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The Usefulness of the Digitalization Integration Framework for Developing Digital Supply Chains in SMEs

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Abstract: Although studies in the field of digital supply chains (DSC) have increased in recent years, there is still a lack of theoretical and empirical studies that show how DSC can be successfully implemented. There is a lack of studies in small and medium-sized enterprises (SMEs) in particular. This paper addresses this situation and explores the usefulness of the digitalization integration framework (DIF) proposed by Büyüközkan and Göçer in 2018 for the development of DSC in SMEs. More precisely, based on a case study design involving Swedish SMEs operating in the same supply chain, this paper provides insight into the DSC process of these Swedish SMEs adopting the DIF. The results of the study enable the proposal of an updated framework consisting of five main components in the digitalization process, namely: digital strategy, digital organization and culture, digital operations, digital products and services, and digital customer experience. Furthermore, each component consists of several steps, called sub-components, which could be considered by SMEs when developing DSC to increase the success of this challenging activity.

Keywords: digital supply chain; digitalization; small and medium-sized enterprises; SMEs; adoption; digital transformation

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1. Introduction

Most companies are operating in business environments that are characterized by complexity, rapid technological growth, and constant changes [1,2]. The pandemic and the invasion of the Ukraine have made these environments even more unstable [3]. The pace of adopting new technologies has also increased significantly due to the most recent developments, especially the pandemic [4]. These new technologies affect every industry and organization. Supply chains, in particular, are affected by these changes and their consequences [3,5].

On the one hand, the actors in a supply chain including suppliers, partners, companies, and dealers create, use, and share knowledge and information with others [6]. The high internet penetration rate among people together with the availability of different digital communication tools have also significantly changed the buying behaviour and demand patterns of customers; and this, in turn, has imposed great pressure on supply chain managers. The supply chain disruptions caused by the pandemic have also shown that the design and structure of supply chains need to be reconsidered drastically [7]. Hence to cope with these challenges as well as upcoming ones, decision-makers in companies are required to rethink and reshape their supply chain practices and amend them so that they comply with recent developments [8–10]. Because of that, decision-makers need to change their attention from focusing primarily on cost reduction to the establishment and execution of new strategies and processes to make their company more agile and resilient by connecting value creation more strongly with digitalization [11].

Small and medium-sized enterprises (SMEs) play a pivotal role in almost all economies of the world. According to the European Commission, SMEs represent 99% of all businesses in the European Union (EU). SMEs are defined in the EU recommendation 2003/361 on

the basis of two factors, namely: staff headcount, and turnover or balance sheet total. Micro enterprises have less than 10 employees and less than two million EUR turnover; small companies have less than 50 employees and less than 10 million EUR turnover; and medium-sized enterprises have less than 250 employees and less than 50 million EUR turnover.

SMEs are also crucial actors in supply chains [12]. Like their larger counterparts, SMEs must adapt their business operations, including their supply chains, so that they are better able to cope with present and upcoming challenges. The adaptation of new strategies, approaches, or technologies is, however, more challenging for SMEs than for large companies [13]. This can further hamper the development of supply chains that are adapted to constantly changing business requirements [3].

Several supply chain researchers have tried to develop roadmaps to facilitate the digitalization of supply chains. For instance, Queiroz et al. (2019) [14] have provided a framework to shed light on digital supply chain capabilities in enterprises to help them change from old supply chains to digital ones. Other scholars have studied the digital transformation of supply chains in Industry 4.0 and offered frameworks in this regard (e.g., [15]). Büyüközkan and Göçer [6] developed a framework based on existing literature to develop digital supply chains (DSC). This framework consists of three main areas which are: digitalization, supply chain management, and technology implementation.

Despite the expected advantages of DSC, many companies find it challenging to apply these strategies and approaches in practice and often fail during the application process [16–18]; reasons might be linked to the costs involved. Furthermore, it has been stated that there is a lack of empirical and theoretical research regarding the implementation process of DSC [6,18]. As regards SMEs, research on DSC in SMEs is scarce in general [19]. in particular, there is a need to study the DSC process in SMEs to improve these firms' DSC transition process [18] and to learn about the challenges associated with DSC that these firms face [6]. To address this unsatisfactory situation, in this paper the digitalization integration framework proposed by Büyüközkan and Göçer [6] is utilized to learn about its usefulness for SMEs in the process of developing DSC. Therefore, the main question of this study is: How suitable is the digitalization integration framework for SMEs interested in developing DSC? The framework will be investigated in Swedish SMEs operating in the same supply chain. Sweden is considered a suitable setting for this study, as SMEs account for 99.9% of all enterprises—96.5% of which are micro companies, i.e., they have up to nine employees—and contribute around 40% of the value-added to the national economy [20].

The findings of the study presented in this paper make possible the proposal of an updated digitalization integration framework.

This paper proceeds as follows. The theoretical background addresses the relevant literature regarding DSC in SMEs. It also includes an introduction to the digitalization integration framework used in this study. After that, the methodology is presented which is followed by the presentation and discussion of the study's findings. The paper ends with a conclusion where the study's limitations and future research avenues are also outlined.

2. Theoretical Background

2.1. Digitalization

In recent years, the global economy has changed significantly due to the digitalization of companies and their business models. Technologies have improved, e.g., new mobile phones have been developed, data processing systems have improved, as have distributed data processing and data storage [21–23]. These digital changes are often categorized as digitalization. Kraus et al. [21] state that "digitalization is considered as new methods of working environment communication and collaboration and can be defined as the adoption of digital technologies and data to generate revenue, develop the business, and change/transform business processes". Hoberg et al. [24], p. 6, defines the wider area of digital transformation, which "can be understood as an organizational change process where digital technologies (such as big data analytics, sensor networks, cloud services)

are used to radically change [...] how a company creates value [...], how it interacts with its customers and business partners [...], and how it competes in established and emerging markets." According to Peppard and Ward [25], companies strongly believe that by digitalizing their processes, they can ensure or achieve organizational survival and growth through higher overall performance and competitive advantage.

Governments also expect enormous benefits and gains for society through digitalization [26]. Grebe et al. [27] found that companies, especially SMEs, are worse than smaller or larger companies at adapting or responding to digital transformation. Kim et al. [28] showed in a study of high-growth companies in Korea that only 6.2% of SMEs were implementing digital transformation, which was significantly lower than the equivalent percentage of larger companies, 15.1%. Furthermore, 69.4% of SMEs and 53.5% of large companies said that digital transformation is important, but they do not know how to deal with it. Therefore, according to [28], different strategies such as corporate and industrial strategies need to be developed to address the different capabilities of different types of companies.

2.2. New Technologies and Digital Supply Chains

Supply chains have been described as networks of enterprises and their suppliers to produce, distribute and deliver a specific product or service [6]. Digital transformation helps organizations to take advantage of more functions, for instance, barcode scanning, location-based services, and near-field communication [29] to improve the above-mentioned operations.

Traditional supply chains are predominantly based on a series of largely isolated, fixed processes, whereas DSC breaks down this isolation to create a supply chain based on an integrated system [30]. Integrated systems in DSC refer to systems that can support interactions between different organizations and their activities in a supply chain, for instance, through software, hardware, and, communication networks [31]. These activities often cover the companies' purchasing, manufacturing, warehousing, transferring, and selling of products [30]. According to the Digital Supply Chain Initiative (2015), DSC is a customer-centric platform that takes and utilizes the actual information that is emerging from different sources. As digitalization progresses, this enhances the number of connected devices permanently and also increases data exchange [32]. Various tools and devices from different areas of technological development such as the Internet of Things, cloud computing, artificial intelligence, and augmented reality have been developed over the years to enable traditional supply chains to transform into digital ones [6].

The literature also discussed various tools and devices from different areas of technological development that have been used to enable the transformation of traditional isolated supply chains in to digital ones. Table 1 summarizes selected digital technology enablers as discussed in the literature based on [6].

Table 1. Technologies in DSCs based on Büyüközkan and Göçer (2018) [6].

Technologies in DSC	Sources	Description
Internet of things (IoT)	[33–35]	IoT means the entities that have an IP address for internet connection which lets them connect and exchange data with other devices, so communication appears between these entities and other network devices and systems.
Cloud Computing (CC)	[36–38]	CC provides a network of virtual services so that its users can access them from anywhere.
Data Mining (DM)	[39]	Data mining means deep analysis of data to extract key knowledge, patterns, or information from small or big data.
Artificial Intelligence (AI)	[39–41]	Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and simulate their actions. AI can also refer to learning and problem-solving.

Table 1. *Cont.*

Technologies in DSC	Sources	Description
Augmented Reality (AR)	[42–44]	AR refers to the extension of physical reality by adding layers of computer-generated information to the real environment. Information in this context could be any kind of virtual object or content, including text, graphics, video, sound, haptic feedback, Global Positioning Systems (GPS) data, and even smell (Büyüközkan& Göçer, 2018, p.166) [6].
Robotics (R)	[45–47]	R technology in logistics is a branch of engineering that involves the conception, design, manufacture, and operation of R (Büyüközkan& Göçer, 2018, p.166) [6].
Sensor Technology (ST)	[48,49]	ST is essential for robust detection and filling status, product quality, packaging quality, and equipment status in a wide range of field conditions (Büyüközkan& Göçer, 2018, p.166) [6].
Omni Channel (OC)	[50,51]	OC is a multi-channel approach to sales that seeks to provide consumers with a seamless shopping experience whether the consumers are shopping online from a desktop or mobile device, by telephone, or in bricks and mortar stores (Büyüközkan& Göçer, 2018, p.166) [6].
3D Printing (3DP)	[52–54]	Identified as additive manufacturing, 3D printing refers to various processes used to synthesize a three-dimensional object.
Social Media (SM)	[55,56]	Social media can defined as platforms where people build networks and share information
Big Data (BD)	[57–59]	BD refers to any large amount of structured, semi-structured, or unstructured data that has the potential to be extracted for information.
Self-Driving Vehicles (SDV)	[60]	SDV is a vehicle that is capable of sensing its environment and navigating without human input (Büyüközkan& Göçer, 2018, p.166) [6].
Unmanned Aerial Vehicles (UAV)	[61–63]	UAV is an aircraft without a pilot on board, generally known as a drone. UAVs can be remote-controlled aircraft or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems (Büyüközkan& Göçer, 2018, p.166) [6].

Existing research has also highlighted several advantages of DSC such as speed [38,64,65], flexibility [65], global connectivity [65], real-time inventory [65], transparency [65], scalability [65,66], innovativeness [66], proactivity, and eco-friendliness [6]. Yet, the increased interconnectivity also creates risks such as the loss of proprietary knowledge or unintended disclosure of business insights to other partners [67]. Additionally, it also bears the risk of becoming the focus of cyber-attacks [68].

2.3. Digital Supply Chain Frameworks

According to [6], the process of DSC can be divided into three main domains: digitalization, technology implementation, and supply chain management. As the first domain of DSC and the focus of this article, digitalization can be decomposed into five specific processes, namely: digital strategy, digital organization and culture, digital operations, digital products and services, and finally digital customer experience. The first process, digital strategy, is the most important stage, and represents the current status of digitalization in the enterprise as well as how to deal with deficiencies regarding strategic instruments. The authors divided the process of digital strategy into three stages: digital goal setting, digital strategy formulation, and digital strategy implementation.

Defining digital goal setting is a vital step as through it, the decision-makers decide on what digital strategy they want to achieve, what is important, or what is irrelevant. The second step, digital strategy formulation, is a process that refers to choosing the best appropriate objective to accomplish the supply chain's goals and vision [69]. The last step in the digital strategy process is digital strategy implementation. This step tries to answer the questions of "how, when, where, and who" with regard to reaching the proposed objectives, goals, and vision.

Digital organization and culture is the second process in the digitalization process. It represents the ability to accept and utilize new processes individually and within the organization. This process is divided into three steps: analysing the current organization and culture, digital organization and culture management, and transforming into digital organization and culture. Organizational culture refers to the attitude of employees and how they are adaptable to new changes. If the current culture in organizations resists change, the result will be a divided organization: one part moving into the future and motivated by the new perspective of the organization while the other part struggles to retain the traditional culture.

The third process, digital operations, is divided into worker enablement, digital operations management, and implement digital operations. Worker enablement could be described as the virtualization of individual-level work. With increasing use of email and other digital communication platforms, the process of work is separated from a physical place. This means that employees can now communicate with customers or co-workers who they will probably never meet in person, or in areas that they will never be to. Deeper knowledge of specific products and services, and the collected data from other actors and in different regions, allow managers to make decisions based on real information, not assumptions. All these transactions accrue in the digital operations management stage and help managers to perform more accurately and to better prioritize. Implementing a Ddgital operations strategy is the last step in digital operations, and differs from operations management. There are two perspectives on implementing an operations strategy as follows: structure and system implementation, and monitoring and improving implemented operations. Implemented operations are separated from employees and operations management, and finalize the operations.

The core of almost every successful supply chain is novel digital products and services. Digital products and services refer to digital platforms which enable people to interact and do business through them. This stage is further decomposed into three steps as well as previous processes: Ccstomer requirement lifecycle, product and service ecosystem, and customization and personalization.

The last process in the digitalization domain is digital customer experience which has a significant role in digitalizing the supply chain. It relates to the data that is to be collected from the exploration of customers, their behaviours, their personalities, and expectations. DSC can only develop when executives are equipped with this information. Developing DSC requires a transformation of the entire customer experience. This stage is divided into three steps: customer understanding, customer touchpoints, and top-line growth. Customer understanding is where companies are beginning to take full advantage of previous investments in new systems and technologies to gain an accurate understanding of analytics based on different market segments, specific geographical locations, and socially informed knowledge. The customer touchpoints represent which services of the organization could be improved significantly by digital initiatives, providing customer services, cross-channel coherence, and self-service. Top-line growth refers to applying digitalization to enhance in-person sales negotiations, improve predictive marketing and streamline customer processes.

2.4. SMEs and DSC

Industry 4.0 has had a major impact on manufacturing, production lines, sales, and delivery to customers [69] which has also accelerated the digital transformation in supply chains. Larger enterprises can adjust their processes in the supply chain with fewer challenges than SMEs [68]. SMEs are, however, the pillar of economies and very important for large multinational manufacturing companies so that the latter can offer their products and services. In contrast to larger firms, smaller ones often lack the critical knowledge regarding digitalizing the company needed in extremely complex supply chains as part of Industry 4.0. This may lead SMEs to suffer if they are not able to transform themselves, using the latest new technologies, and adapt to digital supply chains [70]. SMEs also

often lack the financial resources to invest in recent technologies although they have the same needs as larger firms to be efficient and effective in allocating and managing their resources [71].

The scarce literature that is available on DSC dedicated to SMEs suggests that many of these firms still struggle with the acceptance and implementation of technologies relevant to DSC [72]. Considering the direct and indirect costs associated with digitalization in general [21], this is an aspect that poses an additional challenge to SMEs in their efforts to digitalize their supply chains, and thus a point that should not be underestimated. Sarath and Shah [70] identified 11 technologies within DSC in the literature, whereas SMEs seem to take advantage of only 4 technologies namely, information communications technologies, big data, cloud computing, and blockchain.

In light of the previous discussion, the authors of this paper have identified a gap in the availability of frameworks that address SMEs in particular, i.e., frameworks that take into account the specificities of these enterprises. In order not to reinvent the wheel, the framework of [6] will be tested for its suitability in SMEs. Figure 1 illustrates the research gap.

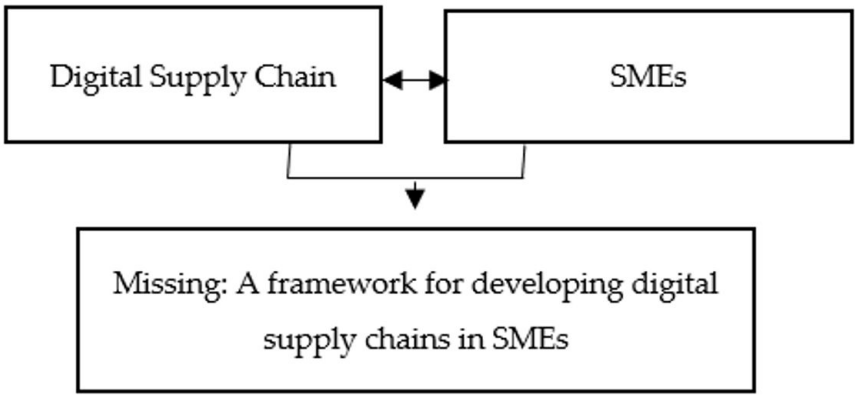


Figure 1. Research gap.

3. Research Methodology

To learn about the usefulness of the digitalization integration framework for SMEs with a view to develop DSC proposed by [6], and to better understand the challenges along the DSC process, a qualitative research approach was chosen. More precisely, this study was based on a qualitative case study approach. According to Yin [73], a case study approach is applicable if three requirements are fulfilled, namely, the research questions address the "how" and "why"; the researcher has no control over events; and the focus is on a phenomenon within its real-life context.

Since the investigation into a small firm's development phase for DSC complies with the three requirements, a case study approach was considered suitable. As one of the researchers was involved in working with the company, full access to the company regarding research-relevant data was possible. Additionally, the researchers did not influence decisions made by the decision-makers or any other parties involved during the research process. The real-life context criterion was fulfilled because the study was conducted in an operating SME. Additionally, Yin [73] stresses the importance of clearly defining the case to be studied. In this study, the case of inquiry forms the supply chain of a Swedish company and its supplier and customers that is to be transformed into a DSC.

3.1. Data Collection

The data collection process was divided into two phases. The first phase was based on observations while the second phase involved data collection by the means of semi-structured interviews.

3.1.1. Observation

"Observation is the technique of gathering data through direct contact with an object—usually another human being. The researcher watches the behaviour and documents the properties of the object" [74], p. 98. The researcher who worked in the company acted as a "participant as observer" [75] and collected data from the company which was working on the development of DSC. The observation took place in March–July 2022.

The observation focused on each feature of the framework by [6]. The position of the researcher as a business developer in the company helped significantly for the observation of the relations among the actors in the supply chain, how strategies were made in the company, how the company decided on digitalization subjects, and to see what the process of implementing new technologies was in the company. Finally, challenges experienced in the transformations could also be detected.

During the period of observation, the researcher participated in the weekly meeting of managers. In these meetings, the project managers, area managers, and department managers discussed issues that they were struggling with, and new ideas they had for the short-term and long-term development of the company. Moreover, they discussed required devices, tools, platforms, software, or human resources, as well as suppliers and customers. Based on the above, the CEO and the members of the board analyzed the issues raised in more detail. The researcher in the role of the company's business developer also proposed possible solutions for the problems at hand. Besides the weekly meetings and given that the researcher was also working with the firm's digital marketing, it was also possible to observe what was happening on the digital side of the company.

3.1.2. Semi-Structured Interviews

Interviews are highly used in qualitative research [76,77]. Galletta [78], p. 24, states that "the semi-structured interview provides a repertoire of possibilities. It is sufficiently structured to address specific topics related to the phenomenon of study while leaving space for participants to offer new meanings to the study focus." Semi-structured interviews help respondents to answer the questions in their own way based on the real situation they are facing.

The interview questions were developed based on the relevant literature review and the chosen framework. Through semi-structured interviews, the researchers tried to gain new insight into the phenomenon under investigation. To minimize the risk of misunderstanding, the interview questions were sent to the respondents before the interview and the researcher asked about unclear responses after the interview. The interview was divided into four sections. Sections 1–3 were based on the three domains of the "Integrated digital supply chain model" namely: digitalization, technology implementation, and supply chain management. The last section was about the most important challenges which the company was struggling with during the transformation to DSC.

The interview with the area manager of the company was done face to face while the interviews with the supplier and customers were done via Microsoft Teams. The interviews with the latter followed the same structure as outlined.

3.2. The Respondents

For the study, it was crucial to have firms involved that have something to say about the topic under investigation. Thus, a suitable company had to fulfil four criteria: (1) to be an SME located in Sweden, (2) it should operate in the same supply chain as the other companies, (3) it should have adopted certain digitalization practices, and (4) it should be familiar with DSC. The selection of interviewees also followed some critical factors. For instance, as the companies had no supply chain manager it was important to select a person who was in contact with the actors in the supply chain. In addition, he or she had to be aware of the decision and process of digitalization in the company.

Table 2 details information about the persons involved. Due to confidential issues, the name of the respondents remains anonymous throughout the study.

Table 2. Information about the interviewees.

Respondent	Job Position	Interview Duration	Job Description
R1	Area manager	Approx. 70 min	Chief of the Prefabrication department, decision maker of new purchases, contact with the suppliers and customers.
R2	Sales manager	Approx. 45 min	Direct contact with BuildHouse * as the main supplier, engaged with the digitalization process in the company.
R3	Project manager	Approx. 45 min	One of the main project managers, in contact with the other actors in the supply chain and engaged with the digitalization process in the company.

* Not the real name but an artificial name to ensure anonymity.

3.3. Data Analysis

The data collected were analyzed using the thematic analysis method. According to Clarke and Braun [79], thematic analysis is a method for identifying, analyzing, and interpreting patterns of meaning ('themes') within qualitative data. Moreover, Clarke and Braun [79] state that thematic analysis is a very flexible and diverse approach to data analysis. As the gathered data from the observations and interviews were linked with the integration framework for the development of DSC, the categories, concepts, and themes formed the basis of the analysis. The thematic data analysis started with the coding of the data collected from the observations and the interview transcripts. The collected data was divided into three categories which make up the three domains of the framework: digitalization, technology implementation, and supply chain management. Each category contains several concepts. The coded themes were the components that made up the categories.

4. Findings

The thematic analysis of the digitalization section was based on the "integration framework for DSC". The empirical data gathered through observation and semi-structured interviews allowed the researchers to add and remove some aspects of the framework to have it more aligned with an SME setting.

4.1. Digital Strategy

Based on the observations from BuildHouse, the pivotal and major step of the digitalization strategy in the company is analyzing the effectiveness of implementing new technologies such as using new software and buying promotion versions of software that the company is currently using. According to the CEO of BuildHouse, one of the main questions in this step was to answer the following question: "Would the new technology help the actors in the supply chain to communicate better and decrease the time and costs required?" Next, the importance of the purpose of the strategy would be discussed in the board meetings. This step can be the same as the goal setting in the framework. The next step was to divide the procedures and process of implementation of the new technology into smaller steps in the company, [6] called the digital strategy formulation. Finally, the last step was to implement the strategy in the enterprise.

According to the interview with R1 and the respondent from BuildHouse, it was confirmed that they evaluate the efficiency in the first step: "Firstly, we analyze the possible options. We should have the exact dates and lots of detailed information about the orders. This is the reason for the importance of reliable and adequate software for the company". Digital goal setting and formulation of the strategy were the next steps of the digital strategy at BuildHouse. After all of these steps, the implementation of the new technology was to be carried out.

R2 emphasized that "The first step in Digital Strategy is to look [at what] our need [is], why do we need it? Is it for us or the benefit of the customer?" The respondent stated that "We have a long plan to build a platform [so] that our customer can order through the website", which directly refers to "digital goal setting" in the framework. After these steps, the formulation and implementation of the digital strategy was to be done in the company.

Considering the digital effectivity analysis, R3 stated that: "we think about efficiency first. We are efficient with the programs we have now, we try to make it as simple as possible. We are not looking into digitalization now. We are trying to make everything as simple as possible." According to the respondent R3, the digital formulation step is missing in the digital strategy process in this company.

Table 3 summarizes the findings regarding the process of Digital Strategy.

Table 3. Themes for the digital strategy process.

Source	Digital Effectivity Analysis	Digital Goal Setting	Digital Formulation	Digital Strategy Implementation
Observation	X	X	X	X
R1	X	X	X	X
R2	X	X	X	X
R3	X	X		X

4.2. Digital Organization and Culture

According to observations in BuildHouse, preparing the staff to adapt to new technology is one of the significant subjects that the decision-makers discuss. It is important to predict the resistance to change of the staff notably from older generations. The top managers of the company try to analyze the strengths and weaknesses of the human resource, then they decide how to manage the transformation, how the employees should learn about the new technology, and inform them why the company needs to be more digitalized in the supply chain. For instance, in May 2022, the company decided to use a project planning program based on Excel, to reduce the resistance of some employees to use a new program: a couple of meetings were held, first to explain the necessity of the program, second to present its advantages, and third to educate the staff on how to use it. Finally, they told the employees how the new software could reduce the risks during the period of the project and could help to have better connections with the suppliers of raw materials. Through these meetings, the company was trying to take steps to transform into a digital culture.

According to R1, the process of digital organization and culture is approved by her as well. She stated that: "When we started the concrete factory in the company, we tried to make every process in outlook to give information to all of the employees in charge [such as] the production manager and the other staff. This helped us to digitalize each process and have the right documentation in our history. The company and other staff find it so positive to work with the new system. If we want to make a new change, we face resistance and uncertainty [about] new technologies. It is difficult to adapt production employees to newer technology".

R2 believes that because of the pace of digital transformation in other companies especially in the supply chain, they must transform in to a digital culture, but it takes time. On the other hand, R3 also believes that the environment affects digital transformation; on that matter, he stated: "We are high tech in the office. Here we are using the latest program and equipment for physical manufacturing. Also, in the factory, we have the latest equipment [such as] laser cutting, but computer program [s are] hard to use [in the factory, manufacturing steel beams] because of the harsh environment. For example, tablets [would probably be broken]".

Table 4 presents the findings regarding the process of digital organization and culture.

Table 4. Themes for the process of digital organization and culture.

Source	Analyze the Current Organization and Culture	Digital Organization and Culture Management	Transform into a Digital Organization and Culture
Observation	X	X	X
R1	X	X	X
R2			X
R3	X	X	X

4.3. Digital Operations

To implement new technologies and use them appropriately in the company, the first important thing is to make the staff familiar with them. As it is mentioned in the previous section, after educating the staff, it was time to enable them to work with the new technologies. In the case of using the new project planning excel program, the top managers made sure that the planning program worked appropriately on the project managers' computers, tablets, and mobile phones. Another example of working enablement discussions in the company was about working from home. After several meetings with members of the board, they announced that more than 90% of BuildHouse staff could not work from home, only the Accounting and Marketing departments had this opportunity in special cases. The most significant reason for this decision was that there with only 10 employees working in the office, if 50% of the office staff wanted to work from home, only 5 people would remain on site.

After enabling the staff in using the new technologies, the implementation stage was to take place. One of the weaknesses in the digital operation phase was the lack of management of digital operations in the company, and the main reason for this weakness was the lack of human resources, time, and cost. The lack of management of digital operations was referred to by R1, R2, and R3. For instance, R2 stated: "In the future, we have to have digital operation management, but the customers that we have now [are] from the old guard; [however], now we are seeing [...] more and more from the younger generation who start to work in our customers' companies, so recently I'm getting some questions [such as] 'why do I have to call or mail? I want to do it on the computer, ' and I have to answer [that] we do not have this technology right now".

The last step of digital operation management is implementing the technology where it is considered. This means that after enabling the employees, the companies start to implement new digital technologies in the desired operations.

Table 5 outlines the findings regarding the process of digital operations.

Table 5. Themes for the digital operations process.

Source	Worker Enablement	Digital Operations Management	Digital Operation Implementation
Observation	X		X
R1	X		X
R2	X		X
R3	X		X

4.4. Digital Product and Services

Based on the products and services which BuildHouse is providing, they are limited to product data sheets, newsletters, brochures, and catalogues. In this regard, the company is not spending much time or money on customizating them or analyzing the lifecycle or eco-system of digital products and services. For instance, product data sheets are some standard papers according to the features of the products, raw materials, and production process, so no change is allowed.

R1, R2, and R3 confirmed the lack of customization of digital products and services because of the type of products which they manufacture. "Unfortunately, we do not have this type of customized digital product and we should have always direct contact by telephone or email to maintain continuous progress and right delivery".

Only R2 mentioned the customer requirement lifecycle: "According to the feedback and investigations [into] changes, we revise our digital products [such as] digital brochures once or twice a year. Sometimes we hire companies to check all these data".

Table 6 presents the findings regarding the process of digital products and services.

Table 6. Themes for the process of digital products and services.

Source	Customer Requirement Life Cycle	Product and Services Eco-System	Customization and Personalization
Observation			
R1			
R2	X		
R3			

4.5. Digital Customer Experience

Most of the conversations with customers and suppliers is through e-mail and Microsoft office teams. Because of the important features and details of the products that should be manufactured, every single piece of information should be written and documented. Therefore, the best way is to communicate via e-mail. Regarding the touchpoints that are the ways by which that customers can meet the brand of the company, BuildHouse has taken a big step compared with the previous years: a digital marketing department was established in October 2021, as the importance of customer touchpoints was noted by the decision-makers. Therefore, a significant budget was being considered to invest in social media, websites, and other offline marketing materials such as banners, flags, and signs. Understanding the brand and increasing brand awareness in the digital environment, getting to know the competitors, and analyzing their digital marketing strategies are important steps that the company has been taking through this period of time. Consequently, the vital role of digital customer experience had been noted BuildHouse's leadership.

Based on the responses, all participants appear to agree with the principles of customer understanding and customer touchpoints, because they believe that in today's market, it is important to invest in the branding of the company. Moreover, R1 and R2 stated that it is vital to work and invest in top-line growth to increase sales. For instants, R2 stated, "Well, in today's market we should invest in digital platforms that can help us to grow our sales".

Table 7 presents the findings regarding the process of digital customer experience.

Table 7. Themes for the digital customer experience process.

Source	Customer Understanding	Customer Touchpoints	Top-Line Growth
Observation	X	X	X
R1	X	X	X
R2	X	X	X
R3	X	X	

5. Discussions

According to the analysis of thematic data, the five processes—namely, digital strategy, digital organization and culture, digital operations, digital products and services, and digital customer experience of the digitalization framework proposed by [6]—are relevant for SMEs. Yet, the findings also suggest that some of the components of each process need to be amended to be better aligned with an SME setting. These amendments will be presented and discussed in the following section.

The first component of digital strategy is digital effectivity analysis which was confirmed by the data collected. As SMEs are significantly at risk of losing money, before setting new strategies, they try to analyze the effectiveness of new technology. After that, the company plans what the digital strategy wants to achieve in the supply chain, what is important for them, and what should be eliminated. It may also create a road map for digitalization to support the process and the successful completion of the sub-goals. In [6], this component was called digital goal setting. After that, through digital formulation, the best solutions are to be chosen to achieve the goals [6]. Finally, the DSC strategy will be implemented in the company: this is named the digital strategy implementation [6] in the framework applied.

Another important aspect is digital organization and culture. The findings of this study suggest that a new component should be added as the first step in this process. The companies first analyse the current organization and culture [6], with a view to gaining insight in to the current understanding of the staff regarding digitalization, and the employees' attitude toward new technologies and to working with them. Based on this insight, the consequences for the existing organizational culture will be analyzed and actions will be initiated so that the culture can be transformed into one that better fits the new requirements. Then, in the next step to "transform into digital organization and culture" [6], the supply chain starts to transform into the new digital organization and culture [6].

After implementing the digital strategy, the next step is digital operations. According to the DSC framework of [6], this step starts with enabling the staff to work more digitally. For instance, working with emails, and platforms, and working from home. The relevance of worker enablement was stressed in this study as well. As mentioned before, management of digital operations was missing, a finding that indicates that this is a step not considered in the DSC process. Worker enablement was highlighted and then came the implementation of the new technology, called digital operation implementation. Therefore, the step of digital operation management as suggested by [6] appears unnecessary in SMEs as it may add an extra hurdle to an already time-consuming and challenging process and would also ask for additional resources which might not be there or reserved for other activities related to the DSC process. Thus, this step was removed.

The next process is digital products and services. According to [6], this consists of three components: customer requirement life cycle, product and services eco-system, and customization and personalization. The supply chain studied creates and uses digital products and services. Digital brochures and catalogues, PDF files of documents, and 3D files of products for visualizations are used. Customer requirement life cycle or product and services eco-system and customization do not form parts of the DSC process. In view of this consideration, an updated DSC framework for SMEs seems to do without these two aspects.

According to [6], the digital customer experience is another important step in the DSC process. The findings received suggest that its components—i.e., customer understanding, customer touchpoints, and top-line growth—matter. This step of the process underlines the need for understanding the customers' requirements and behaviour, the role of company branding, and the measures and activities aimed at increasing sales. These are all aspects one would expect in all organizations regardless of size to remain successful. It is therefore not surprising that these foci were also found in the setting under study.

The updated framework is presented in Table 8.

Table 8. The digitalization process framework to develop DSC for SMEs.

Digital Strategy	Digital Organization and Culture	Digital Operations	Digital Products and Services	Digital Customer Experience
Digital effectivity analysis	Analyze the current organization and culture	Worker enablement	Digital products and services	Customer understanding
Digital goal setting	Digital oganization and culture management	Digital operation implementation		Customer touchpoints
Digital formulation	Transform into digital organization and culture			Top-line growth
Digital strategy implementation				

6. Conclusions and Implications

Based on a case study approach, this paper explored the usability of the digitalization integration framework (DIF) proposed by Büyüközkan and Göçer [6] for its application in SMEs. The results of the study led to the proposal of an updated framework empirically grounded in a supply chain involving SMEs. The updated framework covers those categories and components that appear crucial for supporting SMEs in their efforts to transform into SDC.

The study's findings suggest that most of the components of the integrated DSC framework proposed by [6] are also useful for SMEs. The three main processes of the framework are digitalization, technology implementation, and supply chain management; thus, the supply chain actors should do some planning and also determine some tasks related to these three domains to increase the development of a successful DSC. The digitalization process supports the realization of the five components in SMEs, which are digital strategy, digital organization and culture, digital operations, digital products and services, and digital customer experiences.

As regards the sub-components, the findings suggest that there is room for amendments to better fit an SME setting. For instance, digital effectivity analysis has been added as the first sub-component for digital strategy. On the other hand, digital operation management is not considered relevant in SMEs for developing DSC.

6.1. Theoretical and Practical Implications

The main theoretical contribution of this paper is an updated DIF that fills the gap of knowledge in the existing literature regarding the process of developing DSC for SMEs, both empirically and theoretically [6,18]. Thus, the study contributes to the existing literature on DSC in general, and DSC in SMEs in particular, by providing an improved understanding of the process of DSC and what is considered relevant to make the process successful. This will allow future research on DSC in SMEs to conduct studies in this area that build on a more solid foundation.

As regards practical implications, the proposed framework can be used by SMEs that are both interested in becoming more digitalized and with regard to the digitalization of their supply chains. The framework, i.e., its dimensions and components, can enhance the knowledge of the persons involved in the digitalization process. In particular, the persons in charge get an insight into the possible implications of digitalization, i.e., in terms of the financial and non-financial resources required. This means that the DSC process is more likely to be achieved in larger SMEs. It also provides a kind of road map to define a plan and concrete tasks for a successful implementation of this process.

6.2. Limitations

As with any research, this study has limitations. For instance, to test the suitability of the DIF, a small supply chain was used. Larger supply chains may have other requirements and challenges when it comes to the development of DSC. The selection of the building and construction industry may also have led to limitations; the same applies to the choice of Sweden. In addition, the study did not differentiate between different types of SMEs, although the authors of this study are aware that the development of DSC is a very different challenge for micro-enterprises than for larger SMEs. In this study, the extent to which the pandemic has affected the process was not investigated and is therefore not included in the components of the frameworks used.

6.3. Future Research

The updated framework proposed in this study is the outcome of data collected in a supply chain involving three companies located in Sweden. To see whether this framework is useful and valid for other SME settings, it is recommended that future researchers test the framework. The testing would allow amendments and further refinements so that one would come closer to a generic integrated DSC framework applicable to many SMEs.

A further suggestion in this context would be to study the challenges to developing DSC found in SMEs, as this insight may also bring further information that could be incorporated into the framework to improve it further in terms of relevance and practical use for SMEs. Considering that the development of DSC is time-consuming and costly, future research could also find out which components of the framework should be present, and which are simply "nice to have". When doing so, different categories of SMEs should be studied in order to see, above all, whether the framework could function as a generic framework for all types of SMEs, or whether different categories (micro, small and medium-sized companies) require different types of frameworks. This would further underline the relevance of the framework for SMEs. Moreover, future research could also consider how robust this framework and its components are, in internal and external crisis situations. Does the weighting of some components shift in these situations, and if so, which ones and to what extent?

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