UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

# SUSTAINABLE DIGITAL TRANSFORMATION

*A study on how Swedish manufacturing firms can achieve sustainable digital transformation*

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SUSTAINABLE DIGITAL TRANSFORMATION: A STUDY ON HOW SWEDISH MANUFACTURING FIRMS CAN ACHIEVE SUSTAINABLE DIGITAL TRANSFORMATION

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## ABSTRACT

The revolution of digital technologies has transformed the fundamental nature of a various range of organizations and business models, which increase productivity and creativity to address market demand more effectively than ever and allow faster information sharing thus reaching higher levels of collaboration. However, digital transformation often comes with many challenges, which require lots of time, effort, and willpower to get major transformative effects from new technology. Additionally, the Covid-19 pandemic has given many organizations unexpected crash courses in digitalization, while much progress such as hardware and infrastructure has been made, many organizations are facing the challenges of integration fragmented and shifting the transformation in a way that is sustainable.

Therefore, this thesis aims to identify the implementation of sustainable digital transformation in Swedish manufacturing companies. In more specific, the research seeks to provide up-to-date insights into how companies are doing their digital transformation, how sustainability is incorporated, the linked opportunities and challenges, and how to do it effectively, by analyzing and defining essential factors that contribute to it.

To find an in-depth understanding, a qualitative research strategy was chosen with the exploratory and abductive approaches. The research was based on both theoretical framework and semi-structured interview. The interviewees were selected following the predetermined area, resulting in six interviews. The findings from the interviews were thereafter analyzed by thematic coding and compared with the theoretical framework.

The findings identified three attributes of digital transformation: *a transformation process*, with *digital technologies involved,* to *capture most value*, which can be categorized into five elements: *business model, customer experience, operation, employee experience, digital platform***.** To assess the level of sustainability of the digital transformation, the Framework for Strategic Sustainable Development (FSSD) is used with five levels: *system, success, strategy, action,* and *tool*. Then, the thesis identified three key opportunities with thirteen incorporated: *revenue and business*, *streamlined operation*, *sustainability*; five key challenges with eleven incorporated: *resistance to changes, one-size-fits-all training approach, technical debt, complexity-in-use, energy inefficiency*. Next, the five key actions with sixteen incorporated to achieve sustainable digital transformation were identified: *a strong culture of innovation and sustainability; strong leadership team with clear visions and implementation plan; recruiting, training, and supporting talents; communication is key; deep understanding of users.* Finally, all attributes were connected and presented in a framework.


**Keywords**: Sustainable digital transformation, key opportunities, key challenges, key actions

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# I. INTRODUCTION

*The introduction consists of the background, problem discussion, purpose, research questions, delimitations, and implications. The background paired with the problem discussion aims to give the reader a general understanding of the background of this paper. This leads to the purpose of the topic with a specific research question and then narrow down into two sub-questions. Also, the delimitations and implications are stated to display the scope of this paper.*

## 1.1 Background

Since the first invention of the microchip in 1958 brought out the next industrial revolution and later on, personal computers by IBM, there are significant influences of digital technology in the economy and society. Digital technologies such as computers, robots, and smart equipment are changing significantly, becoming more powerful, and transforming organizations much faster than in the past (Demirkan, Spohrer, & Welser, 2016). These technologies enable the connectivity among billions of people through devices, in associated with the unprecedented processing power, storage capacity, and access to the knowledge thus creating a huge number of opportunities for entrepreneurs and innovative managers alike (Demirkan et al., 2016). This revolution is also transforming the fundamental nature of various ranges of organization and business models across industries such as healthcare, finance, logistics, education, manufacturing, retail, hospitality, transportation, telecommunication, e-government, energy, utilities, agriculture, and more (Demirkan et al., 2016). On one hand, incumbents invest heavily in digitalization that requires intensive resources such as tools, technology, culture, and human resources. On the other hand, many new startups have adopted digital processes and tools since their establishment to gain a competitive advantage over incumbents.

This changing event to become more digital is what Vial (2019) called digital transformation, which is "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 1). Digital transformation has also described the manifold sociotechnical phenomena and processes of using and adopting the technologies in broader individual, organizational, and societal contexts (Legner et al., 2017). At a micro-level, digital transformation encompasses the profound changes taking place in society and industries through the use of digital technologies (Vial, 2019). Meanwhile, at the organizational level, the companies are considered to find solutions with the technology innovation by devising "strategies that embrace the implications of digital transformation and drive better operational performance" (Vial, 2019, p. 118).

The digital transformation's ultimate goal is to boost productivity and creativity through different stages of decision making, connectivity, innovation, and augmentation, among others, from both individual level and organization level (Demirkan et al., 2016). Digital transformation enables organizations to address market demand more effectively than ever, and allow faster information sharing thus reaching higher levels of collaboration (Demirkan et al., 2016). It is also considered as the means to better products and services with their customers, distance themselves from (or keep up with) their competitors, and connect various aspects of their businesses (Hay, 2021).

## 1.2 Problem Discussion

Digital transformation is necessary for companies to keep up with their competitors and gain competitive advantages. The Covid-19 pandemic has catalyzed rapid digitalization and motivated corporations to use the technology available more effectively. However, digital transformation often comes with many challenges in its implementation as it is a complex upgrade for incumbents and investment intensive for startups (Vial, 2019).

In this connected world, it takes time, effort, and willpower to get major transformative effects from new technology (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014). Cloud computing, mobile computing, big data, data science, data analytics, and social computing are technologies that enable digital transformation (Chandola, 2015). The growth of these technologies is inclining so fast that many incumbents and start-ups continue to adopt the latest and the most efficient technology for their ever-ongoing digital transformation. Liu, R. et al. (2019) also mentioned in their report the direct and indirect negative impact related to the digital transformation is quite severe. This negative impact of digital transformation is also what Coad, A. et al. (2021) mentioned in "The Dark Side of Innovation" editorial. To explain further, innovation can be positive or negative, and those good and bad outcomes are typically unevenly distributed (Coad, Nightingale, Stilgoe, & Vezzani, 2021). Innovation or, in this case, digital transformation may cause side-effects that are overlooked or ignored by incumbents and start-ups (Coad et al., 2021). Those harmful dimensions could be the issues of scale between explorations by lead users versus the dependence of mass consumers that harmful can accumulate and interact thus causing new problems, end-of-product-life consideration which often is predictable from the start but ignored in the end, among others (Coad et al., 2021). This could risk public health, environmental degradation, or the fabric of society (Coad et al., 2021).

Moreover, Fitzgerald et al. (2014) also emphasize the challenges that the companies need to face of getting clear business benefits from new digital technology despite of the need for digital transformation. The firms may lack management temperament and relevant experiences to understand how to effectively drive transformation through technology (Fitzgerald et al., 2014). According to a survey conducted by Bonnet & Westerman (2018) among 1,300 executives in more than 750 global organizations, only 38% of respondents is considered to have the digital capability needed to become digital masters, and only 35% said to have the leadership capability for digital transformation.

The pandemic has given many organizations unexpected crash course in digitalization, while much progress such as hardware and infrastructure has been made, many organizations are facing the challenges of integration fragmented and shift the transformation in a way that is sustainable (J. Lauterbach & Mueller, 2014). Sustainable is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 39). Digital transformation has been proven to have many positive impact to sustainability (El Hilali, El Manouar, & Idrissi, 2020). For example, route optimization using AI in supply chain sector that reduced CO2 emission (Demir, Bektaş, & Laporte, 2014; Jabali, Van Woensel, & De Kok, 2012; Kuo, 2010), or Big Data could change physical data storage to digital reduce material usage and improved dematerialization for producing goods and material with minimal material input (Abadi, 2009; Bernardini & Galli, 1993). Thus, many companies have already implemented or even radically innovated their digital transformation. However, some of digital transformation activities in companies can contributed to several negative impacts to sustainability, namely e-waste, cybersecurity, and increased electricity consumption. Therefore, it is crucial to include sustainability in digital

transformation to reduce or diminish this negative impact (Liu, Gailhofer, Gensch, Köhler, & Wolff, 2019; Salomaa & Juhola, 2020). Therefore, some implementation of digital transformation needs to improve to be more sustainable. Thus, the term of sustainable digital transformation born to answer this need.

Based on the backgrounds mentioned above and their importance, we are motivated to find how Swedish companies implement a sustainable digital transformation, the opportunities, the challenges and lastly, strategic solutions that may contribute to the success of the sustainable digital transformation.

### 1.3 Purposes

This thesis seeks to contribute to the literature on sustainability digital transformation that is not so often reviewed but needs further study. Also, to add further insights that previous research lacks by combining theoretical frameworks with empirical findings. Furthermore, this thesis also aims to provide up-to-date insights into how companies are doing their digital transformation, how sustainability is incorporated, the linked opportunities and challenges, and how to do it effectively, by analyzing and defining essential factors that contribute to it.

This paper is conducted in the manufacturing industry context in Sweden since it is expected to provide more concrete insights and meaningful results. Sweden is ranked the first in the sustainability country ranking in 2021 (RobecoSAM, 2021) and the second in the Global Innovation Index 2020 (Dutta, Lanvin, & Wunsch-Vincent, 2020) thus expecting to gain the most meaningful insights from the country in the top list. Moreover, the manufacturing industry is among the industries that have significant need to transform digitally, and to keep the transformation sustainable to reduce the negative impacts on the economy, society, and environment as such, as well as to boost the productivity that the digital transformation could bring to the organizations in this industry.

### 1.4 Research Questions

The aim of this research is to identify the implementation of sustainable digital transformation in Swedish companies, also to find opportunities, challenges, and strategic solutions. In order to find these research aims, we formulate a research question and sub-questions as follows:

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*RQ: How can a Swedish manufacturing firm implement sustainable digital transformation?*

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*Sub-question 1: What are current implementations of sustainable digital transformation in Swedish manufacturing firms?*

*Sub-question 2: What are the opportunities in sustainable digital transformation?*

*Sub-question 3: What are the challenges in sustainable digital transformation?*

*Sub-question 4: What are the key actions to achieve sustainable digital transformation?*

### 1.5 Delimitations

To enable providing the most concrete and meaningful insights for the research questions, the scope of study will be delimitated of companies within the geographic area, company size, industry, which is stated and reasoned in the table 1 below.

**Table 1. Interviewees Selection**

| Factors | Selections | Reasons of choice |
|---|---|---|
| Geographic area | All county (län) in Sweden, including both headquarters and local branches | Study about the top country in sustainability and innovation, and to minimize the variation within the limited dataset, constraint in resources and researched time, also, the learning environment is based in Sweden. |
| Company size | Medium and large size, which is from 50 employees and above | Medium to big organization are more likely to experience and struggle with the digital transformation. |
| Industry | Manufacturing industry | Potentially undergo digital transformation, and sustainable aspect is top prioritized that can bring huge impacts to economics, environment, and society. |
| Subjects | * Managers/ Project Leaders of Digital Innovation/ Change/ Transformation team.<br>* Employees who contributed or participated in the digital transformation process | Only focus on subjects that have experiences in digital transformation, not in the sustainable department. The reason is to inspect digital transformation team's viewpoints regarding to sustainability. |

### 1.6 Implications

There are some limitations of this study related to some aspects of the research.
Firstly, the time limitation when collecting primary data could lead to small numbers of interview subjects. It could also become a constraint if the researchers could not find the similarity regarding company size, interviewee's position, etc. between the interview subjects to make comparison later on. For these reasons, the study results are applied to the manufacturing industry but may not for other industries.

Secondly, the researcher's background is considered another limitation since the study was conducted from a business and economic viewpoint. The researchers have limitations on in-depth technical understanding. Therefore, some technical aspects may not be deepened.

# II. THEORETICAL FRAMEWORK

*The main purpose of this literature review is to present theories related to the central topic of this thesis including digital transformations and sustainability, which includes the definition, the elements, how those two related to each other, opportunities, challenges, and key actions within the digital transformation journey.*

## 2.1 Sustainable Digital Transformation

### 2.1.1 Digital Transformation

#### *2.1.1.1 The definition of Digital Transformation*

It is necessary to have a clear definition of the concept of digital transformation. Therefore, a list of different definitions of this concept is presented in table 2 below. Based on these definitions, the definition of digital transformation within the scope of this thesis is stated ultimately.

**Table 2. Digital transformation definitions in literature**

| Authors | Digital Transformation Definition | Change process | Technology involved | Improve performanc | Capture new values | Strategic way |
|---|---|---|---|---|---|---|
| Vial (2019) | "…a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 118) | ✓ | ✓ | | | |
| Andriole (2017) | "Digital transformation is not a software upgrade or a supply chain improvement project. It's a planned digital shock to what may be a reasonably functioning system." (Andriole, 2017, p. 20) | ✓ | ✓ | ✓ | | ✓ |
| Horlacher et al. (2016) | "…digital transformation as their use of new digital technologies […] in order to enable major business improvements like enhancing customer experience, streamlining operations or creating new business models […] the digital transformation goes beyond merely digitizing resources and involves the transformation of key business operations, products, and processes, culminating in revised or entirely new business models." (Horlacher, Klarner, & Hess, 2016, p. 6) | ✓ | ✓ | ✓ | ✓ | |
| Legner et al. (2017) | "Digital transformation describes the changes imposed by information technologies (IT) as a means to (partly) automatize tasks." (Legner et al., 2017, p. 304) | ✓ | ✓ | | | |
| Vial (2019) | "The best understanding of digital transformation is adopting business processes and practices to help | ✓ | ✓ | ✓ | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | the organization compete effectively in an increasingly digital world." (Vial, 2019, p. 120) | | | | | |
| Haffke et al. (2016) | "Digital transformation encompasses the digitization of sales and communication channels, which provide novel ways to interact and engage with customers, and the digitization of a firm's offerings (products and services), which replace or augment physical offerings. Digital transformation also describes the triggering of tactical or strategic business moves by data-driven insights and the launch of digital business models that allow new ways to capture value." (Haffke, Kalgovas, & Benlian, 2016, p. 2) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bekkhus (2016) | "…the use of digital technologies to radically improve the company's performance." (Bekkhus, 2016, p. 2) | ✓ | ✓ | ✓ | | |
| Demirkan et al. (2016) | "Digital transformation is the profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritized way" (Demirkan et al., 2016, p. 14) | ✓ | ✓ | ✓ | ✓ | ✓ |
| Vial (2019) | "Digital transformation involves leveraging digital technologies to enable major business improvements, such as enhancing customer experience or creating new business models." (Vial, 2019, p. 120) | ✓ | ✓ | ✓ | ✓ | |
| Westerman et al. (2014) | "The use of technology to radically improve performance or reach of enterprises." (Westerman, Bonnet, & McAfee, 2014, p. 1) | ✓ | ✓ | ✓ | | |
| Fitzgerald et al. (2014) | "The use of new digital technologies (social media, mobile, analytics or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations or creating new business models)." (Fitzgerald et al., 2014, p. 2) | ✓ | ✓ | ✓ | ✓ | |

Note: the definitions in table 2 are sorted by reverted time chronologically

There is a common term among these definitions above, which is the application of digital technology to change different aspects thus improving business performance. However, as mentioned by the majority of the researchers, the digital transformation requires adopting digital technology to enhance customer experiences, operation business model, and so on, to leverage the changes and opportunities in the increasingly digital world. In this thesis, the definition is formed following the Guidelines for conceptual definition (Vial, 2019). The definition should be uniquely formal defined with clear terms and consistent within their field (Vial, 2019). Moreover, the definition should capture essential properties and avoid tautology or circularity (Vial, 2019). With this in mind, the definition of digital transformation that will be used in this research is as follow:

**Digital Transformation is a profound transformation process of business model, operation, customer experience, employee experiences, or platform by adopting new digital technologies and their impacts in a strategic and prioritized way to capture most values.**

*2.1.1.2 The elements of digital transformation*

According to Davenport, Godfrey, & Redman (2020), the Digital Transformation comes down to four key business areas, including technology, data, process people, and organizational change capacity. To gain success in this journey, the most important step requires bringing together and coordinating a significant range of effort to assemble the right team of technology, data, and process people who can make a perfect team, with a strong leader of change management (Davenport, Godfrey, & Redman, 2020).

Demirkan et al. (2016) also agreed with this approach by emphasizing the IT professionals, executives, and entrepreneur (talent) roles to understand the new business models, the technology paradigms, the culture evolution as well and management practices to ensure the success of the digital transformation (Demirkan et al., 2016).

Meanwhile, Legner et al. (2017) distinguished three aspects of digital transformation, including the result of digital transformation (related to the organization's goals after carrying out the digital transformation), the de-facto processes of the transformation (i.e. the necessary to change), and the digital transformation's underlying technology backgrounds (Legner et al., 2017). Regarding the approach based on the result of the digital transformation, Fitzgerald et al. (2014) referred the digital transformation's aspects based on its benefit, which are better customers experiences and engagement, streamlined operations and new lines of business or business model. In particular, the first benefit of improving customer relationships are the most successful aspect of a company within the digital transformation by enhancing products and services in customer-friendly ways (Fitzgerald et al., 2014).

Having more detailed approach, Kiron et al. (2016) navigated the complexity of the digital transformation into digital congruence, which contains six as aspects of culture, people, structure, and tasks aligned with each other, company strategy, and the challenges of constantly changing the digital landscapes (Kiron, Kane, Palmer, Phillips, & Buckley, 2016). If the culture, people, structure, and tasks are in sync, the businesses process can move forward successfully and confidently (Kiron et al., 2016).

There are various approaches to categorize different elements of digital transformation. However, approach used in this thesis is presented based on Bonnet & Westerman (2021) since this approach is evaluated to be mutually exclusive and collectively exhaustive. In one paper, it is divided digital transformation capacity (as digital masters) into digital capacity and leadership capacity (Westerman et al., 2014). The digital capacity is the ability to use innovative technology to improve elements of the business, meanwhile, the leadership capacity enables the companies to envision and drive the organizational change in a systematic and profitable ways (Westerman et al., 2014). Nine years later, these researchers published new paper to update the previous one with more emphasis on employee experiences and business model innovation, as well as the digital platforms, which powers other elements to enables further innovation if it is structured and managed well (Bonnet & Westerman, 2021). According to them, the elements is divided into five main groups, including transforming the customer experience, operations, employee experience, business models, and digital platform (Bonnet & Westerman, 2021).

**Table 3. Digital transformation elements framework (Bonnet & Westerman, 2021)**

| BUSINESS MODEL<br>Digital enhancements<br>Information-based services extensions<br>Multisided platform businesses | | |
|---|---|---|
| CUSTOMER EXPERIENCE<br>Experience design<br>Customer intelligence<br>Emotional engagement | OPERATIONS<br>Core process automation<br>Connected and dynamic-operations<br>Data-driven decision-making | EMPLOYEE EXPERIENCE<br>Augmentation<br>Future-readying<br>Flex forcing |
| DIGITAL PLATFROM<br>Core<br>Externally facing<br>Data | | |

The customer experience includes experience design, customer intelligence and emotional engagement (Bonnet & Westerman, 2021). Meanwhile the experience design relates to the equal measure of empathic creativity and technological prowess to get the understanding of human behaviors and customer insights then digitally reengineer customer experiences, the customer intelligence integrates customers' data and understanding customer behavior, and the emotional engagement relates to the emotional connect to create compelling customer experience (Bonnet & Westerman, 2021).

The operation is considered to enable unique customer experiences and business models by move beyond back-office efficiency, by engaging core process automation, connected dynamic operations and data-driven decision-making (Bonnet & Westerman, 2021).

Recently, the companies started to focus on employee experiences as they are either the greatest inhibitors or the greatest enablers of transformation success (Bonnet & Westerman, 2021). It can be achieved by the augmentation of productivity and performance boosted by robotics and digital technologies, or future-reading by providing the employees with the necessary skills and reshape the corporate capabilities, or flex forcing to response to fast-paced digital opportunity and threats (Bonnet & Westerman, 2021).

Remarkably, every industry now and then is paying attention to how business model innovation is yielded by digital prowess of digital enhancements, information-based service extensions or multisided platforms (Bonnet & Westerman, 2021). The companies are more into expanding product-based business models with information-based services by combining sensors, communication networks, apps, among other to create and capture new values (Bonnet & Westerman, 2021).

Last but not least, the transformation of digital platform provides a clean, well-structure platform with technology, application and data could power a company's business processes by core platform (a strong foundation for operational and transactional systems), externally facing platform (connect to customers and ecosystem partners), and data platform which

provides to perform intense analytics, as well as build and test algorithms (Bonnet & Westerman, 2021). The five elements mentioned above is summarize in the table 3.

### 2.1.2 Sustainability

#### *2.1.2.1 Definition*

Sustainability is growing as an essential factor in economic and social activities that have become a well-covered and researched topic in recent years. Based on a study conducted by Hoffman (2018), sustainability courses taught in most business schools in the US with sustainability as a topic for 50% of new research in 2018. Furthermore, 88% of students in US business schools realized the crucial importance of sustainability for business, and 67% of students were eager to incorporate sustainability in their future job (Hoffman, 2018, p. 185). Besides academia, the business sector is also interested in sustainability; 78% of corporations listed in the S&P 500 conducted sustainability initiatives and produced annual reports based on environmental and social metrics (Hoffman, 2018). However, despite the growth and interest, sustainability is a complex term with a broad scope that lacks standard definitions (Moore, Mascarenhas, Bain, & Straus, 2017). Without the standard, operationalizing and measuring sustainability will be difficult and unclear (Moore et al., 2017). Thus, understanding the correct definition of sustainability in relation to the research is important.

As the simplest definition, sustainability is the "capability of being maintained at a certain rate or level" (Gruen et al., 2008, p. 9). From this simplest definition, Gruen emphasized "capability to maintain" as the center focus of sustainability, which means that sustainable activities and subjects need to maintain the longevity, resources, and process for continuous usage. On the other hand, the first definition of sustainable development emerged from the World Commission on Environment and Development report by Brundtland in 1987, which is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 39). From Brundtland's definition, sustainability is defined as capability for development that will not threaten the future. Both definitions of Gruen and Brundtland are flexible and not limited to one aspect of activities or processes but can be applied to different aspects such as environment, social and economy. Thus, making these definitions of sustainability is the most used and derived.

Moore et al. (2017) conducted research of sustainability definitions from 209 original literatures from healthcare intervention field. From this research, Moore et al. (2017) found the five key constructs of individual and organizational sustainability definition from the research. The five constructs are "(1) after a defined period of time, (2) the program, clinical intervention, and/or implementation strategies continue to be delivered and/or (3) individual behavior change (i.e., clinician, patient) is maintained; (4) the program and individual behavior change may evolve or adapt while (5) continuing to produce benefits for individuals/systems." (Moore et al., 2017, p. 7). These key constructs aimed to determine sustainability definitions that usually differ from organization to organization and people to people.

**Table 4. "Summary of definition references abstracted to sustainability constructs" (Moore et al., 2017, p. 5)**

| Definition references | Time | Continued delivery | Behavior change | Evolution/ adaptation | Continued benefits |
|---|---|---|---|---|---|
| Aarons et al. (2011) | | | X | | |
| Blasinsky et al. | X | X | | | |
| Bossert (1990) | X | X | | | X |
| Buchanan et al. (2005) | X | | X | | X |
| Chambers et al. (2013) | X | X | | X | X |
| Doyle et al. (2013) | | | X | | X |
| Evashwick and Ory (2003) | X | X | | | |
| Fleiszer et al. (2015) | X | X | | X | X |
| Glasgow et al. (1999) | X | X | X | | X |
| Goodman et al. (1993) | | X | | | |
| Greenhalgh et al. (2004) | | | X | | |
| Gruen et al. (2008) | | X | | | X |
| Johnson et al. (2004) | | X | | X | X |
| Mancini and Marek (2004) | | X | | | X |
| National Health Service (2007) | X | | X | X | X |
| Olsen (1998) | | | | | X |
| Paine-Andrews et al. (2000) | X | X | X | | |
| Pluye et al. (2004) | | X | | X | |
| Scheirer (2005) | X | X | | | X |
| Schell et al. (2013) | X | X | | | X |
| Shediac-Rizkallah and Bone (1998) | | X | | | X |
| Stetler et al. (2007) | X | | X | | X |
| Stirman et al. (2012) | X | X | | X | X |
| Swerissen and Crisp (2004) | | X | | | X |

Most of the literature Moore's analyzed showed that the sustainability definitions related to one or more key constructs from the table above. Continued delivery (the 2nd construct), continued benefits (the 5th construct), and time (the 1st construct) are mentioned the most by researchers when defining sustainability. Moore et al. (2017) summarized that most of the literature on sustainability definition articulates sustainability as continuous delivery and benefits over time. Also, even though not mentioned very often, some definitions noted behavior change and adaptation as sustainability definitions, which closely related to Brundtland's definition of sustainability.

*2.1.2.2 Corporation roles in sustainability*

Lawrence and Weber further discussed the definition of sustainability from Gruen and Brundtland in their notably popular book Business and Society: stakeholders, ethics, and public policy. Lawrence and Weber suggested that society needs to incorporate sustainability in its activities, "for human society to survive over time it must operate sustainably, in a way that

does not destroy or deplete these natural resources for future generations." (Lawrence & Weber, 2013, p. 178), and "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Lawrence & Weber, 2013, p. 185). They also mentioned the crucial roles of corporations in sustainable activities "corporation should act in a way that enhances society and its inhabitants and be held accountable for any of its actions that affect people, their communities, and their environment." (Lawrence & Weber, 2013, p. 48). From this discussion, even though Lawrence and Weber argued that society (citizen, corporations, government included) needs to live sustainably and implement sustainability in their activities, corporation roles in sustainability are considered more significant. The reason is that corporations contributed more to sustainable activities that produced sustainable products for society compared to regular citizens or government (Lawrence & Weber, 2013). Moreover, corporations also gained extensive access to exploit natural resources that raised sustainability concerns that negatively impacted the environment, society, and economy (Lawrence & Weber, 2013). Because corporations' activities both contributed to the improvement or retrogression of sustainability, corporations not only became the liable party but also sustainability pioneers (Lawrence & Weber, 2013).

Delmas, Lyon & Maxwell (2019) also mentioned corporation roles as pioneers. They argued that the roles of the corporation in sustainability are the pioneers that induce the large-scale sustainability transition (Delmas, Lyon, & Maxwell, 2019). Market leader corporations with innovation and sustainable mindset led its industry to do better practice even led in across multiple industries (Delmas et al., 2019). Even though smaller corporations contributed to innovative and sustainable change in their industry, the ripple effect from smaller corporations is not as significant as market leader corporations (Delmas et al., 2019). For example, DuPont, an established chemical company from USA decided to eliminate the production of six keys of chlorofluorocarbon (CFC) that contributed greatly to the ozone-destroying greenhouse gases (Reinhardt & Porter, 2001). DuPont stopped CFC commodities far before the Montreal and Kyoto Protocol of Sustainability deadline (Delmas et al., 2019; Reinhardt & Porter, 2001). DuPont action as pioneer changed and motivated many other companies to eliminate CFC, thus contributing to 40% less CFC from chemical and other industry production activity in USA only (Reinhardt & Porter, 2001). Moreover, CFC consumption also decrease drastically afterward (Reinhardt & Porter, 2001). Although DuPont decision was to contribute to its social responsibility as a corporation, DuPont won favorable view from media and public, thus gained economical strategic benefit (Delmas et al., 2019; Reinhardt & Porter, 2001). DuPont became a market leader in non-CFC commodities that gained a higher margin from CFC commodities (Delmas et al., 2019; Reinhardt & Porter, 2001). On the other hand, even though small and medium enterprises tried and some of them succeed to implement sustainable digital transformation, the impact to the industry is very small (Reinhardt & Porter, 2001).

### 2.1.3 Sustainable Digital Transformation

Based on the European Digital SME alliance, Sustainable Digital Transformation is "process of digitalizing the economy in a long-lasting, green, and organic way aimed to support and enable Europe's twin transitions to a green and digital economy by building on its key strength: innovative SMEs and their business ecosystems" (Alliance, 2020, p. 3). As mentioned in the different sections above, digital transformation is a profound transformation process of business model, operation, customers experience, employees' experiences, or platform by adopting new digital technologies and their impacts in a strategic and prioritized way to capture most values. On the other hand, sustainability is the capability to maintain delivery and benefits over time without compromising future generations in the process (WCED, 1987). Thus,

combining these two, sustainable digital transformations can be defined and used in this paper as **activities to maintain and transform business model, operation, customer experience, and employee experience to have low or zero impact to the environment, economy, and society over time**.

Several studies of sustainable digital transformation showed different results and arguments to find the actual relationship between both theories. Many of these studies focused on the impact of digital transformation on sustainability, primarily related to the three pillars of sustainability: environment, social, and economy. Bican and Brem (2020) asked a big question of whether there is sustainable digital at all. In their case-study research from 12 high-tech German companies, the answer for that question is relative and depends in many cases (Bican & Brem, 2020). For example, if digital transformation allowed many managers from different locations to participate in virtual conferences instead of travelling to one place, it brings a positive effect on the environment, but it negatively impacts the environment if used to mine cryptocurrency (Bican & Brem, 2020). Based on the Deloitte and GeSI report of "Digital with Purpose", theoretically, the impact of digital transformation is positive for sustainability. Digital technologies accelerated the progress to reach the UN SDGs goals in the environment, society, and economic sectors (GeSI, 2019). One of the positive impacts of the economic sector is digital technology promoted sustainable industry, for example, transparency production uses digital systems to monitor the supply chain and process optimization (GeSI, 2019). Camodeca and Almici (2021) tested the UN SDGs, Deloitte and GeSI assumption of the positive impact of digital transformation by performing textual analysis to assess Italian firms' digitalization efforts (Camodeca & Almici, 2021). The findings showed that digital technology is positively related to fulfilling the sustainable agenda in these firms (Camodeca & Almici, 2021). However, even though digital transformation showed several positive impacts on some of the three pillars of sustainability, one single sustainable digital transformation effort rarely affect the whole (Bican & Brem, 2020). This is because the overall sustainability in the company relied on the complex inter-connecting activities of digital transformation, production, human resources and business model (Bican & Brem, 2020).

Despite some of its proven positive relationship with sustainability, a sustainable digital transformation requires corporations to commit to certain indicators and frameworks that ensure sustainability. As mentioned above, sustainability is complex and often vague in its application. This is because sustainability is often translated differently in societal, economic, and environmental contexts. The different understanding of sustainability created different processes and activities, which increases the difficulty to group and pinpoint sustainable activities, especially in digital transformation. Moreover, no sustainability standard or criteria explicitly has been applied for digital transformation. Thus, different corporations tended to follow specific sustainability standards and guidelines depending on their preferences. Even though many companies committed and reported their sustainability effort through the annual report, this report is based on the in-house investigation with a high probability of conflict of interest. Thus, measuring sustainability needed proactive efforts from an external independent part of the company to identify the accuracy of the sustainability report (Adams, 2004). Based on some research, there is no finite method, indicator or framework that is all-for-one for analyzing the sustainable digital transformation (Feroz, Zo, & Chiravuri, 2021; Pendergrass, Sampson, Walsh, & Alagna, 2019; Savastano, Amendola, Bellini, & D'Ascenzo, 2019; Stuermer, Abu-Tayeh, & Myrach, 2017). Each industry had a different approach in its digital transformation to be sustainable (Stuermer et al., 2017). However, Savastano et al. (2019) and Stuermer et al. (2017) suggested looking into the company's digital transformation activities and analyzing them based on sustainability standards. Activities or operations followed

sustainability standards based on indicators or frameworks will determine corporations' digital transformation sustainability level (Stuermer et al., 2017). Their suggestion is based on the meaning of indicator as a parameter that provides a directional point to inform and describe the state of a phenomenon (Sahely, Kennedy, & Adams, 2005). With that said, sustainable digital companies can be translated to companies that follow the sustainability framework and show high positive indicators.

### 2.1.4 Sustainable Implementation Tools

In practice, corporations, organizations, and governments follow different plans or frameworks to be sustainable. Most of them relied on the governmental body or sustainable organization with experts' advice to compose their sustainability plan (Stuermer et al., 2017). The most derived and followed sustainability action plan is the United Nations Sustainable Development Plan (UN SDGs). The plan attributed several indicators to indicate sustainability on many activities. Besides UN SDGs, the Framework for Strategic Sustainable Development (FSSD) is the most applicable and easy-to-follow sustainability framework that corporations, especially Swedish corporations follow (Aldabaldetreku, Lautiainen, & Minkova, 2016; Lindahl, Robèrt, Ny, & Broman, 2014; Thompson, Lindahl, Hallstedt, Ny, & Broman, 2011).

#### *2.1.4.1 The United Nation Sustainable Development Goals*

The United Nation Sustainable Development Goals (UN SDGs) are the most prominent sustainability plan with broad scope consist of different goals to achieve sustainability (UN, 2015). The 17 UN SDGs goals (Appendix E) consisted of action plans for the entire aspect of human life to improve sustainability.

In order to fulfil all goals mentioned in Appendix E, United Nations (UN), its inter-agency and expert group developed global sustainability indicators that refined, and renewed annually (UN, 2015). The UN SDG also consisted of global indicators combined the three metrics of environmental, economic and social to evaluate sustainable activities (UN, 2015).

Based on Deloitte and GeSI report of Digital Transformation impact to sustainability, digital transformation contributed for the improvement of 103 of 169 from the SDGs target (GeSI, 2019). The contribution classified into three categories: Biosphere, Society and Economy. Firstly, in the Biosphere categories, digital transformation contributed to the climate change (UN SDGs 13$^{th}$) and natural resources (UN SDGs 6$^{th}$, 14$^{th}$, 15$^{th}$). While in the Society category contributed to fulfilment of basic human needs (UN SDGs 1$^{st}$, 2$^{nd}$, 3$^{rd}$, 4$^{th}$), sustainable amenities and utilities (UN SDGs 7$^{th}$ and 11$^{th}$) and a fair and just society (UN SDGs 5$^{th}$ and 16$^{th}$). Lastly, in the Economy category contributed inclusive growth (UN SDGs 8$^{th}$ and 10$^{th}$) and sustainable industry (UN SDGs 9$^{th}$ and 12$^{th}$) (GeSI, 2019).

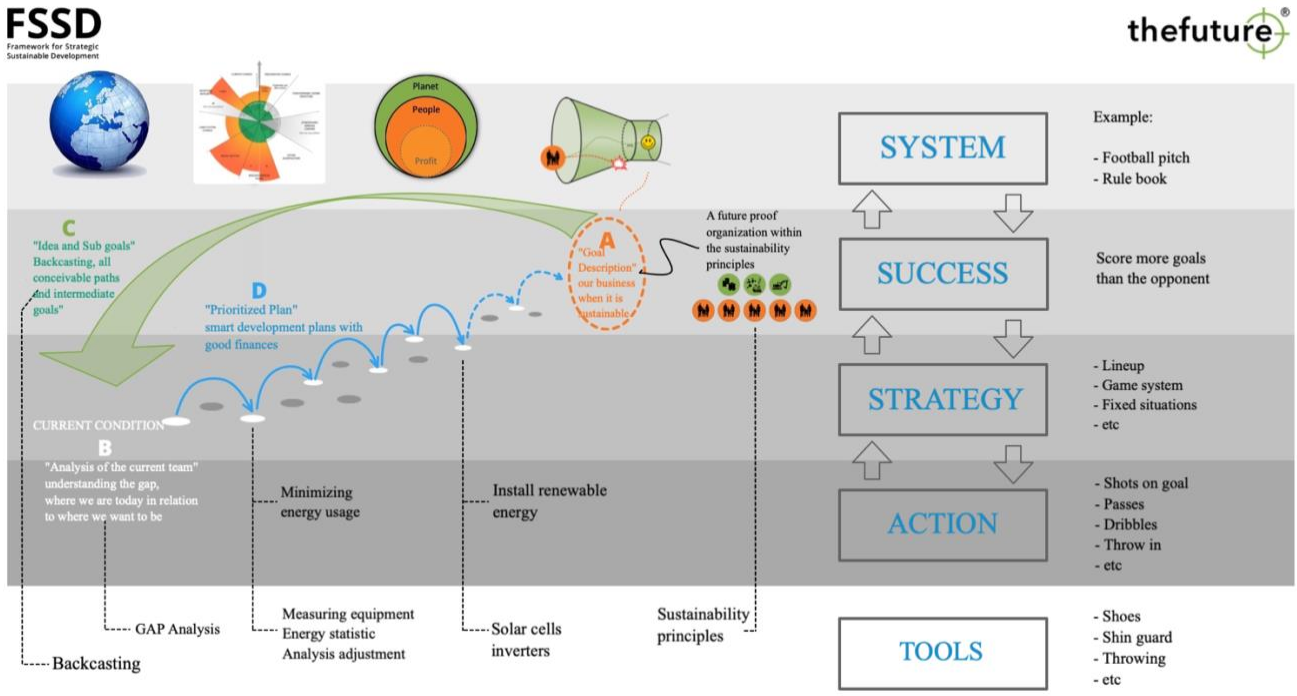
#### *2.1.4.2 The Framework for Strategic Sustainable Development (FSSD)*

In response to limiting and eliminating sustainable ecological, social and financial problems and answering the big question of how humanity succeeds without having a finite sustainable operational and systematic approach, a sustainability consensus began in Sweden in the 1990s (Robèrt, Torekull, & Peterson, 1993). From this consensus and several refinements (Robèrt et al., 2012; Robèrt, Holmberg, & Weizsäcker, 2000), the Framework for Strategic Sustainable Development (FSSD) was finalized. FSSD proved to aid organizations in understanding, acclimating, designing, and implementing sustainability (Broman & Robèrt, 2017). FSSD also emphasized sustainability as the central business components (Broman & Robèrt, 2017).

Furthermore, Broman & Robert (2017) concluded that FSSD helped management model and assessed sustainable potentials and prevent unwanted results even from unknown problems from sustainable implementation (Broman & Robèrt, 2017). Thus, identifying FSSD methods direct or indirect implementation in the company helped to show the sustainability degree of the company.

FSSD consisted of four features that is intercorrelated. These features are the funnel metaphor, the five-level model, the principled definition of sustainability, and the operational procedure towards a sustainability transformation. These four features can be used together or separately to establish sustainability by using Five-level model as the main non-prescriptive procedure to implement sustainability (Broman & Robèrt, 2017). Figure 01 below showed relations of four main features of FSSD that are intercorrelated to the five-level model.

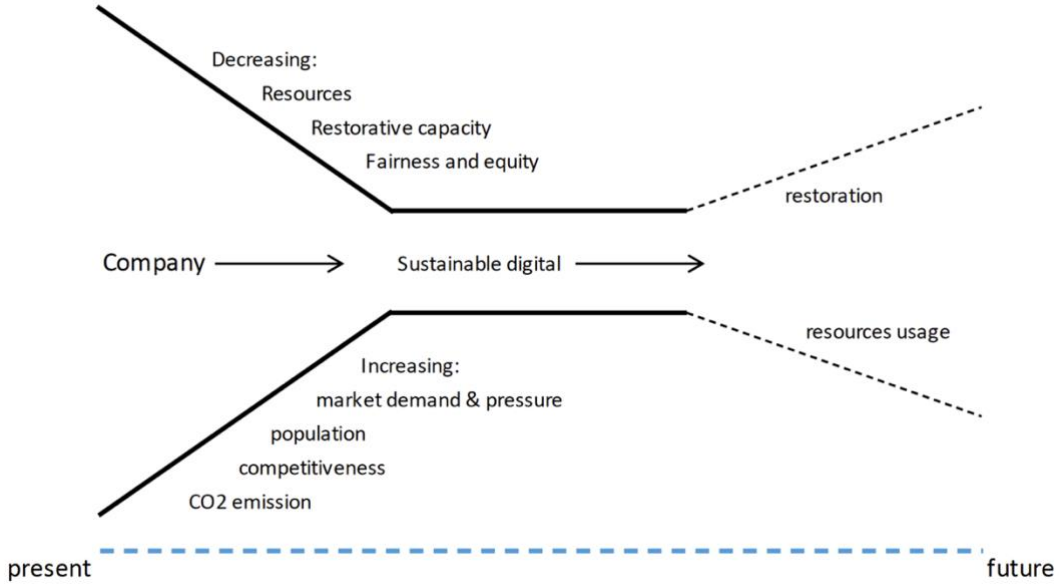
**Figure 1. Framework for Strategic Sustainable Development model (metoden.com, 2020)**




*The funnel metaphor*

Firstly, the funnel metaphor described as "A funnel metaphor facilitating an understanding of the sustainability challenge and the self-benefit of competent proactivity." (Broman & Robèrt, 2017, p. 4). This metaphor's purpose is to illustrate and visualize the sustainability challenges and benefit in economy, environment and society in the present situation (Broman & Robèrt, 2017). Proactively using funnel metaphor indicated that corporations are aware of new sustainable processes or trends which positively affect their sustainability transformation (Broman & Robèrt, 2017). The funnel metaphor is a part of five-level model, which essential to map sustainability system (Broman & Robèrt, 2017).

**Figure 2. The funnel metaphor (Broman & Robèrt, 2017, p. 6)**



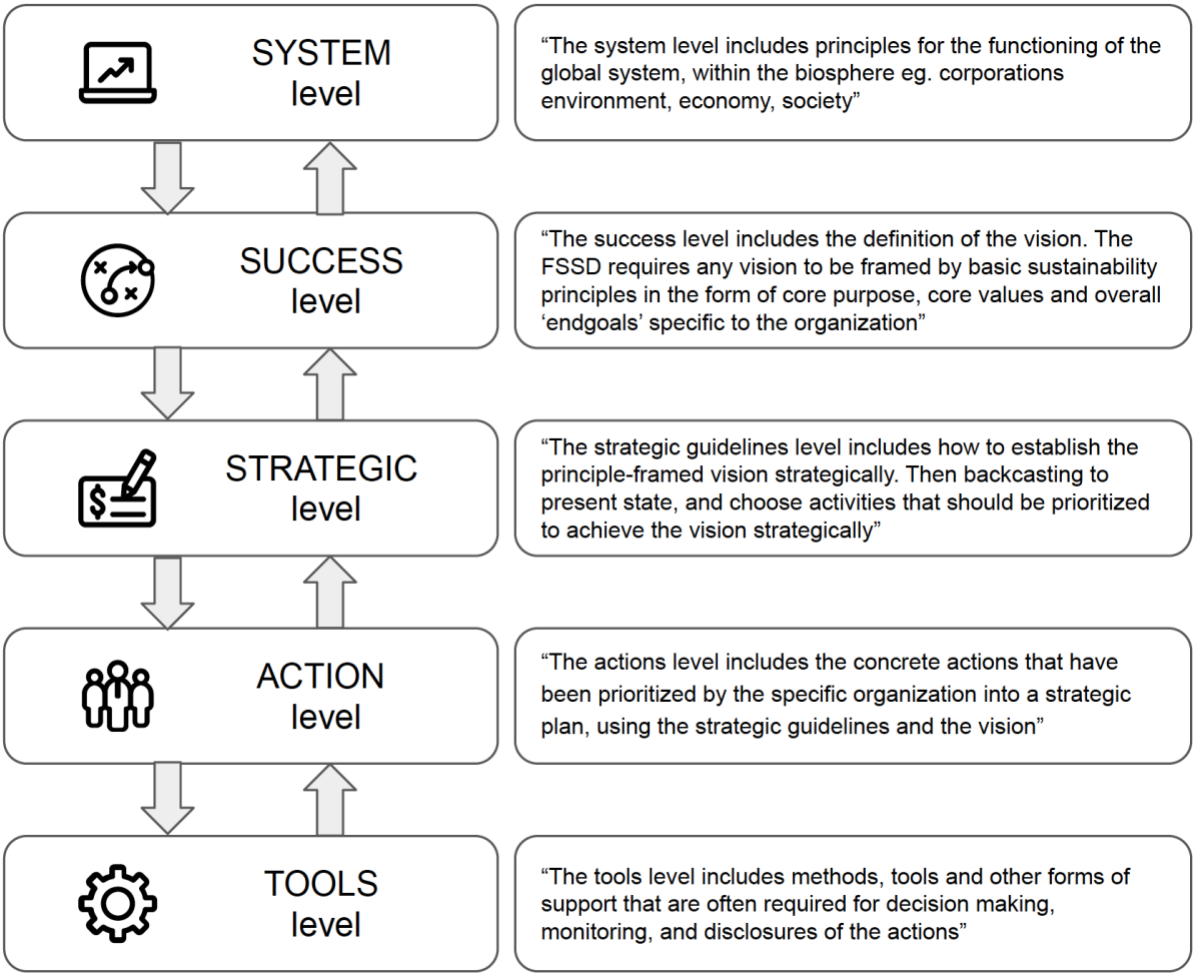

From figure 2 above, the funnel metaphor illustrated the company inside a funnel. As the company moved through time, it faced decreased resources (environment), restorative capacity (economy), fairness and equity (society) while market demand and pressure (economy), population (society), competitiveness (economy) and CO2 emission (environment) increased (Broman & Robèrt, 2017). The funnel got smaller over time, and without any improvement, innovation, or transformation to a sustainable way, the company faced dire consequences that threatened the whole business (Broman & Robèrt, 2017). On the other hand, when the company chose to improve, in this example, by using sustainable digital, the ability to restore the business increased, also making the process more efficient, allowing fewer resource usage (Broman & Robèrt, 2017).

*Five-level model*

Secondly, the five-level model is comprised of five levels that are interconnected with each other. The five-level model uses other features of FSSD to plan, implement and innovate sustainability. Five-level model is system, success, strategic guidelines, actions, and tools (Broman & Robèrt, 2017). The system level contributed to the corporation's understanding and awareness of its system where it belongs. Understanding the system showed the corporation's first action in moving to sustainability. The funnel metaphor is usually used to identify and map the corporation's system (Broman & Robèrt, 2017). The success level helped to form the corporation principal definition of sustainability. The correct and crafted principal definition is crucial for forming a core purpose, values, and strategy that incorporate sustainability. Sustainable principles and the ABCD method are usually used to help to form the standard definition and core purpose of sustainability (Broman & Robèrt, 2017). The strategic level helped the corporation plan and implement the sustainable core purpose and values strategically by using the backcasting and baseline method from the ABCD method (Broman & Robèrt, 2017). Backcasting and baseline methods are used to adjust present capabilities and the vision to strategically select prioritized activities (Broman & Robèrt, 2017). The action level contributed of concrete action that is taken from the strategy level that needs to be done to achieve sustainability (Broman & Robèrt, 2017). The tools level consisted of a variety of tools that are used to manage, control or plan sustainability such as environmental laws,

sustainability steps, or sustainability reports (Broman & Robèrt, 2017). From figure 3 below, the five-level model consisted of all levels needed in sustainability also function as the main features of the FSSD method that correlated to all features such as tunnel metaphor, sustainability principles, and operational procedure.

**Figure 3. Five level model (Broman & Robèrt, 2017, p. 6)**



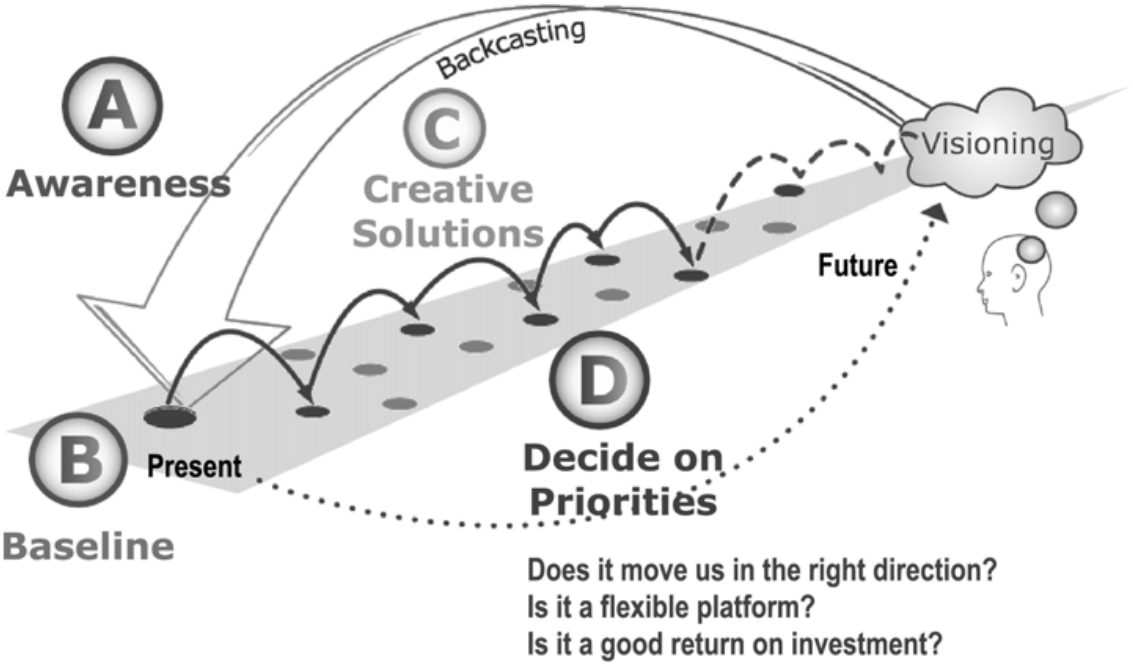

*Sustainability principles*

To be useful for planning, backcasting, and design sustainability, the management and employees needed to formulate and understand the generally applicable sustainability definitions. The definitions needed to function as the basis to plan "analysis guidelines, innovation, development" (Broman & Robèrt, 2017, p. 6). Correct formulation and understanding of these sustainability definitions contributed to the success of sustainability implementation also re-design in the company (Broman & Robèrt, 2017). Thus, this feature is the core concept for success level in the five-level model. In this feature, Broman and Robèrt (2017) derived Brundtland's broad definition of sustainability and other researchers into eight generally applicable definitions for corporations mentioned in Appendix B.

*Operational procedure*

Lastly, the operational procedure consist of ABCD-method that function as a guideline application, support the planning and redesign tool for sustainability framework above (Broman & Robèrt, 2017).

**Figure 4. ABCD-method (Broman & Robèrt, 2017, p. 6)**




The first step in this method is A = Awareness and Visioning, which means the company needs to be aware of sustainability impact in their process, and later on, vision for a better sustainable future with backcasting to current and past conditions (Broman & Robèrt, 2017). After visioned new goals, B = Baseline is the next step in this method. The company needs to create a gap analysis of the present situation and future vision (Backcasting), such as evaluating processes, products, human capital, and energy usage (Broman & Robèrt, 2017). Later on, C = Creative Solutions with involve brainstorming to find potential solutions and lastly D = Decide on Priorities, which action makes the company move to sustainability fastest (Broman & Robèrt, 2017).

## 2.2 Opportunities for Sustainable Digital Transformation

The overall benefit of sustainable digital transformation is to increase the productivity and creativity of both individuals and organizations (Demirkan et al., 2016). Digital transformation will help the firms to address market needs much more quickly than used to be possible, and to enable a higher level of collaboration for sharing information much faster (Demirkan et al., 2016). Having more detailed ideas, Fitzgerald et al. (2014) stated that if an organization effectively manages digital technology, it can expect to gain one or more benefits: better customer experiences and engagement, streamlined operation, and new lines of business or business model (Fitzgerald et al., 2014). Moreover, it is found that improving customer relationships were the area which the organization has the most success within sustainable digital transformation, followed by improving the overall customer experience, and enhancing products and services in more customer-friendly ways (Fitzgerald et al., 2014). In addition to that, digital technology can help to sharply improve internal communication, especially using social media (Fitzgerald et al., 2014). Remarkably, digital transformation opens up opportunities for an organization to create new business, or launch new products and services (Fitzgerald et al., 2014). Meanwhiles, some ideas suggested that digital technology can tell customers to schedule maintenances, and avoid failures thus improving operations (Fitzgerald et al., 2014).

Digital transformation provided several opportunities to help companies achieve sustainability. The opportunities of digital transformation identified by its positive impact and contribution to the sustainability (El Hilali et al., 2020). Digital transformation has proven to lower the cost of capital of 90% of the researched companies from extensive usage of data that allow companies to make better decisions towards sustainability in their business activities (Clark, Feiner, & Viehs, 2015). These decisions allowed the company to implement correct sustainability standards, which usually took a long time and resources to analyze using only human power (Clark et al., 2015). The same report also showed that 88% of companies that practiced sustainable digital transformation showed a solid increase in Environmental, Social and Governance (ESG) in their operation (Clark et al., 2015). ESG increase is achieved by good digital governance by changing obsolete non-digital, and unsustainable business processes. Later on, the new process that incorporated sustainability goals in its core affected the whole business process over time (Clark et al., 2015).

The growing awareness of sustainability positive impact shifted several companies to become not only sustainable but also "net positive" (El Hilali et al., 2020, p. 5). Net positive companies strived not only to reduce the harmful impact but also to bring an all-around positive impact on the world (El Hilali et al., 2020). For example, a solar company is considered a net positive company in comparison with a coal mining company with a sustainable effort (El Hilali et al., 2020). Even though some negative impacts in solar panel production still occurred, the positive impact of solar-panel outweighs its negative production impact, which is reflected positively in the company sustainability report (El Hilali et al., 2020). Moreover, with a net positive, companies are placed as a leader in sustainability and gained a strong market foothold which gives them a competitive advantage (El Hilali et al., 2020). Companies that focused on their sustainable digital transformation have proven to be one step closer to become net positive (El Hilali et al., 2020). This is because sustainable digital transformation provided solutions to several environmental, social, or economic problems (El Hilali et al., 2020). Digitalized route optimization in manufacturing and delivery companies contributed to less CO2 emission, shortened driving time, improved driver comfortability, and the overall operational system to gain more profit (El Hilali et al., 2020). Digital technology with sustainability-focused also improved financial companies and contributed to better taxation, transparency, and fair-pay (El Hilali et al., 2020).

The opportunities for sustainable digital transformation are summarised in table 5 below.

**Table 5. Opportunities for sustainable digital transformation in literature**

| Attributes | | Authors |
|---|---|---|
| Customer experiences and engagement | Better responses to market | Demirkan et al. (2016), El Hilali et al. (2020) |
| | Improve customer relationship | Fitzgerald et al. (2014) |
| | Enhance more friendly products/ services | Fitzgerald et al. (2014) |
| Streamlined operation | Increase productivity and creativity | Demirkan et al. (2016) |
| | Faster information sharing | Demirkan et al. (2016), Fitzgerald et al. (2014) |
| | Better maintenance schedule | Fitzgerald et al. (2014) |
| | Avoid failures | Fitzgerald et al. (2014) |
| | Cut cost | El Hilali et al. (2020) |
| Revenue and business | Boost revenue for current business | El Hilali et al. (2020) |
| | Create business model | Fitzgerald et al. (2014) |

| | | |
|---|---|---|
| | Launch new products/ services | Fitzgerald et al. (2014) |
| Sustainability | Incorporated sustainability goals effectively | El Hilali et al. (2020) |
| | Reduce harmful impact (increase "net positive" | El Hilali et al. (2020) |
| | Reduce C02 emission | El Hilali et al. (2020) |
| | Better resource usages | El Hilali et al. (2020) |
| | Better brand image | El Hilali et al. (2020) |
| | Better taxation | El Hilali et al. (2020) |
| | Transparency and fair play | El Hilali et al. (2020) |

### 2.3. Challenges during the sustainable digital transformation

Based on the McKinsey report on challenges in sustainable digital transformation, resistance to changes from the employees contributed to 70% failure of sustainable digital transformation in many companies in the US alone (Bucy, Finlayson, Kelly, & Moye, 2016). On the other hand, instead of improving the user's efficiency contributing to sustainability, digital transformation potentially carried too complex technological tools, causing its implementation failure (Bucy et al., 2016). Energy usage of these digital technology also often overlooked by the companies, which contributed to added cost of production even usage of non-sustainable energy sourcing (Booth, Patel, & Smith, 2020). From these ongoing problems, several challenges of sustainable digital transformation were grouped into three big parts, leadership, technological and environmental challenges below.

#### 2.3.1. Leadership challenges

*Resistance to changes*

Change is necessary for the employee workforce, corporate culture, partner ecosystems, law, and regulations (Demirkan et al., 2016). However, most human being is resistant to change. Apparently, due to the absence of control and understanding of what lies ahead, people are afraid of making bad choices (Dineva, 2022). This resistance is common in business world, whether the unknown is a new tool, new market, or new sustainability standard, it is understandable to feel trepidation about the upcoming impacts (Dineva, 2022). Therefore, no matter how much change a person has experienced, the afraid of the unknown is often the biggest barrier to change (Dineva, 2022). To be specific, sustainable digital change becomes more difficult when the organizations have grown comfortable (Andriole, 2017). The established company reached a consistent level of profitable revenue generation, having well-functional processes with a current business model, thus becoming typically unwilling to transform as long as they continue winning in the marketplace (Andriole, 2017). Especially to fulfill several new sustainability standards in sourcing and production. Change to sustainability also is considered to be expensive, time-consuming, inexact, and painful, and may cause in-house politics when change initiatives are slow and complex (Andriole, 2017).

*Group thinks – Drive change from the top*

Moreover, "group think" is also a trap that may cause potential damage when a leadership team remains introspective without seeking insight from elsewhere (Dineva, 2022). This could also lead to feelings of disposability among staff especially when change is afoot (Dineva, 2022). The feeling of disposability threatens the company to lose its credibility in creating sustainable society fairness and equality. In fact, to make the transformation in any sector or aspect successful, the implementation needed to start from the top down (Frankiewicz & Chamorro-Premuzic, 2020). Therefore, it has never been clearer that the leader has a huge impact on every single aspect of an organization. Their mindset, integrity, competence, openness to change as

such would make the organization stand out and be the main differentiator (Frankiewicz & Chamorro-Premuzic, 2020).

*One-size-fits-all digitalization approaches in staff training*
Mueller and Lauterbach (2021) agreed that the one-size-fits-all digitalization approaches do not work in human resources training, moreover in implementing sustainable digital efforts. Therefore, there are some aspects that needs to put into consideration such as content of trainings, format of trainings, the timing of training (M. Lauterbach, 2021). The content of trainings depends on learning how to use a tool versus what the availability of a new tool means for how people execute their work (M. Lauterbach, 2021). Moreover, the format of training may need to decide whether it is lecture-style or self-learning or social learning as such (M. Lauterbach, 2021). Last but not least, the timing of the training is also important, it could be pre-go-live only, or throughout the weeks or months after go-live until the work is done effectively again (M. Lauterbach, 2021).

### 2.3.2. Digital/ Technology challenges

*Technical debt*
When a company embarking on sustainable digital transformation, the language barriers between different departments increase, which can bound to technical debt (Hay, 2021). Technical debt is the term illustrating an action when an organization choose an imperfect short-term solution inquiring a more substantial fix later, which includes disparate systems, added software to accommodate them and added effort to work around them (Hay, 2021). In particular, technical debt adds enormous friction any time staffs need to coordinate work together across silos (Hay, 2021). Moreover, there is the on-going cost to exchange data among system, the unquantifiable expenses linked with being slowed down by your systems, whether the organization is in the midst of digital transformation or responding to a competitor's move; and the price that must pay to redesign or simplify systems eventually (Hay, 2021).

The technical debt stems from the structure of the businesses, the systems and languages to get the work done among departments of the firm (Hay, 2021). Particularly, as the business grows and changes, the departments transform the way of working digitally with databases, computer systems, and applications as such (Hay, 2021). While this could boost the efficiency of each department, it can also create disparate, multiple level of database that do not communicate to each other very well (Hay, 2021). Mueller and Lauterbach (2021) also agreed on the dependencies among processes and system are important drivers in an area's tasks if the organization want to make sustainable digital transformation successful. Therefore, it is necessary that an organization develop a common language with a subset of term aligning with key concepts to make the tasks manageable (Hay, 2021).

*The complexity-in-use*
The complexity-in-use is a term explaining the reason why learning and using digital tools is easy and straightforward for users in one context and difficult and cumbersome in another (M. Lauterbach, 2021). This complexity-in-use can lead to vastly different digitalization journeys for different departments even using the same systems (M. Lauterbach, 2021). There are two dimensions which can explain this difference including system dependency and semantic dependency (M. Lauterbach, 2021). Particularly, the system dependency is about how much of a task and the relevant environment is implemented in the system through data and algorithms, meanwhile, the semantic dependency analyzes the extent of which users require to understand businesses' logic of the task implemented in the system (M. Lauterbach, 2021). The system

dependency increases when there are more business concepts represented in the system, while semantic dependency increases when the understanding of these concepts is deeper and how system processes them is required (M. Lauterbach, 2021). This complexity-in-use requires a plan for accelerated digitalization including conducting the complexity pre-implementation map, then designing a step-by-step transformation plan based on the analysis, and finally, having measure for this transformation process (M. Lauterbach, 2021).

### 2.3.3. Environmental challenges

Liu et al. (2019) mentioned direct and indirect environmental challenges contributing to digital transformation's unsustainable and negative impacts.

*Direct impacts*
The challenges of digital technology directly contribute to the most damage to the environment are resource usage and energy consumption because electronic devices use intensive resources and energy in their making and operation (Liu et al., 2019). Moreover, digital technology growth at an exponential pace that many companies adopted caused a thirst for energy and resource needs (Booth et al., 2020). Unchecked usage and production to run digital technology have become systematic challenges contributing to environmental harm over the past decades (Booth et al., 2020). Thus, using fewer resources and energy in electronic device production and operation becomes the biggest challenge to overcome to limit the direct negative impact on the environment (Liu et al., 2019). Corporations, above all, needed to look into details or innovate on how to control their new digital transformation resources and energy usage (Booth et al., 2020).

*Indirect impacts*
Even though dematerialization, converting physical goods into digital goods (Liu et al., 2019) positively impacts sustainability (Abadi, 2009; Bernardini & Galli, 1993), there are still several indirect negative impacts coming from this process. Digital products still need some material to produce and energy to run (Liu et al., 2019). One of the examples of indirect impact is the e-book vs paper books. Based on Liu et al. (2019) and Moberg et al. (2011) research, e-books indirectly impact health through the usage or time spent reading them on electronic devices (tablets, smartphones or computers). Another example is supply chain management which adopted digital technology. The traditional supply chain transformed into dynamic and connected through a data-sharing network (Liu et al., 2019). This network often requires a high volume of data to be readily available, transmitted from the data centers through the entire value chain. The network of infrastructure needed to run the supply chain is mentioned to have an indirect impact on the environment in the long run (Liu et al., 2019).

The challenges during the sustainable digital transformation are summarized in table 6 below.

**Table 6. Challenges during the sustainable digital transformation in literature**

| Group | Attributes | | Authors |
|---|---|---|---|
| Leadership challenges | Resistance to changes | Absence of control | Demirkan et al. (2016), Dineva (2022) |
| | | Unknown impacts | Dineva (2022) |
| | | Current comfortability | Andriole (2017) |
| | | Expensive, time-consuming | Andriole (2017) |
| | | In-house politic | Andriole (2017) |
| | Group thinks | Introspective insights | Dineva (2022) |
| | | Disposability | Dineva (2022) |
| | One-size-fits-all training approach | Content of training | M. Lauterbach (2021) |
| | | Format of training | M. Lauterbach (2021) |
| | | Timing of training | M. Lauterbach (2021) |
| Technology challenges | Technical debt | Disparate systems | Hay (2021) |
| | | Added software | Hay (2021) |
| | | Added effort | Hay (2021) |
| | | Language barriers | Hay (2021), M. Lauterbach (2021) |
| | Complexity-in-use | System dependency | M. Lauterbach (2021) |
| | | Semantic dependency | M. Lauterbach (2021) |
| Environmental challenges | Direct impact | Over usage of energy and resources, unsustainable sourcing | Liu et al. (2019) |
| | Indirect impact | Health, complex infrastructure | Liu et al. (2019) |

## 2.4. Key actions for sustainable digital transformation

### 2.4.1. Building a strong culture of innovation and sustainability

It is important to create an effective sustainable digital culture. Kane et al. (2016) supported the idea of creating the effective digital culture should be an intentional effort (Kiron et al., 2016). Especially during the rise of digital implementation that cause some sustainability concern, such as excessive amount of energy usage. Broman and Robert (2017) also mentioned that to incorporate sustainability in the company's culture, a core purpose aligned with sustainability pillars is needed. Sustainable core purpose contributed to the success of a sustainable long-term plan. Thus, making the company. The effective digital also emphasized the culture to embrace risk, which goes beyond admonitions of taking acceptable risk, because digital maturing organization "build risk taking into the fabric of how they manage" (Kiron et al., 2016). The argument behind this is that if the growth of overall development cost is too low, this may lead to the increase of the organization's exposure to risk because there is not enough adequate experimentation and learning. (Frankiewicz & Chamorro-Premuzic, 2020) also agreed with this approach when he suggested to build an agile community, which has been people-led and technology-supported.

However, there is a opposite thought about the transformation from Frankiewicz and Chamorro-Premuzic (2020). Meanwhile the statement that is "speed is king, that action is key, that perfect is the enemy of good, and that you should be willing and eager to fail fast" has become cliché in management thinking, Frankiewicz and Chamorro-Premuzic (2020) supports the strategy of adapting constant change and rapid disrupted present by speeding up and operate at pace (Frankiewicz & Chamorro-Premuzic, 2020). Even though there is always a trade-off between speed and quality, if an organization's culture does not tolerate quick experiments in the context that lesson learnt from failed experiences will help the firm grow stronger, then it is necessary to make sure that long-term plan will be successful (Frankiewicz & Chamorro-Premuzic, 2020). In other words, "it's okay to succeed slowly if you can't fail fast" (Frankiewicz & Chamorro-Premuzic, 2020). Therefore, no matter the strategy is, the importance is to reach the goals.

### 2.4.2. Having strong leadership team with clear visions and implementation plan

One of the most important factor that contribute to the transformation of an organization is the head of the firm (Frankiewicz & Chamorro-Premuzic, 2020). Even though industry, context, culture, people, legacy, and actual tech matters, the competences of senior leaders will be the main differentiator and help the firms to stand out (Frankiewicz & Chamorro-Premuzic, 2020). Especially in the context of sustainable digital transformation, big changes cannot happen unless having top leaders vein to begin with (Frankiewicz & Chamorro-Premuzic, 2020). Dineva (2022) also mentions the importance of the top leaders tasked with driving digital strategy to challenge the status-quo and perception of risk.

Moreover, Koehler (2021) suggested to balance investments to technology during the sustainable digital transformation. They argued that not every problem requires a big tech solution, normally the solutions only need complementing big technology platforms with several small steps, together with new processes, new policies, and behavior changes (Koehler, 2021). However, this does not mean only launching only small technology, the key is to have a portfolio solution that delivers results better (Koehler, 2021). Although this decision can be daunting because of the unknown it represents, the leaders should understand the barriers behind digital decision-making process to come up with the decision since shying away from the digital transformation can be far riskier path (Dineva, 2022).

Koehler (2021) also suggested to be choosy where to innovate and where to integrate, which means to innovate and customize only where it leads to true competitive differentiation, sustianability and to integrate technology by third-party. Besides, defining clear fact-based measures will help the firm to avoid messing up the values that digital transformation could bring, whether they are efficiency improvement, customer acquisition or retention, better customer insights, carbon footprint decrease, and the like (Koehler, 2021).

### 2.4.3. Recruiting, training, and supporting talents

It can be denied that talent play an important role in the sustainable digital transformation. Indeed, this journey is less about technology but more about people (Frankiewicz & Chamorro-Premuzic, 2020). Frankiewicz and Premuzix (2020) argued that it is not difficult to buy any technology, but the ability to adapt with digital future depends on skill sets of talents (Frankiewicz & Chamorro-Premuzic, 2020). Also, when investing in talents, it is necessary to make sure talents understand the benefit to their own jobs and career path and how it connects to the organization's purpose (Koehler, 2021).

For current talents at companies, focus on reskilling and upskilling talents so that they are better equipped to adapt with the change is important (Frankiewicz & Chamorro-Premuzic, 2020). This approach of leveraging human adaptivity could also simultaneously augment humans and technology because the most brilliant innovation is irrelevant if the workforce is unable to use it (Frankiewicz & Chamorro-Premuzic, 2020). Remarkably, soft skills are focused more than hard skills to make the organization more digital by investing in talents that are most adaptable, curious and flexible (Frankiewicz & Chamorro-Premuzic, 2020).

Moreover, Koehler (2021) suggested changing relationship between talents and technology by not only making people comfortable with using technology but also get them excited about working in the new way (Koehler, 2021). For example, do not just focus on teaching people how to use remote working tool effectively, but also help them to be comfortable managing and motivating their teams remotely (Koehler, 2021). In addition to that, (Kiron et al., 2016) implied not only offering training course to digitally mature organization, but also practicing in the workplace itself can actually drive new knowledge creation.

### 2.4.4. Communication is key

It is important to acknowledge the organization the necessary to change. Researchers agreed upon the necessary of effective communication within the change process (Myers, Hulks, & Wiggins, 2012). At first glance, communication seems to be simple in the form of talking, negotiating, encouraging, listening, and the like. However, it is the most challenging task to make sure the messages are transferred correctly from the communicators to listener (Myers et al., 2012). Myer et al. (2012) suggested two main strategies for effective communication during the transformation, which are programmatic and participatory (Myers et al., 2012). Programmatic communication of change refers the way that the information from top-down about what will happen and what strategy to adopt (Myers et al., 2012). This approach generates compliance and minimize the resistance by delivering the right message to the right person at the right time, which enables everyone receive the same information (Myers et al., 2012). On the other hand, participatory communication implies employee participation in the change process instead of passively acting upon it (Myers et al., 2012). Therefore, this enable two-way communication of listening, dialogue and making contribution thus making the employees contributing to the digital transformation process (Myers et al., 2012).

Furthermore, when communicating during the digitalized process, it is advised to have a shared language that indicate to one term or concept (Hay, 2021). With this approach, the concept should be clearly defined so that the task is manageable (Hay, 2021). For example, different teams such as sales, marketing, finance across the enterprise can use a single, shared database to retire departmental systems, minimize work-arounds, and eliminate the technical debt (Hay, 2021).

### 2.4.5. Deep understanding of users and resources needed

First of all, it is important to look into the target users to understand what is necessary that digital transformation can bring (Smith, 2021). The users can be customers, consumers, or even employees related to the digital transformation process (Smith, 2021). Understanding the user started with innovating digital technology suited to their needs based on their point of view (Guinan, Parise, & Langowitz, 2019). In order to innovate precisely, the innovators or, in this case, a company need to thoroughly understand all aspects and end-to-end of what users do when using the digital product (Guinan et al., 2019). Including the users in the innovation process could also give the company a new perspective on innovating (Guinan et al., 2019).

For example, a new digital implementation in the company needs to cater to or improve the user's daily activities rather than change everything completely. Even though when a significant digital or processes change is necessary, the overall design still requires following the user's perspective (Guinan et al., 2019).

In addition, connecting digital technology to differentiated user outcomes is key (Koehler, 2021). When defining the unique value that a firm can bring to users, it is crucial to determine how technology can excel in differentiating capabilities. Having a clear goal in mind while incorporating sustainability enables prioritizing users' demand and advancing the unique value proposition of the firms (Koehler, 2021).

Acquired new insight from users' data could also bring a much more significant competitive advantage (Frankiewicz & Chamorro-Premuzic, 2020). Often, too many business leaders operate under the wrong assumption that smart data scientists or fancy technology tools could solve the problem (Frankiewicz & Chamorro-Premuzic, 2020). However, the most prominent tech companies' brain powers are their radical data-driven cultures (Frankiewicz & Chamorro-Premuzic, 2020). Therefore, being able to translate data to get a deep understanding of users is a key strategic advantage and biggest asset (Frankiewicz & Chamorro-Premuzic, 2020).

Besides innovating from the user's perspective and data, sustainable digital transformation is about building the right thing by doing the right thing (Guinan et al., 2019). Thus, in the process, sustainable digital transformation needs to consider whether the digital technology is already sourced, made, and operated sustainably or not (Guinan et al., 2019). If the digital transformation requires scarce resources or energy that are unsustainable, the company should try to access a new source that less impactful to the environment.

The key actions to achieve sustainable digital transformation are summarised in table 7 below.

**Table 7. Key actions to achieve sustainable digital transformation in literature**

| Attributes | | Author |
|---|---|---|
| A strong culture of innovation and sustainability | Effective digital culture | Kane et al. (2016), Kiron et al. (2016) |
| | Effective sustainable culture | Broman and Robert (2017) |
| | Embrace risk | Kiron et al. (2016) |
| | Agile community | Frankiewicz & Chamorro-Premuzic (2020) |
| | Sustainable long-term plan | Frankiewicz & Chamorro-Premuzic (2020) |
| Strong leadership team with clear visions and implementation plan | Top leaders to challenge the status-quo and perception of risk | Frankiewicz & Chamorro-Premuzic (2020) |
| | Balance technology investment portfolio | Koehler (2021) |
| | Choosy between innovate and integrate | Koehler (2021) |
| | Clear fact-based measures | Koehler (2021) |
| Recruiting, training, and supporting talents | Recruit adapt-to-digital-future skillsets, focus on soft-skill (adaptive, curious, flexible) | Frankiewicz & Chamorro-Premuzic (2020) |

| | | |
|---|---|---|
| | Connect talents' career paths to organization's purpose | Koehler (2021) |
| | Reskilling and upskilling talents | Frankiewicz & Chamorro-Premuzic (2020) |
| | Make talents excited working with technology | Koehler (2021) |
| | Training course and workplace practicing | Kiron et al. (2016) |
| Communication is key | Acknowledge necessary to change | Myers et al. (2012) |
| | Programmatic communication | Myers et al. (2012) |
| | Participatory communication | Myers et al. (2012) |
| | Using shared language | Hay (2021) |
| Deep understanding of users | Innovating based on user' point of view | Guinan, Parise, & Langowitz (2019) |
| | Include users in the digital innovation | Guinan, Parise, & Langowitz (2019) |
| | Use sustainable resources and energy | Smith (2021) |
| | Generate effective insights from data | Frankiewicz & Chamorro-Premuzic (2020) |
| | Prioritize demand | Koehler (2021) |

# III. METHODOLOGY

*The methodology is the fundamental and essential part of the thesis that functions as a research foundation. The methodology will help answer research questions by connecting empirical data and theory. First, the research strategy and design are presented. Followed by the primary and secondary data collection. Further, the data analysis method and research quality presented.*

## 3.1 Research Strategy

Research strategy provided general approach applied to conduct a study (Bell, Bryman, & Harley, 2018). The research strategy method to answer the research question is divided into quantitative and qualitative strategies (Bell et al., 2018). The difference between these two research strategies is how research should be carried out (Bell et al., 2018). The quantitative research strategy is focused on measurements and numbers using a statistical method to test the hypothesis that emerged from existing literature (Bell et al., 2018). The qualitative research strategy is focused on perspectives of in-depth phenomenon, usually without testing the hypothesis but compared it to the existing literatures (Bell et al., 2018).

This thesis aims to explore the real-world implementation, opportunities, challenges, and strategic solutions of sustainable digital transformation in Swedish firms that are not so often reviewed. Furthermore, in the context of digital transformation, the transformation process can give some insight into opportunities, challenges, and key actions from the point of view of different firms in the manufacturing industry. Therefore, the qualitative research strategy is suitable and chosen for this thesis. As Bell, Bryman & Harley (2018) has mentioned, the qualitative method allows researchers to collect behavior, values, and beliefs of studied objects about the analyzed topic to provide a conceptual understanding of events or phenomena. Moreover, the qualitative method also places the perspective of those being studied as vital since they provide a point of orientation (Bell et al., 2018).

However, it is necessary to consider some critiques following the qualitative research strategy. Firstly, sometimes it is considered to be too impressionistic and subjective (Bell et al., 2018). The findings may rely too much on the researcher's often unsystematic views about what is significant and important (Bell et al., 2018). Thus, personal bias and non-resonated choices may occur in this thesis. Hence, this aspect will be taken into consideration to minimize the negative impact of this strategy. Secondly, it is often argued that there is difficulty in replicating a qualitative study due to the lack of standard process and data collections (Bell et al., 2018). Thirdly, it is stated that the scope of the findings of qualitative investigations is restricted and generalized to other settings since the data collection is conducted with limited interview subjects within some organizations or localities (Bell et al., 2018).

Besides qualitative strategy, the research approach method needs to be defined to help researchers build meaningful and based findings later on (Bell et al., 2018). Bell et al. (2018) mentioned that qualitative research frequently utilizes an inductive approach that uses findings to shape and establish a new theory. However, the limitation of the inductive approach, such as inadequate or limited data collection, might not be sufficient enough to conclude or establish a new theory (Bell et al., 2018). On the other hand, deductive approach relied heavily on testing previous and existing theory using hypothesis (Bell et al., 2018), which is not suitable for this thesis research because of limited previous research on this topic. Thus, the abductive approach is chosen because it is based on a paradox or an incomplete set of data to form the likeliest possible explanation or theory (Bell et al., 2018; Tavory & Timmermans, 2014).

### 3.2 Research Design

Research design provided basis framework for data collection and analysis (Bell et al., 2018). Because of the limited studies specific to this thesis topic, based on Shukla (2008), exploratory research design is suited and chosen for this thesis. The exploratory research design is often chosen for qualitative analysis with an abductive approach because the nature of exploratory research design is exploring the phenomenon with limited previous theories or studies (Shukla, 2008), similar to the aforementioned analysis strategy. Moreover, higher flexibility and adaptability of exploratory design (Shukla, 2008) are considered appropriate for this thesis that seeks to find a new phenomenon of sustainable digital implementation. The thematic analysis is chosen as the basis of the analysis method to find the implementation of sustainable digital transformation in Swedish manufacturing companies.

Besides exploratory research design, this thesis used a cross-sectional approach to investigate patterns between several variables in different cases (Bell et al., 2018). Even though the cross-sectional design is mainly used for the quantitative research strategy, using cross-sectional design in qualitative research strategy is not unusual (Bell et al., 2018). Because this thesis aims to find how to implement sustainable digital transformation and other factors by analyzing and correlating different patterns from different respondents', the cross-sectional approach is seen as suitable. However, the usage of cross-sectional design is only limited to finding the correlation between variables, not its causality (Bell et al., 2018). Thus, this thesis does not explicitly point out the best factors or variables that are most important for sustainable digital transformation.

Based on the research strategy and design chosen above, this thesis methodology started with selecting relevant theories to find the definition and frameworks in sustainable digital transformation common in Swedish manufacturing companies. These theories are necessary to find the basic standard of sustainable processes in companies. Moreover, they functioned as the basis for formulating the interview questions and thematic analysis. Then, semi-structured interviews are conducted to several people in position that linked closely to sustainable digital transformation in Swedish manufacturing companies. Later, the information from these semi-structured interviews were transcribed, coded, and analyzed using thematic analysis. Finally, the conclusion is referred from adapting the interview information and theories using interpretive and abductive approaches.

### 3.3 Primary Data Collection

Primary data collection is data collected by the researchers from primary sources, which become the empirical findings of their research (Bell et al., 2018). In order to collect information and insights to answer the research questions mentioned above, primary data collected from a series of interviews with people in the firms from different Swedish companies that undergo sustainable digital transformation is conducted.

#### 3.3.1 Interview

Considering three types of qualitative interview namely, unstructured, semi-structured and structured interview, the semi-structured interview is chosen and used for this thesis. This is because the semi-structured interview allows space to find new insight and still follow the guidelines simultaneously. In particular, during a semi-structured interview, the researchers will base on the prepared list of questions as an interview guide, but still have the room to dig into the topic following the answers of the respondents (Bell et al., 2018). In fact, the question

does not need to follow exactly the outline and the schedule time frame, since there may be new insights and interesting points of view related to the research question that the respondents provide, but the researchers have not prepared (Bell et al., 2018). However, in general, the overall structure of the interviews will be following the guidelines and similar wording will be used among all the interviewees.

Selected interviewees were contacted through LinkedIn, email, or other channels to set up an interview. The interview guideline consisted of explanations about the research purpose, the option to be anonymous and recording permission were informed before the interview presented in Appendix A.

### 3.3.2 Companies selection

Database from the School of Business, Economics, and Law is used to identify the population of manufacturing companies in Sweden with medium-to-large size firms. Based on Bell et al. (2018) and Saunders et al. (2009), a sample is needed for this research. Interviewing the entire population is impracticable, costly, and takes so much time (Bell et al., 2018; Saunders, Lewis, & Thornhill, 2009). The sample also needs to be representative of the entire population. However, the minimum limit is not fulfilled due to the limited time and resources to conduct the interviews. There were 6 interviews in total to collect primary data for this paper. The reasons for choosing those companies are because they (1) have experienced digital transformation, (2) in accordance with the scope of research: medium to big size Swedish manufacturing firms, and (3) can be contacted and agreed to have an interview with. Table 8 below presented the respondents' data for this thesis.

**Table 8. Interview information**

| Respondent | Role within company | Firm size (*) | Industry | Date of interview | Interview length |
|---|---|---|---|---|---|
| R1 | Chief Marketing Officer | Medium | Healthcare | March 14th, 2022 | 40 mins |
| R2 | Project Leader (Digital Transformation) | Large | Retail | March 17th, 2022 | 30 mins |
| R3 | Senior Digital Engineer | Large | Consumer Goods | March 20th, 2022 | 45 mins |
| R4 | Digital Product Manager | Medium | Automotive | March 31st, 2022 | 45 mins |
| R5 | Software Developer | Large | Telecommunications | March 31st, 2022 | 30 mins |
| R6 | Digital and Environmental Analyst Specialist | Large | Consumer Goods | May 6th, 2022 | 35 mins |

(*) The firm size is divided into “Medium” (50-249 employees) and “Large” (250 or more).

## 3.4 Secondary Data Collection

Secondary data is relevant information related to the topic of research that is presented by other studies, research, and authors (Bell et al., 2018). The secondary data presented in the Theoretical Framework was gathered through a systematic review of the literature to deliver a correct understanding of theories needed as a base to answer the research questions. The

secondary data also functioned as the foundation for building the interview guidelines and questions for the semi-structured interviews. Besides secondary data from studies or research presented in the Theoretical Framework, additional secondary data that consists of additional information for analysis is needed (Bell et al., 2018).

### 3.4.1 Studies or Research

Secondary data was collected from a systematic literature review after defining the research topic and question. The secondary data of studies or research in the form of journals or books is based on literature published in academic journals and business journals. To obtain the secondary data, to enhance the opportunity to find relevant papers, multiple databases is used. These included the University of Gothenburg library ("Super search"), Google Scholar, EBSCO Business Source Premier, and the like, based on the keywords mentioned below.

Key words: digital transformation, sustainable transformation, technology, change management, resistance, development

### 3.4.2 Sustainability reports

Secondary data collection is needed to support information from the semi-structured interview given by the respondents and analyze the company's sustainability tool. After the interview, sustainability reports and the company's information from the website are collected and analyzed. Sustainability reports are used mainly to add and refer to some information mentioned by the respondent during the interview. The sustainability reports were cited anonymously not to reveal the respondent's company.

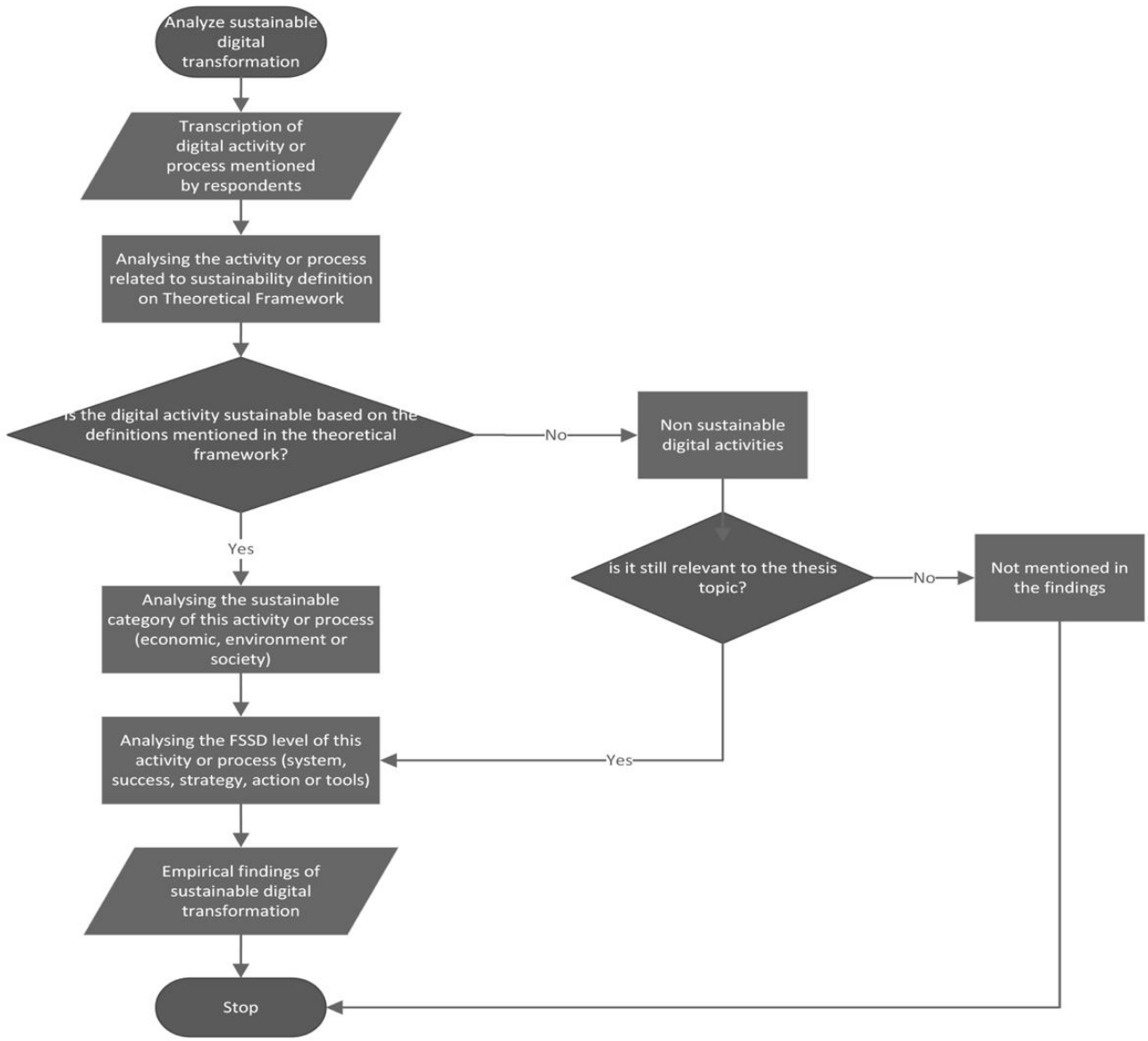
## 3.5 Data Analysis

The thematic approach is the most common approach in data analysis for a qualitative study by highlighting specific themes in transcripts or filed notes (Bell et al., 2018). Thus, based on the research strategy and design mentioned before, a thematic approach is chosen and used to analyze the data collected. The first step in the data analysis process is formed from a theoretical framework providing background information on sustainable digital transformation. The background information consisted of theories of definitions, processes, reasoning, goals, and tools related to sustainable digital transformation. This background information provided the researchers with the foundation to identify digital transformation activities and whether these activities are sustainable or not. Moreover, this information also functions as the basis for semi-structured interview questions and thematic coding. Later, semi-structured interviews with the selected person from the selected company are transcribed and processed based on the analysis flowchart for the sustainability part shown in figure 5.

From figure 5 below, the process started with analyzing transcription data of digital activities or processes gathered from the respondents. In order to identify its sustainability, data of the digital activities or processes are later coded and analyzed based on the sustainable definitions mentioned in the theoretical framework. The sustainable digital activities or processes are implied by one or more sustainability definitions, such as the capability to maintain, continuous delivery, continuous benefits, or not compromising future ability. When the digital activities or processes are considered sustainable, the next step is to analyze which sustainable category it belongs to, identified by its core purpose based on the three sustainability pillars (economic, environment and society). For example, a digital enhancement that improves the continuity and usability of the product contributes to the company's profit in the long run or gains a

competitive advantage over competitors belongs to the economic pillar of sustainability. Later on, the analyses continued with FSSD's level identification, which followed the themes based on Appendix B. On the other hand, activities and processes identified as unsustainable but relevant to this research topic are further processed by identifying the level of FSSD to which they belong. For example, a digital improvement that has not contributed to a company's efficiency after implementation is still relevant and belongs to FSSD's Strategy level. However, irrelevant activities and processes are not mentioned, for example, products material improvement that has not contributed to or correlated to the digital sector. Finally, the empirical findings of sustainable digital transformation presented and further discussed based on the theoretical framework to answer the research question. On the opportunity, challenges and key actions, the data analysis follows similar paths but with different indicators.

**Figure 5. Sustainable digital transformation data analysis flowchart**



### 3.6 Research Quality

As qualitative research is often considered as subjective (Bell et al., 2018), it is necessary to emphasize the quality concerns and how to mitigate them. The quality of a study is evaluated based on the reliability and validity (Bell et al., 2018), as they are a common concern within business research.

#### 3.6.1 Reliability

Reliability is the term related to the consistency of a measure of a concept, which includes stability, internal reliability, inter-observer consistency (Bell et al., 2018).

The stability refers to the stable measure for the sample of respondents over the time of research, which enables the confidence level of the result not fluctuating (Bell et al., 2018). Since the research strategy of this thesis is qualitative, and the method of collecting primary data is semi-structured interview, the pure replication of the study can be challenging. For example, the flow of interview is mainly depended on the context and situation, to be specific, the responds are ranged corresponding to the interview subjects' position, experiences, working sectors, interpretations and understanding to the questions, and the like. To increase the stability of the study, the selection of interview subjects is narrowed down the variation as much as possible by employing an interview guide, setting clear scopes and limitation, choosing suitable positions and level of experiences before sending invitations. However, variation may still exit, so this study may not fully mitigate the problem.

The internal reliability concerns the consistence's index or scale, in other word, whether or not respondents' score on any one indicator tend to be related to their scores on the other indicators (Bell et al., 2018). This study is comparing different indicators, models, and frameworks in the theoretical framework to evaluate their level of suitability to this study. However, one final framework or model will be used throughout the study. This could increase the internal reliability level.

The inter-observer consistency resolves around the possibility of the disagreement of data interpretation thus leading to the inconsistency, where more than one researcher in the study (Bell et al., 2018). In this thesis, since there are two researchers involved, to minimize the impact of different interpretation, clear instructions, open communication, knowledge sharing, and findings agreement are consent among researcher to increase the level of inter-observer consistency.

#### 3.6.2 Validity

Another limitation related to qualitative research is the validity of the study, which refers to the integrity of the conclusions that are generated from the study (Bell et al., 2018). In this thesis, it is focused on the external validity and the internal validity. The external validity is concerned with the question whether the results of the study can be generalized beyond the specific research context, meanwhile, internal validity relates mainly to the degree of confidence of the causality being tested (Bell et al., 2018).

In the first place, the external validity is strong when the sample from which data are collected has been randomly selected (Bell et al., 2018). However, the numbers of semi-structured interview were less than what the standard level of sampling size, because of the time constraints of the research. As a result, a purposive sampling method is used. When non-random methods of sampling are chosen, external validity becomes questionable (Bell et al.,

2018). However, this issue was mitigated by establishing a clear selection of interview subjects, as well as carefully reviewing the respondents' level of experiences before making interview. Although the result of this thesis is applied to Swedish manufacturing firms' context, most of the theoretical framework based on global research, therefore the result could be generalized in other contexts, such as in other geographies, industries as such. In the second place, internal validity is also questionable, and personal experiences and understanding of researchers also increase the level of ambiguity (Bell et al., 2018). To mitigate this issue, thematic analysis was used in this paper to increase the consistency and transparency.

# IV. EMPIRICAL FINDINGS

*In this chapter, the empirical finding from the primary data collection based on the semi-structured interviews are presented. The purpose is to synthesize data based on thematic coding method. First, the digital transformation implementation is presented with its definition and elements. Then, the sustainability processes in respondents' companies will be explained based on the FSSD framework. Next, the opportunities associated with sustainable digital transformation are presented. Moreover, the challenges during the sustainable digital transformation are synthesized. Finally, the key actions that is advised from respondents are summed up.*

## 4.1 Sustainable Digital Transformation

### 4.1.1 Digital transformation implementation

#### *4.1.1.1 Digital transformation views*

The first part of the interviews was concerned with the respondents' view on digital transformation, to be specific, what digital transformation is in their definitions. The main attributes of the respondents' views are summarized in table 9 below.

**Table 9. Responses' summary of digital transformation views**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| A transformation process | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Using technologies/ digital tools | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Improve the performances/ experiences | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Opportunity to capture new values | | | | ✓ | | ✓ |

All respondents agreed that the digital transformation process is a change process that involved digital tools or technology to improve the performances or experiences of target users.

> *"It's basically you know transform working process, the way of working to more streamline to more digital way."* – R3

> "*[Digital transformation] mostly has something to do with the transformation process or business model that can bring the more user-friendly experiences to the customer. Also, it has something to do with the employee experience and platform as well, by adopting the new digital technique/ technologies."* – R5

Moreover, respondents R4 and R6 emphasized the opportunities that come along with the digital transformation to capture new values.

> *"[Digital transformation] is complicated, it is not easy [...] but I think digital tools, digital solutions are an opportunity because they can really enable a lot of things."* – R4

> *"Digital transformation is using the available technologies to change the way of working from the conventional way to make use of technology, and to make more revenue."* – R6

*4.1.1.2 Digital transformation elements*

The next step of the interviews is to understand the elements of the digital transformation in their organization. Each respondent's answer is categorized in different elements when mentioning their digital transformation. The attributes in table 10 below are based on (Bonnet & Westerman, 2021), which is used as the main category of digital transformation elements in this study as mentioned in the theoretical framework.

**Table 10. Responses' summary of digital transformation elements**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|---|
| Business model | Digital enhancements | ✓ | | ✓ | ✓ | | |
| | Information-based services extensions | ✓ | | ✓ | ✓ | | |
| | Multisided platform businesses | | | | | | |
| Customer experience | Experience design | ✓ | | ✓ | ✓ | ✓ | |
| | Customer intelligence | ✓ | | ✓ | ✓ | ✓ | |
| | Emotional enhancement | | | ✓ | ✓ | | |
| Operation | Core process automation | | | | | | |
| | Connected and dynamic operations | | ✓ | ✓ | | | |
| | Data-driven decision making | | | | | | ✓ |
| Employee experience | Augmentation | | ✓ | ✓ | | | |
| | Future readying | | | ✓ | | | |
| | Flex forcing | ✓ | | | ✓ | | |
| Digital Platform | Core | ✓ | | | | | ✓ |
| | Externally facing | ✓ | | | | | |
| | Data | | | | | | ✓ |

*Note: The cells that are in grey color means that these areas are not in the scope of the interviews. There may or may not have the digital transformation within the scope(s) in grey color. However, because each respondent's role is in one department among several departments in the organization, this leads to the fact that the interview cannot cover all digital transformation implementations of each studied firm.*

**Business model**

First of all, the digitization in the business model is highlighted in the answer of the respondents R1, R3, and R4. It can start from a very traditional selling product company, then add a new business function with a new business model to provide additional products or services, together with the current products or services. It could be digital enhancements that respondents R1, R3, and R4 mentioned enhancing their existing business models digitally such as turning product sales into service offerings; and/or having information-based service extensions that combine apps and sensors (respondents R1 and R3) to create values for customers and new sources of revenue.

> "*We have been a physical product company for so long. Now we need to transform into digitalization, [..] how it can help with communicate with the end-customers to transform knowledge. We are also looking to sell the subscription to the apps.*" – R1

*"We don't want to stop in selling [product] only but to innovate more. […] We want to digitalize products; we talk not only e-commerce but also within IoT."* – R3

*"Supporting completely different new business model that is the case here*." – R4

**Customer experiences**

Improving customer experiences is a common purpose among respondents in the digital transformation process. In the first place, creating experience design aims to have a better understanding of customers and consumers' behaviors, and get more meaningful insight through observation, listening, and experimentation with the technology involved during the process. This is one of the key points that respondents R1, R3, R4, and R5 have mentioned.

"*The Digital Transformation was using the app and platform to enhance consumer experiences."* – R1

"*We try to bring to the customer easier approaches to further exploit the uses of our technology."* – R5

In the second place, using customer data among different processes allows the organization to get more understanding of customer's behavior, this is also the very first phase of the digital transformation process. Using data combining with technology will enhance customer's experience that respondents R1, R3, R4, and R5 agreed.

"*Based on the information that we had, our own team will elaborate how to elaborate what they think, how to innovate new products."* – R1

"*We do the market research to try to understand what the customer need."* – R3

Finally, gaining emotional connection with customers is also essential in creating compelling customer experiences, which respondent R3 emphasized.

*"This is not to make people feel watched, but for efficiency and effectivity."* – R3

"*They may feel that the products will replace them. The [staffs] thought that they won't ever be helped by the system, they argue about can we trust the system…We need to show the system as reliable with high performance as possible, by developing very reliable software. Also, make sure they don't feel threatened about it."* – R3

**Operations**

Management teams also understand the importance of digitalization of the operation process to increase the back-office efficiency such as building a connected and dynamic operation process. It could be the digital threads that connect machines and process into a single source to manage, optimize and communication better, which the respondents R2, R3 and R6 has mentioned.

"*We developed the self-service tool that allows co-workers to raise question digitally. We succeed […] obviously with lots of improvements when you do things digitally."* – R2

> *"Internally, we digitalize documents, use a lot of office tools, using one drive, shared cloud that became the best practice. […] It's easy to use, and in general very benefitting."* - R3

**Employees' experience**

The purposes of digital transformation are not limited to their customers but also to enhance their employees' experience. More and more companies have begun to focus on employees' experiences as much as they do on the customer's experiences. For example, respondents R2, R3, and R4 have highlighted the need to digitalize their internal processes to enable people to work faster and smarter as well as to increase productivity.

> "*We need to simplify the way of support we give to our co-workers with HR questions*." – R2

> "*With cloud application, It is really easy and proper authentication, which makes my life easier, the collaborating is very easy in the documents, easily restored, you might even lose it forever, but you can restore it remote-friendly*." – R3

> "*It is beneficial, we can basically just go there SharePoint solution, library for the employees], and then look for the document that we interest."* – R4

Moreover, respondent R2 thought that digitalization allows the employees to get the rights that they own, which increases employees' satisfaction with the organization's process.

> "*And what we also did in the transformation was that the co-worker is owning their own data […] so, it's very important that the co-workers can access to all the documents. From the co-worker's perspective, it was quite happy*." – R2

In addition, to respond to the high demand for the digital transformation, which is often in the fast pace, the respondents R1 and R4 highlighted the necessity to build agility in finding talents that are open and adaptive to the changes.

> "*We have built a very good based-line to prepare for the future…. I think the company is much more prepared with the coming phase [the digital area], which is good."* – R1

> "*It's kind of profile that has been recruited into this company […], we want to have people who are open for change are willing to change. I think that makes it much easier to drive this transformation*." – R4

**Digital platform**

There are different types of platforms that an organization can develop through the digital transformation. The respondent R1 mentioned developing an app, which is a core platform to enhance business processes. This app is also considered as an externally facing platform to connect to customers and enhance customer experiences.

> "*…develop entirely new products, included touchscreen […], release an app to surveillance the products, to add more functionality*." – R1

Meanwhile, respondent R6 mentioned developing a data platform to collect data in one centralized location, then perform intense analytics, as well as build and test algorithms.

"*We have data in one place, […] to support our customers have access to this data relevant data they want and up-to-date data, […] to help capturing the data, pulling out the value chain and in a gentle way."* – R6

### 4.1.2 Sustainability process

Below is presented the sustainable digital process based on the semi-structured interview. In this section, the sustainability within companies' digital transformation is identified by finding and analyzing processes mentioned by the company using the five-level model of FSSD as coded in Appendix D.

#### *4.1.2.1 System*

In this section, the funnel metaphor is the core concept to identify a company's awareness of its digital system (economic, social, and environmental). Do the respondents aware of the system involved in the digital sector. Aware of factors involved within the digital system means that the respondents (or the company) move one step closer to developing sustainability transformation. Based on the analysis, the company's awareness of its system varies, summarized in table 11 below.

**Table 11. Summary analysis of system level**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| Aware of decreasing resources (environment) | ✓ | ✓ | ✓ | | | ✓ |
| Aware of decreasing restorative capacity (economy) | ✓ | ✓ | | ✓ | | ✓ |
| Aware of decreasing fairness and equity (social) | | | ✓ | | | |
| Aware of increasing market demand and pressure (economy) | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Aware of increasing population (social) | | | | | | |
| Aware of increasing competitiveness (economy) | ✓ | ✓ | ✓ | | | ✓ |
| Aware of increasing CO2 emission or other pollutive (environment) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Most respondents mentioned being aware of increasing CO2 emission and other pollutive. The respondents mentioned about the importance of reducing CO2 emission and other pollutive in order to contribute to the environment pillar of sustainability. They have seen the damaging impact from many sectors. For example, chemicals usage that pollute environment, heavy metal pollution from e-waste, or pollution from unrecycled products.

The second most mentioned is the awareness of increasing market demand and competitiveness. Some respondents implied the awareness of increasing market demand and competitiveness by emphasizing the importance of innovating their products using the digital technology.

*"30 customers in qualitative studies, based on information that we had, our own team will elaborate how to elaborate what they think, how to innovate new products [with digital technology]."* – R1

*"We also try to do market research, to understand what actually the customer need […] we have customer success specialist, dedicated person to keep track on customer need, complain [of product that using digital technology]."* – R3

The third most mentioned is the awareness of decreasing resources (environment) and restorative capacity (economy). Respondents were aware of the decreasing resources by emphasizing the importance of reducing resource usage such as fuel for energy, lithium, and paper. At the same time, restorative capacity is implied by the importance of keeping up with digital media as a tool to keep business ongoing. Respondent R4 highlights the importance that the company would struggle to keep in the business without digital transformation.

> *"We are [implementing] digitalization, so we are not using paper, which also supports the environment […] we are doing right now is trying to digitalize, to get rid of all the paper."* – R2

> *"We want the resources as efficient as possible, that's why we developed this technology, incorporating digital system."* – R3

> *"Companies live in a very uncertain situation and it's really important to be able to adapt and move fast and that's where digital transformation comes in […] if you don't manage to come as a company for example to really achieve digital transformation then it can be your death I would say. It can push you out of the business basically."* – R4

> *"We have [sustainability implemented] especially in our team. We believe that is a necessary action to do. We need to do something to reduce the environmental impact and the bad impact of and the use of this [natural] resource."* – R6

Meanwhile, the least mentioned aspect is the awareness of decreasing fairness and equity—only a respondent mentioned this aspect. Respondent R3 mentioned that decreasing fairness and equity might be caused by digital technology innovation. The newly implemented digital technology might disrupt the employee's existence in the company.

> *"This new product that adopt the digital technology is very disruptive for [the employees]. Means that [the employees] never work like this (with software, app, and notification to do their job) so they feel that the [new digital technology] products will replace them. [the employees] thought that they won't never be helped by the [new] system, they argue about can we trust the system. Not only the tech side but also way of working worry [the employees]."* – R3

This disruption caused by the new implementation of digital technology caused a more significant gap between unfairness and inequality. Aware of this adverse impact, the respondent R3 company tried to assure the employees that the new digital technology exists to help their work instead of a threat.

> *"But in order to make [the employees] and our clients to trust the new system, we need to show the system as reliable, with high performance as possible by developing very reliable software. Also make sure they don't feel threatened about it. […] to make sure everyone feel the benefit, in a sense that we make sure that we have a good balance in it, [the employees] perspective need to be being help and not to be replaced […] We want everybody to have a part in this innovation."* – R3

> *"How to solve it [the disruptive new technology] took a lot of time, trust, training, dialog, we try to make sure that we involve everyone. We have a good balance in how we presence our technology."* – R3

*4.1.2.2 Success*

The success level is to help the companies to form a vision, idea or plan that incorporates sustainability in their digital transformation. With the correct vision, idea or plan, the company will be able to implement sustainability successfully. In order to form these visions, the company need to understand the correct definition of sustainability, adopt sustainability as a central factor in its activities, and embed sustainability in its core purpose and values. Later on, the back casting and prioritized plan is needed to achieve overall end-goals specific to the organization (Broman & Robèrt, 2017). Below is a summary table from the interviews.

**Table 12. Summary of analysis success level**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| Good sustainability understanding | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Good sustainable digital transformation understanding | | | | ✓ | | |
| Sustainable core purpose & values | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sustainable digital end goals | | ✓ | ✓ | ✓ | | ✓ |

From the summary table above, all respondents showed good understanding of sustainability based on definitions provided in the theoretical framework. Most respondents defined sustainability as an action to reduce resource usage, lower environmental negative impact from production activities, and long-lasting activities.

> *"I think sustainability has lots of definitions. It has to do with the industry, how we are using our material, how we are reusing water. […] Sustainability is something that is long-lasting. So whatever we do, it is long-lasting and does not harm our environment in any sense."* – R2

> *"Energy-saving, reducing CO2 emission, make the process in the way that protects every [aspects] involved in [the production], sustainability is very complex. We can look at different angles and have different meanings, sustainability is a huge process. Sustainability also means that everybody needs to take steps to one side to something large."* – R3

> *"Use what we have from resources now in a smart way. Try to save these resources circle […] recycled etc and then we can save more resources for the future generation. So, it's in the terms to think in a smart way of your day-to-day and guarding our choices and everything. Not only I'm talking here about like the company view, but it's also personal view to think smart and in a sustainable way in all our choices."* – R6

In contrast, most respondents found it hard to get the correct definition in the specific field of sustainable digital transformation. Respondent R2 thought that sustainable digital transformation is necessary but did not easily cross his/her mind when talking about sustainability. Respondent R2 company also has many other products or ways of working that

need a more sustainable focus. Thus, defining it on the spot during an interview is tricky. Only one respondent was able to define the correct sustainable digital transformation.

> *"I think and that digital tools really help to create more sustainability because with digital tools you can make a lot of things more efficient. For example, by having the direct-to-consumer approach or a business model that is supported by digital tools then we remove a lot of extra steps."* – R4

On the other hand, sustainable core purpose and values are already embedded in all the respondent's companies based on their description. The sustainable core purpose and values consist of goals to become climate positive, reduce CO2 emission, and technology-oriented activities that led to innovation for sustainability and circular economy.

> *"We do have [sustainable core purpose] that we talk about a lot. […] We have a whole department assessing our partners and their sustainability approach."* – R2

> *"[The company] put heavy commitment responsibility report on sustainable. Overall, we have some climate actions, with material design, recycle of product."* – R5

> *"The management is implementing more sustainability too. This is why the company try to change from manufacture to app-based (software)."* – R1

> *"Yes, in [the company], we are quite proud of it, so much attention to sustainability. Especially in the product and manufacturing process. We are using windmill to generate electricity in the production. [We] try to reduce CO2 emission and slowly move to zero-emission: join together with the UN in a global program, we make a promise that we will reduce and slowly become zero-emission. We have a sustainability report every year."* – R3

> *"I would say it's a quite long history with sustainability and especially in our industry. I would say we are, and we are one of the leaders in this area. So, we invest a lot of sustainability, in sustainability project. We try to incorporate this in all our decisions."* – R6

Four of the respondents mentioned sustainable digital transformation end goals in their activities. These respondents mentioned the future goals in implementing sustainability in their activities and end-products. The rest of the respondents who did not answer about the end goals argued that they had little to no information about this.

> *"We want to make better environment [with digital transformation]. Reduce the emission and discarded usage of our products"* – R3

> *"When you start, you need to have a vision and I guess this (sustainability) was their [company's] vision. They [company] wanted to create a [product] that is sustainable from all points of view"* - R4

> *"We make our investment in that area [digital technology]. Also, it will be used more and more in the future because we see this trend maybe in few years, it will be when you ask for a quotation you don't ask only for the price and quality and also maybe you ask for the sustainability in general"*- R6

*4.1.2.3 Strategy*

The strategy level consists of analyzing the current team, understanding, and finding what is needed to fill the gap where the company today to where it wants to be, based on the vision and end-goals mentioned in the Success level. Back casting method is used to find the gap. Back casting method functions to strategically pick the most fitted plan that is the most viable with the current condition. Below is the summary of the interviews.

**Table 13. Summary of strategy analysis**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| Good back casting | | ✓ | | ✓ | | |

Two respondents mentioned back casting to the current situation from the table above when talking about the end goal of sustainability. R2 mentioned that the future plan of digital implementation needed employees conditioning. The employees currently used to work without new digital technology. Thus, without proper conditioning of this new technology, the implementation would take time, as the employees may resist change.

> *"We have to make sure that the organization [employees] understands the changes that we need to go.[…] Because going from the regular that you can meet people, email them or send them the chat, to that we made them go through the system […] It becomes a little pain point for some people […] It took time, but people understood it eventually."* – R2

R4 mentioned about the roadmap or plan ahead often changed based on the current condition and market factor. Thus, any changed plan would strategically move the company to a better goal.

> *"We are creating the road map ahead and want the digital landscape. […] it's like we maybe decide to go we take a decision, let's go for this solution and then after one week maybe we have to rethink because maybe our partners said say that kind of this solution doesn't work, you cannot choose this one, you have to change and then we have to change everything."* – R4

On the other hand, the rest of the respondents who showed no backcasting were have little to no information about the strategy.

*4.1.2.4 Action*

The action level consists of the concrete sustainable action that the companies have done in their digital sector, both in their digital added product or enhanced digital way of working. The end goals and strategic plan mentioned in the previous section are the information needed to scrutinize the possible actions.

**Table 14. Summary of action analysis**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| Good economic sustainable digital efforts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Good environment sustainable digital efforts | | | ✓ | ✓ | ✓ | ✓ |
| Good societal sustainable digital efforts | | | ✓ | ✓ | | ✓ |

R1 mentioned some sustainable action in his/her company's digital sector vaguely. As mentioned in the previous section, R1 company already developed a product that implemented digital aspects to improve usability (economic sustainability). However, when asked whether this new digital product uses sustainable materials that are related to environmental sustainability, R1 could not provide more information. Moreover, the company also planned to move into digital-based products to become more sustainable, in which the overall end-goal already formed. However, the concrete sustainable action for the environment and society for this end goal is lacking.

R2 mentioned the usage of a cloud system in the company's new digital system implementation that improved the way of working (economic sustainability). However, R2 is unsure about the cloud system's energy source (environment sustainability) since the company used a third party for the cloud server. Action in societal sustainability mentioned by R2 is also lacking. On the other hand, the company's production process uses renewable energy and fewer resources efficiently.

R3 mentioned that the company had invested a lot in sustainable innovation for its new digital products to gain competitive advantages (economic sustainability). The company also invested in renewable energy for electricity usage, currently used as the primary energy source for production and daily office activities (environment sustainability). Moreover, the company recycled its broken/used products and used less raw material in the production (environment sustainability). The company also showed an effort to incorporate new digital technology as a helping tool and avoid the technological disruption that threatens the employees (societal sustainability). However, even though this company has already implemented good sustainability in the economy, society, and environment, the energy source for the cloud and server system from the third-party provider used as the daily repository and application center is still unknown.

> *"We are using windmill generated electricity in the production. Try reduce CO2 emission and slowly moving to zero emission: join together with UN in a global program, we make a promise that we will reduce and slowly becoming zero emission. We have sustainability report every year. We take part to develop and provide product that reusable, environment friendly […] not using too much raw materials."* – R3

R4 mentioned that the company's core values are to be sustainable in activities, production, and its products. The company added digital technology to their products to adapt to answer rapid change, market demand and to improve efficiency. For example, many digital technology innovations applied in their product compete with competitors (economic sustainability). These digital products also source sustainably, are easily recycled (environment sustainability), and shape the market to avoid polluting products (societal sustainability). However, no specific digital added way of working mentioned

> *"We have a completely different business model compared to traditional […] companies and I think that the digitalization and digital solutions, digital tools are key to that they will enable us to reach, to enable that [sustainable] business model. Without digital tools, we will not be able [to have a sustainable business model], because we have a direct-to-consumer business model and in order to really enable that model we need to have digital solutions."* – R4

> *"I think also for example if you look at the [company] itself, you can really see the sustainability. I mean we develop [sustainable product] so I mean sustainability. It's one of our core values and I think the latest [product] that we released has as a target that by 2030 everything in our [products] should be easy to be recycled. If you take plastic parts or like a [different part], it's made of so many different materials, so it's really difficult to recycle it afterwards, so they're really trying to work with this part. Making sure to use recycled materials but also to make sure that components can be recycled easily later on."* – R4

R5 mentioned some projects requiring a code of conduct to comply with sustainability standards from the beginning, such as reducing the device's power usage (environment sustainability). Also, the company keeps innovating its products to gain a more competitive advantage over the competitors (economic sustainability). However, the respondents could not give an example when asked about social aspects of digital transformation.

> *"Everything we do should follow some code of conduct or some sort to comply with the sustainability at the very beginning […] The [product] where I'm working, we will try to reduce the power usage of the device such as like put them into sleep mode when they're not in use, or set up the minimum amount of resource that is required. We really trying to find like a bug or troubleshoot like how to make it as efficient as possible."* – R5

R6 mentioned some projects collaborating with academia from Swedish universities to gather environmental data. These environmental data are used as one of the bases for the new digital technology to make it easier for customers to check the environmental impact of their products (societal sustainability). The new digital technology is also used to minimize paper usage (environment sustainability) and improve efficiency in checking and reporting data from suppliers (economic sustainability).

> *"We are trying to help capturing the environmental data […]. So, currently not only environmental data, any data, quality data or any related data, [we can] ask it from the supplier when we need it and [this data] has been given to us in a different way, emails papers, so it's all over the place. So, we are kind of visualize this process, so we have the data in one place"* – R6

#### *4.1.2.5. Tools*

The tools level contributed to all systems, equipment, and processes required to evaluate and monitor sustainable digital transformation in the company. In this part, the tools are focused on sustainability reports from each respondent's company. Sustainability reports consist of processes done by the company to reduce environmental impact, become circular, and many other activities that promote and develop sustainability. Thus, this report functions as a tool to monitor and evaluate the ongoing sustainability development.

**Table 15. Summary of tools analysis**

| Attributes | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|
| Annual sustainability report | | ✓ | ✓ | ✓ | ✓ | ✓ |

Based on the sustainability report 2021 of R2's company, a new tool to support product development, circular capabilities, and environmental footprint are developed (R2, 2021). The positive sustainability effort also increased from 2020. However, this tool and effort are not

used explicitly for the digital part of the company, as the company's most extensive manufacturing activities are the report's primary focus.

R3 sustainability report mentioned specific digital efforts for their product and internal operations (R3, 2021). Digitalization aims to increase sales growth and gain competitive advantage and efficiency, which is positively related to sustainability. The innovative digital technology allowed users to improve their usability and effectiveness in the product part. R3 also mentioned this information from the semi-structured interview. In the internal operations part, digitalization is used to plan demand, stocks, deliveries, production flows, and decision to be more effective, that help employee in their way of working.

R4 sustainability report mentioned a strategy involving four areas (climate, circularity, transparency and inclusion) to accelerate the transition to sustainability. Sustainability specialists are also hired by the company to guide organizations (in every department) in implementing sustainable thinking and processes (R4, 2021). The company also imposed a code of conduct applied to all employees, suppliers, and any party working with the company. The code of conduct consists of several corporate policies such as anti-corruption and data protection. Even though the company has already established several efforts for sustainability for every department, the specific effort in the digital area lacks some information.

In the R5 sustainability report, several sustainable efforts, such as reducing carbon emissions and energy savings already mentioned and controlled by the code of conduct (R5, 2021). The company also pledged its ambition to be a net-zero company in years to come. Reducing energy use in its digital sector is the priority as the company already continues to make a substantial investment in energy-efficiency-led R&D.

In the R6 sustainability reports, the emphasis on digital technology through several strategic frameworks to enable efficiency and usage of fewer resources in the entire value chain is mentioned (R6, 2021). The report also showed the company’s effort to become net-zero in years to come by incorporating other actors such as suppliers to operate with green energy in the supply chain.

### 4.2. Opportunities for sustainable digital transformation

When it comes to why the organizations want to digitalize, there are different purposes among the respondents, which are summarized in table 16 below.

**Table 16. Responses' summary for opportunities for sustainable digital transformation**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|---|
| Revenue and business | Boost sales for current products | ✓ | | | | ✓ | ✓ |
| | Launch new products/ services | ✓ | | ✓ | | | |
| | Create business model | | | | ✓ | | |
| Streamlined operation | Increase productivity and creativity | ✓ | ✓ | ✓ | | | ✓ |
| | Faster information sharing | | ✓ | | | ✓ | |
| | Better maintenance schedule | | | | | | ✓ |
| | Avoid failures | | | | | | ✓ |
| | Cut cost | | ✓ | ✓ | | | |
| Sustainability | Reduce harmful impact | | | | | | ✓ |
| | Reduce C02 emission | | ✓ | ✓ | | | ✓ |
| | Better resource usages | | ✓ | ✓ | | | ✓ |
| | Better brand image | | | | | | ✓ |
| | Transparency and fair play | | | ✓ | | | ✓ |
| | Follow the regulations | ✓ | ✓ | | | | ✓ |

The digital transformation could also start by building a completely new business model to disrupt the market or the industry.

> *"We started with something new already, [we develop] completely new business model, [in the industry with] lots of newcomers so that we can really read the change… they can really enable a lot of things."* – R4

Meanwhile, the purpose is also to increase the productivity of working among employees, since it is argued that digitalization within the organization allows better collaborations and connectivity, and faster information sharing, thus reducing the time and effort. Therefore, the process also helps to reduce the costs in different functions of the organization such as production, operations, human resources, and the like. Respondents R1, R2, and R3 agreed with these benefits in their internal digitalized transformation process.

> *"Digital transformation makes work easier and faster."* – R1

> *"The purpose is to make it more efficient effective, collaboration, reducing overhead. […] We want [to use] the resources as efficient as possible."* – R3

Also, respondent R6 thought that digitalization also helps to have better maintenance schedules and avoid failure within the operation of the firm.

> *"… use more technology and crystallize to reduce errors*." – R6

Furthermore, sustainable digital transformation is aiming to reduce harmful impact and carbon dioxide emission, and better use of natural resources, thus helping to protect the environment and having greener business activities. Respondents R2, R3, and R6 specified this point of view.

> "*We are digitalization, so we are not using paper, which also supports the environment, society, and economy."* - R2

> *"We join UN in a global program, we make a promise that we will reduce and slowly become zero-emission. […] We take part to develop and provide a product that is reusable, and environment friendly. […] We want to make a better environment, reduce the emission and discarded usage of our products."* - R3

> "*We need to reduce this impact as much as possible, to save the planet, to save more resources and capability on this planet for the future generation*." – R6

Sustainability also helps to increase brand image as respondent R6 highlighted:

> "*I would say we are one of the leaders in [sustainability], we invest a lot of sustainability, over sustainability project. […] Maybe customers when asking for a certain product, they will not only, soon and hopefully soon, we care about the price and the quality and the service, also they will have the prerequisite of environmental."* - R6

Sustainable digital transformation also brings transparency and fair play to the organization and the users as respondents R3 and R6 argued:

> *"This new product that adopts the digital technology is very disruptive for [the employees]. This means that [the employees] never work like this (with software, app, and notification to do their job) so they feel that the [new digital technology] products will replace them. [The employees] thought that they won't ever be helped by the [new] system, they argue about can we trust the system. Not only the tech side but also a way of working worry [the employees]." – R3*

> *"[Digital transformation] helps increasing the transparency in the way the job being done."* – R6

Moreover, sometimes the digital transformation process is encouraged by the need to follow the regulations of the governments where the firms are operating. For example, the General Data Protection Regulation that is stated in the EU law on data protection and privacy in the European Union and the European Economic Area requires all the firms doing business within this region to follow, which respondent R2 mentioned:

> *"[Before] Everything is done by paper or email. The data that we are sharing is not in line with GDPR. So we succeed with it in that sense [the regulations with data]."* – R2

Or some legislation related to the material or products that require to follow in a specific market, which the respondents R2 and R6 mentioned:

> "*Improving battery so it's not using too much lithium material. Also, a lot of regulation about that [sustainability] in different countries, many countries pushing sustainability forward with [the product]. […] Sustainability is mostly forced by government regulations. So, the company needs to follow sustainability requirements to sell the products*." – R1

"*We comply with the legislation recommendation in each country that we have a market of it.*" – R6

### 4.3. Challenges during the sustainable digital transformation

In this part, views of respondents are gathered and summarized in table 17 below.

**Table 17. Responses' summary of challenges during the sustainable digital transformation**

| Attributes | | | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|---|---|
| Leadership challenges | Resistance to change | Unknown impacts | ✓ | ✓ | ✓ | ✓ | | |
| | | Current comfortability | ✓ | ✓ | | | | |
| | Group thinks | Disposability | | | ✓ | | | |
| | One-size-fit-all training | Content of training | | ✓ | ✓ | ✓ | | |
| | | Format of training | | ✓ | ✓ | ✓ | | |
| Technology challenges | Technical debt | Disparate systems | | | | ✓ | | |
| | | Added software | | | ✓ | | | |
| | | Added effort | | | | ✓ | ✓ | ✓ |
| | | Language barriers | | | | | | ✓ |
| | Complexity in use | System dependency | ✓ | | | | ✓ | |
| Environmental challenges | Over usage of energy and resources, unsustainable sourcing | | | | ✓ | | | ✓ |

Four out of six mentioned resistance to change as challenge in their digital transformation project. R1 mentioned that the government's strict regulations to certify the new product with added digital features hinder the company's rapid product innovation; it also takes so long to reach the market. R2 mentioned some resistance to change during the new digital system implementation. The resistance mostly came from the middle management level, who used to work without new digital tools. R2 also emphasized that the biggest challenge is to make sure the whole organization and employees understand that the changes are the only option to keep improving. R3 mentioned that the difference in education level and culture caused resistance to change from the employees. R4 mentioned that the resistance to change is present even in the most innovative company. Primarily when the company aimed to keep innovating their digital transformation to avoid becoming obsolete. Factors such as volatile and uncertain world dynamics and many events happening super-fast pushed the company to innovate more, which caused resistance to change in some employees.

*"The biggest challenge that we have was to make sure that the organization understands the changes that we need to go […] another part of the organization wasn't that active, was actually have the most painful time to change. So, they are still not happy with the change. […] co-workers didn't have any difficulty, more like managers and the HR department."* – R2

*"A lot of challenge, these new products that adopt the digital technology is very disruptive for [some of the employees]. Means that the [employees] never work like this (with software, app and notification to [do their job]) so they feel that the products will replace them. The [employees] thought that they won't never be helped by the system,*

> *they argue about can we trust the system. Not only the tech side but also way of working worries the [employees].”* – R3

Group think is only mentioned by R3. This is related to some employees' feeling of disposability towards the new digital technology mentioned in resistance to change. Some employees who consider the new digital technology a threat might influence others in some way or another, creating a groupthink that inhibits implementation.

Besides resistance to change, technical debt also mentioned by four out of six respondents as challenge in their digital transformation project such as difference in knowledge inter department and investment of technological decision. R3 mentioned the difficulty in innovating the new digital technology added product. The product was an inter-department innovation effort. Thus, it took so much time and effort because the information and knowledge barriers are significant (technical debt). R5 mentioned that the company suffered from technical debt in the digital implementation process even though have a strong background about the core technology. For example, a new digital technology had different approach and effectivity in its implementation in different departments. R6 mentioned that the biggest challenge contributing to the company's current project of new digital implementation is the data quality gathered from different sources sometimes differs from what was requested. The difference in data quality is arguably caused by technical debt between departments because departments have different ways to gather and present data.

> *“Another challenge is training to the end user, same thing, but more difficult, education level not so high […] We also have offices in Germany, US. Sometimes different culture needs different approach too. It is very hard.”* – R3

> *“The biggest challenge of doing that [new digital project] is collect data and make sure that the quality data quality is acceptable. Get what you are asking for in the right units. So, this is a big problem of course and of course you have a lot of reasons. Sometimes like the data is not available, data quality varies a lot”*- R6

One-size-fits-all training mentioned by three respondents. R2 mentioned that the company already conducted small events to highlight the development of digitalization, which most of the employees and management accepted, in its actual usage, some employees are still going against it in some ways or another. Some of the employees emphasize the loss of real interaction in the office due to the digitalization, which R2 found challenging. R2 also argued that sometimes training for digital technology is not needed because many people can use some digital technology in their daily activities, such as smartphones. Thus, training for the digital system is over-complication that is not needed every time. R3 mentioned about the training difference based on country, and education level. R4 also mentioned about challenges of training employees for new digital technology. The training needed to be tailored because people learn in different ways. The importance of support from the middle to top management in the implementation process is rarely conducted and is also considered an additional challenge to overcome. Besides the employee factor, the current system is also not good enough to handle the constant modifications because every process and activity is connected.

> *“When you want to change your way of working which is also about digital transformation, you need a change and then you have to really come endure with that. because it takes time for people to get used to a new way of working. It's not enough to*

*say: OK we have a new process this is how it works; we have a new system this is how it works, OK use it now. It's just doesn't work that way."* – R4

R1 and R5 mentioned about complexity in use such as customer complain because the new digital added product is too complex to use even though the new technology helped the products' usability based on several other customer reviews. R5 mentioned about the hardest challenges is to adapt the customers to the digital technology. Customers is more concerned to its usability, for example no severe operating error during the process, rather than what inside the technology.

*"Our challenge is somewhat a black box to the customer, they don't really care what's inside, but you have to come with the best approach to deliver our technology so that the customer can rely on it, and it has less shock. It will not cause any severe operation error during the customer operating process."* – R5

Over usage of energy mentioned by R3 and R6. R3 mentioned that the digital system, such as cloud systems collaborated with a third party, was using non-renewable energy, which related to the energy inefficiency. R6 also mentioned the energy inefficiency or unsustainable energy challenges that need to be solved between the company and its supplier.

### 4.4. Key actions to achieve sustainable digital transformation

The final part of the interview was relating to the solutions, or the key actions given by the respondents that contribute to the success of the sustainable digital transformation. The respondents' actions taken is presented in table 18 below.

**Table 18. Responses' summary of key actions to achieve sustainable digital transformation**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 |
|---|---|---|---|---|---|---|---|
| A strong culture of innovation and sustainability | Effective digital culture | ✓ | | ✓ | ✓ | | ✓ |
| | Embrace risk | ✓ | | ✓ | ✓ | | |
| | Effective sustainable culture | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Sustainable long-term plan | | ✓ | ✓ | ✓ | | ✓ |
| Strong leadership team with clear visions and implementation plan | Determinant top leader | | ✓ | | ✓ | | |
| | Speed of implementation | ✓ | | | | | |
| | Group project with board support | | ✓ | | | | ✓ |
| | Middle management role | | | | ✓ | | |
| | Clear implementation process and measures | | | | | ✓ | |
| Recruiting, training, and supporting talents | Recruit adapt-to-digital-future skillsets, focus on soft-skill (adaptive, curious, flexible) | | | | ✓ | | ✓ |
| | Reskilling and upskilling talents | | ✓ | ✓ | | | ✓ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Training course and workplace practicing | | | | ✓ | | |
| | Frequent and simultaneously support | | | | ✓ | ✓ | ✓ |
| Communication is key | Acknowledge necessary to change | | ✓ | ✓ | | | |
| | Programmatic communication | | ✓ | ✓ | | | |
| | Participatory communication | | | | | | |
| | Open, clear, transparent | | ✓ | | | | |
| | Deal with fear of being replaced | | | ✓ | | | |
| Deep understanding of users | Innovating based on user' point of view | ✓ | | ✓ | | ✓ | ✓ |
| | Include users in the digital innovation | ✓ | | ✓ | | ✓ | ✓ |
| | Use sustainable resources and energy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Generate effective insights from data | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | Prioritize demand | | | | | ✓ | |
| Suitable technology | Easy-to-use | | ✓ | | | | |
| | Reliable system | | ✓ | ✓ | | ✓ | |

### 4.4.1. Building a strong culture of innovation and sustainability

A strong culture of innovation and sustainability is described as the agility and openness to sustainability, as well as to embrace risk. All of respondents saw this strategy as something important.

> "*It's really important to be able to adapt and move fast and that's where digital transformation comes in. […] I would say all companies live in a very uncertain time, and you know the world is changing really fast and that and that requires that company can also adjust and move at the same pace if you want to survive. […] If you have that culture in the company and people that are resilient to change then you will succeed. I think yeah it will make the company keep innovating more."* – R4

> "*We have really good organizational environment and as this is a big part of our digitalization and sustainability."* – R6

However, respondent R2 views this strategic solution as a challenge for the firm since it is a big multinational firm. This fits with other ways of transformation in the theoretical framework, which is "it is okay to succeed slowly if you can't fail fast", meaning that if the organization's culture does not enable quick transformation, then a successful long-term plan also works.

> *"We are a big company, but on the other hand, we have lots of old-school ways of working. We cannot see that we are very digital forwards."* – R2

Four out of six respondents also mentioned sustainable long-term plans by highlighting the current trend toward sustainability that incline fast.

*"We want to make better environment [with digital transformation]. Reduce the emission and discarded usage of our products"* – R3

*"When you start, you need to have a vision and I guess this (sustainability) was their [company's] vision. They [company] wanted to create a [product] that is sustainable from all points of view"* - R4

*"We make our investment in that area [digital technology]. Also, it will be used more and more in the future because we see this trend maybe in few years, it will be when you ask for a quotation you don't ask only for the price and quality and also maybe you ask for the sustainability in general"*- R6

### 4.4.2. Having strong leadership's vision with clear goals and implementation plan

A strong leadership and management were something that many of the respondents highlighted as necessary for effective sustainable digital transformation. However, when discussing this capability, the response varied when it came to different aspects of leadership style, organization structure, ways of working, or implementation. Meanwhile, respondent R2 thought the leaders need to be determinant about the success of the transformation, respondent R1 emphasized the speed of transformation.

"*Whoever led the project needed to be quite determinant that it is going to happen*." – R2

"*To move the direction in the digitalization in the company, management running faster, salespeople also.*" - R1

Additionally, in the organization structure, respondents R2 and R6 thought a project group with a supported board could enable the successful of the change. Meanwhile, respondent R4 agreed that transformation usually drives from top-down management but emphasized the layer of middle manager actually play an important role in this journey.

"*I think the core concept is that you should have a group of projects. I have my steering group to discuss my issues/problems, needs for resources, etc. And I had a project board who actually say yes you can do this. […] It is very good thing when it comes to the transformation project that you always have a board that is saying that it is ok.*" – R2

"*It's really important that managers once have done these kinds of changes usually driven from above like from top management down. But I think that the layer of middle managers [...] is really important to enable people to actually embrace this new way of working. […] at the end of the day it always goes back to the to the middle manager to the direct supervisor how to really make sure that this is happening, that the change is being embraced."* – R4

"*Any challenge you faced during the project you will find the support the total support*." – R6

On the other hand, follow the requirement and implementation process and measures also contribute to the effective digital transformation, as R5 agreed.

> "*We need to follow, and we need to strictly follow that specification in order to be adequate to customer demand*." – R5

### 4.4.3. Recruiting, training, and supporting talents

The majority of the respondents agreed that talent is the strategic element in transformation. When it comes to talents, the respondent mentioned three aspects including recruiting, training and supporting talents.

First of all, to create an agile and open to change culture, it can start from the beginning which is to focuse on recruiting talents that are adaptable, curious, and flexible. This could make the transformation much easier, as respondents R4 and R6 highlighted.

> "*There are a lot of newcomers […] you can really breathe that the change is happening all the time. The pace is high, and everybody is open to change. […] The kind of profile that has been recruited into this company, knowing that it's a start-up and knowing that you know we want to have people who are open for change, are willing to change. I think that makes it much easier to drive this transformation."* – R4

Secondly, it is not always easy just recruit new talents. Therefore, the most strategic action is to reskill and upskill talent to adapt to the change. The respondents R2, R3, and R6 highlighted the necessity to train talents through training programs, seminars, and events, as such.

> *"[We hold] lots of leadership training in virtual leadership, which is also part of the digital transformation. […We] doing lots of small events to highlight the development of digitalization, […] lots of training, meetings, events raising awareness."* – R2

> *"[We] are being invested in the current employees and utilizing the current capacity to help in this digitalization transformation."* - R6

Remarkably, the firms need to think about providing suitable ways of training that fit most with the talents. The respondent R4 mentioned that many companies use e-training because of its convenience, however, practicing in the workplace itself matters.

> "*Training itself is not enough, and also training has to be tailored. Because people learn in different ways. I think companies today are like trying to channel everybody into this E-learnings because it's fast, it's easy, it's like you create any learning, then you're expecting everybody to take the E-learning and then you're done. But I think the people it's very important to know that people learn in different ways. […] I mean 70% of what you learn is when you do it, so the training is just the beginning of it."* – R4

Last but not least, supporting talents and users to adapt to the sustainable digital transformation is fairly important. The support needs to be frequent and simultaneously with the training. Respondents R4 and R6 highlighted the need to provide support for a long period of time, follow up often and make sure frustration does not happen. Additionally, a group of supporters that helps with the technical problem is also useful, this could be the IT team, customer service team, or the like as R5 mentioned.

> "*A key thing is managers. they should have given the middle managers the responsibility to follow up on this, and really make sure that this new process/ new way of working implemented and embraced into the company*." – R4

> *"When there is some problem with our device our equipment, they will send some report back to the customer support, and then deliver the report to [development team]. It's our task to analyze and try to troubleshoot the problem."* – R5

### 4.4.4. Communication is key

No respondents could deny the key role of effective communication during the sustainable digital transformation. The communication topic can be about the purpose or benefit of the change (respondent R2, R3), or the implementation plan (respondent R2), or help them to deal with different resistance that makes users not want to change. This is also related to the programmatic communication style, which uses the right approach to the right person at the right time to reduce resistance to change.

> *"I think afterward [the employees] understood when [the project team] make it clear about the scope of the project, what we want to achieve in the project. It took time but people understood it eventually."* – R2

Moreover, being open, clear, and transparent in the process will also eliminate the change according to respondent R2.

> "*Open, transparent, communicate and show them the system, and let them be able to test the system. […] The change is painful when you don't know what you are changing too. If you included people, then it would be easier."* – R2

Remarkably, respondent R3 mentioned the necessity of dealing with the fear of being replaced by the technology of some users.

> "*We make sure that we have a good balance in it, the [users'] perspective needs to be being help and not to be replaced."* – R3

### 4.4.5. Deep understand users

Looking at the target users to have a deep understanding of them would enable the success of the sustainable digital transformation. Indeed, it is impossible to implement any changes successfully without knowing the reason why. Therefore, three out of six respondents mentioned that market surveys, interviews, observation are important to get insights to innovate from the users. Moreover, data analytics also mentioned as important tool to acquire more insight to innovate.

> "*We also try to do market research, to understand what actually the customer needs."* – R3

> "*We have some very high-level system designers who had to define what would be the next feature to develop. […] The more thoughtful we are the better user experience we can bring."* – R5

> "*It will be used more and more in the future because we see this trend may be in few years. It will be when you ask for a quotation you don't ask only for the price and quality and also maybe you ask for the sustainability in general."* - R6

All of the respondent also mentioned about the importance to limit the resources or energy needed to innovate and operate digital technology.

> *"We need to do something to reduce this environmental impact and resources. [This] is because at the end and as industry, as a human, of course you cannot make it zero [impact]. If you eat, you cook, [you] have an impact on the environment. So, we believe we need to reduce this impact as much as possible. So, to save the planet, to save more resources and capability in this planet for the future generation as well as we see."*- R6

### 4.4.6. Easy-to-use and reliable system

It is commonly mentioned above about the importance of people, in this part, the importance of an easy-to-use and reliable system is highlighted. In fact, the respondent R2 thought that the digitalization in the organization should not be too complicated, which is as easy as the workers use social media:

> "*I think we should be able to learn ourselves*." – R2

Meanwhile, the system that the firm gigiveso the users should be reliable, which means there are not too many bugs and errors, so that the users believe this digitalized action could help them to have better performance.

> "*We need to show the system as reliable, with high performance as possible by developing very reliable software."* – R3

> "*How to solve it took a lot of time, trust, training, dialog, we try to make sure that we involve everyone. We have a good balance in how we present our technology. We want everybody to have a part in this innovation*." – R3

# V. ANALYSIS AND DISCUSSION

*In this chapter, the empirical findings are analyzed and compared with the theoretical framework and summarized. The purpose is to compare the strategies and implementation in sustainable digital transformation between theory and reality. The analysis and discussion part will follow the flow including digital transformation, sustainability, opportunity of sustainable digital transformation, challenges during the sustainable digital transformation, and key action to achieve sustainable digital transformation as final.*

The findings from the respondents are discussed and analyzed in this part by adding one point for each sustainability effort and zero for no effort (Appendix F-J). The addition of binary numbering is to provide a percentage of answer and a correct degree of sustainability based on the comparison of theoretical framework and empirical findings.

## 5.1 Sustainable Digital Transformation

### 5.1.1 Digital transformation implementation

#### *5.1.1.1 Digital transformation views*

The view on digital transformation and the main attribute of the definition identified in the primary and secondary data collections are compared in table 19 below. The table presents both the attributes identified by literatures and respondents.

**Table 19. Comparison of digital transformation views identified by literatures and respondents**

| Attributes | Identified by both literatures and respondents | Identified by only literature | Identified by only respondents |
|---|---|---|---|
| A transformation process | ✓ | | |
| Digital technologies involved | ✓ | | |
| Strategic and prioritized way | | ✓ | |
| Capture most value | ✓ | | |

As shown in table 18, it is often noticed by all respondents as a (1) process of change in different aspects of the organization (2) with digital technology involved to (4) improve current stages or capture new values. This aligned with table 2 about digital transformation definition n literature, where the major of authors often capture attributes (1), (2) and (4). However, all of the respondents did not mention the attribute (3) that digital transformation should be implemented in a strategic and prioritized way. In this thesis, the digital transformation is defined as "a profound transformation process of business model, operation, customers experience, employees' experiences or platform by adopting new digital technologies and their impacts in a strategic and prioritized way to capture most values", which is based on mostly the theoretical framework. As all the attributes were identified by the theoretical framework already, no new perspective on the view of digital transformation was mentioned by the respondents. Both the theoretical framework and the empirical findings align with the background of the thesis and highlight the clear view of digital transformation.

*5.1.1.2 Digital transformation elements*

When investigating on different elements within the organization during the digital transformation, five key elements was used as the main attributes based on (Bonnet & Westerman, 2021) to compared between literatures and respondents, which is presented in the table 20 and Appendix F.

**Table 20. Comparison of digital transformation elements identified by literatures and respondents**

| Attributes | | Identified by both literatures and respondents | Identified by only literature | Identified by only respondents |
|---|---|---|---|---|
| Business model | Digital enhancements | ✓ | | |
| | Information-based services extensions | ✓ | | |
| | Multisided platform businesses | | ✓ | |
| Customer experience | Experience design | ✓ | | |
| | Customer intelligence | ✓ | | |
| | Emotional enhancement | ✓ | | |
| Operation | Core process automation | | ✓ | |
| | Connected and dynamic operations | ✓ | | |
| | Data-driven decision making | ✓ | | |
| Employee experience | Augmentation | ✓ | | |
| | Future readying | ✓ | | |
| | Flex forcing | ✓ | | |
| Digital platform | Core | ✓ | | |
| | Externally facing | ✓ | | |
| | Data | ✓ | | |

Even though the sub-attributes regarding "Multisided platform businesses" and "Core process automation" are only identified by only literature, all of the five main elements were identified by both the literature and the respondents. This can be argued that either the interview subjects are not working within these elements, or the organization has transformed these elements before since those are two main key elements of digital transformation. Moreover, customer experience is the most common element among respondents, accounting for 83%, meanwhile, the operation element is the least common element, which accounts for 33%.

In the literature review, this framework is evaluated to be mutually exclusive and collectively exhaustive when compared to other authors' frameworks. After the collecting primary data stage from the interview, this assessment is proved to be true. Indeed, when investigating different aspects of digital transformation from respondents' organizations, it can be categorized in one or more sub-elements based on a framework from Bonnet & Westerman (2021) used in this paper. The framework is updated recently by Bonnet & Westerman, which is one year before the year conducting this thesis, therefore, this is a good framework to use proved by empirical findings.

### 5.1.2 Sustainable digital transformation

#### *5.1.2.1 System level*

From the System table mentioned in Appendix G, five out of six respondents showed good awareness at the System level, and answered four to five awareness from their interview. The most mentioned awareness answered by all respondents is about the increasing CO2 and other pollutive, which is one of the problems mentioned in this thesis. High awareness of CO2 and other pollutive showed that all companies understand the problem. This high awareness might also potentially change the company's activities to reduce the CO2 and other pollutive in the future. Moreover, awareness of this matter also showed the company's accountability in solving this real problem. As mentioned in the literature; corporations contributed significantly to emissions and pollution. The second most mentioned by five out of six respondents is awareness of the market demand and competitiveness. Both codes refer to the economic pillar of sustainability, one of the core concepts in companies that provide the market with desirable products and gain a competitive advantage over its competitor. Only one respondent (R3) mentioned awareness of fairness and equity concerning the digital transformation. R3 highlighted the potential disruptive factor of digital technology towards employees, such as digital technology replacing employees. This disruptive factor was mentioned in the literature and problem discussion that is often overlooked by companies. However, R3 company was aware of this matter and placed a plan to remove it by gaining employees' trust and educating them about the technology that exists to help, not replace.

Lastly, none of the respondents mentioned awareness of the increasing population. Even though none of the respondents explicitly mentioned or showed an awareness increase in population, they were aware of the increasing market demand. Increasing market demand can be implied that the respondents were aware of the growing market, where consumers grow more significantly because the population grows. The respondent showed a good system level by mentioning 60% of the attributes. High points in this level indicated that the respondents, as the company's representative, were aware of their company's position within the connected and dynamic interrelationship of the digital environment that contributed to further strategy to establish sustainability.

#### *5.1.2.2 Success level*

All respondents showed good Success level by mentioned 70% of the attributes. All respondents showed good sustainability definitions and core purpose, a positive determinant that contributed to the success of its implementation in each of their companies. Even though five out of six respondents have not entirely defined sustainable digital transformation, arguably, this can be overlooked since all respondents already understand the primary meaning. However, a correct understanding of the sustainable digital definition is needed in the future to ensure excellent planning and strategy, especially with the rising implementation of digital technology in the companies.

Four out of six respondents mentioned sustainable digital end goals. Sustainable end goals are embedded, implemented and part of their strategy. This shows that the companies have already embraced continuous delivery and benefit while limiting harmful side impacts in their day-to-day activities. Furthermore, the companies' sustainable end goals implied that the companies already have planned goals and took part in sustainability for digital transformation or created an enhanced digital product that aimed to be sustainable in the first place. High points in this level indicated that the respondents, as the company's representative, were able to plan analysis

guidelines, innovation, and development of digital sustainability which contributed to the success of its implementation in the company.

#### *5.1.2.3 Strategy level*

Only two out of six respondents showed a Strategy level in the interview (33%). Backcasting from the ABCD method is the primary determinant at this level. The two respondents mentioned that the end goals (mentioned in the Success level) are strategically crafted by comparing the current condition and core values to the end goal itself.

On the other hand, R3, which has shown a good core purpose and end goals in the Success level, did not mention backcasting in its strategy. The rest of the respondents who did not show any backcasting argued that they had limited information about how the company implemented its digital strategy. High points in this level indicated that respondents, as the company's representative, showed a strategy to fill the gap where the company today to where it wants to be that contributing to the success of digital sustainability.

#### *5.1.2.4 Action level*

All respondents showed sustainable actions in the digital activities, either in their products or way of working. Only three out of six respondents showed good action levels covered the three pillars of sustainability in their products (economy, environment, and society) while the other three only showed the economic and environmental pillars. R3, R4, and R6 highlighted their new digital products that are sustainable in all three pillars. These products were developed to gain a competitive advantage and met the characteristic features of environmental and societal sustainability. However, in other actions that mentioned the use of digital technology for the way of working, for example, the third-party cloud system that is widely used in R3's company, the electricity used to run this digital technology is not known whether it comes from a sustainable origin or not. Moreover, despite having a goal to be entirely sustainable in their way of working, R4 could not mention specific examples because of anonymity. Most of the respondents only showed actions related to the economic pillar of sustainability. As mentioned previously in the literature on sustainable digital transformation, it is hard for one action to contribute to all three pillars of sustainability, especially when businesses or companies often prioritize continued benefits over environmental and social benefits. Overall, the respondent showed a good action level by mentioning 72% of the attributes. High points in this level indicated that respondents, as the company's representative, showed concrete sustainable actions that the companies have done in their digital sector, both in their digital added product or enhanced digital way of working. These concrete actions also represented empirical information on sustainable digital activities in the companies.

#### *5.1.2.5 Tools level*

Five of six respondents' companies produced sustainability reports annually. However, only three reports mentioned explicitly digital efforts for their products and internal operations. These reports showed how helpful digital transformation is for the production and way of working in the long run and how the companies try to innovate its digital sector to be more sustainable. On the other hand, the rest of the reports without explicit digital efforts showed some indirect indication that might be correlated to digital sustainability. One example is using renewable energy in production and offices, which contributes to the environmental pillar of digital sustainability. All reports also showed more sustainable end-goals than what respondents mentioned during the interview. For example, R5 did not mention any digital end-goals related, but the company sustainability report mentioned the aim to become a net-zero

company. High point in this level indicated that the company already evaluate and monitor sustainable digital transformation with published tools such as sustainability reports.

#### *5.1.2.6 Summary of sustainable digital transformation*

Based on the analysis and discussion above and the percentage rate in Appendix G, the Tools level consisting of sustainability reports showed the highest percentage of answers (83%). This level contributed to the firm's effort to monitor and evaluate its sustainability. Even though some of the reports lack the specific measure or even end-goals in digital transformation, the overall sustainability effort in different areas, such as renewable energy usage and net-zero end goal, indirectly demonstrated the company's good intention in supporting sustainable digital transformation. Placed in the second rank with 72% of answers, the Action level contributed to showing the concrete sustainable actions that the firms have done in their digital sector. Only half of the findings showed complete sustainable digital action in the three pillars of economy, environment, and society. Bican & Brem (2020) mentioned that one single sustainable digital transformation effort rarely affects the whole. However, as digital technology continues to share ample spotlight to achieve sustainability, the firms need to consider the three pillars' impact more in the future. Placed in the third rank with 71% of answers, the Success level showed that most of the firms were able to plan analysis guidelines, innovation, and development of digital sustainability which contributed to the success of its implementation. System-level placed in the fourth rank with 60% of answers. System-level contributed to the awareness of the firm's position within the connected and dynamic interrelationship of the digital environment, contributing to further strategy to establish sustainability. Most of the findings mentioned at the System-level were still closely related to the economic pillar of sustainability, which is similar to Action's level findings. Arguably, as the first level of sustainability implementation, economic pillar-centered findings in this level could be one of the reasons why the firm's Action level is heavily focused on the same pillar. Lastly, the Strategy level is placed last in this rank with 33% of answers. The primary determinant in this level, which is backcasting sustainability end goals to the firm's current condition, showed a low score even though most firms already showed some good concrete actions. Arguably, since most of the respondents were not the firm's top leader or the high strategic decision-maker, the strategy level suffers from limited information. The respondents also mentioned this lack of knowledge of strategy during the interview.

### 5.2 Opportunities for Sustainable Digital Transformation

Similar to the sustainable digital transformation analysis, a comparison between the different opportunities identified through the theoretical framework and empirical findings are shown in the table 21.

Based on the finding in table 21, similar amounts of opportunities were identified by both literature and respondents or only by literature, while only one opportunity was identified by only respondents, which is "follow the regulations". It is remarkable but not so surprising since the studying country is Sweden, which is on the top list of sustainability countries. It can be stated that most of the attributes were mainly identified by literature. The respondent presented one new opportunity for sustainable digital transformation, which is following the regulations from the governments or economic areas.

Meanwhile, the "customer experiences and engagement" attribute is mentioned by different authors in the literature, no respondents stated those opportunities. This can be explained that the respondents focus on the ultimate benefit, such as revenue and business. In addition, all of

the sub-attributes related to "streamlined operation" opportunities are identified by both respondents and literature (Appendix H). So, it can be argued that sustainable digital transformation brings a huge opportunity within the operational process of the organization. Regarding the sustainability opportunities, there is a small discrepancy between literature and respondents. Most of the respondents believed "reduce CO2 emission" and "better resource usages" are the benefit of sustainability, which accounts for 50%. Besides, the "incorporated sustainability goals effectively" and "better taxation" were not mentioned by respondents, this aligned with the lowest percentage of "strategy level" in sustainability assessment (5.1.2) that there is a lack of strategic view of sustainability among interviewed subjects.

**Table 21. Comparison of opportunities for sustainable digital transformation identified by literatures and respondents**

| Attributes | | Identified by both literatures and respondents | Identified by only literature | Identified by only respondents |
|---|---|---|---|---|
| Customer experiences and engagement | Better responses to market | | ✓ | |
| | Improve customer relationship | | ✓ | |
| | Enhance more friendly products/ services | | ✓ | |
| Revenue and business | Boost sales for current products | ✓ | | |
| | Launch new products/ services | ✓ | | |
| | Create business model | ✓ | | |
| Streamlined operation | Increase productivity and creativity | ✓ | | |
| | Faster information sharing | ✓ | | |
| | Better maintenance schedule | ✓ | | |
| | Avoid failures | ✓ | | |
| | Cut cost | ✓ | | |
| Sustainability | Incorporated sustainability goals effectively | | ✓ | |
| | Reduce harmful impact | ✓ | | |
| | Reduce C02 emission | ✓ | | |
| | Better resource usages | ✓ | | |
| | Better brand image | ✓ | | |
| | Better taxation | | ✓ | |
| | Transparency and fair play | ✓ | | |
| | Follow the regulations | | | ✓ |

### 5.3 Challenges during the sustainable digital transformation

A comparison between the different challenges identified through the theoretical framework and empirical findings are shown in the table 22.

**Table 22. Comparison of challenges of sustainable digital transformation identified by literatures and respondents**

| Attributes | | Identified by both literatures and respondents | Identified by only literature | Identified by only respondents |
|---|---|---|---|---|
| Resistance to changes | Absence of control | | ✓ | |
| | Unknown impacts | ✓ | | |
| | Current comfortability | ✓ | | |
| | Expensive, time-consuming | | ✓ | |
| | In-house politic | | ✓ | |
| Group thinks | Introspective insights | | ✓ | |
| | Disposability | ✓ | | |
| One-size-fits-all training approach | Content of training | ✓ | | |
| | Format of training | ✓ | | |
| | Timing of training | | ✓ | |
| Technical debt | Disparate systems | ✓ | | |
| | Added software | ✓ | | |
| | Added effort | ✓ | | |
| | Language barriers | ✓ | | |
| Complexity-in-use | System dependency | ✓ | | |
| | Semantic dependency | | ✓ | |
| Environment direct impact | Over usage and unsustainable sourcing | ✓ | | |
| | Finding sustainable cloud provider | | | ✓ |
| Environment indirect impact | Health, complex infrastructure | | ✓ | |

Respondents mentioned six out of seven challenge attributes based on the literature. “Resistance to change” and “one-size-fits-all training” is the challenge respondents mentioned the most, which accounts for 50% (Appendix I). However, when it comes to the sub-attribute level, only “unknown impact” and “current comfortability” are both identified by literature and respondents. In fact, “unknown impact” is the main reason that increases the resistance to the change, which accounts for 67%. It is also agreed in the literature that most humans are resistant to change because of the absence of control and afraid of making bad choices (Dineva, 2022). As mentioned in the theoretical review, an established company often has well-functional processes that sometimes hinder a new system from functioning, which call “group think”. The

"unknown impact" also leads to the disposability in "group thinks" since the company is threatened with losing its creditability, which both mentioned by Dineva (2022) and respondent R3. It is also highlighted the importance of introducing and training employees to acclimate to the new system, which often takes time. Lauterbach (2021) introduced the three aspects of training which are content, format, and time. Among those, respondents R2, R3, R4 emphasized the necessity of having a suitable format of training to each type of users, which is aligned with the content and format of training elements in the literature.

The "technical debt" and "complexity in use" seem to be the common challenges that both identified by literature and respondents. It is understandable because the transformation is directly linked with technology, especially the more advanced technology, the more difficult the challenges are. Also, the direct environmental challenges related to the "over usage of energy and resources" and "unsustainable sourcing" were both agree by Liu et al. (2019) and respondents R3 and R6. Meanwhile, Liu et. Al (2019) emphasized the damage to the environment due to intensive energy consumption, R3 mentioned how to ultimate the algorithm to save energy and memory. R6 also argued unsustainable sourcing should be solved between the company and its suppliers. Especially, the importance to find a sustainable cloud provider as mentioned by respondent R3 which is not identified in the literature. R3 argued that the providers who use non-renewable energy is linked with the problems of energy inefficiency.

### 5.4 Key actions to achieve sustainable digital transformation

Connecting the views, the opportunities, and the challenges of sustainable digital transformation, the key actions to achieve sustainable digital transformation identified through the theoretical framework and empirical findings are presented in table 23 below. All of the key actions except for the technology attribute were identified by literature and respondents. A strong culture of innovation and sustainability and a deep understanding of users contributed to the highest percentage of answers with 71% and 67%, respectively (Appendix J). Although not all the sub-attributes are both mentioned, the five main actions are generally agreed upon. It can be stated that there is a discrepancy between theoretical framework and empirical findings when implementing strategic solutions in detail to achieve sustainable digital transformation. Remarkably, the technology actions are newly mentioned by respondents to develop an easy-to-use and reliable system for users.

There is an agreement between respondents and literature authors to build a strong culture of innovation and sustainability. Kane (2016) and Kiron (2016) suggested building an effective digital culture and embracing risk, to which respondents R1, R3, R4, and R6 agreed. Remarkably, all of the respondents agreed to build an effective sustainable culture that Broman and Robert (2017) have suggested. Among those, 67% of respondents emphasized having a sustainable long-term plan that Frankiewicz and Chamorro-Premuzic (2020) suggested. These authors also suggested having an agile community, however, there is no respondent mentioning so.

There is a huge discrepancy between respondents and literature in terms of having a strong leadership team. Meanwhile, the respondents emphasized that speed of implementation (R1), a group project with board support (R2 and R6), and middle management role (R4), those sub-attributes have not been identified in the literature. Koehler (2021) mentioned the balance of technology investment portfolio and being choosy between innovation and integration, however, no respondent has mentioned those. However, both respondents and authors agreed

to have top leaders challenge the status quo, as well as a clear implementation process and measures.

Mentioning the talents, Frankiewicz & Chamorro-Premuzic (2020) emphasized the necessity to recruit adapt-to-digital-future skillsets and reskilling and upskilling talents, to which respondents R2, R3, R4, and R6 agreed. Kiron et al. (2016) suggested having training courses and workplace practices, which is agreed by respondent R4. This is also connected with the one-size-fits-all training challenge. Koehler (2021) argued to connect talents' career paths to the organization's purpose as well as making talents excited about working with technology, however, no respondent has provided these actions. Instead, 50% of respondents suggested having frequent and simultaneous support, which has not been found in the literature.

Regarding communication, Myers et al. (2012) emphasized acknowledging the necessity to change and have programmatic communication, which means delivering the right message to the right person at the right time. Respondents R2 and R3 agree with those authors by saying to explain the benefit of the change or the implementation plan. Myers et al. (2012) also mentioned using participatory communication, but no respondent has suggested this action. Similarly, no respondent had the same idea as Hay (2021) to use a shared language when communicating across departments. However, respondent R2 suggested being open, clear, and transparent in communication, and respondent R3 suggested helping the users deal with the fear of being replaced, which has not been identified in the literature.

Remarkably, all of the respondents agreed with all sub-attributes regarding the deep understanding of users that Guinan, Parise, & Langowitz (2019), Smith (2021), Frankiewicz & Chamorro-Premuzic (2020), and Koehler (2021) suggested. This attribute is considered to be a strategic action to achieve sustainable digital transformation. Meanwhile, no author has mentioned having a suitable technology that 50% of respondents have suggested. This could be because of one limitation of this paper, which is the technology aspect not being deepened.

**Table 23. Comparison of key actions to achieve sustainable digital transformation identified by literatures and respondents**

| Attributes | | Identified by both literatures and respondents | Identified by only literatures | Identified by only respondents |
|---|---|---|---|---|
| A strong culture of innovation and sustainability | Effective digital culture | ✓ | | |
| | Effective sustainable culture | ✓ | | |
| | Embrace risk | ✓ | | |
| | Agile community | | ✓ | |
| | Successful long-term plan | ✓ | | |
| Strong leadership team with clear | Top leaders to challenge the status-quo and perception of risk, be determinant | ✓ | | |
| | Speed of implementation | | | ✓ |

| | | | | |
|---|---|---|---|---|
| visions and implementation plan | Group project with board support | | | ✓ |
| | Middle management role | | | ✓ |
| | Balance technology investment portfolio | | ✓ | |
| | Choosy between innovate and integrate | | ✓ | |
| | Clear implementation process and measures | ✓ | | |
| Recruiting, training, and supporting talents | Recruit adapt-to-digital-future skillsets, focus on soft-skill (adaptive, curious, flexible) | ✓ | | |
| | Connect talents's carrer path to organization's purpose | | ✓ | |
| | Reskilling and upskilling talents | ✓ | | |
| | Make talents excited working with technology | | ✓ | |
| | Training course and workplace practicing | ✓ | | |
| | Frequent and simultaneous support | | | ✓ |
| Communication is key | Acknowledge necessary to change | ✓ | | |
| | Programmatic communication | ✓ | | |
| | Participatory communication | | ✓ | |
| | Using shared language | | ✓ | |
| | Open, clear, transparent | | | ✓ |
| | Deal with fear of being replaced | | | ✓ |
| Deep understanding of users | Innovating based on user' point of view | ✓ | | |
| | Include users in the digital innovation | ✓ | | |
| | Use sustainable resources and energy | ✓ | | |
| | Generate effective insights from data | ✓ | | |
| | Prioritize demand | ✓ | | |
| Suitable technology | Easy-to-use | | | ✓ |
| | Reliable system | | | ✓ |

# VI. CONCLUSION AND SUGGESTION

*In this section, the answers to the research questions are presented. The implementation of sustainable digital transformation in Swedish firms is presented and correlated with its opportunities, challenges, and strategic solutions.*

## 6.1 Answer the research question

This thesis aims to add further insights that previous research lacks by combining theoretical frameworks with empirical findings. Furthermore, this thesis aims to provide up-to-date insights into how companies are doing their digital transformation, how sustainability is incorporated, the linked opportunities and challenges, and how to do it effectively by analyzing and defining essential factors that contribute to it. Thus, from these purposes, the following research questions were formulated:

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*RQ: How can a Swedish manufacturing firm implement sustainable digital transformation?*

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The main research question above is divided into four sub-questions:

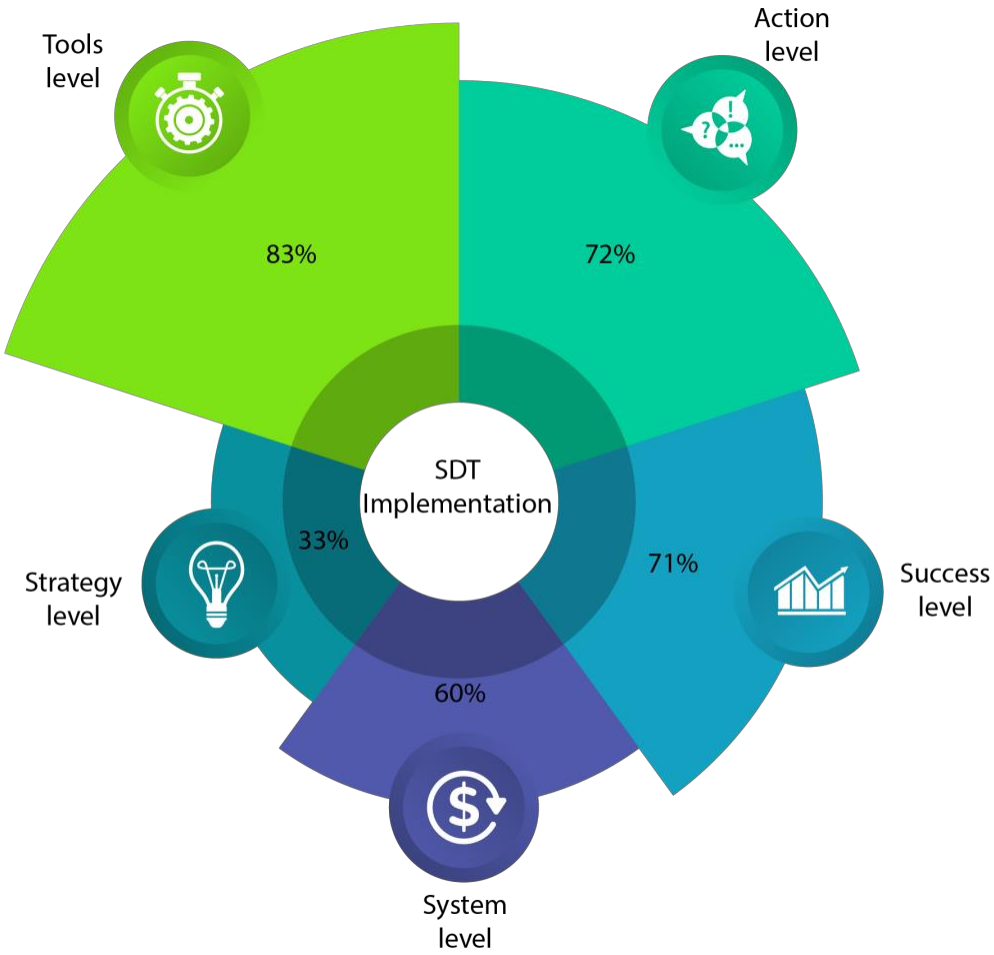
*Sub-question 1: What are current implementations of sustainable digital transformation in Swedish manufacturing firms?*
*Sub-question 2: What are the opportunities in sustainable digital transformation?*
*Sub-question 3: What are the challenges in sustainable digital transformation?*
*Sub-question 4: What are the key actions to achieve sustainable digital transformation?*

Based on the discussion formed from comparing the theoretical framework and empirical findings, the authors proposed the following answers to the research questions:

### 6.1.1 Implementation of sustainable digital transformation in Swedish manufacturing firms

Based on the empirical findings and discussion, the implementation of sustainable digital transformation in Swedish manufacturing firms are shown in Figure 6 below. Besides the digital sustainability, the elements of digital technology were also adopted well within the firms. This is shown by the findings with 56% of answers covers from all five elements of digital transformation (business model, customer experience, operation, employee experience, and digital platform).

**Figure 6. Summary of SDT implementation based on five level model FSSD in Swedish firms**




### 6.1.2. Opportunities in sustainable digital transformation

Established from the theoretical framework and empirical findings, three key opportunities are identified: *revenue and business, streamlined operation, sustainability*. Each key opportunities incorporated with several sub-opportunities, which are presented below.

**Table 24. Conclusion of opportunities in sustainable digital transformation**

| **Key opportunities** | **Opportunities incorporated** |
|---|---|
| Revenue and business | Boost sales for current products |
| | Launch new products/ services |
| | Create business model |
| Streamlined operation | Increase productivity and creativity |
| | Faster information sharing |
| | Better maintenance schedule |
| | Avoid failures |
| | Cut cost |
| Sustainability | Reduce harmful impact |
| | Reduce C02 emission |
| | Better resource usages |
| | Better brand image |
| | Transparency and fair play |

### 6.1.3. Challenges in sustainable digital transformation

Similarly, established from the theoretical framework and empirical findings, five key challenges are identified: *resistance to changes, one-size-fits-all training approach, technical debt, complexity-in-use, energy inefficiency*. Each key challenges incorporated with several sub-challenges, which are presented below.

**Table 25. Conclusion of challenges in sustainable digital transformation**

| Key challenges | Challenges incorporated |
|---|---|
| Resistance to changes | Unknown impacts |
| | Current comfortability |
| | Disposability |
| One-size-fits-all training approach | Content of training |
| | Format of training |
| Technical debt | Disparate systems |
| | Added software |
| | Added effort |
| | Language barriers |
| Complexity-in-use | System dependency |
| Environment direct impact | Over usage and unsustainable sourcing |

### 6.1.4. Key actions to achieve sustainable digital transformation

Established from the theoretical framework and empirical findings, the five key to achieve sustainable digital transformation were identified: *a strong culture of innovation and sustainability; strong leadership team with clear visions and implementation plan; recruiting, training, and supporting talents; communication is key; deep understanding of users.* Each key action incorporated with several sub-actions, which are presented below.

**Table 26. Conclusion of key actions to achieve sustainable digital transformation**

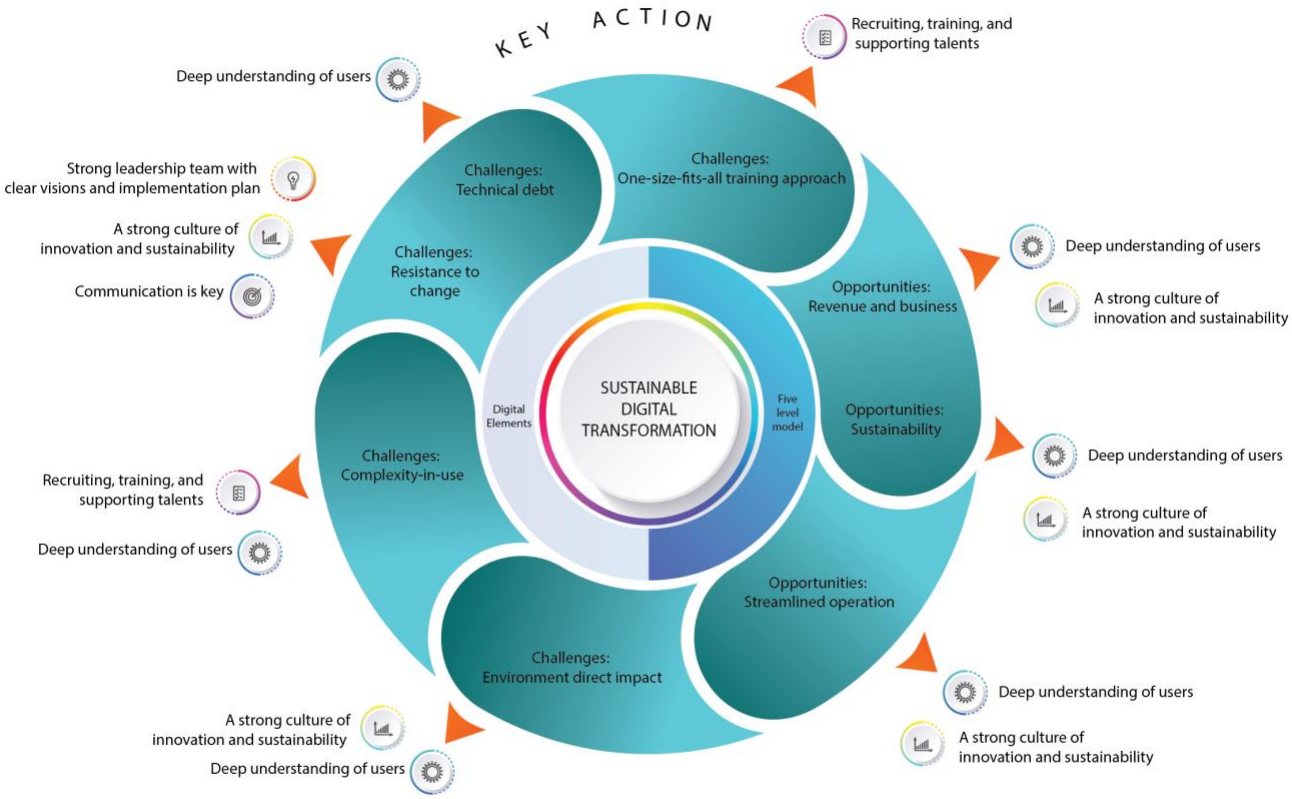
| Key actions | Action incorporated |
|---|---|
| A strong culture of innovation and sustainability | Effective digital culture |
| | Effective sustainable culture |
| | Embrace risk |
| | Sustainable long-term plan |
| Strong leadership team with clear visions and implementation plan | Top leaders to challenge the status-quo and perception of risk, be determinant |
| | Clear implementation process and measures |
| Recruiting, training, and supporting talents | Recruit adapt-to-digital-future skillsets, focus on soft-skill (adaptive, curious, flexible) |
| | Reskilling and upskilling talents |
| | Training course and workplace practicing |
| Communication is key | Acknowledge necessary to change |
| | Programmatic communication |

| | |
|---|---|
| Deep understanding of users | Innovating based on user' point of view |
| | Include users in the digital innovation |
| | Use sustainable resources and energy |
| | Generate effective insights from data |
| | Prioritize demand |

### 6.1.5. Connecting implementation, opportunities, challenges and key actions

The connection between implementation, opportunities, challenges, and actions is rooted in the main research question of how a Swedish firm can implement sustainable digital transformation. In order to answer this main research question, the logical step of finding out the current implementation of the researched topic is coded and analyzed using digital elements and five-level FSSD frameworks. Further, the opportunities and challenges are identified and analyzed from the current implementation. These challenges and opportunities are essential to planning or strategizing digital transformation. Later on, key actions are identified as the basis of focus for digital transformation strategy.

**Figure 7. Connection of implementation, opportunities, challenges and key actions**



### 6.2. Recommendations

From the empirical findings and discussion, three recommendations are developed to help firms implement sustainable digital transformation effectively. By following these recommendations, firms can plan, strategize, measure, and control their digital transformation to be more sustainable.

The first recommendation is to have a balanced viewpoint on sustainability's three pillars, namely, economy, environment, and society. As mentioned in the literature, digital transformation potentially contributed to 103 out 169 UN SDGs. However, based on the empirical findings, many firms still focus their efforts or strategy on one or two pillars of sustainability that limit their total contribution to the UN SDGs. Even though achieving sustainability in all three pillars is a complex process, a balanced viewpoint is needed as the first step to planning and strategizing the following sustainable digital action contributed to complete coverage of economic growth, environmental protection, and social equity that greatly help to shape the circularity future.

The second recommendation is to focus on communication when implementing the sustainable digital transformation. The change is painful when people do not know where to change to, therefore, a clear and frequent communication about the benefit of the change, getting people involved in the change, as well as using the right language to the right person at a right time are key points.

The third recommendation is providing training and supporting to talents. It is crucial to remember that the middle management or direct supervisor plays a significant role in provide frequent and necessary support when talents need help. Moreover, organization often thinks of proving e-learning or training sections to get used to the digital transformation. However, it is essential to remember that different users need various types of training, and on-job-training is also a great way to get user adapt to the change.

The last recommendation is to check cloud providers for their sustainability. Based on the empirical findings, most of the respondents were surprised when asked whether their digital cloud system from the third-party provider is using renewable energy for their servers or not. One of the respondents expressed that this factor was not considered before, which, arguably, many firms also missed to check on this.

### 6.3. Further research

As mentioned in the introduction and literature, sustainable digital transformation is a new concept that has not been extensively researched. Comprehensive digital technology adopted by many firms with its unknown and sometimes overlooked impact on sustainability pushes the need for further research. This thesis had tried to explain how the implementation of sustainable digital transformation, its challenges, opportunities, and key actions in Swedish firms. With this in mind, several recommendations for future research that could help to further identify and analyze implementation of sustainable digital transformation is suggested.

First, future research is suggested to do the research in another country than Sweden, preferably in developing countries. Based on the literature mentioned above, Sweden is ranked first in the sustainability ranking. Thus, most Swedish firms have already adopted sustainability in their core purpose and reflected it in their digital transformation. With many developing countries are produced more goods for the international market and its loose sustainability regulations,

new findings on the challenges, opportunities, and key actions may provide more insight to be compared with this thesis. Furthermore, provide more comprehensive research in this sector. Otherwise, research in a developed country other than Sweden will also provide comparable results of implementation, challenges, opportunities, and key actions based on different determinants such as geography, culture, or government regulations.

Second, future research is suggested to explore detailed analysis of the digital action of the firms by interviewing a sustainability manager and digital transformation manager. With more information on concrete sustainable digital action from these two respondents, the results will provide richer information and different perspective range about challenges, opportunities, and key actions that, in some ways, are insufficient in this thesis. An interview with a high decision-maker such as CEO or Director is also suggested for the future research to find the end-goals or future strategy that is insufficient in this thesis, showed by low strategy empirical findings.

Third, analyze more companies from different industry is suggested for the future research. This thesis focused on medium to big manufacture company which undergo digital transformation. Other research from different industry will provide more insight into different sustainable digital implementation, opportunities, challenges, and key actions.

Lastly, an exploratory case study focused on one or several companies is suggested for future research. With an exploratory case study, future researchers can focus on deeply analyzing different digital sustainability from bottom to top. This will give a more thorough and greater understanding of the aforementioned factors and contribute more to providing more comprehensive research in this sector.

# APPENDIX

## Appendix A

**Interview guideline**

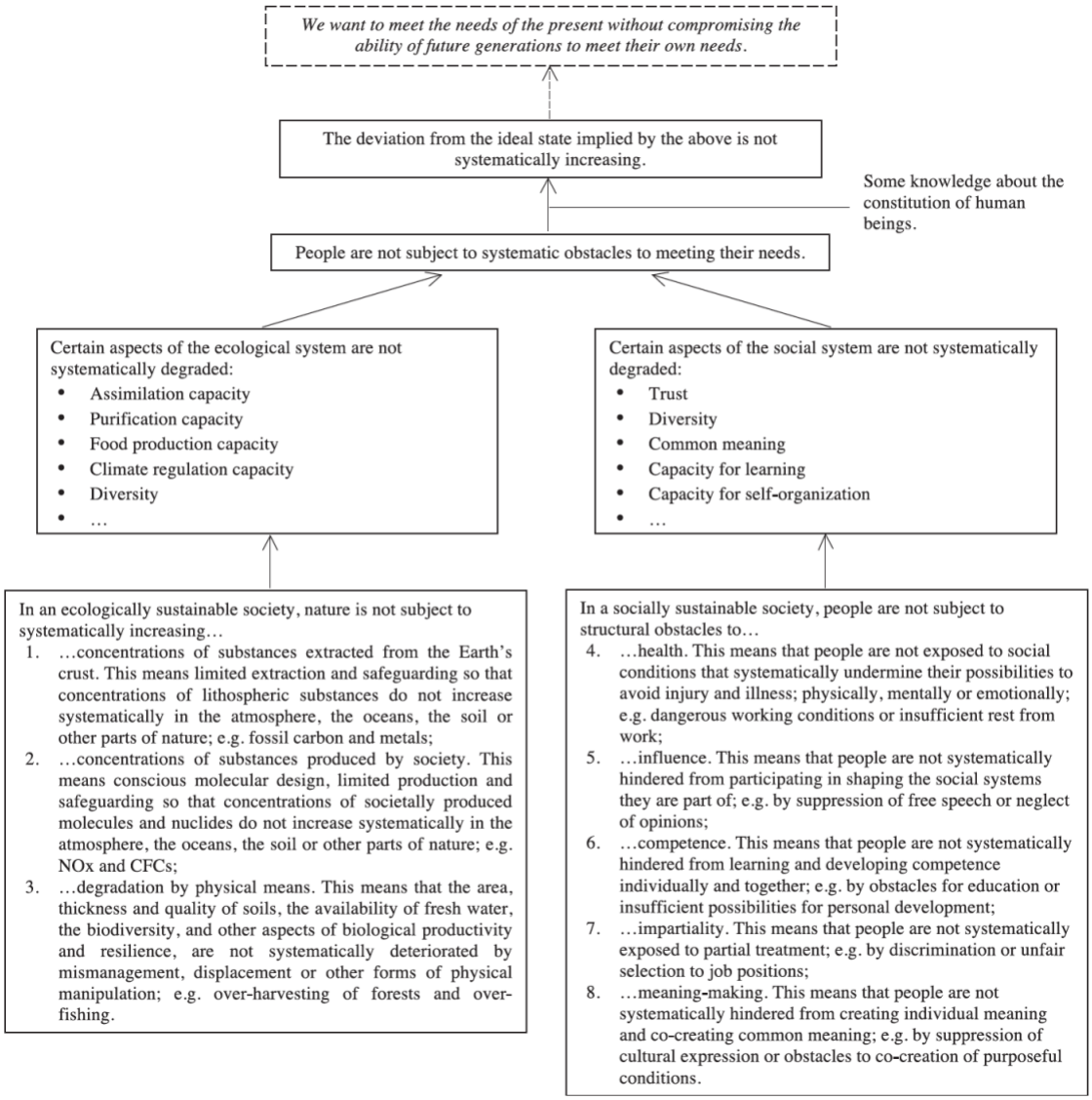
1. Introducing ourselves: name, university, master program
2. Explaining the research purpose
3. Explaining about respondent anonymity for this research
4. Asking permission for voice recording

**Questions:**

1. What do you know about digital transformation?
2. How is the digital transformation in your company? (Do your company have digital transformation? If yes, what is it/ what are they)
3. How long since the implementation of that digital transformation?
4. Are you involved in any plans/ implementations of digital transformation? If yes,
    a. What steps are needed for the digital transformation plan?
    b. What steps are needed for the digital transformation implementation?
5. What challenges when implementing digital transformation?
6. What is the sustainability definition from the point of view of the company?
    a. What is the sustainable digital transformation?
7. Is sustainability a norm in the company?
8. What makes the company implement sustainability in the first place?
9. Does the company implement sustainable digital?
10. How does the company implement sustainable digital transformation?
11. Is there any change from before digital transformation implementation in correlation to sustainability?
12. Is there any future sustainability plan for digital transformation?

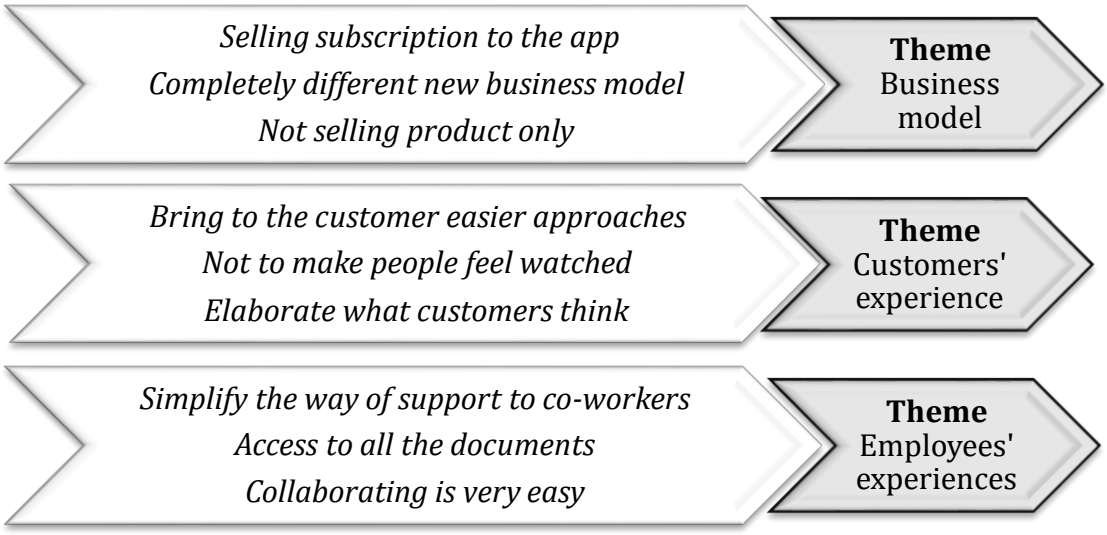
## Appendix B

"The chart shows relations between various entities related to a principled definition of sustainability. The arrows have the following meaning: what is in the box at the tail of the arrow (if true/ fulfilled) makes what is in the box at the head of the arrow possible/ true/fulfilled." (Broman & Robèrt, 2017, p. 13)

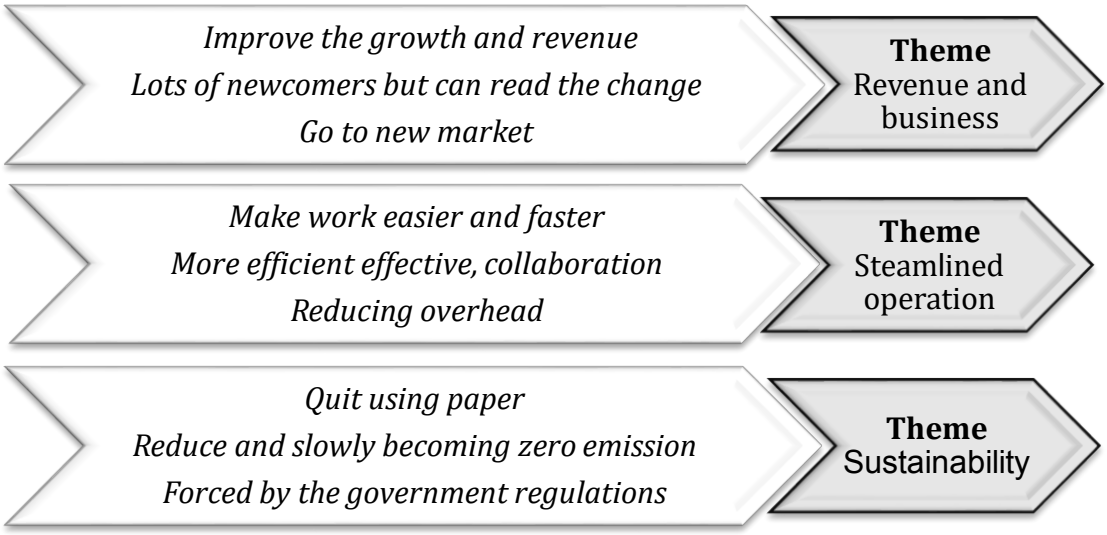


**Appendix C**

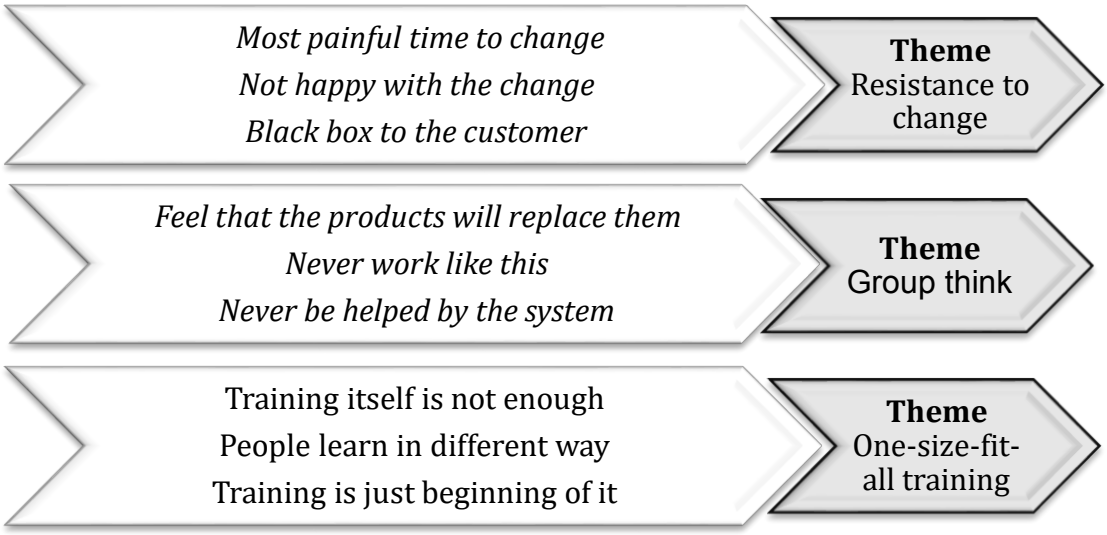
***Examples of coding primary data collection – Implemetation (Definition, element)***



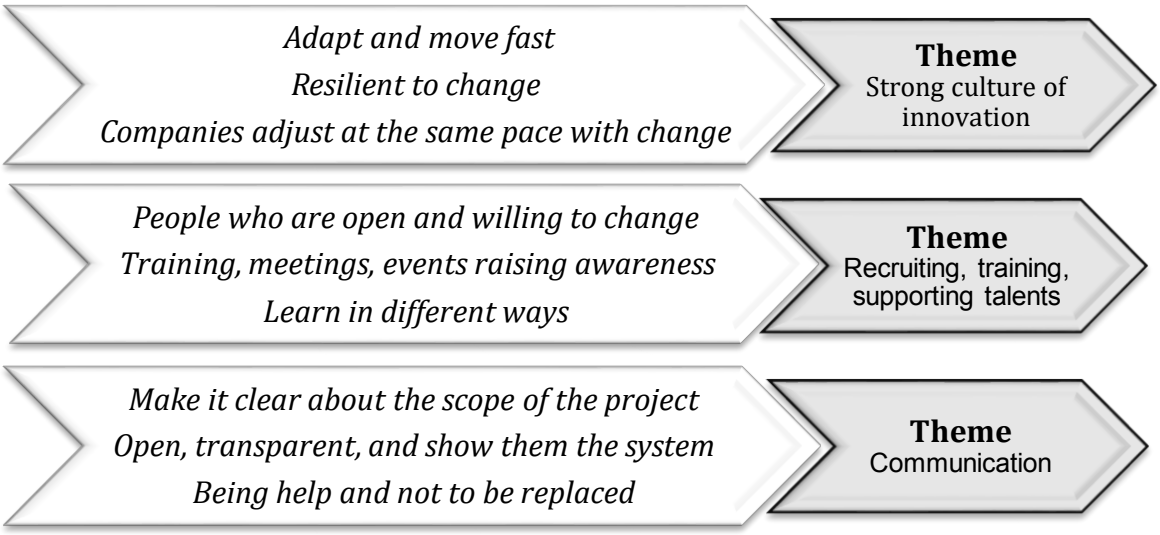

***Examples of coding primary data collection – Opportunites***



***Examples of coding primary data collection***




***Examples of coding primary data collection – Key actions***



**Appendix D**

**Sustainability thematic codes**

| Theme | Description | Measurement | Code |
|---|---|---|---|
| System level | System-level refer to anything included and connected in the sustainable digital transformation. The funnel metaphor is the core concept of this level. The company need to understand the economic, social and environmental pressure in the system (Broman & Robèrt, 2017) | DT elements, Aware of decreasing resources (environment), restorative capacity (economy), fairness and equity (social) | Aware of decreasing resources, Aware of restorative capacity, Aware of fairness and equity |
| | | Aware of increasing market demand and pressure (economy), population (social), competitiveness (economy), C02 emission (environment) | Aware of increasing market demand, Aware of increasing population, Aware of increasing competitiveness, Aware of increasing C02 emission |
| Success level | Success level refers to how companies understand sustainability, how sustainability is a central factor in the activities, how sustainability is embedded in the core purpose, core values and overall end-goals specific to the organization. Part of ABCD method (Awareness, Creative solution & Decide on Priorities) is usually used in this level (Broman & Robèrt, 2017) | Understanding sustainability well (based on definitions in theory), define sustainability well | Good sustainability understanding, Good sustainable digital transformation understanding, Have sustainable core purpose/values, Have sustainable digital transformation end goals |
| Strategic level | From the definition, principle or vision mentioned in Success level. The company should be back casting to the present state and choose activities that should be prioritized to achieve the vision strategically. Usually, using part of the ABCD method (Backcasting and Baseline) (Broman & Robèrt, 2017) | Knowing if the sustainability vision moving the company to the right direction, is it agile/flexible, is it good investment by using gap analysis | Good backcasting |

| | | | |
|---|---|---|---|
| Action level | "The actions level includes the concrete actions that have been prioritized by the specific organization into a strategic plan, using the strategic guidelines and the vision to inspire, inform, and scrutinize the possible actions." (Broman & Robèrt, 2017, p. 6) | Sustainability education of staff, phasing out certain substances, introducing certain procurement practices, phasing out non-renewable energy sources, requiring certain working conditions throughout the value chain, etc. | Good sustainable economy digital efforts, good sustainable social digital efforts, good sustainable environment digital effort |
| Tools Level | "The tools level includes methods, tools and other forms of support that are often required for decision making, monitoring, and disclosures of the actions to ensure they are chosen in line with the strategic guidelines to arrive step-by-step at the defined success in the system." (Broman & Robèrt, 2017, p. 6) | Modeling, simulation, life cycle assessment, management systems, indicators, sustainability KPIs | Sustainability report |

**Appendix E**

**The United Nation Sustainable Development Goals (UN, 2015)**

**Appendix F**

**Binary numbering of Digital Transformation elements**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Points |
|---|---|---|---|---|---|---|---|---|---|
| Business model | Digital enhancements | ✓ (1) | | ✓ (1) | ✓ (1) | | | 3 | 3 |
| | Information-based services extensions | ✓ (1) | | ✓ (1) | ✓ (1) | | | 3 | 3 |
| | Multisided platform businesses | (0) | | (0) | (0) | | | 0 | 3 |
| Percentage of answer: 67% | | | | | | | | | |
| Customer experience | Experience design | ✓ (1) | | ✓ (1) | ✓ (1) | ✓ (1) | | 4 | 4 |
| | Customer intelligence | ✓ (1) | | ✓ (1) | ✓ (1) | ✓ (1) | | 4 | 4 |
| | Emotional enhancement | (0) | | ✓ (1) | ✓ (1) | (0) | | 2 | 4 |
| Percentage of answer: 83% | | | | | | | | | |
| Operation | Core process automation | | (0) | (0) | | | (0) | 0 | 3 |
| | Connected and dynamic operations | | ✓ (1) | ✓ (1) | | | (0) | 2 | 3 |
| | Data-driven decision making | | (0) | (0) | | | ✓ (1) | 1 | 3 |
| Percentage of answer: 33% | | | | | | | | | |
| Employee experience | Augmentation | (0) | ✓ (1) | ✓ (1) | (0) | | | 2 | 4 |
| | Future readying | (0) | (0) | ✓ (1) | (0) | | | 1 | 4 |
| | Flex forcing | ✓ (1) | (0) | (0) | ✓ (1) | | | 1 | 4 |
| Percentage of answer: 33% | | | | | | | | | |
| Digital Platform | Core | ✓ (1) | | | | | ✓ (1) | 2 | 2 |
| | Externally facing | ✓ (1) | | | | | (0) | 1 | 2 |
| | Data | (0) | | | | | ✓ (1) | 1 | 2 |
| Percentage of answer: 67% | | | | | | | | | |
| Total | | 7 | 2 | 8 | 6 | 2 | 3 | 27 | 48 |

## Appendix G

## Binary numbering addition of the empirical findings five-level model

**System**

| Codes | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max point |
|---|---|---|---|---|---|---|---|---|
| Aware of decreasing resources (environment) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | (0) | ✓ (1) | 4 | 6 |
| Aware of decreasing restorative capacity (economy) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | (0) | ✓ (1) | 4 | 6 |
| Aware of decreasing fairness and equity (social) | (0) | (0) | ✓ (1) | (0) | (0) | (0) | 1 | 6 |
| Aware of increasing market demand and pressure (economy) | ✓ (1) | (0) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 5 | 6 |
| Aware of increasing population (social) | (0) | (0) | (0) | (0) | (0) | (0) | 0 | 6 |
| Aware of increasing competitiveness (economy) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | 5 | 6 |
| Aware of increasing CO2 emission or other pollutive (environment) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| Total | 5 | 4 | 5 | 4 | 2 | 5 | 25 | 42 |

**Percentage of answer: 59,52%**

**Success**

| Codes | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Point |
|---|---|---|---|---|---|---|---|---|
| Good sustainability understanding | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| Good sustainable digital transformation understanding | (0) | (0) | (0) | ✓ (1) | (0) | (0) | 1 | 6 |
| Sustainable core purpose & values | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| Sustainable digital end goals | (0) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | 4 | 6 |
| Total | 2 | 3 | 3 | 4 | 2 | 3 | 17 | 24 |

**Percentage of answer: 70,83%**

**Strategy**

| Codes | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Point |
|---|---|---|---|---|---|---|---|---|
| Good back casting | (0) | ✓ (1) | (0) | ✓ (1) | (0) | (0) | 2 | 6 |
| Total | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 6 |

**Percentage of answer: 33,33%**

**Action**

| Codes | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Point |
|---|---|---|---|---|---|---|---|---|
| Good economic sustainable digital efforts | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| Good environment sustainable digital efforts | (0) | (0) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 4 | 6 |
| Good societal sustainable digital efforts | (0) | (0) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | 3 | 6 |
| Total | 1 | 1 | 3 | 3 | 2 | 3 | 13 | 18 |

**Percentage of answer: 72%**

**Tools**

| Tools | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Point |
|---|---|---|---|---|---|---|---|---|
| Annual sustainability report | (0) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 5 | 6 |
| Total | 0 | 1 | 1 | 1 | 1 | 1 | 5 | 6 |

**Percentage of answer: 83%**

**Appendix H**

**Binary numbering of opportunities**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max point |
|---|---|---|---|---|---|---|---|---|---|
| Revenue and business | Boost sales for current products | ✓ (1) | (0) | (0) | (0) | ✓ (1) | ✓ (1) | 3 | 6 |
| | Launch new products/ services | ✓ (1) | (0) | ✓ (1) | (0) | (0) | (0) | 2 | 6 |
| | Create business model | (0) | (0) | (0) | ✓ (1) | (0) | (0) | 1 | 6 |
| Percentage of answer: 33% | | | | | | | | | |
| Streamlined operation | Increase productivity and creativity | ✓ (1) | ✓ (1) | ✓ (1) | (0) | (0) | ✓ (1) | 4 | 6 |
| | Faster information sharing | (0) | ✓ (1) | (0) | (0) | ✓ (1) | (0) | 2 | 6 |
| | Better maintenance schedule | (0) | (0) | (0) | (0) | (0) | ✓ (1) | 1 | 6 |
| | Avoid failures | (0) | (0) | (0) | (0) | (0) | ✓ (1) | 1 | 6 |
| | Cut cost | (0) | ✓ (1) | ✓ (1) | (0) | (0) | (0) | 2 | 6 |
| Percentage of answer: 33% | | | | | | | | | |
| Sustainability | Reduce harmful impact | (0) | (0) | (0) | (0) | (0) | ✓ (1) | 1 | 6 |
| | Reduce C02 emission | (0) | ✓ (1) | ✓ (1) | (0) | (0) | ✓ (1) | 3 | 6 |
| | Better resource usages | (0) | ✓ (1) | ✓ (1) | (0) | (0) | ✓ (1) | 3 | 6 |
| | Better brand image | (0) | (0) | (0) | (0) | (0) | ✓ (1) | 1 | 6 |
| | Transparency and fair play | (0) | (0) | ✓ (1) | (0) | (0) | ✓ (1) | 2 | 6 |
| | Follow the regulations | ✓ (1) | ✓ (1) | (0) | (0) | (0) | ✓ (1) | 3 | 6 |
| Percentage of answer: 36% | | | | | | | | 29 | 84 |

**Appendix I**

**Binary numbering of challenges**

| Attributes | | | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Point |
|---|---|---|---|---|---|---|---|---|---|---|
| Leadership challenges | Resistance to change | Unknown impacts | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | (0) | 4 | 6 |
| | | Current comfortability | ✓ (1) | ✓ (1) | (0) | (0) | (0) | (0) | 2 | 6 |
| | Percentage of answer: 50% | | | | | | | | | |
| | Group thinks | Disposability | (0) | (0) | ✓ (1) | (0) | (0) | (0) | 1 | 6 |
| | Percentage of answer: 17% | | | | | | | | | |
| | One-size-fit-all training | Content of training | (0) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | (0) | 3 | 6 |
| | | Format of training | (0) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | (0) | 3 | 6 |
| | Percentage of answer: 50% | | | | | | | | | |
| Technology challenges | Technical debt | Disparate systems | (0) | (0) | (0) | ✓ (1) | (0) | (0) | 1 | 6 |
| | | Added software | (0) | (0) | ✓ (1) | (0) | (0) | (0) | 1 | 6 |
| | | Added effort | (0) | (0) | (0) | ✓ (1) | ✓ (1) | ✓ (1) | 3 | 6 |
| | | Language barriers | (0) | (0) | (0) | (0) | (0) | ✓ (1) | 1 | 6 |
| | Percentage of answer: 25% | | | | | | | | | |
| | Complexity in use | System dependency | ✓ (1) | (0) | (0) | (0) | ✓ (1) | (0) | 2 | 6 |
| | Percentage of answer: 33% | | | | | | | | | |
| Environmental challenges | Over usage of energy and resources, unsustainable sourcing | | (0) | (0) | ✓ (1) | (0) | (0) | ✓ (1) | 2 | 6 |
| | Percentage of answer: 33% | | | | | | | | | |

**Appendix J**

**Binary numbering of key actions**

| Attributes | | R1 | R2 | R3 | R4 | R5 | R6 | Total | Max Points |
|---|---|---|---|---|---|---|---|---|---|
| A strong culture of innovation and sustainability | Effective digital culture | ✓ (1) | (0) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | 4 | 6 |
| | Embrace risk | ✓ (1) | (0) | ✓ (1) | ✓ (1) | (0) | (0) | 3 | 6 |
| | Effective sustainable culture | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| | Sustainable long-term plan | (0) | ✓ (1) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | 4 | 6 |
| Percentage of answer: 71% | | | | | | | | | |
| Strong leadership team with clear visions and implementation plan | Determinant top leader | (0) | ✓ (1) | (0) | ✓ (1) | (0) | (0) | 2 | 6 |
| | Speed of implementation | ✓ (1) | (0) | (0) | (0) | (0) | (0) | 1 | 6 |
| | Group project with board support | (0) | ✓ (1) | (0) | (0) | (0) | ✓ (1) | 2 | 6 |
| | Middle management role | (0) | (0) | (0) | ✓ (1) | (0) | (0) | 1 | 6 |
| | Clear implementation process and measures | (0) | (0) | (0) | (0) | ✓ (1) | (0) | 1 | 6 |
| Percentage of answer: 23% | | | | | | | | | |
| Recruiting, training, and supporting talents | Recruit adapt-to-digital-future skillsets, focus on soft-skill (adaptive, curious, flexible) | (0) | (0) | (0) | ✓ (1) | (0) | ✓ (1) | 2 | 6 |
| | Reskilling and upskilling talents | (0) | ✓ (1) | ✓ (1) | (0) | (0) | ✓ (1) | 3 | 6 |
| | Training course and workplace practicing | (0) | (0) | (0) | ✓ (1) | (0) | (0) | 1 | 6 |
| | Frequent and simultaneously support | (0) | (0) | (0) | ✓ (1) | ✓ (1) | ✓ (1) | 3 | 6 |
| Percentage of answer: 36% | | | | | | | | | |
| Communication is key | Acknowledge necessary to change | (0) | ✓ (1) | ✓ (1) | (0) | (0) | (0) | 2 | 6 |
| | Programmatic communication | (0) | ✓ (1) | ✓ (1) | (0) | (0) | (0) | 2 | 6 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Participatory communication | (0) | (0) | (0) | (0) | (0) | (0) | 0 | 6 |
| | Open, clear, transparent | (0) | ✓ (1) | (0) | (0) | (0) | (0) | 1 | 6 |
| | Deal with fear of being replaced | (0) | (0) | ✓ (1) | (0) | (0) | (0) | 1 | 6 |
| Percentage of answer: 20% | | | | | | | | | |
| Deep understanding of users | Innovating based on user' point of view | ✓ (1) | (0) | ✓ (1) | (0) | ✓ (1) | ✓ (1) | 4 | 6 |
| | Include users in the digital innovation | ✓ (1) | (0) | ✓ (1) | (0) | ✓ (1) | ✓ (1) | 4 | 6 |
| | Use sustainable resources and energy | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 6 | 6 |
| | Generate effective insights from data | ✓ (1) | (0) | ✓ (1) | ✓ (1) | ✓ (1) | ✓ (1) | 5 | 6 |
| | Prioritize demand | (0) | (0) | (0) | (0) | ✓ (1) | (0) | 1 | 6 |
| Percentage of answer: 67% | | | | | | | | | |
| Suitable technology | Easy-to-use | (0) | ✓ (1) | (0) | (0) | (0) | (0) | 1 | 6 |
| | Reliable system | (0) | ✓ (1) | ✓ (1) | (0) | ✓ (1) | (0) | 3 | 6 |
| Percentage of answer: 33% | | | | | | | | | |

## REFERENCES


Abadi, D. J. (2009). Data management in the cloud: Limitations and opportunities. IEEE Data Eng. Bull., 32(1), 3-12.

Adams, C. A. (2004). The ethical, social and environmental reporting-performance portrayal gap. Accounting, Auditing & Accountability Journal.

Aldabaldetreku, R., Lautiainen, J., & Minkova, A. (2016). The role of knowledge management in strategic sustainable development: Comparing theory and practice in companies applying the FSSD. In.

Alliance, t. E. D. S. (2020). Sustainable Digitalisation: Strengthening Europe's Digital Sovereignty. 3. Retrieved from https://www.digitalsme.eu/digital/uploads/Position-paper-Sustainable-Digital-Transformation_FINAL.pdf

Andriole, S. J. (2017). Five myths about digital transformation. MIT sloan management review, 58(3).

Bekkhus, R. (2016). Do KPIs used by CIOs decelerate digital business transformation? The case of ITIL.

Bell, E., Bryman, A., & Harley, B. (2018). Business research methods: Oxford university press.

Bernardini, O., & Galli, R. (1993). Dematerialization: long-term trends in the intensity of use of materials and energy. Futures, 25(4), 431-448.

Bican, P. M., & Brem, A. (2020). Digital business model, digital transformation, digital entrepreneurship: Is there a sustainable "digital"? Sustainability, 12(13), 5239.

Bonnet, D., & Westerman, G. (2021). The new elements of digital transformation. MIT sloan management review, 62(2), 82-89.

Booth, A., Patel, N., & Smith, M. (2020). Digital transformation in energy: Achieving escape velocity. McKinsey and Company. Available online: https://www. mckinsey. com/industries/oil-and-gas/our-insights/digital-transformation-in-energy-achieving-escapevelocity (accessed on 27 January 2021).

Broman, G. I., & Robèrt, K.-H. (2017). A framework for strategic sustainable development. Journal of cleaner production, 140, 17-31.

Bucy, M., Finlayson, A., Kelly, G., & Moye, C. (2016). The 'how'of transformation.

Camodeca, R., & Almici, A. (2021). Digital Transformation and Convergence toward the 2030 Agenda's Sustainability Development Goals: Evidence from Italian Listed Firms. Sustainability, 13(21), 11831. Retrieved from https://www.mdpi.com/2071-1050/13/21/11831

Chandola, V. (2015). Digital transformation and sustainability: Study and analysis. Havard University, Cambridge.

Clark, G. L., Feiner, A., & Viehs, M. (2015). From the stockholder to the stakeholder: How sustainability can drive financial outperformance. Available at SSRN 2508281.

Coad, A., Nightingale, P., Stilgoe, J., & Vezzani, A. (2021). The dark side of innovation. In (Vol. 28, pp. 102-112): Taylor & Francis.

Davenport, T. H., Godfrey, A. B., & Redman, T. C. (2020). To fight pandemics, we need better data. MIT sloan management review, 62(1), 1-4.

Delmas, M. A., Lyon, T. P., & Maxwell, J. W. (2019). Understanding the role of the corporation in sustainability transitions. Organization & Environment, 32(2), 87-97.

Demir, E., Bektaş, T., & Laporte, G. (2014). A review of recent research on green road freight transportation. European journal of operational research, 237(3), 775-793.

Demirkan, H., Spohrer, J. C., & Welser, J. J. (2016). Digital innovation and strategic transformation. It Professional, 18(6), 14-18.

Dineva, S. (2022). Convincing Your Company Leaders to Invest in New Technology. Retrieved from https://hbr.org/2022/01/convincing-your-company-leaders-to-invest-in-new-technology

Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2020). Global innovation index 2020: Johnson Cornell University.

El Hilali, W., El Manouar, A., & Idrissi, M. A. J. (2020). Reaching sustainability during a digital transformation: a PLS approach. International Journal of Innovation Science.

Feroz, A. K., Zo, H., & Chiravuri, A. (2021). Digital transformation and environmental sustainability: A review and research agenda. Sustainability, 13(3), 1530.

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing digital technology: A new strategic imperative. MIT sloan management review, 55(2), 1.

Frankiewicz, B., & Chamorro-Premuzic, T. (2020). Digital transformation is about talent, not technology. Harvard Business Review, 6(3).

GeSI, D. (2019). Digital with Purpose: Delivering a SMARTer2030. In: Brüssel.

Gruen, R. L., Elliott, J. H., Nolan, M. L., Lawton, P. D., Parkhill, A., McLaren, C. J., & Lavis, J. N. (2008). Sustainability science: an integrated approach for health-programme planning. The Lancet, 372(9649), 1579-1589.

Guinan, P. J., Parise, S., & Langowitz, N. (2019). Creating an innovative digital project team: Levers to enable digital transformation. Business Horizons, 62(6), 717-727.

Haffke, I., Kalgovas, B. J., & Benlian, A. (2016). The Role of the CIO and the CDO in an Organization's Digital Transformation.

Hay, R., Yonke, and Zachman. (2021). Effective Digital Transformation Depends on a Shared Language. 2022(01 March 2022). Retrieved from https://hbr.org/2021/12/effective-digital-transformation-relies-on-a-shared-language

Hoffman, A. J. (2018). The next phase of business sustainability. Stanford Social Innovation Review, 16(2), 34-39.

Horlacher, A., Klarner, P., & Hess, T. (2016). Crossing boundaries: Organization design parameters surrounding CDOs and their digital transformation activities.

Jabali, O., Van Woensel, T., & De Kok, A. (2012). Analysis of travel times and CO2 emissions in time-dependent vehicle routing. Production and Operations Management, 21(6), 1060-1074.

Kiron, D., Kane, G. C., Palmer, D., Phillips, A. N., & Buckley, N. (2016). Aligning the organization for its digital future. MIT sloan management review, 58(1).

Koehler, J., Leinwand, Matt Mani. (2021). How Your Company Can Be More Strategic About Its Tech Spending. HBR. Retrieved from https://hbr.org/2021/12/how-your-company-can-be-more-strategic-about-its-tech-spending

Kuo, Y. (2010). Using simulated annealing to minimize fuel consumption for the time-dependent vehicle routing problem. Computers & Industrial Engineering, 59(1), 157-165.

Lauterbach, J., & Mueller, B. (2014). Adopt, Adapt, Enact, or Use? A Framework and Methodology for Integrating Conceptual Mechanisms of IT Adoption and Use. Paper presented at the Information Systems & Organizations 2014 (IFIP 8.2 Working Conference).

Lauterbach, M. (2021). How to Speed Up Your Digital Transformation. Retrieved from https://hbr.org/2021/08/how-to-speed-up-your-digital-transformation

Lawrence, A. T., & Weber, J. (2013). Business and society: Stakeholders, ethics, public policy: Tata McGraw-Hill Education.

Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P., . . . Ahlemann, F. (2017). Digitalization: opportunity and challenge for the business and information systems engineering community. Business & information systems engineering, 59(4), 301-308.

Lindahl, P., Robèrt, K.-H., Ny, H., & Broman, G. (2014). Strategic sustainability considerations in materials management. Journal of cleaner production, 64, 98-103.
Liu, R., Gailhofer, P., Gensch, C.-O., Köhler, A., & Wolff, F. (2019). Impacts of the digital transformation on the environment and sustainability. Issue Paper under Task, 3.
Moore, J. E., Mascarenhas, A., Bain, J., & Straus, S. E. (2017). Developing a comprehensive definition of sustainability. Implementation Science, 12(1), 1-8.
Myers, P., Hulks, S., & Wiggins, L. (2012). Organizational change: Perspectives on theory and practice: Oxford University Press.
Pendergrass, K. L., Sampson, W., Walsh, T., & Alagna, L. (2019). Toward environmentally sustainable digital preservation. The American Archivist, 82(1), 165-206.
R2. (2021). Sustainability Report 2021.
R3. (2021). Sustainability Report 2021.
R4. (2021). Sustainability Report 2021.
R5. (2021). Sustainability Report 2021.
R6. (2021). Sustainability Report 2021.
Reinhardt, F. L., & Porter, J. (2001). Down to earth: Applying business principles to environmental management. Alternatives Journal, 27(3), 41.
RobecoSAM, A. (2021). Country Sustainability Ranking Update—November 2021. Scandinavian Trio Tops Overall Sustainability Ranking.
Robèrt, K.-H., Göran, B., Ny, H., Byggeth, S., Missimer, M., Connel, T., . . . Oldmark, J. (2012). Sustainability handbook: Studentlitteratur.
Robèrt, K.-H., Holmberg, J., & Weizsäcker, E. U. v. (2000). Factor X for subtle policy-making: objectives, potentials and obstacles. Greener Management International(31), 25-37.
Robèrt, K.-H., Torekull, B., & Peterson, N. (1993). Det nödvändiga steget: AffärsFörlet Media Utveckling.
Sahely, H. R., Kennedy, C. A., & Adams, B. J. (2005). Developing sustainability criteria for urban infrastructure systems. Canadian Journal of Civil Engineering, 32(1), 72-85.
Salomaa, A., & Juhola, S. (2020). How to assess sustainability transformations: a review. Global Sustainability, 3.
Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students: Pearson education.
Savastano, M., Amendola, C., Bellini, F., & D'Ascenzo, F. (2019). Contextual impacts on industrial processes brought by the digital transformation of manufacturing: A systematic review. Sustainability, 11(3), 891.
Shukla, M. (2008). Book Review: Strategic Management. Asia Pacific Business Review, 4(2), 134-134. doi:10.1177/097324700800400216
Smith. (2021). Lessons from Hollywood's Digital Transformation. HBR. Retrieved from https://hbr.org/2021/12/lessons-from-hollywoods-digital-transformation
Stuermer, M., Abu-Tayeh, G., & Myrach, T. (2017). Digital sustainability: basic conditions for sustainable digital artifacts and their ecosystems. Sustainability science, 12(2), 247-262.
Tavory, I., & Timmermans, S. (2014). Abductive analysis: Theorizing qualitative research: University of Chicago Press.
Thompson, A., Lindahl, P., Hallstedt, S., Ny, H., & Broman, G. (2011). Decision support tools for sustainability in product innovation in a few Swedish companies. Paper presented at the International Conference on Research into Design (ICoRD).
UN. (2015). Retrieved from https://www.un.org/sustainabledevelopment/sustainable-development-goals/
Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The journal of strategic information systems, 28(2), 118-144.

WCED, S. W. S. (1987). World commission on environment and development. Our common future, 17(1), 1-91.
Westerman, G., Bonnet, D., & McAfee, A. (2014). Leading digital: Turning technology into business transformation: Harvard Business Press.