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Drivers of health-tech innovation in Region Skåne

Nicole Skoglund

ni3481sk-s@student.lu.se

Abstract: In direct comparison with other industries, technological innovations are slow to diffuse within the healthcare sector. Scholars estimate that the failure rate of implementing innovation within healthcare organizations range between 30% to 90%. This poses a question as to why the healthcare sector is lagging in the adoption of new technologies. This thesis examines the micro-, industry-level-, technological system level and macro- driving forces of technological innovations in the healthcare industry of Region Skåne during the period 2018 and forward. A case study containing semi-structured interviews was conducted on six professionals working on a regional technical innovation project in southern Sweden, namely, Sweden's Digital Healthcare System (SDV). The case study's findings reveal how healthcare innovations have been the creative response to positive driving forces, for instance strong top-down management, and negative driving forces, such as the COVID-19 and organizational problems. Negative transformation pressure on the micro-level, such as the burn out of healthcare workers and the administrative overload faced by healthcare workers, also played an instrumental role in driving SDV forward in promise of increased efficiency. Additionally, opportunities such as potential complementary innovations (eg. AI solutions, big data for population health control, integrating pre-existing medical technologies) drive the innovation forward. Findings reveal that the strategic decisions which managers take is paramount to innovation success, often having the ability to mold which innovational complementarities can be leveraged to help shape the trajectory of pre-existing technologies for the better.

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Abbreviations

AI	Artificial Intelligence
COVID-19	Corona Virus Disease of 2019
EHR	Electronic Healthcare Record
ML	Machine Learning
S&T	Science & Technology
SDG	Sustainable Development Goal
SDV	Skåne's Digitala Vårdsystem (Skåne's Digital Healthcare System)
TFP	Total Factor Productivity

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1 Introduction

1 out of 4 Swedes are projected to be 65 years or older by 2040 (Swedish Institute, 2021). Amongst many other developed countries, Sweden is facing turbulence in their healthcare system due to an aging population. Additionally, life expectancy in Sweden is amongst the highest in the world (Swedish Institute, 2021). The tax-funded welfare state encounters increased pressure, as it promises to provide healthcare for all Swedish citizens. Therefore, Sweden must begin to prepare for a future where their elderly abundant population can be supported. Although Sweden's healthcare system ranks high on cross-country comparisons of population health, health outcome measures and the quality of care, it surprisingly ranks low on indicators for technical efficiency (Anell, Glenngård & Merkur, 2012; Tchouaket, Lamarche, Goulet & Contandriopoulos, 2012). Concurrently, Sweden is at the forefront of innovation, being known as one of the most advanced countries in terms of displaying innovative practices, as indicated by high ranks in Science and Technology (S&T) indicators via OECD and Eurostat (Chaminade, Zabala & Treccani, 2010). This calls for exploration as to why technical efficiency is low in Sweden's healthcare sector and what may help drive technological innovations within the healthcare sector.

Kim, Gaukler & Lee (2016) suggest that, in direct comparison with other industries, new technology and innovation is slow to adapt within the healthcare sector. Jacobs, Weiner, Reeve, Hofmann, Christian & Weinberger (2015) estimate that the failure rate of implementing innovation within healthcare organizations range between 30% to 90%. This poses a question as to why the healthcare sector is lagging in the adoption of new technologies in Sweden and if this is deemed a continuing trend post-pandemic. One explanation supporting the notion of the healthcare industry being slow adopters of new technologies is related to the fact that healthcare organizations have difficulty in managing innovation within such a large system (Boer & During, 2001; Damanpour & Gopalakrishnan, 2001; Dougherty & Dunne, 2011; Francis & Bessant, 2005; Kim, Gaukler & Lee, 2016). Other scholars such as Barlow (2016) emphasize that, although innovations have the potential to tackle existing challenges, they often catalyze new challenges and can reinforce a vicious cycle of unforeseeable circumstances, such as issues in creating, implementing, embedding or sustaining innovation in healthcare.

Paradoxically, Swedes are amongst the quickest in the world to embrace new technologies and applications (Chaminade, Zabala & Treccani, 2010). Nonetheless, healthcare quality is a major driver for innovation and improvement of social ecosystems (Kim, Gaukler & Lee, 2016). If technology has the potential to help provide quality healthcare and produce more innovations (whether the latter is for the better or for the worse is another question), it is crucial to understand what drives innovation. Additionally, citizens of Sweden are extremely reliant on their public healthcare system, therefore it is crucial to not only protect, but to ensure that there

exists a steady positive development of the Swedish social safety net. It is vital to advance the healthcare system and make it more efficient in order to support Swedish citizens.

One of the largest challenges the healthcare industry is facing in contemporary society has to do with how to increase the quality and effectiveness of the healthcare sector. If innovations have the possibility to combat larger issues which exist in society, such as the inefficiency of the healthcare sector, then they need to be understood and leveraged to tackle such issues. In this way actors are able to have more control and guidance over the developments of innovations in the healthcare sector.

Furthermore, this thesis makes use of a conceptual framework on *drivers of innovation* that clarifies what enables innovation, but also what factors affect the directionality of innovation and which factors help incentivize individuals to innovate. Innovation is not only about the creation of inventions but also about their diffusion to society (Abi Younes, Ayoubi, Ballester, Cristelli, de Rassenfosse, Foray, Gaule, Pellegrino, van den Heuvel, Webster & Zhou, 2020). Ensuring a comprehensive diffusion takes particular significance as it translates directly into saved lives and economic growth (Abi Younes et al., 2020). It is obvious that the impact of the COVID-19 crisis has put pressure on healthcare systems and lagged the development of the United Nation's SDGs. As innovations tend to carry some form of promise, whether it be in the form of productivity or some form of societal transformation, it is paramount to understand what steers innovations which are in support of regional, national and global goals.

Thus, with the goal of identifying the driving forces in the adoption of new technology within Sweden's healthcare sector, this paper is supported with an exploratory case study. Semi-structured interviews have been conducted on stakeholders within Region Skåne's healthcare sector working on a specific project, namely Sweden's Digital Healthcare system (SDV), a technological innovation which aims to increase the efficiency of Skåne Region's healthcare sector through a cloud-based Electronic Healthcare Record (EHR) system (Region Skåne, 2021). In order to understand and control the directionality of such needed future innovations, this thesis timely analyses the drivers of SDV.

A large body of literature covers why innovation in healthcare services and policy is critical (Barlow, 2016, p. 2). Nevertheless, few case studies have captured the Scandinavian perspective of innovation in healthcare in times of crisis. As divergent views exist on the drivers of innovation within healthcare, divergent views on how innovation flourishes will naturally persist (Akenroye, 2012). Additionally, the unique nature of Sweden's environment must also be considered since, as in every case, it is dependent on a unique set of elements such as users, markets, technology, science institutions, political regulations, society and culture. This case study offers insights into healthcare innovation drivers within the Swedish context, which is publicly financed on a taxation basis and covers the entire population. Whilst healthcare is a global phenomenon, healthcare systems are organized in different ways around the world due to the differences in organization between people, institutions, resources and other stakeholders. In order to leverage innovation to societies' advantage, it is crucial to gain a comparative perspective and understand which factors drive innovations in different parts of the world.

1.1 Research Problem

The Swedish welfare state is built upon a strong social consensus favoring extensive state intervention to ensure all Swedish citizens have a high-quality life (Thakur, Cerra, Horváth & Keen, 2003). As innovation has the potential to raise the quality and effectiveness of healthcare (Barlow, 2016), it is crucial to understand such innovations and steer them towards greater society. At the same time, there exists a notion that innovation within the healthcare sector is lagging compared to other industries (Kim, Gaukler & Lee, 2016). Thus, this piece aims to investigate which driving forces are enabling the development of the technological innovations within Sweden's healthcare sector. In order to understand the driving forces of technological innovation within Sweden's healthcare sector, a case study will assist in answering the main research question:

RQ: What drives the development of technological innovations in Region Skåne's healthcare sector?

Two smaller sub-questions will support the previously mentioned overarching research question, as it breaks the research question into manageable pieces:

SQ1: What opportunities do stakeholders perceive from the development of technological innovations?

SQ2: How are technological innovations in healthcare shaped by crisis?

1.2 Innovation in Healthcare Case Study: Skåne's Digital Healthcare System (SDV)

Region Skåne, the county of Scania located in southern Sweden, is the first in Sweden to develop a modern digital healthcare system that makes use of a private cloud-based technology in order to optimize the healthcare system. Under a five-year-plan, 1,706 million SEK investments were generated to develop Skåne's Digital Healthcare System (SDV), a newly procured tool and private-cloud for patients' electronic health records (EHR) (Region Skåne, 2021). SDV is developed by several healthcare workers through Region Skåne, together with procurement actors from Cerner Corporation, an American supplier of health information technologies.

Region Skåne's visions are in line with Sweden's national goal to become a world leader in e-health by 2025 (Blix & Levay, 2018). The implementation of innovation and social changes have the potential to increase the healthcare sector quality performance, which is currently deemed by scholars as inadequate in both developing and developed countries (Kim, Gaukler & Lee, 2016). Together with procurement professionals at Cerner Corporation, Region Skåne

is spearheading the digitization initiative through project SDV, which since 2017 has aimed to connect healthcare throughout the county of Skåne with common working methods. Region Skåne is set to fully implement SDV by 2022, where the technical platform consists of a new patient record system, the expansion of infrastructure connectivity (mobile devices, medical devices and imaging) as well as the implementation of preventative tools via algorithms.

This case study aims to focus on why SDV became an innovation and which factors drive the development of the cloud-system and other potential complementary innovations. Additionally, this paper examines to what extent the coronavirus crisis can be seen as an inflection point for a technological revolution within Sweden's healthcare system, with Skåne as a starting point. By scoping into the relationship between technology and economic development, it timely analyses the role of stakeholders in promoting healthcare innovation during crisis, exploring how these stakeholders play an active role in unleashing innovation where it is needed the most - within the healthcare sector.

2 Theory

Developed countries are faced with the challenge of providing quality healthcare to an aging population, while countries with developing health systems must find a suitable way of ensuring their populations are provided with access to healthcare (Barlow, 2016). Innovation is essential to meeting these challenges, although they have the possibility of catalyzing new challenges (Barlow, 2016). Thus, it is crucial to understand the management of healthcare innovation and locate which drivers help the development of technological innovations. This section captures previous literature, research on the drivers of innovation within the healthcare sector and introduces relevant theoretical frameworks which pertain to the research topic.

2.1 Previous Research

Innovation in healthcare remains a complex topic with a heavy body of literature, having been researched from several angles. This section will cover the academic contributions made by previous scholars. The studies identified contribute to the enhancing and enrichment of this thesis research as it provides solid ground and substantial information on the potential drivers of innovation in the Swedish context. Nevertheless, it should be noted that the researcher is aware of the complexities of the studies and to what degree generalizations can or cannot be made. Thus, they are understood as contextual historical processes which may illuminate a few possible recurring drivers which will assist in understanding the drivers of innovation in the case of SDV.

2.1.1 Innovation in Economic Thought

Over the past fifty years, our understanding of innovation and its determinants has become richer, more detailed and refined (Martin, 2012; Dodgson, Gann & Phillips, 2013). Joseph Schumpeter (1954), one of the most prominent economists in the history of economic thought of innovation, captures the dual role of innovation in economics through his famous statement on *creative destruction*, "[the] process of industrial mutation … that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of creative destruction is the essential fact of capitalism" (Swann, 2014, p. 11; Schumpeter, 1954, p. 83).

Acknowledging that creating something can lead to the destruction of something else, the idea of creative destruction lends itself to the trajectory of many innovations and positions itself

differently from the conventional view within neoclassical economics, which insists capitalist competition as the main driver of innovation (Swann, 2014, p. 12). This illuminates that innovation is dynamic and goes through a process of industrial mutation that incessantly revolutionizes the economic structure from within.

One of Schumpeter's (1947) greatest contributions to innovation and economic history was the distinction between *creative response* and *adaptive response* as a response to a firms' environment. Creative response recognizes the measures taken outside of a firms existing practices whilst adaptive response implies taking measures within existing practices (Schumpeter, 1947, p. 150) Ultimately, Schumpeter (1947) clearly makes a distinction between different kinds of reactions to changes in the environment, so when a firm or industry does something that is outside of the range of existing practices, it is creative response which is being spoken of.

Several scholars have distinguished between *local search* and *distant search* in the process of innovation (Verspagen, 2009; Rosenkopf & Nerkar, 2001; Benner & Tushman, 2003; He & Wong, 2004; Katila & Ahuja, 2002; Greve, 2007; Taalbi, 2014). Local search refers to the exploitation of nearby solutions whilst distant search refers to the exploration of, as Schumpeter put it, "new combinations". Verspagen (2009) defines local search as, "[when] firms search for new, yet undiscovered techniques, each of which has a probability of being discovered which linearly declines with technological distance from their current technology" (Verspagen, 2009, p. 13).

Local search is often attributing to March's (1991) idea of firm *exploitation*, as opposed to *exploration* which can be attributed to distant search. Exploration includes things captured in distant search, requiring the departure from existing skills and capabilities by engaging in terms related to "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March, 1991; Benner and Tushman, 2003; Hoffman and Hegarty, 1993; Alexiev et al., 2010). March (1991) argues that adaptive responses, through refining exploitation more rapidly than exploration, are likely to become effective in the short run but self-destructive in the long run.

Several scholars also support Schmookler's (1962) statement on how firms only search for these new combinations when there is reason to believe that the returns on the innovation exceed the costs of the search (Schmookler, 1962, p. 19; Taalbi, 2014). Alexiev et al. (2010) revealed that distant search plays an important role in orchestrating organizational reorientations (Tushman & Rosenkopf, 1996; Virany, Tushman & Romanelli, 1992), new product launches (Boeker, 1997; Ciborra, 1996; Eisenhardt & Tabrizi, 1995; Song & Montoya-Weiss, 1998) and changes in R&D strategies (Kor, 2006). This paper covers what forces drive stakeholders to seek technological innovation through distant search and underpins how globalization plays an active role in this search process.

Additional literature examines the role of interaction between relevant stakeholders in the innovation process. Nelson & Winter (1982) recognized the richness of increasing concentration in a single domain as well as understanding the dynamics between actors and

drivers. Winter (1984) suggests that exogenous technological opportunities are a source of change for firms which struggle to increase productivity, although these opportunities may be costly and uncertain. Acknowledging the mechanisms of evolutionary models of technical change and market structure, Nelson & Winter (1982) introduced the conceptual framework of *technological regimes* which are defined as, "shared cognitive routines in an engineering community and explained patterned development along technological trajectories" (Geels & Schot, 2007). Heavily influenced by Sociology of Technology, the technological regimes include any actors which are contributing to the broader development of the technological regime – such as scientists, policy makers, users and special interest groups (Geels & Schot, 2007; Bijker, 1995).

Nevertheless, it is important to highlight that both exogenous and endogenous factors may influence the growth and direction of innovation. Whilst exogenous variables are determined outside of the firms influence, by outer agents, endogenous variables are determined within the firms' sphere. Solow (1956) assumes that technological change is an exogenous phenomenon which contributes to economic growth. By locating the total factor productivity (TFP), one is able to conceptualize the impact of technological change on productivity growth. On the other hand, Romer (1990) argues that exogenous factors are the traditional answer to growth and productivity, illuminating how endogenous factors such as R&D and policy decisions can assist in the implementing of optimal innovations which in turn stir productivity and growth.

North (1989) and Acemoglu & Robinson (2012) illuminate the important role of another endogenous variable – institutions, arguing that institutions are moldable and are subject to change based on a systems' political, social and economic desires. Nevertheless, their research has been critiqued by other scholars such as Haider, Kunst & Wirl (2020) for failing to facilitate an explanation on how the first industrial revolution transformed economies which had been stagnant into forever growing ones (eg. England). This question is reinforced in contemporary economics when observing the unprecedented expansion and growth of China and the Asian Tigers (Haider, Kunst & Wirl, 2020). Thus, it is crucial to understand which factors stir productivity across countries, industries and time.

2.1.2 Innovation in Healthcare

Sweden is one of the world's most advanced countries in terms of displaying innovative practices, as showcased by high ranking on Science & Technology indicators published by OECD and Eurostat (Chaminade, Zabala & Treccani, 2010). The country is relying heavily on R&D as indicated by R&D spending (Edquist & Lundvall, 1993). In 2008, Sweden spent 3.5% of its GDP on R&D whilst the OECD average R&D expenditure is 2.3% (OECD, 2020). Despite Sweden being a research & development (R&D) intensive country, the economic growth, productivity and competitiveness ranks lower than expected and has contributed to the idea of a *Swedish Paradox* (Chaminade, Zabala & Treccani, 2010).

By year 2030 it is estimated that more than one in five Swedish people will be over 65 (Swedish Institute, 2021). In order to adapt to these changes, innovations are needed to deliver public services with increased quality and efficiency, but also in work life in order to attain participation in the work force at a higher level and a longer working life. This is highlighted by the United Nation's Sustainable Development Goals (SDGs), where health, demographic change and wellbeing are defined as some of the most urgent societal challenges worldwide. Sweden's public sector highlights clear goals on how to contribute to developing innovate ways of meeting societal challenges, as can be symbolized by their expenditure on healthcare. For example, the department which deals with healthcare in Region Skåne received 37.2 billion SEK in 2020, an approximate increase by 930 million SEK compared to the prior year (Region Skåne, 2020). It is the highest level of funding received out of all the departments, although highly influenced by COVID-19. Another instance related to increased investments in the healthcare sector is depicted through Region Skåne's 1 billion SEK investment in the installment of SDV between 2017 and 2022.

Sweden's innovation strategy targets societal challenges, allowing for industries to integrate more smart, sustainable and inclusive growth (Regeringen, 2020). In 2018, Sweden had the third highest healthcare expenditure relative to GDP amongst EU Member States (Eurostat, 2020). Using a majority of tax money, Sweden's government is adopting technological innovations in order to reduce costs, improve quality, increase access and create innovations in healthcare (Länsisalmi, Kivimäki, Aalto & Ruoranen, 2006). At the same time, these healthcare systems are expected to support the increasing demographic structure of the population amongst many other challenges (Länsisalmi et al., 2006).

2.1.3 Innovation Challenges for Healthcare in the 21st Century

Why do we need to understand challenges in healthcare innovation? Despite the incredible advances made in healthcare over the last century, healthcare remains an underlying problem in developing and developed countries. Jacobs et al. (2015) estimate that the failure rate of implementing innovation within healthcare organizations range between 30% to 90%. Thus, in order to understand innovation drivers, innovations must be comparatively analyzed on a case-to-case basis in such a way that the analysis considers the nature of the environment of that particular innovation.

Barlow (2016) introduced two fundamental aspects as to why innovation is deemed problematic within the healthcare industry; firstly, due to the lack of diffusion of science and technology (S&T) innovations and secondly due to the challenges which innovation may bring about (Barlow, 2016, p. 1). The latter point takes a critical perspective on innovation, as it has the potential to benefit society but also introduces a vicious cycle of unforeseeable circumstances which may be a problem in itself. For example, issues in creating, implementing, embedding or sustaining innovation may become apparent in the diffusion process of innovations within healthcare. Even within the most advanced healthcare systems, research efforts and innovations

which make it into mainstream healthcare practices are highly disconnected (Barlow, 2016, p. 1).

Innovation challenges often derive from innovation itself. Although a large body of literature covers why innovation in healthcare services and policy is critical (Barlow, 2016, p. 2), few case studies exist within the Nordics. As divergent views exist on the drivers of innovation within healthcare, divergent views on how innovation flourishes will naturally persist (Akenroye, 2012). Additionally, the unique nature of the Swedish environment must also be considered since, as in every case, it is dependent on a unique set of elements such as user and markets, technology, science institutions, political regulations, as well as society and its culture.

This case study offers insights into healthcare innovation drivers within the Swedish context, which is publicly financed on a taxation basis and covers the entire population. Whilst healthcare is a global phenomenon, healthcare systems are organized in different ways around the world due to the differences in organization between people, institutions, resources and other stakeholders. Thus, it is crucial to gain a comparative perspective and understand which underlying issues exist for healthcare innovation in different parts of the world.

2.2 Theoretical Framework

Theoretical frameworks nurture a particular perspective, a set of selective lenses through which one looks at the world. This piece examines how healthcare innovations have been the creative response to positive driving forces, such as windows of opportunities, and negative driving forces, such as the COVID-19 pandemic, economic and organizational problems. The thesis explored these positive and negative *drivers of innovation* (Taalbi, 2014) on four different levels: the micro, the industry-level, technological system level and lastly, macro-level.

2.2.1 Driving Forces of Innovation

Historical debates persist as economic historians and evolutionary biologists ponder whether innovation occurs smoothly and gradually as opposed to in larger leaps. Whilst scholars basing their view on Darwin and Marshall comprehend economics of innovation as an evolutionary, progressive and smooth process, Mokyr (1990) saw innovation behaving through sudden outbursts and exemplifies these outbursts in conjunction with first Industrial Revolution, where many innovations did not have an evolutionary and smooth trajectory (Mokyr, 1990, p. 352).

Instead, Mokyr (1990) interprets innovation as a nonlinear process which cannot be characterized in a stable manner – but through eureka, the sudden and unprecedented eruption of ideas and solutions to problems. Economic historians illuminate that the Industrial Revolution was shaped by a cascade effect of development blocks and entire technological systems, as technologies are subject to spillover effects where innovations act like trees'

branching out and co-evolving with other technologies, institutions and actors (Nelson, 1994, 2001; Taalbi, 2014).

Dahmén (1988) acknowledged that innovation occurred in a paradoxical manner, as revealed in his statement "its center somewhere between two extreme situations" (Dahmén, 1988, p. 138). Mokyr (1990) has addressed the hardship of explaining macro-innovations as they often go against the nature of law and order. With intention to comprehend how innovation flourishes, it is crucial to understand the drivers of innovation processes on several levels. One must comprehend what makes people, firms, users and other relevant actors innovate.

Thus, one of the largest quests of innovation studies is to understand the root of innovative behavior, to comprehend how innovation flourishes. Taalbi (2014) created a conceptual framework, which functions like an organizing device, differentiating between positive and negative drivers of innovation as well as different levels of context. Whilst positive driving forces are characterized by opportunities, negative driving forces are inspired by Dahmén (1988) and are denoted as a "strongly felt necessity to adjust and adapt" (Taalbi, 2014; Dahmén, 1988).

As this thesis aims to capture factors which influence SDV, the drivers of innovation framework will create conceptual clarity and help locate which factors enable innovation. The definition of "drivers" has, in this case, been defined as any wider drivers such as factors which affect the directionality of innovation, factors which incentivize people to innovate and factors which assist innovation in their diffusion process. It should be noted that this definition takes a different interpretation of Taalbi's (2014) driving forces as it does not only consider factors which drive agents to innovate, but also what drives these individuals to continue this innovation process in their strive for innovation diffusion. This is operationalized by gaining an in depth and comprehensive perspective of the entire innovation process through the eyes of SDV agents.

The framework's distinction between positive and negative driving forces is inspired by Dahmén, that distinguished between positive and negative transformation pressure. The levels of drivers are micro-level, industry-level, technological system level and macro level, all which are considered for both negative and positive drivers. Thus, the driving forces take creative response into consideration, as well as the notion that there exist opportunities on different levels in the form of positive opportunities and negative transformation pressure (Taalbi, 2020; Dahmén, 1988; Schumpeter 1947).

2.2.2 Negative Driving Forces

In modelling innovation as a response to negative driving forces, one is able to capture the negative transformation pressure – the conflict between the old and the new, such as declining profits or a strongly felt necessity to adjust and adapt (Taalbi, 2014; Dahmén, 1988). Negative driving forces, also known as negative performance feedback (Greve, 2003a) and failure induced innovation (Antonelli, 1989), are derived from pressure and thus problems. With

origins in the behavioral theory of the firm, negative driving forces can be accounted for when actors cannot profit maximize but instead are satisficing. Negative drivers of innovation can be related to economic of the firm, such as a lack of profit, but also other factors such as lack of meeting customer satisfaction or lack of meeting environmental goals.

This negative transformation pressure or drivers are assumed to spur product innovation. Greve (2003b) illustrates in his study that R&D expenses are increased when low performance causes problemistic search and when excess resources cause slack search. Rosenberg (1969) reveals that awareness of imbalances between components has continually led to an exploration of possibilities for corrective action whose eventual result was major improvements in productivity. This reveals that negative transformation pressure drives firms to innovate by focusing on solving relevant problems.

Building on this literature, Hughes (1987) reveals that bottlenecks are also a source of negative transformation pressure as they stir reconstruction from uneven and complex changes. For example, when a manufacturing system increases one productive unit, all the other components of the system must be modified to contribute efficiency to an overall system output (Hughes, 1987). Attending bottlenecks, especially when focusing on an innovation's growth, may need a sequence of appropriate problem solvers such as inventors, engineers, managers and other actors working with legal matters (Hughes, 1987, 1983, p. 14-17)

2.2.3 Positive Driving Forces

Taalbi (2020) characterizes positive transformation pressure as, "a situation dominated by opportunities, such as opportunities to increase production or advance or exploit new technologies" (Taalbi, 2020, p. 3). Positive driving forces are inspired by Dahmén's theory on *positive transformation pressure* where the innovation process usually has "its axis somewhere between two extreme situations" (Dahmén, 1988, p. 4). These can be dominated by opportunities to take off or make an entrance into a new field of activity, potentially contributing to restructuring the industry in question.

The positive driving forces can be shaped by both internal and external factors, such as external inducement or internal inducement. Penrose (2009) defines external inducement as, "Changes in technology which call for production on a larger scale than before, discoveries and inventions the exploitation of which seems particularly promising or which opens up promising fields in supplementary directions, special opportunities to obtain a better market position or achieve some monopolistic advantage" (Penrose, 2009, p. 58). On the other hand, internal inducement is shaped by a surplus of productive services, such as excess resources or knowledge, which can be found within the firm (Penrose, 2009, p. 59).

2.2.4 Levels of Drivers

The drivers of innovation shed light on four different levels, that is, the micro-level, the industry-level, the technological system level and lastly, the macro-level. This section aims to

clarify the differences between the four levels of drivers. Firstly, the macro-level consists simply of international and national developments which may drive innovation forward, such as economic crises, policies, climate change, cultural and societal changes (Taalbi, 2020). The macro-level depicts which imbalances emerge within a variety of fields and can be considered either positive or negative, depending on the nature of the driver and how it is interpreted. Taalbi (2017) argues that imbalances from technological change are positive, whereas imbalances emerging from economic, environmental and societal effects are mainly of negative nature. On the other hand, Malerba (2002) argues that technological progress and opportunities are positive driving forces of innovation which occur on the meso level, hence, can be interpreted in the context of the technological system level.

Secondly, the technological system level captures an area in between the meso and macro level, considering broader technological systems that span over the industries (Taalbi, 2014). The concept of technological systems stems from Hughes (1983, 1987) who interprets that technologies evolve and have interdependent components, where some technologies are solutions to problems which arise in other technologies (Hughes, 1983, 1987; Taalbi, 2014). It is crucial to consider the network of actors which interact with such technological systems or *development blocks*, a sequence of complementarities between organizations and industries which emerge to resolve technological imbalances (Dahmén, 1950, 1991; Taalbi, 2014). There exist several scholars which illuminate concepts which support the existence of technological systems, such as General-Purpose Technologies (GPT) (Bresnahan & Trajtenberg, 1995; Lipsey, Carlaw & Bekar, 2005), techno-economic paradigms (Perez, 1983; Freeman & Louça, 2001) and National Innovation Systems (NIS) (Freeman, 1995, 2008). All in all, the technological system level is helpful in illustrating inter-sectoral trends, those trends which span between more than one industry.

Thirdly, the industry-level assists in portraying the drivers which emerge within industries or sectors, in this case, the healthcare industry in Skåne. The industry perspective is crucial to capture as it is shaped by industry-specific knowledge, industry know-how, industry-specific opportunities and so on. This sectoral perspective also assists in providing clarification regarding innovation trajectories which exist within a given industry.

Lastly, the micro level represents the firm level. Examining the micro-level allows for specific innovators, firms or organizations to examine what drives their search for new products or processes. In this case, the micro-level is Region Skåne, more specifically, the section of Region Skåne which deals with the installment and deployment of SDV.

Table 1. Possible Driving forces of Skåne's Digital Healthcare System (Framework inspired by Taalbi 2014)

	Positive	Negative
Micro-level	Increased total factor productivity, increased quality of healthcare, demand	burn out of healthcare workers, too much administrative work, lack of human capital
Industry-level	-	Un-organized work structure, Competitive pressure, distant search
Technological systems level	Potential complementarities, technological opportunities	New innovation challenges, increasing threats of malicious attack, imbalances
Macro-level	Globalization, alignment with global, national & regional goals	COVID-19, aging population

2.2.5 Possible Driving Forces of SDV

What may be the possible driving forces for SDV? This section illuminates how the researcher conceives potential driving forces of Skåne's Digital Healthcare System (SDV). *Table 1* illustrates the mere speculations which are derived from interpreting information on Region Skåne's website, which includes descriptions on SDV, as well as previous research on driving forces.

Possible micro-level drivers of innovation

On the positive micro-level, three driving forces are predicted. Firstly, the belief that SDV will increase the total factor productivity (TFP) can be seen as a fundamental positive driving force. Total factor productivity often measures the long-term technological change or dynamics brought forward by technical innovations. Thus, it acts as a catalyzer and driver of innovation. Secondly, the increased quality of healthcare is noted as a positive driving force on the micro-level and is closely related to the prior driver. The outcome of an increased rate of TFP, in the context of SDV, would be the increased quality of healthcare. Lastly, it is assumed that there exists a demand of a technological system which enforces a more organized work structure. This driver attributes directly to the needs of the healthcare sector, as healthcare workers are under constant pressure due to the many lives which depend on them.

Three fundamental negative transformation pressures are assumed to exist on the micro-level, that is, the burn out of healthcare workers, the overload of administrative tasks and a lack of human capital thus technological inefficiency. Firstly, the increasing burn out of healthcare workers is seen as a negative transformative driver on the micro-level, where it is assumed that healthcare workers are increasingly facing burnout periods due to COVID-19 and other related factors, such as job stress, time pressure and limited organizational support.

Secondly, the bombardment of administrative work can be seen as another negative driving force. Managing staff as well as the patients' care experiences requires heavy amounts of administrative work, such as the updating of patient journals - a task which requires meticulous care. A study on healthcare workers in Sweden revealed that only 37% of their time was directly spent on the patient (Vårdfokus, 2021). Morgantini, Naha, Wang, Francavilla, Acar, Flores, Crivellaro, Moreira, Abern, Eklund, Vigneswaran & Weine (2020) conducted a study on healthcare workers in over 60 countries and reveals that over 50% of healthcare workers reported burn out. Lack of organizational support (eg. in administrative work) was amongst one of the largest reoccurring themes related to the burnout of healthcare workers (Morgantini et al., 2020). This suggests that it is often underestimated how much time administrative work takes, a burden which is put directly onto the doctors or nurses.

Lastly, the lack of human capital can be seen as a negative driver for SDV. Human capital, the unaccounted economic value of a worker's experience and skills (eg. education, training, intelligence, skills), plays a large role in driving forward technological change (Mokyr, Sarid & van der Beek, 2019). Optimizing a technological system to be more efficient is a difficult task which requires much collaboration from healthcare workers and tech-officers. Thus, one of the main hypotheses is that the lack of human capital leads actors in the healthcare industry to explore more exogenous alternatives through distant search.

Possible industry-level drivers of innovation

Three fundamental negative drivers are predicted to influence the industry-level, that is, the current unorganized work structure, competitive pressure and distant search. Previous research emphasize that innovation diffuses slowly within the healthcare industry due to the complex nature of managing innovation in such a large system (Boer & During, 2001; Damanpour & Gopalakrishnan, 2001; Dougherty & Dunne, 2011; Francis & Bessant, 2005; Kim, Gaukler & Lee, 2016). Thus, it is assumed that one the negative drivers of SDV on the industry-level is the need for a more organized work structure. Secondly, it is predicted that there exists competitive pressure within the regional, national and international landscape. Competitive pressure is seen as a transformation pressure which motivates actors on the industry-level to engage in acquiring more technological innovations. These negative transformation pressures on the industry-level motivate the need for technological transformation, as technological solutions have the possibility to enhance the overall productivity of the healthcare sector.

It is predicted that due to the lack of human capital on the micro-level, management actors on the industry-level engage in distant search. Thus, distant search is interpreted as the

fundamental positive driver for SDV. By going out of one's comfort zone and enabling exogenous variables to shape the development of the healthcare industry, one may find new possibilities from the exploration process. Distant search is projected to be a negative driver on the industry-level due to the nature of procurement which Region Skåne is engaged in. Being subject to new as well as distant alternatives opens up doors and technological alternatives. If this distant search is problem driven, then it may be subject to problemistic search, "engineering a solution to a specific problem", due to performance being below aspirations (Cyert & March, 1963, p. 63).

Possible technological system level drivers of innovation

Two positive driving forces are predicted to influence SDV on the technological system level, potential complementarities and technological opportunities. Previous literature reveals that innovational complementarities are common, that is, that major innovations tend to be inductors of further innovations and that they demand complementary ones upstream and downstream (Perez, 2010, p. 188). It is predicted that SDV is seen as a complementary innovation to several technologies already utilized within the healthcare industry, where the existing technologies have the potential to be more integrated with SDV's cloud platform. It is also predicted that more innovations are expected to be implemented in conjunction with SDV due to potential imbalances, which will be elaborated upon when introducing negative driving forces on the technological system level.

Secondly, technological opportunities are seen as a driving force on the technological system level as it has the potential to boost the TFP of the healthcare industry. Technological systems are shaped by techno-economic regimes (Perez, 2010) which have traits of path-dependency and are more resistant to change, having standard-operating procedures. In the case of SDV, the current techno-economic regime is based on the present-day electronic healthcare record (EHR) set up in Sweden's healthcare industry. This particular regime is affected by multiple actors in the regime which are responsible for healthcare policies, healthcare technologies, markets and user preference, culture and science.

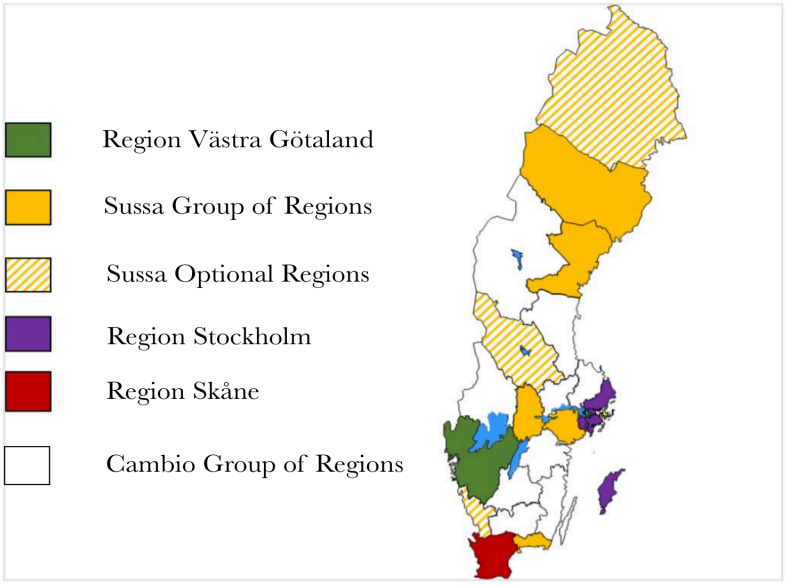
Taalbi (2020, 2017) reveals in his study that approximately 40% of Swedish innovations were due to new technological opportunities, for example, within the field of microelectronics, biotechnology or other scientific discoveries. Although several industries "jumped on the bandwagon" and engaged in new technological opportunities induced by the Information & Communication Technology (ICT) revolution in the 1990s (Jorgenson & Vu, 2016), this paper hypothesizes that Sweden's healthcare sector never embraced the full potential which such technological innovations could bring about. This idea supports the work of Kim, Gaukler & Lee (2016) who illuminate that new technology and innovation generally diffuses at a slower pace within the healthcare industry.

Computer support for Sweden's healthcare industry began in the mid-1960s, where several pilot tests of clinical records were enforced at the Karolinska Hospital in Stockholm (Kajbjer, Nordberg & Klein, 2010). Between the 1970s and 1980s, the development of several patient

administration systems occurred and were based within different counties throughout Sweden (Kajbjer, Nordberg & Klein, 2010). By the 1990s, an explosion of EHRs came to be as twenty-seven different products were created (Kajbjer, Nordberg & Klein, 2010). Since then, the flaws of this regime became more evident. This is mainly due to the fact that large fragmentation and unequal access to medical record information persists throughout all of Sweden. Naturally, the fragmented nature of Sweden's healthcare system would have made it difficult for ICTs to diffuse along so many EHR systems. At this point, it is of particular importance to acknowledge the nature of path-dependency of the regime (Geels & Schot, 2007). The regime is made up of coherent complex scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procures, established user needs, regulatory requirements, technological infrastructures, networks and actors along with culture and their fixed routines (Geels, 2002).

Lövström (2019) illustrates the transformation from twenty-seven EHR products to six different systems, which are mapped out in Figure 1. Since 2018, the goal has been to alter the EHR system market down to two or three main EHR systems. Although fragmentation still persists, the goal of two or three EHR systems is a big leap from the twenty-seven EHR systems which were developed in the 1990s. Today, Region Skåne and Region Västra Götaland are procuring their EHR system from the same provider, Cerner Corporation, although the two regions have two separate contracts. All in all, the technological opportunities which procurement bring about are predicted to be a major driving force for innovation in the healthcare industry.

Figure 1. The Electronic Healthcare System (EHR) Market (taken from Lövström, 2019)



Three fundamental negative driving forces have been predicted on the technological system level, that is, new innovation challenges, the potential increase in malicious attacks and lastly, imbalances. Scholars such as Barlow (2016) emphasize that, although innovations have the potential to tackle existing challenges, they often catalyze new challenges and can reinforce a

vicious cycle of unforeseeable circumstances, such as issues in creating, implementing, embedding or sustaining innovation in healthcare. This is predicted to be the case for SDV, as the project involves changing the routines of an entire region's healthcare staff – something which may be quite difficult.

The potential increase in malicious attacks may act as a catalyzer for more technological robust innovations. This is not a small problem. In the past three decades, healthcare data breaches have grown in both size and frequency. Cybercrime is a prominent threat as revealed by previous malicious attacks, such as the 2015 Anthem Health medical data breach in the United States which involved the theft of up to 37.5 million patient records (Luna, Rhine, Myhra, Sullivan & Kruse, 2015). Luna et al. (2015) constitutes that healthcare data contains highly sensitive information (eg. addresses or sensitive health data) and therefore a potential cyber-attack may have excruciating consequences for some patients (eg. identity theft). Thus, the threat of malicious attacks on EHR systems can be interpreted as a fundamental driving force for more technical robust options such as SDV.

Lastly, imbalances are predicted to be of negative transformation pressure for SDV. Hughes (1987) reveals that previous innovations and invention activity can be seen as a problem which hinders new technological expansion, "[i]numerable (probably most) inventions and technological development result from efforts to correct reverse salients" (Hughes 1983, p. 80). As previously mentioned by Barlow (2016), healthcare innovations have the potential to create a vicious cycle of unforeseeable circumstances. One of the circumstances, in the case of SDV, may be to integrate data from the old EHR system into the new one and how to best manage the "smooth transition" of such data.

Possible macro level drivers of innovation

Macro-level drivers play an important role in shaping innovation. Positive drivers of innovation on the macro-level are predicted to be related to globalization and the alignment of global, national and regional goals. Globalization is predicted to be a driver for SDV as it, for instance, allows countries to gain easier access to foreign knowledge. As knowledge regarding technologies diffuse across the globe, it generates a positive network of cross-pollination - enabling technology-receiving countries to advance their own R&D. Secondly, globalization is playing an increasing role as global competition is enhanced. The increased international competition associated with globalization may contribute to overall prosperity as it strengthens incentives to adopt new technologies and innovate (World Economic Forum, 2021). Thus, globalization drives innovations such as SDV through increased foreign knowledge, innovation activity and competition. Another crucial predicted determinant for SDV is related to the alignment of global goals, such as the SDGs exhibited by the United Nations. Innovation offers the opportunity for firms to align their strategies with ambitious goals, whether on the regional, national or global scale.

Negative transformation pressure drives innovation forward. In the case of SDV, two overarching drivers have been located. Firstly, COVID-19 is predicted to be a driver of innovation as previous literature reveals that crises may catalyze innovation (Perez, 2010). Nevertheless, this is a complex assumption which requires a great deal of analysis. Secondly, aging population is deemed to be one of the largest issues faced within the developed countries (Barlow, 2016) and is thus interpreted as a key driver for SDV.

3 Methods

This study and thesis consist of empirical data gathered through an exploratory case study, making use of qualitative semi-structured interviews, in order to explore which drivers and obstacles exist for technological innovation within Skåne's healthcare sector. Collecting data from a suitable sample and a reliable source is crucial. Thus, a purposive sampling and snowball sampling technique has helped generate adequate participants, allowing for high quality data to be collected and analyzed. Qualitative data was gathered from stakeholders of Skåne's Digital Healthcare System, such as System Strategists, Data Scientists, Procurement Officers and Management. This piece has followed an iterative approach, that is, the repetitive interplay between the collection and analysis of data (Bryman, 2016, p. 566).

3.1 Research Design

As a case study supports this thesis, it is crucial to have a clear research design which can be replicated. The target group was contacted and asked if they would like to partake in the study on innovation in Sweden's healthcare system. It is worth mentioning that the research question was slightly altered after the interviews, as the drivers became more evident than the previous topic (which was on ethics of AI in healthcare). Nonetheless, participants include actors who play a role in shaping the technical innovation which Region Skåne is developing. This includes professionals working on the regional level, but also procurement workers as they play a special role in the implementation of SDV. The target sample consists of actors who influence sociotechnical regimes related to SDV as this community focuses on the development of innovation in Sweden's healthcare system (Geels & Schot, 2007). Thus, snowball sampling - notable for being a branch of purposive sampling - will occur from the researcher asking the participants to propose other participants to partake in the study, allowing for localization of more actors in Sweden utilizing or working with SDV (Bryman, 2016, p. 418).

Semi-structured interviews are attractive due to their flexibility, as they allow for new topics and perspectives to feed into the findings, while still maintaining sufficient structure and practical guidelines (Bryman, 2016, p. 12). As the interviewee has the opportunity to incorporate new perspectives and topics that have not been touched upon previously, semi-structured interviews are the best fit for the study (Bryman, 2016, p. 12). An inductive and iterative approach is utilized as it allows for new findings to feed into the grounded theory and theoretical explanation to derive from continuous data collection and analysis (Bryman, 2016, p. 93). Nevertheless, the iterative data collection and analysis process will take place until theoretical saturation is met, that is, when no new relevant information feeds into the research

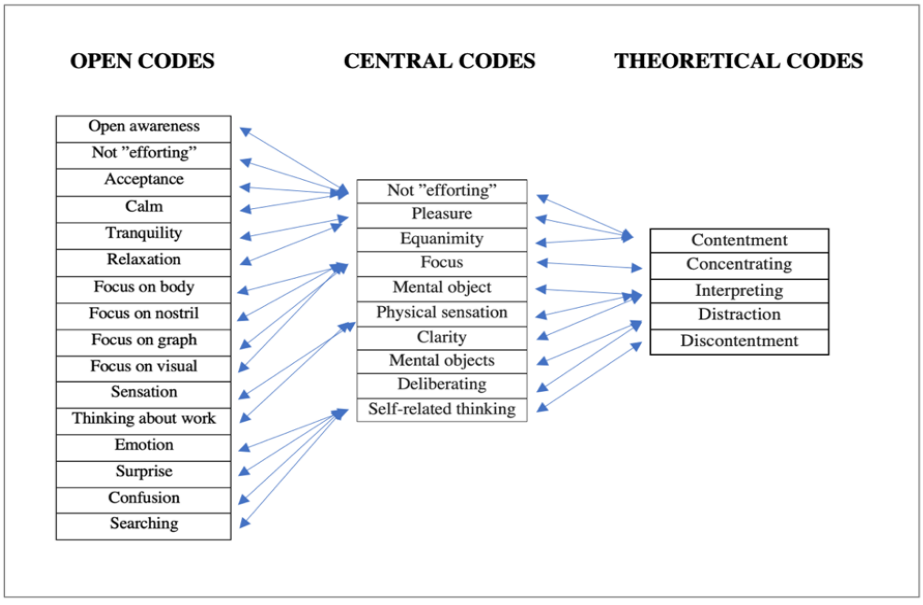
(Bryman, 2016, p. 421). A set of example research questions are located in the Appendix. Lastly, the interviews are recorded in order to ensure that the entirety of the interview is captured (Creswell, 2014, p. 244).

3.2 Data Analysis

The data is derived from the semi-structured interviews and are analyzed in a systematic manner. Therefore, the Miles & Huberman framework is utilized, which consists of four steps - data collection, data reduction, data display and lastly, drawing conclusions (Punch, 2005, p. 171). To begin, data collection is conducted through semi-structured interviews, where the data derived from the recorded interviews are transcribed into a qualitative data analysis computer software called NVivo (Bryman, 2016, p. 591). The NVivo software helps manage the data more effectively, especially pertaining to the next step, data reduction (Bryman, 2016, p. 591; Creswell, 2014, p. 246). Data reduction entails clearing and cleaning through the large data set by editing, cutting & condensing the data in a selective manner (Punch, 2005, p. 171). For example, ridding of information that may not pertain to the central topic of the research.

The third step, data display, involves the arrangement of information in a concrete compressed form (Punch, 2005, p. 171). This gives a clear overview of the cleaned data set. Meanwhile, a coding and memoing process helps generate themes along with clear examples through quotes or ideas (Garrison, Santoyo, Davis, Thornhill, Kerr & Brewer, 2013). The codes assist in capturing central themes which derive from the data, as displayed in Figure 2. These codes were actively retrieved and re-evaluated through an iterative process, as each and every single one of the participants has a set of perceptions and insights which relate to their world. Finally, once there is theoretical saturation, conclusions were drawn from the data into the grounded theory (Punch, 2005, p. 172). Lastly, conclusions are made through the theoretical lens where interpretations are formed and supported by quotes from the data (Creswell, 2014, p. 250).

Figure 2. Coding Process (Inspired by Garrison et al., 2013)



3.3 Critique & Ethical Issues

It is crucial to highlight the limitations and ethical aspects prevailing in the thesis and research. First of all, the research was conducted entirely online as the COVID-19 pandemic prohibited face-to-face interviews. Digital interviews may limit the number of observations which one could be gaining from conducting face-to-face interviews (Bryman, 2016, p. 215). Thus, the digital interview set up may have an impact on the generated data and the overall reliability of the data. In addition to this, the pandemic may make the sampling method more difficult due to the unstable business landscape.

Secondly, although the snowball sampling technique attempted to achieve a higher sample size, not all SDV workers or procurement officers were able to respond and complete the interview. This may affect the validity of the study. Additionally, strictly speaking, there may be confidential information which the interviewees would not want to discuss with the researcher. This could also contribute to the validity of the research.

Another limitation is the cross-directional nature of the study, as it considers procurement workers and SVD workers, which may be problematic due to the nature of large organizations, under multiple layers of hierarchy and management. It was especially important to consider the power dynamics in the study, particularly in the case of interviews which included many professionals from the same employers (Scheyvens, 2014, p. 4). I was committed to creating a non-hierarchical and non-exploitative relationship between myself and interviewee. One of the main strategies that I utilized when extracting personal data was to be non-judgmental in order to make the interviewees feel secure and respected. In order to mitigate the risk of any potential organizational conflicts in the interviews, the interviewees identities remain anonymous, and the data obtained from the interviewees is fully confidential.

Pertaining to the research design, it may be difficult to know how representative the sample is of the target group (Bryman, 2016, p. 204). As the sample size is fairly small, the representativity of the sample is a critical point which needs to be considered. On top of this, as the research question was slightly altered in the midst of interviews, as drivers became more evident, the reliability may not be very high. Another limitation is that the research is limited to the Swedish context, more specifically the SDV context, and therefore any findings cannot be generalized. Drivers of innovation in healthcare may look different depending on where in the world one is, as healthcare systems and technological capabilities do not look the same in China, UK, US or other innovation-leading countries. In fact, findings are highly contextual to Region Skåne and considering the fragmented nature of healthcare systems in Sweden, it is questionable to what extent generalizations can be made from a national perspective as well.

The researcher has acknowledgement of positionality, that is, how aspects of the researcher's position may influence the study, such as in the way information is collected and interpreted (Scheyvens, 2014, p. 61; Sultana, 2007, p. 376). It is important to consider how gender, class, sexual orientation, ethnicity, age and other attributes may affect the way one gathers and

interprets information. Values also play a role in shaping personal beliefs and feelings. The researcher does recognize and acknowledge that a research cannot be value free, as values exist everywhere. Nevertheless, to ensure a safe research space, it has been vital for the researcher to be self-reflective and exhibit reflectivity (Bryman, 2016, p. 39) Taking these limitations into consideration through reflexivity has assisted the researcher during the analysis process and when concluding the results.

4 Empirical Analysis

This section presents and analyzes the empirical findings gathered from the qualitative data with the overall aim of locating **what drives the development of technological innovations in Region Skåne's healthcare sector**. The sub-questions are answered, indicating what opportunities stakeholders perceive in the development of technological innovations and how technological innovations in healthcare are shaped by crises. The theoretical frameworks formerly presented will guide the structure of the empirical analysis.

4.1 Setting the Scene

In this case study, six interviews were conducted with stakeholders working with the development of Skåne's Digital Healthcare System. These stakeholders include professionals working with the implementation of SDV on the regional level (via Region Skåne) as well as individuals working with the procurement of the digital healthcare system (via Cerner Corporation). Their professional roles ranged from project leaders and system developers to government management and clinical decision support strategists. Due to the diversity of the sample, the individual voices are not to be lumped into one large narrative, but instead offer unique, separate voices and different perspectives on the subject of innovation drivers within the healthcare industry.

In order to localize the most central themes related to the driving forces, the interviewees were first asked to discuss their role in the development of SDV. Building on this, the interviewees had the opportunity to express what they felt were the main forces which were pushing the innovation forward. The nature of the semi-structured interviews allowed for new themes to be introduced throughout the interviews.

4.2 Drivers of Innovation

This section analyzes the positive and negative driving forces which were generated from the case study on professionals working on the development of SDV. By analyzing the driving forces of innovation in the case of SDV, one gets closer to understanding how health-technology innovations flourish.

As aforementioned, the piece utilizes Taalbi's (2014) four levels of analysis which considers the micro-level, industry level, technological system level and macro-level. Table 2 summarizes

the positive and negative driving forces for SDV. This framework illuminates that opportunities exist in the form of positive opportunities and negative transformation pressure (Taalbi, 2014, 2020; Dahmén, 1988; Schumpeter, 1947).

Table 2. Driving forces of Skåne's Digital Healthcare System (SDV) (Framework taken from Taalbi 2014)

	Positive	Negative
Micro-level	Enriching patient & staff value, higher efficiency, increased availability of healthcare workers, better access to information, demand	Individual burn out of healthcare workers, administrative work, possibility of human error
Industry-level	Top-down push from management	Un-unified organizational structure, distant search
Technological systems level	Innovational complementarities (eg. integrated technological opportunities)	Competition from smaller actors
Macro-level	Globalization, acceptance of technology, regional/national/global goals	COVID-19 crisis, health crisis (aging population, prevention of illness, etc.)

4.2.1 Positive Driving Forces

Micro-level

A micro-level perspective sheds light on the driving forces on the organizational level, which allows for one to understand which internal and external driving forces have allowed for SDV to flourish. On a micro-level, five central positive driving forces were brought up from the case study; 1) *enriching patient and staff value*; 2) *higher efficiency;* 3) *the increased availability of healthcare workers*; 4) *better access to information*; and 5) *demand*. The first three drivers are especially interconnected as the increased efficiency of administrative tasks were associated with the increased availability of healthcare workers, which in turn would enrich patient and staff value as well as communication. The promise to create a better experience for both patients and staff is one of the central driving forces for the innovation to flourish on the micro-level, as indicated by a quote:

> *We feel confident in that we will raise the quality of care, because clinicians will not have to do unnecessary tasks and they can focus on the pure clinician tasks. We are moving into a phase where we believe if a computer can do it, then a computer should do it - making sure that the nurses and doctors work with the care aspect, focus on giving more time to the patient. (2#)*

This reveals all first three positive micro-level driving forces within one single scenario - that ridding of administrative work pressure will allow for more quality engagement between healthcare staff and patients, solidifying more efficient workflows which in turn increases patient and staff value. As computers become timelier integrated into the healthcare system with the responsibility to manage administrative tasks, it will in turn create a more efficient eco-system where healthcare workers can spend the gained time to focus on the most fundamental part of their operations – taking care of the patient. Several interviewees express that healthcare staff loath administrative work as it is tedious and repetitive. At the same time, enriched patient value was found to often stem from an increase in communication and interpersonal interaction between healthcare workers and patients. Thus, ridding of cumbersome administrative work may act as a domino effect and enforce stronger communication and better experiences for both the patient and healthcare worker.

Moving on, there exists a strong belief that SDV will contribute to increased efficiency. For instance, a system strategist denotes that SDV can integrate other medical devices (eg. a scale) which would in turn alleviate "unnecessary tasks" for doctors or nurses (2#). It also alleviates the potential of a human error as the scale can be directly integrated into SDV (2#). This is in line with previous predictions that the TFP may increase due to technological support. Solow (1957) drew a distinction between which factors contribute to innovation, where "residual" factors – often characterized by technical change - could be responsible for up to 87.5 per cent of economic growth (Dodgson, Gann & Phillips, 2013, p. 28; Solow, 1957). There exists a general notion displayed by all interviewees that SDV is the large technical change which will enforce such productivity and therefore economic growth.

Moving on, demand for SDV became a clear driver as healthcare staff feel the digital system will allow for more structured and synchronized organization due to common working methods. At the same time, interviewees confirmed that SDV would support healthcare workings with better access to medical information. Several interviewees felt SDV would contribute to assisting healthcare workers as they would spend less time looking for information (eg. physical documents or technologies which can be integrated into SDV) and would instead find it directly in the system. This is described in the following quote:

> *"Our ways of working with SDV will be timelier integrated and built into the system. Now we are moving into a system which supports our workflows and allows for us to store more structured data in a way we have never done before … Our collective knowledge, leveraged with SDV, will be much better than being completely dependent on one person's knowledge." (1#)*

With real-time updates, the patients are able to stay more in tune with latest briefings and are able to follow patient health-record updates more closely. The increased organizational structure will make it easier to delegate responsibility, practice knowledge sharing for healthcare workers and thus lead to more knowledge retention. The passage reveals that the digital innovation is driven by the demands of healthcare workers as there is a need for more structured work organization and a collective way of sharing medical information about patients. The fact that the interviewee describes the ways of working with SDV as *timelier* suggests that there is a belief that the technology will increase punctuality and therefore overall productivity. Again, this stands in line with prior predictions which hypothesized that there exists a belief that SDV would increase the healthcare industries' TFP. Ultimately, Solow's (1956) idea that technological change is often an exogenous phenomenon which can contribute to economic growth fits well into this contemporary case.

Industry-level

The positive driver on the industry-level allows for opportunity to be located within the healthcare industry on the regional scale. One large fundamental positive driving force was located, that is, the *top-down push from management*. The management team of SDV engaged in distant search and explored distant "new combinations", as Schumpeter puts it. As international possibilities are suggested to outweigh the local search options, the statement is in line with Schmookler's (1962) assumption that firms only search for new combinations when there is enough reason to believe that the returns on the innovation exceed the cost of the search (Schmookler, 1962, p. 19). Under SDV conditions, it is clear that the management team showed desire to engage in creative response through distant search and the exploration of the new technological innovation. In addition, Alexiev et al. (2010) illuminates that distant search plays an important role in the orchestration of organizational reorientations. Thus, the top-down push from management is interpreted as a clear industry level driver.

The goal-oriented and competitive nature of the management team which is responsible for SDV has driven the innovation itself forward. The top-down management style has helped SDV drive forward as the agents have initiated the planning, organizing, leading and controlling of the project. The management style of Region Skåne has played a large role in the acceleration of SDV's diffusion, as exhibited in the following quote:

> *"I think the biggest driver we have in SDV is due to the very great management team. We have a regional director which is really pushing for increased communication and digitalization for the patients. The improvements in patent communication and digitalization are mainly due to smaller innovation companies pushing the limits and stealing patients from the bigger regions." (#5)*

The ambitions of SDV's management team plays a clear and direct role in driving the SDV forward. As the management team has engaged in exogenous technological opportunities, these actors have the pressure of increasing productivity although the procurement of SDV is costly and uncertain. It is deemed one of the strongest endogenous forces, as managers have the role

of creating clear and actionable goals for the team to drive the innovation forward (Mcgrath & Kim, 2015, p. 397).

While the management team is having to ensure that the wants and needs of the patients and the healthcare workers are exhibited through SDV, where communication and digitalization are deemed to be of top priority, they are also responsible for understanding how to create a "sustained competitive advantage" from the emerging smaller innovations (Mcgrath & Kim, 2015, p. 403). Nevertheless, many scholars such as Craig (1996), Gimeno & Woo (1996), Ilinitch, D'Aveni, & Lewin (1996) and Mcgrath & Kim (2015) reveal that competitive advantage is a temporary state which can be doomed and swept away by waves of creative destruction (Schumpeter, 1942). Instead, competitive advantage is deemed as temporary and innovation itself is what drives performance outcomes (Mcgrath & Kim, 2015, p. 403).

All in all, interviewees denote that the management team has played an instrumental role in the enablement of SDV.

Technological system level

The positive drivers on the technological system level exhibited relate closely to those predicted, that is, complementarities and technological opportunities. Complementarities were predicted to exist for SDV, as cloud technologies allow for easy integration of other technologies. This prediction is deemed somewhat true, although a majority of the complementarities taken up by the interviewees are only considered to be *potential* complementarities. The possible complementarities taken up by interviewees were related to the integrating of dental journals, air pollution measurements, pollen reports, big data for population health control, homecare solutions, integration of existing technologies into SDV as applications, and lastly, predictive Artificial Intelligence (AI) and machine learning (ML) solutions in imaging technology and natural language processing. This suggests that there are several innovations which might be integrated and followed by SDV. Although some innovational complementarities were more likely than others, one interviewee illustrates the power which AI-driven preventative healthcare solutions can have in conjunction with SDV:

> *"One of the large things which I think this system might solidify is preventative health care, one of the biggest benefits of AI, finding patterns in the population to make us more aware of risk individuals before they become sick from that risk … I believe it is unethical to not use the power of the data to save lives." (1#)*

This statement signifies that there exist strong possibilities to leverage other high-tech solutions into the private cloud-platform which SDV is grounding. Several scholars (Kaldor, 1981; David 1985; Arthur 1989, 1990, 1994; Taalbi 2020) suggest that these positive interdependencies arise due to increasing returns. This suggests that the performance of technologies improve based on the adoption or installed base. When upper management at Region Skåne decided to invest in SDV and leverage cloud-technologies, they made an active decision to invest time and resources into such technological solutions. Thus, as a result, switching costs may emerge and

since no one has the incentive to fully switch away from SDV, it instead lays the ground for possible ways to alternate, change or add new technological solutions through complementarities. This became a noticeable trend amongst all the interviewees, as all interviewees suggested new innovations which could, in their opinion, complement SDV. Essentially, this indicates that further innovations could follow the cloud-based technologies acquired by Region Skåne through technological integration. Nevertheless, one would have to speculate further in order to comprehend whether these complementarities may come in the form of a chain of innovations or singular innovations.

It is worth noting that the same interviewee clarified that it is not possible to actualize these AI related population health solutions as of current state as the legal barriers are too high. Whether the current socio-technical system which mitigates complementarities has enough leverage and power to change is a question which many scholars wish to find explanation to. Certain types of technical change require the alignment of relevant adjustments to occur, both institutionally and within sectors (Freeman & Perez, 1988, p. 871). Thus, it is understood that the complementarities are mere possibilities for the future, although nothing is set in stone.

Jacobs et al. (2015) illuminates that diffusion of innovation within the healthcare sector is difficult and subject to high variance, as the failure rate of implementing innovations within the healthcare sector range from 30% to 90%. This suggests that implementing more innovations within the healthcare sector may be very challenging and may depend on several driving factors which are unique to specific innovation cases. Nonetheless, the idea that complementarities may develop in conjunction with SDV is supported by scholars such as Perez (2010) who argue that large innovations have the tendency to induct other innovations. Implementing a large-scale cloud technology for all patient data in the region suggests that Region Skåne has opted for path-dependency. Evidence of path-dependency and rigid structures is a well-known phenomenon within several industries, such as the energy industry, as evidence shows how difficult energy transitions to renewables may be in some cases (Malanima, Warde & Kander, 2013, p. 256).

However, further research needs to be conducted on to what extent path-dependency matters for innovation development within the healthcare sector. As opposed to the energy sector, adopting another new technology in healthcare may not inhibit the use of another technology. Path-creation, as opposed to path-dependency, may be apparent if all stakeholders are regarded as knowledgeable agents with the capacity to react in ways other than those prescribed by existing social rules and technological artifacts (Park & Lee, 2004).

Schumpeter (1939) addresses how innovation is dependent on the element of timing, “One essential peculiarity of the working of the capitalist system is that it imposes sequences and rules of timing. Its effectiveness entirely rests on this and on the promptness with which it punishes infringements of those sequences and rules” (Schumpeter, 1939, p. 412). Freeman (1991) imposes this statement and illustrates that the economy, institutional environments but also environmental factors (eg. environmental catastrophes) act as gatekeepers which allow for innovation to flourish. Thus, the success rate of innovations in healthcare is deemed as complex and may be based on a case-to-case basis. Moving on, another interviewee illuminates a different possible kind of complementarity:

> *"We have the possibility to replace existing technologies and turn them into applications which can be integrated directly into the SDV system. Innovation Skåne, Cerner and Region Skåne have put together a sandbox environment to develop, experiment and test these solutions. SDV will allow us to accelerate some of the other digital solutions we have in mind. This would improve connectivity." (5#)*

This passage suggests that professionals working with SDV are aware of potential complementarities and may leverage them through the cloud technology. The sandbox environment suggests that stakeholders are provided with a safe space to test and potentially integrate complementary innovations. Thus, cloud-technologies may act as a "base technology" which allows for further innovations to flourish. This suggests that path-creation may outweigh path-dependency.

Macro-level

Several interviewees agreed that the notion of globalization was a positive driving force for SDV, as revealed in one statement, "*I think it is not a bad thing to get more perspective from health-tech abroad, it is a good thing. They have a different perspective and may find a better way*." (3#) This suggests that agents at Region Skåne exhibited a positive outlook on internationalism and globalization due to potential competitive advantages which exit abroad. Globalization was found to be a driver of innovation in the case of SDV, as Region Skåne saw non-Swedish or non-European technology options as not only a possibility, but in many cases an advantage. Such openness suggests that there is an increased trust in foreign technological innovations. In the case of SDV, globalization has allowed for networks to expand across the Atlantic Ocean from the United States to Sweden, allowing for knowledge to diffuse into new environments.

Knowledge is a form of human capital which can be seen as an important commodity on the organization level, making way for new options of utilizing the acquired knowledge. For instance, some interviewees suggest that the new knowledge regarding the private cloud technology will allow for new R&D processes or further expansions of the cloud system to be made. For example, one interviewee mentioned some possibilities for potential future expansions:

> *"Hopefully by introducing it in Region Skåne first, other regions will be able to jump on the same boat and acquire the system too, in a smoother way, where you would potentially only need to look into the transformation and training part."(5#)*

As Region Skåne become first adopters of the cloud-system which SDV offers, the interviewee clarifies that the stakeholders have made an active decision to take on the hard work of configuring the entire system with the possibility to expand the system into new regions. This

suggests that Region Skåne encourages other regions to be open to international possibilities in regard to technological innovations. In addition, Salter & Alexy (2015) suggest that innovations are increasingly becoming the product of collaboration between a range of actors, such as users, universities, firms, government, procurement officers, etc. Since globalization can solidify collaboration amongst stakeholders around the world, it allows for networks of complex knowledge to form and create an ecosystem of endogenous and exogenous influence.

Moving on, a culture of technology acceptance has become increasingly prevalent according to majority of the participants. Digital contacts in primary care doubled during 2017 and currently 99 % of all prescriptions for medication are electronic (European Commission, 2019). The culture of acceptance for technology reinforces humans to interact with technology, in order to utilize it like a tool. This is showcased in two passages, one from a procurement officer and another working with technical development of SDV:

> *"I think we have come far in terms of basic technological level in the last 20 years … This example of dictation, when you speak into a machine and it records your voice as if it is an assistant, a lot of physicians were originally against this. Now that we have started using this dictation technology in Skåne, many of the physicians are saying it is very good! We need to teach people how to interact with technology in the right way." (6#)*

> *"I think we need to push for bigger digital transformation in order to solidify this relationship between the patient and the doctor. I have seen this with my colleges, that we are changing here. Digitalization is an opportunity, one which is being taken." (5#)*

There exist strong incentives for both individuals to leverage technology to meet the needs of society, whether it be the individual healthcare workers or the patients themselves. Both interviewees suggest that rapid digitalization has occurred and will continue to occur. In the first case, technology acts as an instrument that can alleviate heavy workloads of doctors, physicians or nurses. Thus, it is not only the acceptance of technology, but the experience of technology and witnessing its full potential which drives SDV. In the latter case, technology is interpreted in a positive manner and embraced as a tool which solidifies interaction between patients and healthcare workers. Thus, the acceptance of technology drives SDV forward as many understand the foreseeable implications of the technology.

"*There is a large drive for Skåne to be the best healthcare provider by 2025*." (5#)

Goals on the global, national and regional scale were predicted and confirmed to be drivers for SDV. This is alluded to in the quote revealed above. Technology is seen as an instrument which can increase alignment with such goals. The United Nations' SDGs allow for strategic planning to be made in order to meet the goals. SDG Goal 3 (Good health and well-being) enforces that a range of relevant stakeholders ensure and promote healthy lives and well-being for everyone. As such, it is the most relevant global goal for SDV. From a macro perspective, Sweden is taking an active role in integrating the global goals, whether they are based on economic, social or environmental factors (Regeringen, 2020). Investments in health are interpreted as investments into the development as society as a whole (Regeringen, 2020).

SDV has engraved such global, national and regional goals on the micro and meso level, where upper management on the meso level ensure that opportunities for better health and well being are prevalent. Since 2014, Sweden's public health policy has changed in order to eliminate all avoidable health gaps between population groups within one generation (European Commission, 2019). Professionals working on SDV take an active role in following through such commitments on the micro-level by working on smaller tasks which fulfill the overall goal of SDV, to create a cloud EHR system which increases the quality of healthcare and creates a better experience for patients as well as staff (Region Skåne, 2021). This driver was mentioned by every single interviewee as every interviewee mentioned the need for more equal or efficient healthcare, for instance in the two following passages:

> "*We believe this system will improve patient equity in the long term. Just the fact that we have a modernized system compared to the past systems will definitely make health quality improve. We have decision support, which will improve the decisions which all the staff in healthcare take. This will improve patient safety by default."* (4#)

This passage reveals that regional, national and global goals which focus on health equality and well-being are drivers of innovation for SDV. Actors in SDV illuminate having an aligned vision which resonated well with the global goals. SDV as an innovation indeed offers the opportunity for Region Skåne's healthcare strategy to align more with SDG 3. Thus, the results from the data reveal that the predicted drivers, globalization and global, national as well as regional goals – were relevant and in line with the empirical findings.

4.2.2 Negative Driving Forces

Micro-level

Three negative drivers were captured on the micro-level; 1) *individual burn out of healthcare workers*; 2) *administrative work*; and 3) *the possibility of human error*. Firstly, the individual burn out of healthcare workers was found to often stem from the collective stress which healthcare workers feel on a daily basis from work-related stress. Several interviewees mention that majority of work-related stress derive from the need to do tedious administrative work, such as updating patient journals or overseeing staffs or budget. Thus, the individual burn out of healthcare workers and administrative work often relate to one another, although both separate points drive SDV forward. The following first passage reveals tedious administrative burdens which healthcare staff deal with whist the latter passage illuminates the need for technology to take a share of the administrative work which healthcare workers are faced with:

> "*When one patient is leaving the hospital and this patient will be going to an elderly home facility, there are three exist notes that needs to be written. One note needs to be written for electronic medical records (EMR), another note has to be written for the patient, and one note for the nursery home. They cannot be the same! In the one to the*

patient, you need to use normal understandable language, in the one for the health record you need to use more scientific language, and then in the nursery facility, something in-between!" (3#)

"*We know that healthcare workers do not like to do administrative work. We need to ease the burden of documentation, otherwise the burn out of physicians and nurses is too big. They cannot take it. We should leverage technology to make things easier, so that those things will ease up*." (6#)

Both passages portray the immense administrative burden which healthcare staff face on a daily basis. A great amount of time is dedicated to administrative work, when in reality, many interviewees mention healthcare workers often dislike administrative duties. The second passage reveals that the interviewee drew a clear association between the burn out of healthcare workers in relation to administrative tasks. Thus, these two forces create strong transformation pressure and enforce innovation to mitigate the burden of administrative workloads.

Lastly, two interviewees portray that the possibility of human error in the healthcare industry drives technological innovation forward. A possible human error means that an unintended and undesired action becomes actuality. As the possibility of human error exists, many interviewees acknowledge that technology can mitigate these human errors within the healthcare sector. For instance, one interviewee describes:

"*One of the ways we try to alleviate work for the doctors or nurses is by connecting a bedside medical devices, having integration with eg. a scale. If there is a digital screen showing a number, then there is a great possibility that this device can send that directly to the system automatically. It takes away the possibility for a human error, since this device could just send a value to the new system*." (2#)

This passage suggests that integration of technologies allow for humans to minimize their potential error whilst also increasing efficiency. The possibility of a human error, such as the dysfunction in memory or attention, may contribute to weakening the overall healthcare industry. The option to mitigate such errors are seen as opportunities and thus, the possibility of human errors can be seen as a clear driver for SDV as SDV allows for technologies to be integrated into the cloud system.

Industry-level

On the industry-level, the most reoccurring negative driver of SDV exhibited by all interviewees was related to the region's un-unified organizational structure. The interviewees often associated SDV as a system that would mitigate the un-unified organizational structure and instead create more structure. For example, two interviewees clarify the impact of the negative driver:

"*We need to have regional coherency in the ways of working, a unified way of documenting. We cannot have 20 different ways of documenting if a patient is in pain. There should be one template which they can reuse, so when they program or add a new algorithm, then it can take certain parameters which are already there into consideration."* (2#)

"*We are trying to unify the way we work in Region Skåne, so that the work flows we build into the system is the same across the entire region. Before and even at the moment, the way healthcare workers work within one hospital or municipality is very different, which can be restrictive. We are trying to work more in the same way to be more efficient."* (1#)

The interviewees recognize that the un-unified structure of work which exists contributes to less efficiency and more confusion. It is no shock that an un-unified structure exists within the working methods of healthcare professionals in Skåne, considering the history of fragmented EHR systems which have been emplaced since the 1960s and forward (Kajbjer, Nordberg & Klein, 2010). Path-dependency of such fragmented EHR systems may contribute to un-unified organizational culture which persists in Skåne. As SDV acts as an administrative tool which creates more structure and has the potential to assist healthcare workers to work in a more unified way, the un-unified structure reinforces the need and desire of such an innovation. Thus, the un-unified and fragmented structure which persists throughout the region was deemed as one of the largest drivers for SDV.

Secondly, distant search, through problemistic search – became an apparent transformation pressure as agents of SDV sought to adopt cloud technology from Cerner Cooperation in the US due to healthcare performance being below aspirations. This is in line with Cyert & March's (1963) and Greve's (2003) contributions to academia which demonstrate that problemistic search occurs when the organization performs below aspiration levels, as managerial preferences are bound towards more financially risky actions with the hope of meeting those aspiration levels. This is supported by Antonelli's (1989) idea of failure-inducement, which assumes that firms make innovative efforts when performance falls below a minimum threshold.

As previously mentioned, it may be that a lack of human capital in the form of scarce technological knowledge on cloud-systems contributes to such lagging performance. The nature of procurement from such a geographically distant organization signifies that a distant search process is undertaken. As imbalances are found in regard to expectations versus reality, managerial behaviors have been steered towards more exploratory possibilities which have the potential to cause major improvements in healthcare productivity (Rosenberg, 1969). This is exemplified well through a managerial interviewee, "*The scale of the system we can implement with Cerner is beyond the possibilities of Swedish competitors*." (5#). One of the large reasons why Skåne Region decided to engage in the procurement process with Cerner Cooperation was due to their technical ability to "*monitor the efficiency by the way we [healthcare workers] are working*" (5#). This is in line with previous research which illustrates that distant search plays an important role in orchestrating organizational reorientations and new product launches (Alexiev et al., 2010; Tushman & Rosenkopf, 1996; Virany, Tushman & Romanelli, 1992; Boeker, 1997; Ciborra, 1996; Eisenhardt & Tabrizi, 1995; Song & Montoya-Weiss, 1998).

Technological system level

One fundamental negative transformation pressure can be associated with driving SDV, that is, the *competition from smaller actors*. Competition from smaller actors appeared to be a driver of innovation in the case of SDV. Swann (2014) argues that the reason stakeholders innovate is to enhance their competitiveness which in some cases in essential for survival (Swann, 2014, p. 247). Individuals or companies that create radical new markets are not necessarily the ones that scale them up into big mass markets (Markides & Geroski, 2004, p. 1). As smaller actors in healthcare have great potential to harvest value of the mass market, they are seen as a threat and act as negative transformational pressure for SDV. This is best portrayed in the following quotes:

> *"We see other players too, like Kry or Doktor 24 which have been active for a long time. ... The improvements in patient communication and digitalization are mainly due to smaller innovation companies pushing the limits and stealing patients from the bigger regions." (4#)*

> *"There is a large drive for Skåne to be the best healthcare provider by 2025, which is being motivated and pushed for even more due to the smaller players." (5#)*

Both quotes reveal that competition from smaller local actors are challenging Region Skåne's healthcare system, as they are capturing a share of the market. The competition is interpreted as a strong pressure, motivating stakeholders to act fast. Due to the fact that the technological progress has been vast within smaller competitors, it forces Region Skåne to adapt new techniques which will put them at a competitive advantage. This goes against the notion of the Swedish paradox, which emphasizes that Sweden has high R&D expenditure but low competitiveness and productivity (Chaminade, Zabala & Treccani, 2010). All in all, SDV agents are struck with the pressure to adopt a new market position, which requires some important strategic decision making. Scholars such as Greve (1996) illustrate that organizations which are driven by low organizational inertia often successfully gain a more advantageous market position, for example through adopting newer technologies. Nonetheless, the intentions of SDV agents' stands in line with Marx's idea of competition, that organizations strive to gain higher profits by adopting labor-saving technologies (Taalbi, 2014; Carchedi, 1991). Furthermore, labor-saving technologies are often fueled by another more overarching macro driver - crisis.

Macro-level

COVID-19 has disproportionately impacted the world's most vulnerable and poor, resulting in a large set back in achieving the SDGs (López-Medina, López, Hurtado, Dávalos, Ramirez, Martínez, Díazgranados, Oñate, Chavarriaga, Herrera & Parra, 2021). Yet, even before

COVID-19, Kraljevic et al. (2014) states that it takes an average of 12 years to develop a new pharmaceutical drug from lab to market. Other scholars acknowledge that technological innovations in healthcare take millions or billions of dollars before they come to public use (Palancia & Fossat, 2020). Nonetheless, the COVID-19 pandemic has turned the world upside down, spurring individuals to create innovative healthcare solutions and solidifying collaboration between agents under unique circumstances. This has also been prevalent for stakeholders of SDV as one interviewee summarizes:

> "*Corona has made it easier to have consultations and discussions with patients online. I think we need to push for bigger digital transformation in order to strengthen this relationship between the patient and the doctor. I have seen this with my colleagues, that we are changing here. Digitalization is an opportunity, one which is being taken*." (5#)

> "*Corona has been a major driving force for innovation in Sweden ... people saw that they aren't even able to get an appointment at the hospital. Corona did speed up this process, to make sure that there are enough online doctors to support this as the demand is there. The door has opened more now since corona, we see that the market has matured more."* (3#)

Corona has developed a stronger digital transformation within the healthcare sector, as exemplified above. This may have more impact than one may imagine, as Sweden's healthcare system is known for its surprisingly low technical efficiency (Anell, Glenngård & Merkur, 2012; Tchouaket et al., 2012). Many of the innovations which have developed since the pandemic are focusing on the right problems, something which is often overlooked. Not all technological solutions within healthcare need to be complicated and expensive (Harris et al., 2018). Instead, many are taking simple and efficient solutions in order to "flatten the curve", thus saving lives and reducing the spread of the virus. Digitalization through, for example, video conferencing, is a trend which is noticeable within many industries, such as the fitness industry, food industry or entertainment industry (Palanica & Fossat, 2020). This trend appears to be prevalent too within SDV and therefore, COVID-19 is forcing individuals to be more resilient which is in turn driving the cloud-based innovation forward. A procurement officer mentions how COVID-19 is changing the daily routines of healthcare workers and how this may contribute to more innovation:

> "*He did these online meetings with his patients, the youngest was 28 and the oldest was 85. They were all instructed on what to do after the operation, they were told to virtually meet the surgeon the next day and follow certain instructions. They could all manage it, they all ended up liking the process! It was so easy! So simple*." (3#)

While facilitating innovation, the COVID-19 emergency has elicited individuals to be resilient in order to cope with the pandemic. It has made individuals define problems thoroughly, be open to new ideas, collaborate with other stakeholders, acknowledge failure as a success instead of defeat, and pushed individuals of all backgrounds to adapt their human behavior. The application of such principles has contributed to strengthening the innovation process of SDV in midst of a global battle against the virus. The fact that younger and older generations interpret the digital experience as "easy" and "simple" suggests that patients are also resilient. The

motivational efforts displayed by these individuals fosters rapid iteration of innovation development. Nonetheless, the passage also suggests that less strict regulations are prevalent. This resonates with the work of Perez (2010), who suggests that "windows of opportunity" arise when the socio-technical regime is destabilized. On the other hand, it may be bold to assume SDV is shaping a technological revolution. Instead, it may simply be one innovation which is part of absorbing ICTs which in turn is modernizing the healthcare system. It appears that the EHR system under development is an example of ICTs diffusing within the healthcare sector, something which has been difficult due to Sweden's fragmented EHR history (Lövström, 2019). This comes as no surprise when acknowledging how difficult it is for the healthcare industry to successively diffuse innovations (Jacobs et al., 2015).

Lastly, as expected, the health crisis was found to be a driver of innovation within the healthcare industry. The health crisis does not necessarily explicitly refer to COVID-19, but the accumulation of population health issues which affect the healthcare industry (eg. increase in illnesses, aging population, etc). The European Commission (2019) published a report which emphasized that there exists a public health issue in Sweden's younger population, as increases in obesity, cancer, mental illness, Alzheimer's disease and other dementias are of growing concern within Sweden. Thus, the health crisis can be seen as a driving force for SDV as it generates hope for more productivity and efficiency.

The health crisis tends to have a significant impact on community health and the economy whilst regions and municipalities are faced with the responsibility to foster a system which supports the care of older and disabled individuals. In 2009, the healthcare expenditures were 80% funded through tax, equivalent to 9.9% of the gross domestic product (GDP) whilst only 4% of the population had voluntary health insurance (Glenngård & Merkur, 2012). This suggests that individuals are highly reliant on the healthcare system on the regional and municipality level and patients expect the tax-funded healthcare system to address a variety of relevant issues. These issues include acknowledging and addressing the long waiting times, increasing choice, improving coordinated care, increasing quality and efficiency indicators, amongst other factors (Glenngård & Merkur, 2012). One interviewee expands on how the population health crisis is influencing the design of SDV:

> *"In this system we can run preventative follow up and big data analysis in order to extend and plan for population health. This is the most powerful and most new technical development in the full system. The mission we have is to implement this in the private and public care within Skåne region."* (5#)

This quote suggests that the population health crisis is a key driver for technical developments within SDV. As the region is responsible for the provision of healthcare services, key issues within population health are defined and taken into consideration through the technical innovation's preventative care solutions. This is further elaborated upon:

> "*We have many population health possibilities in our system. By using population health data, you can find out risks earlier on and begin treatments in an early stage, whether*

it be an early-stage signal for heart failure or indications of diabetes. It is preventative and very proactive care." (5#)

The health crisis is driving SDV forward as revealed by their involvement in leveraging population health data-driven solutions. Not only does SDV focus on battling various diseases, but it also incorporates preventative methods in order to localize and hinder various diseases at an early stage. This is in line with Sweden's national healthcare challenges, as there exists a growing number of people, especially over the age of 65, who develop diseases and disabilities (European Commission, 2019). In fact, research shows that Swedes currently live longer than ever before, but not all remain healthy in old age (European Commission, 2019). Thus, there is an increase in demand on health and long-term care systems. The disparities in population health crisis are driving innovations such as SDV forward, where digital care is on the rise as Sweden aims to be a world leader in exploiting opportunities offered by digitization in healthcare by 2025 (Regeringen, 2020).

5 Discussion & Conclusion

This thesis examines how innovations are shaped in Region Skåne's healthcare industry. It timely analyses what drives the development of technological innovations, considering the plentiful opportunities which stakeholders perceive throughout the innovation process. It assesses how innovations are the creative response to negative transformation pressure as well as opportunities. The study reveals that innovations in the healthcare industry are shaped by several positive and negative driving forces on four different levels, the micro-level, industry-level, technological system level and macro-level. The case study, which was based on exploratory semi-structured interviews, reveals which driving forces exist in the case of SDV, a private cloud-technology which incorporates EHR for individuals in Skåne. The main findings are summarized below.

5.1 Main Findings

What drives agents to innovate within the healthcare industry, especially in times of crisis? Negative macro-level factors such as COVID-19 and the general health crisis contribute to pushing SDV forward, sparking more efficiency and therefore a greater possibility in assisting the masses which are in need of medical assistance. Positive forces on the macro-level appear to be globalization, acceptance of technology and an alignment with regional, national and global goals. Globalization appears to assist SDV as it has allowed for distant search, making use of high-tech solutions originating from the other side of the globe, in the United States. Additionally, SDV has regional, national and global goals at its core, as alluded by interviewees. Such goals assist in driving the innovation forward, as there is a demand for increased efficiency within the healthcare sector as noted on the micro-level. An increase in efficiency and demand within Sweden's healthcare system was also related to three other positive driving forces on the micro-level, that is, more enriching patient/staff value, increased availability of healthcare workers and better access to information.

Negative transformation pressure has driven SDV on the micro-level as well, where the individual burn out of healthcare workers, administrative overload and the possibility of human errors persist. The individual burn out of healthcare workers was often attributed to one large transformation pressure on the industry-level, the un-unified organizational structure which exists in Region Skåne's healthcare industry. This un-unified organizational structure was deemed as unsustainable as it pushes the limits of healthcare workers, where time is precious and scarce. Distant search was deemed a negative transformative pressure due to stemming from a lack of human capital or lack of competitive edge. On the other hand, opportunities on

the industry-level, appear to be a positive and reinforcing top-down push from management, exemplified through their openness to distant search through creative response. The top-down managements engagement in distant search and creative response led agents to be open towards more international possibilities, bringing Region Skåne to interact with healthcare technology specialists which may have more experience or human capital.

Additionally, the competition from numerous smaller actors on the technological system level has driven SDV to engage in more complex technological solutions. Smaller competitors were a strong transformation pressure, as such competitors risk, as one interviewee put it, "stealing" a share of the market. As SDV is driven by low organizational inertia, through adopting newer technologies there is a high chance of gaining an advantageous market position. Lastly, the technologies provided by procurement actor Cerner Cooperation leave great opportunity for agents in Skåne Region to integrate complementary innovations, such as AI solutions, population health solutions or integrated solutions within elderly care, amongst many others. Therefore, the cloud-platform is seen as a great baseline for further technological innovation contributions which may speed up the efficiency of Sweden's healthcare sector to a greater degree.

5.2 Discussion

First of all, the overarching research question "**What drives the development of technological innovations in Region Skåne's healthcare sector?**" is limited to the singular case presented and answers are highly subject to change from case-to-case basis. The drivers of innovation for Region Skåne's SDV project are highly personalized as the overarching question is highly ambiguous. With that being said, the development of SDV is driven by positive factors exhibited by SDV agents, often driven by factors of expectation such as enriching patient & staff value, hopes of higher efficiency, the increased availability of healthcare workers and better access to information. As organizational level expectations were not met, a strong managerial command led to the exploration of global technological opportunities through distant and problemistic search in hope to meet aspiration levels (Greve, 2003; Cyert & March, 1963; Antonelli, 1989). Problemistic search is deemed risky, as managing innovation is difficult (Boer & During, 2001) and may catalyze new challenges (Barlow, 2016).

All in all, the distant search exhibited by SDV's product launch plays an important role in orchestrating organizational reorientations (Alexiev et al., 2010; Tushman & Rosenkopf, 1996; Virany, Tushman & Romanelli, 1992; Boeker, 1997; Ciborra, 1996; Eisenhardt & Tabrizi, 1995; Song & Montoya-Weiss, 1998). These reorientations occur for SDV in hope of gaining higher profits by adopting labor-saving technologies (Taalbi, 2014; Carchedi, 1991) from Cerner Cooperation.

Furthermore, the adoption of labor-saving technologies such as SDV are often fueled by another overarching macro driver – crisis (Perez, 2010). This research considers how technological

innovations in healthcare are shaped by COVID-19 and the health crisis, pushing innovation agents to act outside of their comfort zone as social, legal and economic boundaries become increasingly blurry. Taking advantages of such softened rules and reaping the benefits of crisis is paramount.

Lastly, competition is a key driver of innovation (Swan, 2014, Carchedi, 1991) as smaller and arguably more digitalized competitors have emerged. Acknowledging factors which could lag the healthcare system's competitive advantage, such as the individual burn out of healthcare workers, administrative work, the possibility of human error and un-unified organizational structure, has been instrumental in incentivizing innovation even further. Swann (2014) supports this notion as agents innovate in order to enhance their competitiveness which in some cases in essential for survival (Swann, 2014, p. 247).

5.3 Finding Implications

How does innovation drive the economy forward? Firstly, the case study on SDV revealed that innovations are driven by numerous factors on different so-called levels. Furthermore, it is beneficial to consider the blend of drivers and how they may inter-relate – whether they come in the form of opportunities or negative transformation pressure. Secondly, technological innovations have the possibility to generate additional innovational complementarities which may boost the productivity of the healthcare sector even further. Leveraging such opportunities plays a vital role in diffusing other innovations, many of which have the capacity to meet the needs of one the world's largest contemporary problems, effective and efficient healthcare for all. Additionally, management teams are not only faced with the pressure of adopting smart and strategic solutions to problems which arise within such drivers, but also making strategic decisions when faced with problems which may arise from innovations themselves. Furthermore, it is crucial to acknowledge that technologies which were adopted yesterday leverage a discourse of technological path dependency. All in all, it is paramount to consider to what degree innovational complementarities can be leveraged and help shape the trajectory of pre-existing technologies for the better.

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7 Appendix

7.1 Interview Guide

Topic: What drives the development of technological innovations in Region Skåne's healthcare sector?

This interview aims to encourage thoughtful reflection on how to develop, nurture and maintain innovations within Sweden's healthcare sector. The participation is voluntary and you are free to withdraw your answers from the research at any time. The interview will be recorded, and your identity will remain anonymous.

By indicating your verbal consent, you accept that the data collected from your participation will be used for thesis/journal publication, and you consent for it to be used in that manner. Do you verbally consent to participate in this project and to spend a duration of approximately 30 minutes of your time to participate in the process? [Yes / No]

Sample Questions (Adapted to updated RQ)

1) What do you do? What is your role within the development of digital healthcare solutions?
2) How do you make use of innovation in healthcare? What do you use it for?
3) Have you bought or created the innovation you are using?
4) What factors do you believe impact the innovation process?
5) What do you believe are the driving forces of the technological innovation?
6) What drives Region Skåne to innovate?
7) What sort of factors does this innovation help address?
8) Does the innovation improve patient safety and health equity? How?
9) Is the innovation designed to interact, guide or take decisions?
10) Do you believe current digital healthcare policies are fragmented or outdated in any manner?
11) Does the innovation help address representativeness?
12) Did you put in place educational awareness initiatives to help integrate the technology?
13) Do you see any obstacles or mitigators of this innovation?