 30, no. 7, pp.754–777
- Smith, D. (1990). Beyond Contingency Planning: Towards a Model of Crisis Management, *Industrial Crisis Quarterly*, vol. 4, no. 4, pp.263–275
- Spillan, J., & Crandall, W. (2002). Crisis Planning in the Nonprofit Sector: Should We Plan for Something Bad If It May Not Occur?, *Southern Business Review*, vol. 27, no. 2, pp.18–29
- Spillan, J., & Hough, M. (2003). Crisis Planning in Small Businesses: Importance, Impetus and Indifference, *European Management Journal*, vol. 21, no. 3, pp.398–407
- Starbuck, W. H. (2009). Cognitive Reactions to Rare Events: Perceptions, Uncertainty, and Learning, *Organization Science*, vol. 20, no. 5, pp.925–937
- Statista. (2021). Coronavirus: The Pharma and Medtech Response, *Statista*, Available Online: <https://www.statista.com/statistics/325809/worldwide-medical-technology-revenue/> [Accessed 23 March 2021]
- Stieglitz, N., Knudsen, T., & Becker, M. C. (2016). Adaptation and Inertia in Dynamic Environments: Adaptation and Inertia, *Strategic Management Journal*, vol. 37, no. 9, pp.1854–1864
- Swedish Medtech. (2021). About Swedish Medtech, Available Online: <https://www.swedishmedtech.se/sidor/about-swedish-medtech.aspx> [Accessed 26 March 2021]
- Teece, D. J. (2007). Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance, *Strategic Management Journal*, vol. 28, no. 13, pp.1319–1350
- Teece, D. J. (2018). Business Models and Dynamic Capabilities, *Long Range Planning*, vol. 51, no. 1, pp.40–49
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management, *Strategic Management Journal*, vol. 18, no. 7, pp.509–533

- Thorgren, S., & Williams, T. A. (2020). Staying Alive during an Unfolding Crisis: How SMEs Ward off Impending Disaster, *Journal of Business Venturing Insights*, vol. 14, p.e00187
- Thornhill, S., & Amit, R. (2003). Learning About Failure: Bankruptcy, Firm Age, and the Resource-Based View, *Organization Science*, vol. 14, no. 5, pp.497–509
- Tyre, M. J., & Orlikowski, W. J. (1994). Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations, *Organization Science*, vol. 5, no. 1, pp.98–118
- Ucaktürk, A., Bekmezci, M., & Ucaktürk, T. (2011). Prevailing During the Periods of Economical Crisis and Recession through Business Model Innovation, *Procedia - Social and Behavioral Sciences*, vol. 24, pp.89–100
- Vlčková, J. (2019). SMEs in Medical Technology Global Production Networks: The Case of Czechia, *Society and Economy*, vol. 41, no. 1, pp.65–86
- Vlckova, J., & Thakur-Weigold, B. S. (2019). Global Value Chains in the MedTech Industry: A Comparison of Switzerland and the Czech Republic, *International Journal of Emerging Markets*, vol. 15, no. 1, pp.70–92
- Waldkirch, A. (2021). Firms around the World during the COVID-19 Pandemic, *Journal of Economic Integration*, vol. 36, no. 1, pp.3–19
- Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review, *MIS Quarterly*, vol. 26, no. 2, pp.xiii–xxiii
- Weick, K. E. (1988). Enacted Sensemaking in Crisis Situations, *Journal of Management Studies*, vol. 25, no. 4, pp.305–317
- Wenzel, M. (2015). Path Dependence and the Stabilization of Strategic Premises: How the Funeral Industry Buries Itself, *Business Research*, vol. 8, no. 2, pp.265–299
- Wenzel, M., Stanske, S., & Liebermann, M. B. (2020). Strategic Responses to Crisis, *Strategic Management Journal*, vol. 42, no. 2, pp.V7-V18
- West, N. E. J., Cheong, W.-F., Boone, E., & Moat, N. E. (2020). Impact of the COVID-19 Pandemic: A Perspective from Industry, *European Heart Journal Supplements*, vol. 22, pp.56–59
- Williams, T. A., Gruber, D. A., Sutcliffe, K. M., Shepherd, D. A. & Zhao, E. Y. (2017). Organizational Response to Adversity: Fusing Crisis Management and Resilience Research Streams, *Academy of Management Annals*, vol. 11, no. 2, pp.733–769

- World Health Organization. (2021). Health Technology Assessment, Available Online: <https://www.euro.who.int/en/health-topics/Health-systems/health-technologies-and-medicines/policy-areas/health-technology-assessment> [Accessed 26 March 2021]
- Xia, J., Dawley, D. D., Jiang, H., Ma, R., & Boal, K. B. (2016). Resolving a Dilemma of Signaling Bankrupt-Firm Emergence: A Dynamic Integrative View, *Strategic Management Journal*, vol. 37, no. 8, pp.1754–1764
- Yin, R. K. (2009). *Case Study Research: Design and Methods*, 4th edn, London: SAGE
- Zakery, A., & Saremi, M. S. (2020). Knowledge and Intellectual Capital in Internationalizing SMEs, Case Study in Technology-Based Health Companies, *Journal of Intellectual Capital*, vol. 22, no. 2, pp.219–242



# Appendix A

Clustering Master Thesis - Medtech SMEs										
Company	SMEs (Below 250)	Contacted	Agreed for an interview	Potential Case = (6) convergence products	(1) disposables or high-volume commodities	(2) surgical and medical instruments	(3) therapeutic devices	(4) capital equipment	(5) integrated solutions	(6) convergence products
Medtech X	Yes	Yes					x			x
Medtech X	Yes	Yes								
Medtech X	No					x				
Medtech X	Yes									
Medtech X	No									
Medtech X	No									
Medtech X	Yes					x	x			
Medtech X	Yes						x			
Medtech X	Yes									x
Medtech X	Yes				x					
Medtech X	No									
Medtech SME 2	Yes	Yes	Yes							x
Medtech X	No									
Medtech X	No									
Medtech X	No									
Medtech X	Yes	Yes								x
Medtech X	Yes					x				
Medtech X	Yes					x				
Medtech X	Yes				x					
Medtech X	Yes					x				
Medtech X	No									
Medtech X	Yes	Yes								x
Medtech SME 4	Yes	Yes	Yes							x
Medtech X	Yes	Yes								x
Medtech X	Yes	Yes						x		
Medtech SME 1	Yes	Yes	Yes							x
Medtech X	Yes				x					
Medtech X	Yes						x			
Medtech X	No									
Medtech SME 5	Yes	Yes	Yes							
Medtech X	Yes							x		
Medtech X	Yes				x					
Medtech X	Yes								x	
Medtech X	No									
Medtech SME 3	Yes	Yes	Yes							x

# Appendix B

## Questionnaire | Semi-structured Interview

- Shortly introduce us to your core business model

### **Block 1: Pre-Crisis**

1. How do you prepare for crises?
  - a. Do you have a formal way of handling crises from a pre-crisis perspective?
2. How does your firm identify any potential crises before they occur?
  - a. Does/did your firm systematically examine the causes of this crisis before it came? If so, how? What did you do? In what capacity?
3. Looking back at the pre-corona times, how was your company prepared/or not prepared for Covid-19?

### **Block 2: Crisis-Event**

4. How has the Covid-19 crisis impacted your business?
5. How does/did your firm respond strategically to the Covid-19 crisis?
  - a. E.g., cutting project budget, looking for new suppliers or markets, public relationship, or lay-offing people, strategic alliances, cutting costs,...
6. When was your first strategic response to the Covid-19 pandemic?
7. How has Covid-19 accelerated opportunities or threats for your company?
  - a. Innovations, regulations, processes, clinical studies,...
8. How has Covid-19 changed your organization's strategy? If so, in which way?
  - a. How big was the impact of Covid-19 on your business?
9. What in your business model do you think have helped you to deal with the crisis?
  - a. E.g. would you say that your digitized business model prepared your company for the Covid-19 crisis? If so, why and how?

### **Block 3: Post-Crisis (Outlook)**

10. How will the pandemic impact the future strategy of the company?
  - a. E.g. keep new strategy or return to previous strategy after the crisis
  - b. Will your firm make any modifications in your product, process, market position, or even business model?
11. Do you recognize any future opportunities or threats for your specific business that have been created by the pandemic?
12. What are your key lessons learned for your company from the Covid-19 crisis?
  - a. How do you reflect on the Covid-19 crisis?
  - b. Do you assess your learnings? How?

# Appendix C

## Template after Data Analysis Process

Pre-Crisis	Characteristics	Age
		Size
		Financial Resources
	Crisis-Preparation	Proactive
		Reactive
Crisis-Event	Strategic Responses	Retrenchment
		Persevering
		Innovating
		Exit
		Collaborations
		Financing
	Impact of COVID-19	Digitalization
		Mindset
		Clinical Trials
	Post-Crisis	Recovery / Learning
Future of Work		