MASTER'S THESIS

The Critical Success Factors of a Digital Transformation for Traditional Logistics Service Providers in The Netherlands

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Abstract

Digital Transformation has become increasingly important for traditional service providers, including those involved in logistics. It is specifically those pre-digital organizations where digital technologies pose an existential threat. The critical success factors of a digital transformation for twelve traditional logistics service providers in The Netherlands have been investigated with a multiple case study using semi-structured interviews. The conceptual model of the meta-analysis on digital transformation of Vial and the systemic literature reviews of Osmundsen and Morakanyane on critical success factors of a digital transformation allowed a refined list of digital critical success factors to be formulated. These factors were analysed and compared with the case organizations' digital transformation success, using the success metrics of Bughin and Kraus. The research was conducted with a fuzzy-set qualitative comparative analysis (fs/QCA). The results of the research suggest that traditional logistics service providers that have a high awareness of transformation impacts, high adoption of a digital business model and a high endorsement of cross-functional collaboration have high digital transformation success. The fs/QCA models used in the analysis show a high predictive validity and can be reused for future research.

Key terms

Digital Transformation, Critical Success Factors, Digital Success, Traditional Logistics Service Providers, fuzzy-set Qualitative Comparative Analysis

Summary

Digital Transformation (DT) has become increasingly important for traditional service providers, including those involved in logistics. It is specifically those pre-digital organizations where digital technologies pose an existential threat. With the use of an inductive framework on the DT process and several meta analyses on DT critical success factors (CSFs) and DT success metrics, a list of seven CSFs and four success metrics have been identified for the empirical research.

Both the DT CSFs and the DT success metrics derived from the literature review were tested by conducting a multiple case study for Dutch traditional logistics service providers (TLSPs) using a fuzzy-set Qualitative Comparative Analysis (fs/QCA). To collect the data from each case organization semi-structured interviews were conducted with fitting management roles involved with the transformative journey of their organization. These were conducted at six Second-Party-Logistics (2PL) and six Third-Party-Logistics (3PL) organizations. During the interview, questions were asked related to the following seven DT CSFs: awareness of digital triggers, awareness of transformation impacts, adoption of digital technologies, adoption of a digital business strategy, adoption of a digital business model, endorsement of cross-functional collaboration and endorsement of a supportive organizational culture. Additionally, to measure the outcome "DT success", questions were asked related to four success metrics: the rate of organic revenue growth, the rate of EBIT growth, the return on digital investment and firm growth.

The main result from the analysis, and thus the research, shows that TLSPs that have a high awareness of transformation impacts, high adoption of a digital business model and a high endorsement of cross-functional collaboration have high digital transformation success. Another important result of the research is that the used models of the fs/QCA show a high level of predictive validity, meaning that the models can be re-used and re-tested in future research using a similar or larger sample size. The results have also shown that all DT CSFs and DT success metrics identified in the literature review were present at the case organizations of the study. There are none with a neglectable score across all TLSPs. There is one characteristic that particularly stands out when looking at the individual scores of these TLSPs: 4 out of 6 2PLs scores high on DT Success, while only 1 out of 6 3PLs score high on DT Success. Suggesting that the 2PLs that participated in this research score higher on DT Success than the 3PLs.

There are three recommendations for high digital transformation success that can be concluded from the findings of this study:

- TLSPs need to be aware of the transformation impacts
- TLSPs need to adopt a digital business model
- TLSPs need to endorse cross-functional collaboration

More specifically, this research suggests that a combination of these three success factors prove to have the most positive effect on digital transformation success.

Finally, three recommendations for follow-up research were made and are listed below:

- Conduct the same analysis using a larger sample size
- Conduct future research on the distribution and use of scale items for the constructs
- Conduct a similar study using similar case organizations at a different point in time

Contents

1. Introduction

1.1. Background

Over the past few years, Digital Transformation (DT) has become increasingly important for traditional service providers, including those involved in logistics (Chanias, Myers & Hess, 2019). Traditional service providers are organizations who offered services in a pre-digital economy and whose success was already established during that time. According to Chanias et al. (2019) it is specifically those organizations where digital technologies pose an existential threat. It is forecasted that the worldwide spending on technologies and services that enable a DT is going to reach more than 2 trillion EUR in 2023 (Vacca, Simpson & Smith, 2019). To better understand why organisations invest so many resources in DT, the necessity of a transformation needs to be understood first.

When zooming in on Traditional Logistics Service Providers (TLSPs) specifically, Mathauer & Hofmann (2019) suggest that several market developments force TLSPs to continuously adopt new technologies. One of these developments is the ever-increasing competitive pressure from the global market, another is upcoming new competitors such as marketplace platform providers. E-commerce providers like Amazon Inc. used to be business partners of logistics service providers, but are now building up their own, online-based, logistics solutions.

The combination of the disruption from marketplace platform providers, E-commerce providers and logistics start-ups is transforming the entire logistics industry. As a result, significant pressure is put on traditional logistics markets, such as The Netherlands, and their established market players (Hofmann et al., 2017). To deal with this pressure on the market, and to avoid becoming irrelevant in the future, logistics service providers are forced to rethink their traditional processes and are considering the adoption of a DT to embrace the changing market (Pontius, 2017).

1.2. Problem statement

Seizing the opportunity to adopt a DT has proven to be difficult. According to a survey done by SAP (2017), a total of 84 per cent of global companies see a DT as critical to the company's survival in the next five years, yet only three per cent have completed a companywide transformation.

A McKinsey study by De la Boutetière, Montagner & Reich (2018), that defines a successful transformation as: *"A transformation that, according to respondents, was very or completely successful at both improving performance and equipping the organization to sustain improvements over time."* shows that the success rate of a digital transformation is consistently low. Only 16 per cent of the respondents see improved performance and think that their organisation has equipped them to sustain these improvements long term. Additionally, 7 per cent of the respondents argue that their organisation's performance increased, but that it was not sustained over time. For traditional service providers, this number drops even lower, where success rates fall between 4 and 11 per cent. De la Boutetière et al. (2018) further elaborates on the 'improved performance' and mentions three digital transformation performance measurables: The rate of organic revenue growth, the rate of EBIT (earnings before interest and taxes) growth and the return on digital investment.

As these numbers show, organisations, and in particular traditional (logistics) service providers, are struggling to execute a successful DT. Hence, the purpose of this study is to identify what a successful DT is and, more importantly, distinguish the key factors that contribute to this success for

TLSPs. The study aims to identify this success empirically by focussing on TLSPs based in The Netherlands.

1.3.   Research objective and questions

To gather insights around this problem statement the following main research question will be the focal point of the study:

What are Critical Success Factors of a Digital Transformation for Traditional Logistics Service Providers in The Netherlands?

The main research question consists of three key components that need to be further analysed to successfully answer the question. First, a literature review on the topic *Digital Transformation (DT)* will be conducted and is needed to understand what body of literature exists on this phenomenon. Secondly, the literature review will identify *Critical Success Factors (CSFs)* of a DT, unrelated to the logistics market, as they will be used as input for the empirical research. As a third part of the literature review, methods of measuring *Success* of a DT are identified and also used as input for the empirical research that will lead to the answering of the main research question. In summary, this leads to the following three sub research questions that will need to be answered in this research paper:

1. What is Digital Transformation?
2. What are the Critical Success Factors of a Digital Transformation?
3. How can Success of a Digital Transformation be measured?

The first sub research question will lead to a conceptual definition and a conceptual model of DT. The second sub research question will provide a list of CSFs of DT and the third sub research question a list of DT Success metrics. The conceptual model of DT, the CSFs of DT and the Success metrics of DT will be used as input for the conceptual design of the empirical research and will contribute to answering the main research question.

1.4.   Motivation/relevance

As shown in previous studies, organisations are investing more and more resources in the adoption of digital innovations. Despite these investments, it seems to be difficult for traditional service providers to gain success out of these DT efforts. Hofmann & Osterwalder (2017) address the digital disruptions entering the logistics market by providing a new, and industry-wide, perspective. Therefore, their results are mostly high-over analyses and serve as a starting point for more in-depth empirical testing of theories in practice. Furthermore, Mathauer et al. (2019) have investigated the technological innovations related to DT by logistics service providers, but have only done so with a qualitative research approach and used a relatively small sample size. Additionally, their study mainly focusses on the adoption of digital technologies alone. They argue that the logistics sector offers a lot more avenues for future research about the adoption of a DT. The objective of this study is not to investigate new digital technologies within TLSPs. The objective of the study is to serve as an empirical approach to the theories that have already been discovered, and to discover to what extent they are applicable within logistics. Additionally, by conducting empirical research the aim is to investigate why the percentage of successful transformations is so low, especially for traditional service providers. By focussing on TLSPs in The Netherlands the study aims to distinguish the key factors of a successful DT, focussing on logistics. A more empirical approach to the adoption of a digital transformation within logistics can potentially provide new academic insights for both science and the industry.

1.5.   Main lines of approach

In line with the research questions, the initial focus is on reviewing the literature in chapter 2. To better understand the study, the three research fields *Digital Transformation, Critical Success Factors of a Digital Transformation* and *Digital Transformation Success* are considered for the literature review. The conducted literature review is used as input for the research design (chapter 3), which is a multiple case study using the *fuzzy set Qualitative Comparative Analysis (fs/QCA)* methodology. For the multiple case study, 12 TLSPs in The Netherlands have participated in the research and the data has been gathered using semi-structured interviews. The research focusses on 8 theoretical concepts derived from the literature review, of which 7 relate to DT CSFs and 1 to DT Success. The interview questions relate to one or more of these theoretical concepts. Where deemed necessary the researcher has gathered additional documents to verify and further elaborate on certain interview questions. The results of the interviews of all 12 case organizations are displayed in chapter 4, where each case organization is categorized based on type of company, years of experience in logistics, employees working in The Netherlands and net revenue in The Netherlands. The content of the interview is summarized into three topics: digital awareness, digital adoption and digital endorsement. In addition, the data collected from the interviews in used to conduct the fs/QCA with, showing the results, in combination with a predictive validity analysis, at the end of chapter 4. Based on the results of the fs/QCA, chapter 5 focusses on the conclusions that can be drawn from the conducted research. In this last chapter, the researcher also reflects on the way the research was conducted in the discussion paragraph and concludes the chapter by identifying recommendations for practice and recommendations for areas for further research.

2. Theoretical framework

This chapter, the theoretical framework, presents the results of the conducted literature review and assists in answering the formulated research questions.

2.1. Research approach

The theoretical framework aims to answer three research questions:

- What is Digital Transformation?
- What are Critical Success Factors of a Digital Transformation?
- How can success of Digital Transformation be measured?

The information derived from the literature review is used to design and develop a research artefact, or framework, that will be used to conduct the necessary research to answer the fourth sub research question and the main research question. The framework is created by conducting a theoretical review to examine the body of knowledge on DT, the CSFs of DT and the measurements of the success of a DT. As discussed by Saunders, Lewis & Thornhill (2019), the theoretical review helps to establish what theories exist and the relationship between them. It can reveal existing theories in an area where it is unclear what is happening.

Before conducting the theoretical review the right search parameters had to be defined. Saunders et al. (2019) suggests to be clear about the 6 search parameters of Bell and Waters (2014) to identify the relevant subject matter. The parameters are provided and filled-in in Table 1, including the motivation of the selected values. The search queries were primarily used in the EBSCO database of the Open Universiteit (OU). Second to this database, the search queries were also used in the Google Scholar Database to find additional relevant literature.

Table 1 – Search parameters

Parameter	Value	Motivation
Language of Publication	English Dutch	The majority of the academic body of knowledge on DT is written in English and is therefore a suitable language to start with. Dutch is included as a second option because the research is conducted using Dutch organizations.
Subject Area	Digital Transformation Critical Success Factors Digital Transformation Success	The three subject areas are derived from the research questions and are the main topics that require further investigation via the literature review.
Business Sector	Traditional Service Providers Pre-digital Organizations Logistics	The study focusses on TLSPs, meaning the business sector is logistics in combination with TSPs, or pre-digital organizations. Both concepts should be included in the literature review.
Geographical Area	The Netherlands Europe Worldwide	First, Dutch literature will be analysed as this research aims to answer a research question that relates to Dutch organizations. The search is expanded using research papers that cover the geographical area of Europe and eventually also the rest of the world.

Publication Period	Last 3 years Last 5 years	For a research topic, such as DT, that has not been around for a long time it is important to study the most recent studies to ensure the content, and the technologies suggested, are not outdated. It is therefore decided to initially apply a time window of 3 years and expand it to 5 where needed. The only exception is made for backward snowballing where the older information is a relevant contribution to the research.
Literature Type	Academic Journal Book	The primary source of literature is academic journals related to the subject areas. The content of these journals is enriched using information from study books.

2.2.   Implementation

In figure 2.1 the conducted literature review is modelled according to the model of Moher et al. (2009), which is described by Saunders et al. (2019) in the Systematic Review process steps. The initial evaluation of the literature started with the literature provided by the OU. These sources lead to a good understanding of some of the key subject areas of the literature review and became the starting point for further search queries. The key words, and combinations of them, "*Digital Transformation*", "*Critical Success Factors*" and "*Digital Transformation Success*" were used in the Open Universiteit and Google Scholar databases to expand the number of studies that could be evaluated as an addition to the analysis. The initial inclusion criteria entailed that the literature had to either be an academic journal, book or peer-reviewed article and that it was published within the last 5 years. The only exception to this inclusion criteria was made for the backward snowballing, where articles older than 5 years were also taken into account when deemed relevant to the total analysis. The last inclusion criterium relates to articles where there was a connection with multiple keywords in the search query. These articles proved to be more relevant within the subject area of the study. In total there are 16 studies included in the analysis and theoretical framework.

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┌────────────────────────────┐          ┌────────────────────────────┐
│ Number of studies identified│          │ Number of studies identified│
│  search online databases    │          │      through other sources  │
│                             │          │                             │
│          EBSCO              │          │       Provided by OU        │
│          N = 12             │          │          N = 3              │
│      Google Scholar         │          │ Saved articles of personal  │
│          N = 7              │          │      interest   N = 6       │
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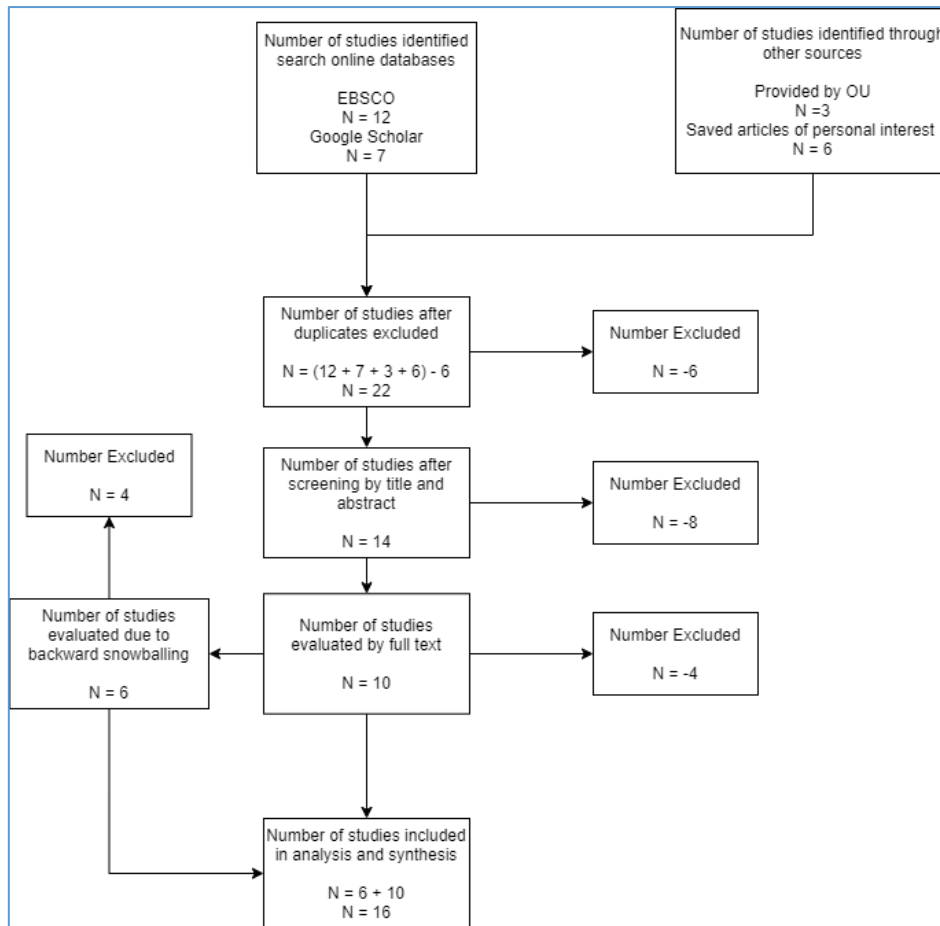|	Number of studies after duplicates excluded N = (12 + 7 + 3 + 6) - 6 N = 22	→	Number Excluded N = -6
Number Excluded N = 4	Number of studies after screening by title and abstract N = 14	→	Number Excluded N = -8
Number of studies evaluated due to backward snowballing N = 6	Number of studies evaluated by full text N = 10	→	Number Excluded N = -4
	Number of studies included in analysis and synthesis N = 6 + 10 N = 16		

Figure 2.1 – Systematic Review

2.3. Results and conclusions

2.3.1. What is a Digital Transformation?

A lot of today's organizations are in the process of a digital transformation, yet the initial concepts of a DT have been discussed by scholars throughout the past four decades. Rockart and Morton (1984) are some of the first scholars who describe the transformation and call it an IT-enabled business transformation. The phenomenon relates to a time in which technology had a significant impact on the business strategy of an organization. For organizations to stay effective they needed to continuously balance out the changes into the different organizational elements and that technology was the key driver of this change (Rockart and Morton, 1984). Henderson and Venkantraman (1993) mention that the continuous balance of change is caused by the disruptive power of the competitive world and that the challenge for organizations is to deal with the disruptions by continually adapting organizational and technical capabilities. Due to the possibility of global connectivity through the upcoming of the internet, this was made easier as organizations could fundamentally reshape their business strategy into a digital one (Bharadwaj et al. 2013).

At that time, despite the increased attention for an IT-enabled, or digital, transformation, scholars had not been able to create a widely accepted definition of DT yet. In the systemic literature review of Morakanyane, Grace & O'Reilly (2017), it is mentioned that the inconsistencies in DT literature and the lacking of a unified and overarching definition formed a huge challenge to understand what DT means within a business context. Although the digital characteristics of a DT were often

mentioned in similar ways, the key differences lie in the identification of the areas that are impacted during the transformation process (Morakanyane et al., 2017). The literature review of Reis et al. (2018) also shows that a lot of different attempts have been made to categorize and define the phenomenon. In the literature review on DT of Reis et al. (2018) the scholars argue that it is a buzzword used to capture the renewed interest for IT-enabled business change from the past only with novel elements included.

A more recent study by Vial (2019) explains that the current view of DT is an evolution of IT-enabled business transformation. According to Vial (2019), DT better reflects the complexity of the environment in which organisations operate and the disruptive abilities that digital technologies can have on individuals, organizations and society. By conducting a meta-study of 282 different studies on DT he identified four essential properties of DT: (1) *target entity*; the affected unit of analysis, (2) *scope*; the extent changes impacts the target entities attributes, (3) *means*; that digital technologies that are used to create changes, and (4) *expected outcome*; the result of the DT process. With the use of these 4 elements, Vial (2019) constructs a conceptual definition of DT:

" *A process where digital technologies create disruptions triggering strategic responses from organizations that seek to alter their value creation paths while managing the structural changes and organisations barriers that affect the positive and negative outcomes of this process.*".

<div align="right">Vial, 2019</div>

The definition of Vial (2019) covers the keys areas that have been discussed in previous work. His elaborate meta-study on the phenomenon shows that he has investigated all aspects and has comprehensively answered the research question: "*What is a Digital Transformation?*".

2.3.2. What are Critical Success Factors of a Digital Transformation?

According to Osmundsen, Iden & Bygstad (2018), critical success factors are organizational elements that are essential for the adoption of a successful digital transformation. Morakanyane et al. (2020), add that a DT success factor should be linkable to a known causal mechanism and say it are only success factors when they are deemed necessary and sufficient for success. Both Osmundsen et al. (2018) and Morakanyane et al. (2020) performed a systematic literature review on CSFs on DT using empirical contributions, allowing to identify multiple factors that contribute to an accomplished DT. The themed categories of DT CSFs derived from both studies can be found in table 2 and are elaborated on throughout this paragraph.

Table 2 – The Critical Success Factors of a Digital Transformation by Osmundsen (2018) & Morakanyane (2020)

DT Success Factors by Osmundsen (2018)	DT Success Factors by Morakanyane (2020)
A supportive organizational culture	Determine Digital Trigger
Well-managed transformation activities	Cultivate Digital Culture
Leverage external and internal knowledge	Develop Digital Vision
Engage managers and employees	Determine Digital Drivers
Grow IS capabilities	Establish Digital Organization
Develop dynamic capabilities	Determine Transformed Areas
Develop a digital business strategy	Determine Impacts
Align business and IS	

A successful DT starts with embedding a supportive organizational culture within the organization (Osmundsen et al., 2018). The organizational culture plays a vital role in the success of a DT and organizations have to actively engage employees who work on the processes affected by the transformation, to shift their mindset to a digital one. If neglected, it can become a source of inertia, which can prevent innovative change, and digital technologies should be adopted in a way that they are in line with the existing organizational culture (Hartl and Hess, 2017). Instead, organizations can leverage the knowledge in people's day-to-day work, which allows employees to become digital transformers themselves (Osmundsen et al., 2018).

In a more recent study on DT success by Morakanyane et al. (2020) they argue that before the adoption of a supportive organizational culture it is necessary to determine the digital triggers first. Organizations have to be clear on what initiated the transformation journey by analyzing the external environment of the organization first (Morakanyane et al., 2020). Once started, successful DT organizations stand out by their ability to manage the transformation activities adequately (Osmundsen, 2018). These organizations endorse cross-functional collaboration by adopting an agile organizational structure. Such a structure, with decentralized functions, allow for constant refining, streamlining and process improvements (Earley, 2014).

The empirical contributions of Morakanyane et al. (2020) show that, in response to the digital and market disruptions, successful organizations spend time on developing their digital vision. Such a vision is often translated into a digital business strategy (DBS) (Osmundsen et al., 2018). A DBS is a combination of business strategy and IS strategy and determines an organisation's engagement in IT activities in relation to the industry average of its competitor. The DBS can set the objectives and determine the pace at which the organization plans to engage in the adoption of a DT (Mithas, Tafti & Mitchell, 2013). In an earlier study by Bharadwaj et al. (2013) they argue that while defining the transformation strategy, organizations need to consider creating a fusion between the organizational strategy and IS strategy. The fusion allows for a reconfiguration of organizational resources towards the DBS, which lowers the possibility of creating strategic gaps (Osmundsen et al., 2018). Organizations that are capable of combining the assembling and deployment of IS resources with alternative organizational resources are more likely to enable a successful DT, as they possess the organizational agility to rapidly adapt to change and redesign the traditional value creation process accordingly (Osmundsen, 2018).

Both Osmundsen et al. (2018) and Morakanyane et al. (2020) argue that successfully transformed organisations were able to determine their digital drivers before commencing on the transformative journey. The drivers that stood out in most of the analysed cases was the change in customer behaviour and expectations, new digital disruptions within the industry, an ever-changing competitive landscape and changes in (inter)national regulations (Osmundsen et al., 2018), (Morakanyane et al., 2020). In response, organizations can stand out by establishing a digital organization (Morakanyane et al., 2020). A digital organization can be established with the use of digital technologies, in particular SMACIT (social, analytics, cloud and internet of things (IoT)) and platforms (Sebastian et al., 2017). To meet the increasing expectations of customers, and to avoid falling behind a competitor, organisations need to have the speed and flexibility to rapidly innovate. To facilitate the necessary speed organisations adopt a digital platform (Osmundsen et al., 2018)(Sebastian et al., 2017). Sebastian et al. (2017) describes the digital platform as *"The technology and business capabilities that facilitate rapid development and implementation of digital innovations"* and argues that a digital platform has to include digital components that can enable both technical and business services, that offer repositories containing large amounts of data and have the analytical capabilities to convert the data into business insight.

Another element that Morakanyane et al. (2020) extracted from their research cases is the ability for organisations to determine the positive and negative impacts the transformation can have externally and internally. Through automation possibilities, business process improvements and cost savings organizations can feel the positive effects of a successful DT, as digital technologies are adopted to create operational efficiency. The positive impacts of DT are felt by an increase of several organizational performance dimensions. The innovativeness, financial performance, the firm's growth, reputation growth and competitive advantage are all positively affected by the transformation (Vial, 2019). However, organizations should not only find ways to increase business value. They also deal with the broader social issues that are associated with the use of digital technologies, especially within the domain of privacy and security, as the use of digital technologies can carry risks on both an individual level and on a society level. Organizations need to ensure they can mitigate the potential privacy and security risks of digital technologies, such as the use of algorithmic decision making, by determining new kinds of impacts upfront (Vial, 2019).

Conclusion

The CSFs of DT discussed in this paragraph range from identifying and determining the digital triggers, or disruptions, to dealing with the impacts the transformation generates. When looking back at the conceptual definition of Vial (2019) in chapter 2.3.1 multiple organizational elements are identified that shape the DT process. These elements are, to some extent, also an important part of the extensive studies of Osmundsen et al. (2018) and Morakanyane et al. (2020) on DT CSFs. The organizational elements are visualized in a conceptual framework by Vial (2019) (Figure 2.2) as DT building blocks, allowing for the possibility to allocate the identified CSFs towards each block. As shown in the conceptual framework, the majority of CSFs discussed in the literature reviews on DT are also an important element in the meta-study of Vial.

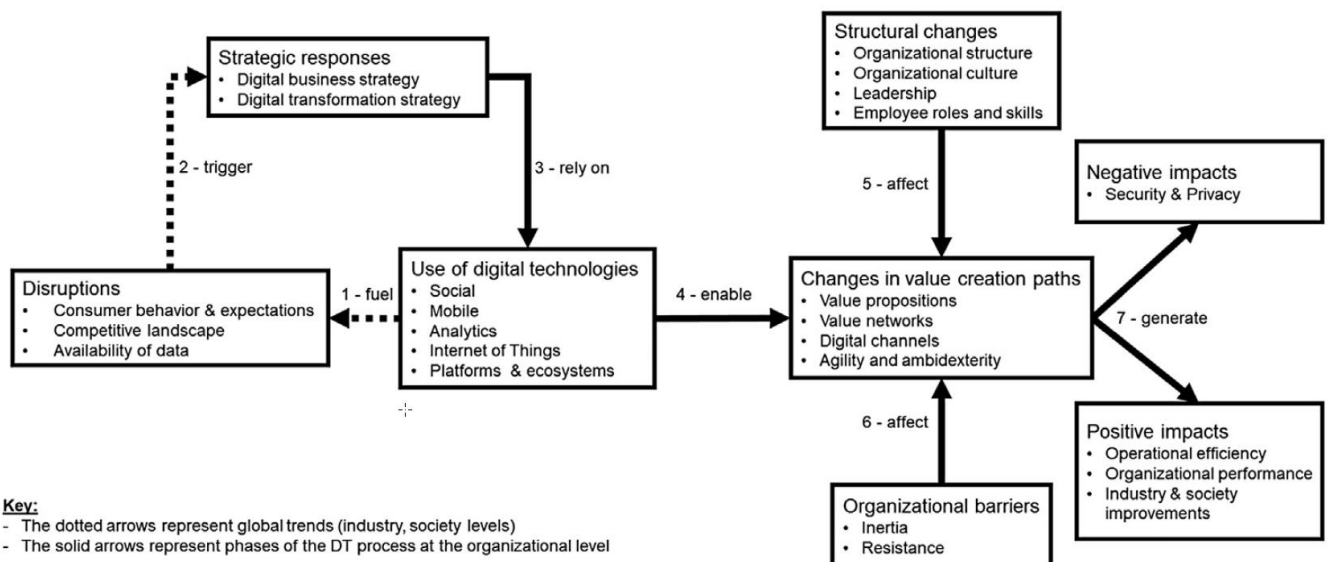*Figure 2.2. – Inductive Framework - Building blocks of the Digital Transformation (DT) process (Vial 2019)*

By bringing the literature on DT CSFs together with the inductive framework of Vial there is a clear overlap visible of areas, or processes steps of DT, that is deemed relevant for a successful transformation. The process steps of the inductive framework are linked to the CSFs in table 3.

Table 3 – Linking DT CSFs to DT process steps

	DT process steps	DT CSFs
1.	Use of digital technologies	• Grow IS capabilities • Establish digital organization
2.	Disruptuions	• Determine digital trigger • Determine digital drivers
3.	Strategic responses	• Develop a digital business strategy
4.	Changes in value creation paths	• Develop dynamic capabilities
5.	Structural changes	• Well-managed transformation activities • Align business and IS • Develop digital vision
6.	Organizational barriers	• Engage managers and employees • Cultivate digital culture • A supportive organizational culture
7.	Impacts	• Determine Impacts • Determine Transformation Areas

After crossing out the duplicate entries and combining similar CSFs into overarching ones, a definitive list of seven CSFs belonging to three different areas; "Digital Awareness", "Digital Adoption" and "Digital Endorsement" can be created. The combined overview of DT CSFs matching the three areas can be found below in Table 4.

Table 4 – A combined overview of Critical Success Factors of a Digital Transformation

	Critical Success Factors of a Digital Transformation
	Digital Awareness
1.	Awareness of Digital Triggers
2.	Awareness of Transformation Impacts
	Digital Adoption
3.	Adoption of Digital Technologies
4.	Adoption of a Digital Business Strategy
5.	Adoption of a Digital Business Model
	Digital Endorsement
6.	Endorsement of Cross-Functional Collaboration
7.	Endorsement of a Supportive Organizational Culture

2.3.3. How can Success of a Digital Transformation be measured?

The CSFs identified in the previous paragraph can contribute to the successful execution of the transformative journey of an organisation. Various scholars have discussed the methodology behind measuring success as performance, as it can help to understand where the organization currently stands, how rapidly they are improving and it enables them to compare results with other businesses (Neely, 1997). Wateridge (1997) is one of the first scholars who brings information on IS/IT project success together and who expand the initial narrow view on success criteria. In his study, he argues that IT projects were initially assessed based on whether or not the project was on time, within budget and to specification. However, in his extensive study, he assembles a list of six criteria deemed most important by IS/IT managers during that time. The IS/IT project needs to: meet the user requirements, achieve the purpose, meet the timescale, meet the budget, resulting in

happy users and meet the quality requirements Additionally, Wateridge (1997) suggests that it is important to identify the success criteria within the organization first and reach an agreement on those criteria by all stakeholders. Only then the criteria of success can be identified and can the promised success be delivered.

To be able to measure the success criteria, there is a need to have a goal and a metric to determine to what extent the goal of success has been reached. When the metrics are aligned with the strategy of an organization then research talks about a *key performance indicator (KPI)* (Eckerson, 2009). A *KPI* is the embodiment of a strategic objective and measures performance against a multidimensional goal. The goals of a KPI are the quantifiable targets, as they specify a measurable outcome (Eckerson, 2009).

In a McKinsey study on DT success, they mention three metrics that can determine the extent to which an organisation has completed their transformative process. The metrics are: (1) the rate of organic revenue growth of an organization, (2) the rate of EBIT (earnings before interest and taxes) growth of an organisation and (3) the return on digital investment (Bughin, LaBerge & Mellbye, 2017). Furthermore, in a study by Kraus, Ribeiro-Soriano & Schüssler (2018), they emphasize an additional metric of success within the context of organizational performance, which is firm growth. The firm growth relates to multiple factors within the organization, such as the core business activities, (digital) investments and relationships outside of the organisation. Those factors combined to impact the organization's business model, which can directly affect their business success (Kraus et al., 2018).

In conclusion, to measure the success of a DT the variable success has to become multidimensional. Looking at the literature on DT success there are four elements identified and will be used to capture the DT success metric. The metrics can be found in table 5.

Table 5 – An overview of Success Metrics of a Digital Transformation

	DT Success Metrics
1.	The rate of organic revenue growth
2.	The rate of EBIT growth
3.	The return on digital investment
4.	Firm growth

2.4.   Objective of the follow-up research

The literature review shows an overview of generic CSFs and generic DT success metrics related to a DT. To understand if these factors are also present and applicable for TLSPs in The Netherlands it is important to investigate this with the use of empirical research.

The inductive framework of Vial (2019) can be used to identify the DT journey and maturity of TLSPs, as it makes the important organizational elements for a successful transformation transparent. Therefore, the framework, in combination with the identified CSFs of the meta-analyses of Osmundsen et al. (2018) and Morakanyane et al. (2020) linked to each building block, will represent the theoretical background of this study for DT CSFs. The financial success metrics of Bughin et al. (2017) in combination with the organizational growth success metric of Kraus et al. (2018) form the metrics for DT Success, which will be a part of the empirical research as the outcome. The empirical research aims to understand which DT CSFs, and to what extent, they are applicable for TLSPs in The Netherlands and explains which relationship the DT CSFs have to the outcome, DT Success.

To answer the main research question *"What are Critical Success Factors of a Digital Transformation for Traditional Logistics Service Providers in The Netherlands?"* the study compares the independent variables (DT KSFs) with the dependent variable DT Success. This is shown in the conceptual model of figure 2.3.
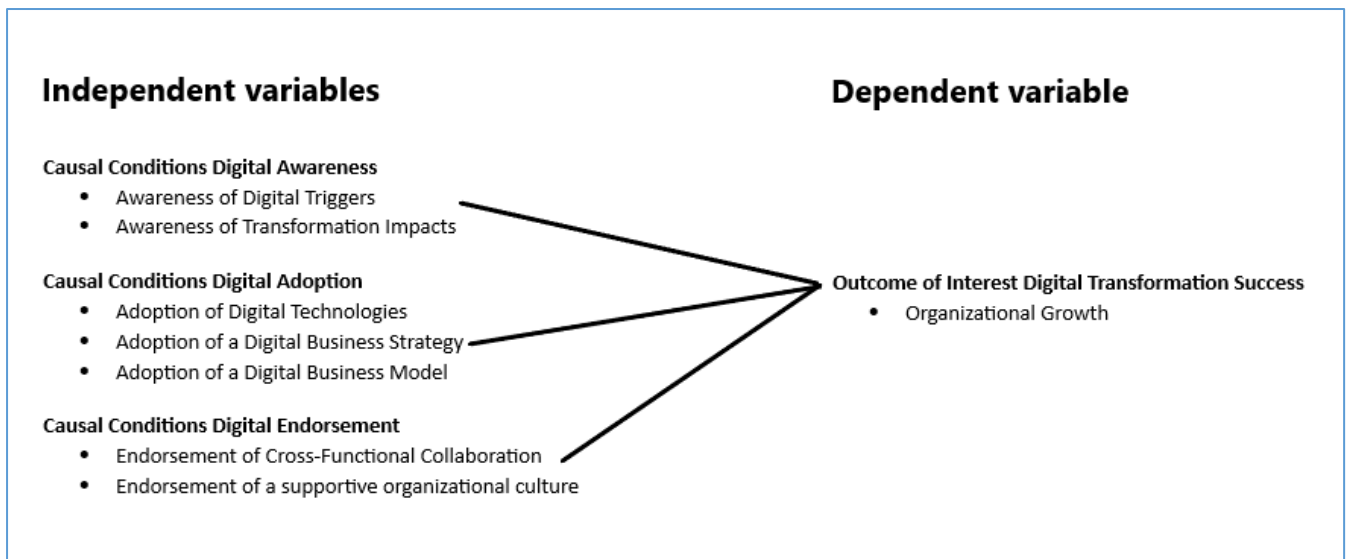

Figure 2.3: Conceptual model IVs & DV

3. Methodology

The methodology chapter provides arguments on the chosen research methods to conduct the empirical research with and explains what lead to the main research approach. The chapter elaborates on how the research will be conducted, how the collected data will be analysed and reflects on the topics validity, reliability and ethics of the research.

3.1 Conceptual design: select the research method(s)

The objective of the empirical research is to test the theories of the DT phenomenon presented in the literature study within different target entities. This allows for a comparison of results that can identify key factors that stand out in the success of a DT. To answer the main research question, it is crucial to identify the CSFs of DT and how successful the target entities are in adopting a DT first. Identifying the DT CSFs and the DT success was done by conducting a literature review. To add to the existing body of knowledge the two subjects of interest, *DT CSFs and DT success*, will be further investigated within the target entity: traditional logistics service providers (TLSPs).

Because this study aims to classify a particular phenomenon and better understand it within a specific context it is useful to conduct explanatory research (Saunders et al., 2019). In this case, explanatory research can allow the researcher to test the theory derived from literature to understand the DT phenomenon within the context of traditional logistics service providers (Edmondson & McManus, 2007). The study aims to conduct a multiple case study. The case study is based on theoretical concepts derived from the literature that are tested within multiple cases to further elaborate on the theoretical concepts (Lee, 2014). For this particular case study, 8 theoretical concepts have been defined, of which 7 relate to CSFs (independent variables (IVs)) and 1 relates to DT success (dependent variable (DV)). An overview of the causal conditions (IVs) related to the outcome of interest (DV) is displayed in figure 2.3 at the end of the previous chapter.

The research will be conducted using multiple cases and the unit of analysis for this case study is TLSPs situated in The Netherlands. To capture a broad selection of TLSPs a mix of two types of logistics organizations will be selected for the research sample: Second-party logistics providers (2PL) and third-party logistics providers (3PL). A 2PL organization leverages a specialized logistics asset that can be used for various customers. They provide their own and external assets in that process. An example of a 2PL can be a courier who offers international road transport. On the other hand, a 3PL offers a multitude of services and can be used to completely outsource the logistics activities of an organization. An example of a 3PL is an organization that completely covers the distribution, warehousing and fulfilment of a non-logistics organization.

3.2 Technical design: elaboration of the method

The goal of the multiple-case study is to identify the results of the seven DT CSFs and the results of DT Success and compare these results between the different target entities. Lee (2014) suggests a Qualitative Comparative Analysis (QCA) can fit that purpose. With the use of a QCA, the researcher can create theoretical concepts of a phenomenon, which can be refined and elaborated on with the use of empirical evidence (Lee, 2014). The empirical evidence can be gathered within different target entities, allowing for the researcher to compare their results. The downside of a QCA is that it focuses on single effects of individual variables, which can be insufficient when measuring complex phenomena such as DT CSFs and DT success (Kraus, 2018). When dealing with a high degree of complexity Kraus (2018) suggests using an alternative QCA method, namely a fuzzy-set qualitative comparative analysis (fs/QCA).

Instead of focusing on single effects of individual variables, a fs/QCA can help identify causal relationships through sets and investigate how combinations of causal relationships are connected within contextual conditions (Kraus, 2018). The fs/QCA can be used to understand the constructs of DT CSFs and DT success and it can identify different causal combinations, within different target entities, that lead to the same success. According to Kraus (2018), fs/QCA is an appropriate method when an outcome, such as success, can have more than one cause. The literature is not particularly unanimous on the key driver, or cause, of DT success. Therefore, the fs/QCA methodology can contribute to the identification of different causal connections within organizations that lead to DT success.

To contribute to the existing literature, a richer theoretical perspective can be developed by using qualitative research methods (Saunders et al., 2019). A qualitative research method can be designed using one (mono) or multiple (multi) qualitative data collection methods, such as semi-structured interviews or observations (Saunders et al., 2019). The data will mainly be collected by using semi-structured interviews, as researchers often use these when conducting explanatory research to identify an underpinning reality by comparing participants' responses (Saunders et al., 2019). By interviewing with a predefined list of themes related to DT CSFs and some key questions, the researcher can guide each interview (Saunders et al., 2019). To consistently use the same theoretically-deduced DT themes, the results of each research participant will be valid and will be comparable between the target entities within the research context (Saunders et al., 2019).

The financial metrics from the interview questions for each case organization will be enriched by doing desk research. For each case organization, this will be done by gathering information from their websites, using financial statements (which is a standardized way to report financial information about an organization) and using annual reports of the public listed TLSPs where it is publicly available. The financial information includes a balance sheet (which is the organization's statement on their financial position) and an income and cash flow statement. Those financial statements also elaborate on the financial metrics revenue growth, EBIT growth and (digital) ROI. The figures also show a trend in organizational growth in comparison to the previous years. In the situation where the information is only partially available via the financial documents, the research participants will be asked to specify these numbers and validate the numbers collected during the desk research. If specifics cannot be fully provided for all metrics, then the participant will be asked to provide an accurate range. This range is validated using a Dutch TLSPs report called *"Top 100 logistics service providers"* on the facts and figures of these organizations in the years 2020 and 2021.

The number of cases analysed is twelve, as according to Fainshmidt et al. (2020), there should be at least twelve cases to guarantee the identification of data patterns, which can facilitate an inductive analysis. The analysis should then be able to prove that the resulting patterns generated by the fs/QCA can lead to broader generalizations and theories. Selecting more than twelve case organizations will drastically increase the workload and will not fit within the given time for the research. The cases will be selected based on purposive sampling: the researcher's judgement will be used to identify the cases that can help to answer the research questions (Saunders et al., 2019). The type of purposive sampling will be homogeneous sampling, as it can ensure similar occupation levels and hierarchy within the target entities (Saunders et al., 2019). The reason for using purposive sampling is because in a case-oriented research approach there is a need to select cases with in-depth knowledge on the research theme to ensure the feasibility of answering the research questions. This can often not be achieved while using a random sampling technique (Thomann & Maggetti, 2017).

Within the case organizations, contact will be made with management teams involved with the DT activities of their organization. In case these people are not available for research participation alternative roles will be identified as a replacement. To prepare for the interview, a list of interview themes and questions to be discussed are shared beforehand. In case of unclarity, contact is made with the participant and in some cases, new participants will need to be introduced to better fit the content of the interview. By applying an initial check on the base level of knowledge on DT activities of the participant within the organizations it can be made possible to ensure a high-quality research participant for the interview. During the interview, all research participants will be asked the same questions from the interview protocol related to the seven DT CSFs and to the DT success metrics.

To be able to study and distinguish the differences in DT phenomena within multiple TLSPs, a fuzzy-set quality comparative analysis (fs/QCA) will be conducted, which relates to case-oriented research (Lee, 2014). The fs/QCA will be conducted using the approach by Pappas & Woodside (2021) as explaining in figure 3.1, a fs/QCA conceptual model. The contrarian case analysis step is skipped, as it is mainly used to examine the distribution of a relatively large sample to detect outliers (cases) that are not explained by the main effect. A process that is difficult to execute correctly with a small sample size (Pappas & Woodside, 2021).
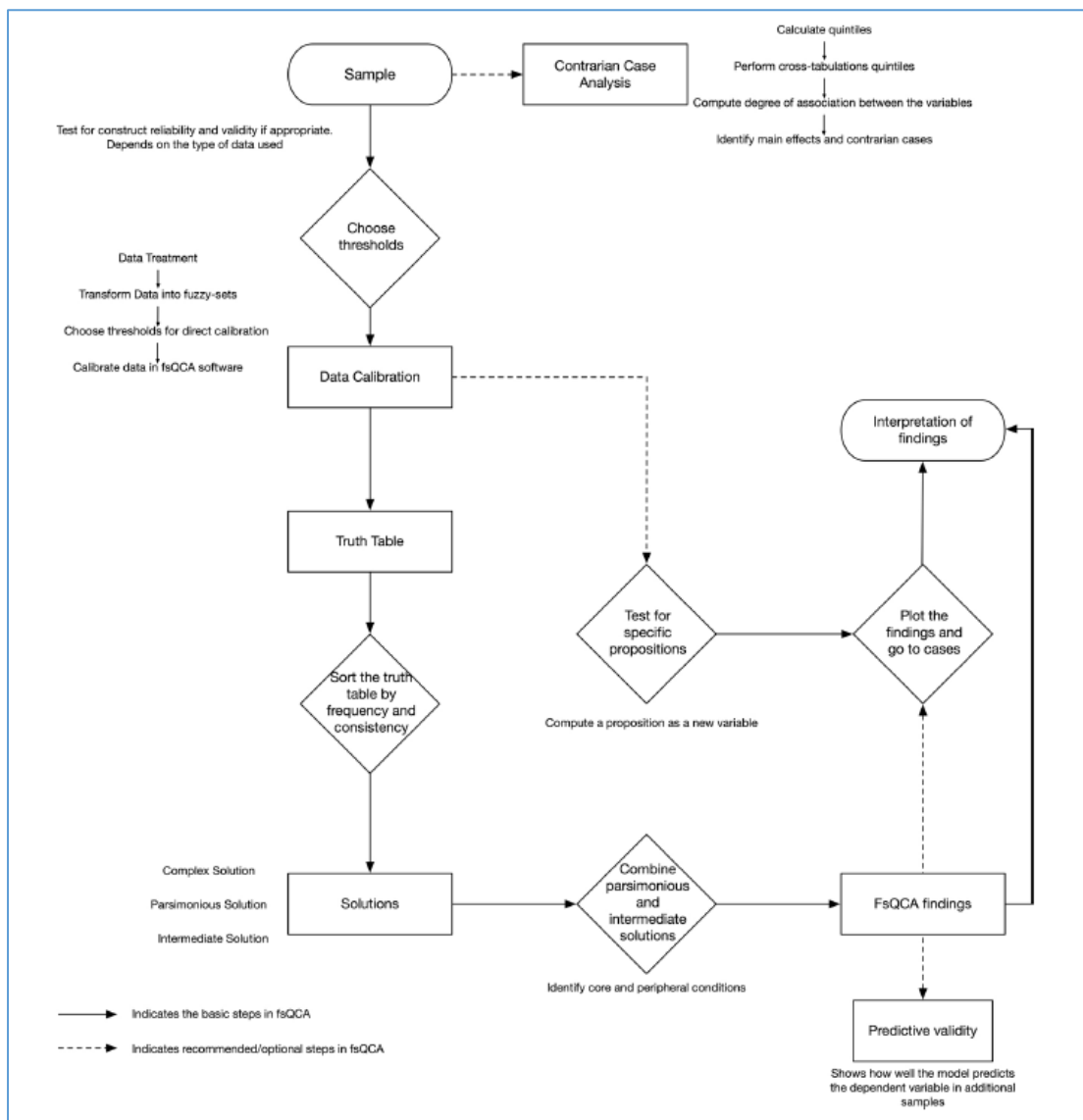

Figure 3.1: Conceptual model of fs/QCA steps (Pappas & Woodside, 2021)

3.3   Data analysis

3.3.1   Sample preparation

The constructs as shown in the conceptual model of figure 2.3 belong to sets of causal conditions and a set of the outcome. The seven IVs belong to three sets of causal conditions and the DV belongs to one set which is the outcome. To measure these constructs they each have their scale items assigned to them. The interview questions are linked to one or multiple scale items, which measure the construct. A full list of interview questions related to the constructs discussed in this chapter can be found in Appendix A: Interview Protocol. The scoring table is a 5-point Likert scale and each scale item is given a score between 1-5, based on the scoring table of the scale items, which can be found in Appendix B. The score of the scale item is calculated by combining the scores of all associated interview questions and dividing it by the number of associated questions. Once the scores of the scale items are calculated, the score of the constructs can be calculated as well. This can be done by combining the scores of the scale items associated with the construct and dividing the total number by the number of associated scale items. In the example of the construct "Adoption of digital technologies" the score is based on 5 scale items; *adoption of social technologies, adoption of mobile technologies, adoption of analytical technologies, adoption of cloud technologies and the adoption of IoT technologies.* The score of the construct is the average score of the combined scale items. After completing this for the remaining constructs, the result is a list of 8 constructs and their associated score between 1-5.

3.3.2   Data calibration

With set theory the membership of theoretical concepts, or objects, within a set is fixed; either the object belongs to a set, or it does not. The difference with fs/QCA is that the sets contain objects that have a degree of membership and can be partially included in a set (Lee, 2014). Determining the degree of membership, between 0 and 1, is done during the research by using theoretical knowledge from the literature related to the objects in the set, and is called calibration. By doing so the research allows it to be compared quantitatively (Lee, 2014).

Data treatment

Once all the constructs of both the IVs and DV have been measured according to the calculation based on the associated scale items it is possible to move onto the next step of the fs/QCA; data calibration. Instead of working with probabilities, the ordinal data of the Likert scale scores are transformed into membership scores. The score explains the degree to which a case belongs to a specific set. For example, the variable "*digital awareness*" can be coded to the condition "high digital awareness" and by transforming the data into a membership score, it is possible to identify the presence, or absence, of this condition. The same transformation of scores is done for the rest of the variables.

Transforming data into fuzzy-sets

The second step of the fs/QCA is to calibrate the variables, creating fuzzy sets with a membership score, or value, ranging from 0 to 1. The value represents the degree to which a case belongs to the calibrated variable. A score of 1 means the case is fully in the set, a *full member,* and a score of 0 means the case is fully out of the set, a *full non-member*. In case the score is 0.5 and exactly in the middle, the case belongs to both the *full member* and *full non-member* set. This is called the *intermediate set* and has maximum ambiguity regarding belonging to a specific set. The data calibration is the process of determining the values of the three levels of membership in the set (full member, full non-member and intermediate) (Pappas & Woodside, 2021). To maximize the

information contained in a 5-point Likert scale calibration, a direct calibration can be done in which the three levels of membership are chosen (Emmenegger, Schraff & Walter, 2014). Direct calibration also allows for easier replication and validation by other researchers (Pappas & Woodside, 2021). In this case, the normally distributed 5-point Likers scale is calibrated as shown in table 6.

Table 6 - Membership table

Membership thresholds	Likert scale point	Membership score
Full-set membership	5 point	0.95
Full-set non-membership	1 point	0.05
Intermediate-set membership	3 point	0.5

As shown in the above table, the exact values 1 and 0 for full-set (non-)-membership are not being used. According to Emmenegger et al. (2014) that is because otherwise, the thresholds would correspond to negative and positive "infinity".

Calibrating the data in fs/QCA software

For the calibration of the data set, a fs/QCA program of Ragin & Davey (2016) is used. In the "Calibrate" function of the program, the three thresholds are configured. Naturally, the cases that are exactly 0.5 or within the intermediate-set membership drop out of the analysis. Due to the low number of samples, it is desired to have as many cases as possible included. To overcome the fact that intermediate-set memberships are removed from the analysis, Pappas & Woodside (2021) suggest adding a constant of 0.001 after the calibration is done to all the causal conditions that do not belong to the full-set membership of 1. As mentioned by Lee (2014), the membership scores of the causal conditions (X_i) need to be calculated the same way as the membership score of the outcome (Y_i). With membership scores being furthest away from the cross over point of 0.5 it means that either the membership scores of one of the causal conditions are consistently more (or equal) to the score of the outcome ($Y_i =< X_i$ – necessary condition) or consistently less than (or equal) to the outcome's score ($X_i =< Y_i$ – sufficient condition). To discover if the causal conditions are either a necessary or sufficient condition it is important to calculate all the causal conditions within all of the selected cases (Lee, 2014).

3.3.3   Run truth-table algorithm

After the calibration of all variables, the data sets include both versions of the variable, the ordinal variable and the fuzzy-set variable. The next step is to run the truth-table algorithm and select the causal conditions (IVs) and the corresponding outcome (DV) for the analysis. The output of the truth-table algorithm is a list of 2^k combinations of causal conditions, called configurations, where k is the number of causal conditions (IVs) associated with the outcome (DV) (Lee, 2014). For example, in the 'Digital Awareness' set the causal condition 'Awareness of Digital Triggers' can either have a high awareness of digital triggers value (T) or a low awareness value (t).

Additionally, for the causal condition 'Awareness of Transformation Impacts,' it can either have a high awareness of transformation impacts (I) or low awareness of transformation impacts (i). These causal conditions lead to the following possible causal combinations:

X1 = high awareness of digital triggers with high awareness of transformation impacts (**TI**)

X2 = high awareness of digital triggers with low awareness of transformation impacts (**Ti**)

X3 = low awareness of digital triggers with high awareness of transformation impacts (**tI**)

X4 = low awareness of digital triggers with low awareness of transformation impacts (**ti**)

A full list of causal combinations and corresponding causal conditions can be found in Appendix C.

To explain the causal relations it is necessary to develop an equation in which either a *"logical and"* or a *"logical or"* is applied. The *"logical and"* is applied when there are >2 causal conditions in the set and is written as * in the equation. The *"logical or"* is applied when there are only 2 causal conditions and is written as + in the equation (Lee, 2014). In the scenario that the empirical research identifies three causal configurations in cases that show a 'High digital transformation success (S), for example, high awareness of digital triggers, high awareness of transformation impacts (TI), high triggers, low impacts (Ti) and low triggers, high impact (tI) it means that these three causal configurations can constitute to the causal conditions for high digital transformation success. Resulting in;

S = TI + Ti + tI

This shows that if "a high awareness of digital triggers" (T) or "a low awareness of digital triggers with a high awareness of transformation impacts" (tI) exists, the digital transformation success is high. It also shows that if high awareness of digital triggers (T) exists it is a sufficient condition for high success (S), regardless of i/I. With that logic in mind, the following equation can be made:

S = TI + Ti + tI

S = T(I+i) + tI

S = T + tI

To assess the relationship between the variables it is required to set a frequency threshold. A high frequency threshold will drastically reduce the coverage of configurations eligible for the analysis. According to Ragin (2008), a frequency threshold of 1 or 2 should be applied in a case where the sample size is small. The next step is to filter the table by "raw consistency" and set a consistency threshold, with a minimum recommended value of 0.75 (Pappas & Woodside, 2021). Secondly, for fuzzy sets, it is also important to look to the software's calculated PRI (Proportional Reduction in Inconsistency) as an alternative measure of the consistency of subset relationships. According to Pappas & Woodside (2021), the PRI consistency score should be used to "avoid simultaneous subset relations of configurations in both the outcome and the absence of the outcome (i.e. negation).". The PRI consistency score should also be high, at least 0.75, and a value below 0.5 indicates significant inconsistency (Pappas & Woodside, 2021). For fuzzy sets, there is a third consistency score calculated, namely the SYM consistency (Symmetric Consistency), which is used to examine the presence and absence of the outcome. Here, the same consistency threshold should be applied (0.75). When the thresholds are kept too low it can result in more necessary conditions, which can reduce false negatives (type 2 errors), but increases false positives (type 1 errors) (Pappas & Woodside, 2021). When dealing with a relatively small sample size it is possible to not meet all configurations in every case. In that case, the 'truth table' requires adjustments and the focus within the analysis is to determine the combination of conditions that are deemed relevant towards the outcome (Kraus, 2018). By coding membership scores to 0 when the consistency score is below the threshold of 0,75 and the scores to 1 when the consistency score is above 0,75 allows the exclusion of causal conditions that are not relevant towards the outcome. By using the fs/QCA's frequency and consistency threshold algorithms, the truth table can be reviewed, the causal combinations are simplified and the solutions leading to the outcome are minimized (Kraus, 2018).

3.3.4   Obtaining solutions

The fs/QCA analysis computes three solutions; complex solution, parsimonious solution and intermediate solution. The solutions are combinations of configurations supported by cases and have the rule "the combination leads to the outcome" consistently applied (Pappas & Woodside, 2021). In short, the solutions are described in the following way:

- *Complex solution*: This shows all possible combinations of conditions for which logical operations are applied.
- *Parsimonious solution*: This shows the "core conditions", which are conditions that cannot be left out from any solution and are a simplified version of the Complex solution.
- *Intermediate solution*: This uses a subset of the parsimonious solution and should be consistent with theoretical and empirical knowledge. Based on this solution, variables can be adjusted to "only present" or "only absent" or "either" when explaining the outcome. Decisions made in this regard need to be backed with theoretical knowledge. The conditions removed in the parsimonious solution are added to the intermediate solution and are called "peripheral conditions".

3.3.5   Interpreting and presenting the obtained solutions

First, it is important to identify the "core conditions". The intermediate solution contains both the peripheral and core conditions, but these peripheral conditions are removed from the parsimonious solution (Pappas & Woodside, 2021). Therefore, to identify the core conditions, a parsimonious solution can be used. After that is done, the parsimonious solution can be combined with the intermediate solution to show a detailed and aggregated overview of both the core conditions and the peripheral conditions in the findings. To improve the presentation of the combined parsimonious and intermediate solutions, the results can be transformed into a more readable table that shows the different configurations, the number of solutions and the consistency and coverage percentages. Consistency focuses on the relation between the sub-sets of conditions and the outcome and is used as a reference to identify the degree to which cases share (combinations of) causal conditions. The coverage shows how relevant the conditions are towards the outcome, as a low degree of coverage suggests multiple paths leading to the same outcome (Kraus, 2018).

3.3.6   Testing of specific propositions

Once the solutions from the fs/QCA results have been identified, it is possible to test specific propositions, see how many cases from the sample relate to those propositions (Pappas & Woodside, 2021). This can be done by creating a model in the fs/QCA software while plotting it against the outcome. The model containing the combination of causal conditions can be seen as one variable and can be computed using the *fuzzyand(x,…,)* function in the fs/QCA software, using the present variables as input (Pappas & Woodside, 2021). As the last step, the model, the newly created fuzzy set of the proposition, is plotted against the outcome using the XY Plot in the fs/QCA software. Pappas & Woodside (2021) suggest that models with a consistency of > 0.80 are eligible for theory advancement. After interpreting the obtained solutions and testing specific propositions that came out of the fs/QCA analysis, the main research question "*What are Critical Success Factors of a Digital Transformation for Traditional Logistics Service Providers in The Netherlands?" c*an be answered.

3.4 Reflection w.r.t. validity, reliability and ethical aspects

Conducting sound explanatory research is important. This paragraph elaborates on key characteristics of research quality, such as internal and external validity, reliability and ethical aspects. This is to ensure that the research methodology and research design are sound.

3.4.1 Internal validity

For a QCA, and more specifically for a fuzzy-set QCA, the data calibration of membership scores can be a risk of the internal validity of the results. As researchers are expected to use their expertise in the research area to do the calibration with the subjectiveness can lead to a flawed calibration process that can in the end lead to inaccurate results (Fainshmidt et al., 2020). The methodology must be formulated in a way that establishes a cause-and-effect relationship between the intervention that is researched and the findings of the research (Saunders et al. 2019). The research findings can become invalid when checks are not put in place to support the cause-and-effect relationship. Incorrect variables can be identified this way, resulting in the wrong use of data in the data analysis (Saunders et al., 2019). It can also become possible that there is a lack of understanding of the actual cause and effect within the different causal conditions. To prevent a flawed calibration process from occurring, the process itself will be documented and will include the rationale behind made decisions. Additionally, any misinterpretation can be avoided by creating a thorough theoretical background in combination with empirical arguments that supports the claim that the reasoning from data to conclusions is fundamentally well-grounded (Saunders et al., 2019).

3.4.2 External validity

The fs/QCA is a case-oriented research approach that focuses on a small to medium-sized sample (N). Because of a relatively small N, external validity plays an important role. The external validity or statistical generalisability of the research tells whether or not the findings of the research can also be applied within a different context, such as a different organization (Saunders et al., 2019). It can be difficult to achieve a high external validity when the sample is not entirely representative. However, several fs/QCA tools can support in providing statistical measures to ensure necessity and sufficiency claims (Thomann & Maggetti, 2017). Additionally, possible confusion regarding the external validity of the research can be avoided by making the empirical scope of the argument explicit and combine it with a solid elaboration on the case selection rationale (Thomann & Maggetti, 2017). The importance of the generalisability of the research results can also lie in smaller settings, where the characteristics of the research are similar. The learnings from the research setting can also benefit future research (Saunders et al., 2019). Regarding the transferability of the research, the research must be documented in a way that is self-explanatory for future studies related to the same, or a similar, topic (Saunders et al., 2019). Overall, for the external validity of fs/QCA results, the assumptions made on the degree of membership scores of the causal conditions within a case must be explained, especially when there is limited diversity in the outcome of the scores (Thomann & Maggetti, 2017).

3.4.3 Predictive validity

For the fs/QCA, an additional validity is relevant to consider during the research: predictive validity. Testing solutions on predictive validity shows to what extent the model can predict the dependent variable for additional cases from a different sample (Pappas & Woodside, 2021). First, the sample needs to be randomly split up into two samples; a sub-sample and a holdout sample. For the sub-sample, the same fs/QCA analysis is performed as the original sample. Via the fs/QCA software, a truth table is generated for the sub-sample. The findings of the fs/QCA for the sub-sample show eligible solutions and each solution is regarded as a model in the testing for predictive validity.

As a next step, the holdout sample is used to model the presence and absence of variables identical to the results of the sub-sample creating one variable per model. This is done using the *fuzzyand(x,…,)* and *fuzzynot(x)* functions of the fs/QCA software (Pappas & Woodside, 2021). Once the solutions from the sub-sample have been modelled in the holdout sample, each variable (model) is plotted against the outcome variable. The results are shown in a separate plot per model and show a consistency and coverage score per model. If the consistency and coverage scores are similar for both samples it means that the model has high predictive validity and can be used for further testing using a larger sample size.

3.4.4   Reliability

Reliability refers to the ability to replicate the research consistently by achieving the same findings while using the same research design (Saunders et al., 2019). For the fs/QCA methodology, It is important to thoroughly document the steps taken while conducting the research. It is also important to document the interview protocol well, use the same protocol for all interviews and make sure that changes made during the data analysis phase are logged. This allows for backtracking to earlier versions of the document and helps to better understand the research steps that have been taken (Saunders et al., 2019). During the interviews, it is also important to avoid any participant or research error. This can be done by avoiding certain factors that alter the way the participant or researcher performs. Similarly, participant and research bias should be avoided as well, by removing factors that allow for false responses, or the researcher's recording of these responses (Saunders et al., 2019).

3.4.5   Ethical aspects

Within the field of research, there are codes of ethics to evaluate risks and avoid poor, or unethical, a practice which is called non-maleficence. These codes are also there to promote good ethical practice, called beneficence (Saunders et al., 2019). It is important to understand and identify the potential harm that can come from the way the research is conducted. To make sure that the research is conducted in an ethical way the researcher will obtain consent from potential participants of the semi-structured interviews before starting. The participants will be informed of the procedure of the interviews beforehand. The researcher will also ensure to protect the confidentiality of what is discussed during the interviews and will anonymize the information of participants used in the research. The researcher will make sure to honour any agreements made with either participants, organisations or other relevant parties involved in the study. Lastly, participants are allowed to withdraw from the research at any given time. If data is already gathered at this stage it will be discussed with the participant what can and will be done with this information.

4. Results

4.1 Introduction

The organizations that have been selected for participation in the research are logistics service providers in The Netherlands. To research a broad selection of organizations the decision was made to select two types of logistics organizations as a case organization; namely Second-Party-Logistics (2PL) and Thrid-Party-Logistics (3PL) organizations. According to Fainshmidt et al. (2020), a fs/QCA requires a minimum of 12 cases to be able to guarantee the identification of patterns in data and confirm an inductive analysis. To be able to do sound research it was therefore required to have at least 12 logistics organizations participate in the research. For this research, 34 organizations were approached to participate in the research, but due to unavailability, unfitting roles of participants within the organization, or lack of knowledge on the topic of digital transformation, only 12 case organizations have been selected to participate, of which 6 are 2PL organizations, and the other 6 are 3PL organizations. The entire group of 12 organizations will be used in the comparative analysis. Within the case, organizations contact was made with management teams involved with the digital transformation activities of their organization. During the interview, all research participants were asked the same questions from the interview protocol related to the seven DT CSFs and DT success. After conducting 12 interviews, one at each organization, 12 case organizations have been identified for the research. In this paragraph, a short background story of each organization will be provided.

4.2 Case organizations

Organization A

Type: Company-owned 2PL – *Experience in logistics:* > 100 years - *Employees in The Netherlands: >* 3000 employees - *Net revenue in The Netherlands: > €500 million*

Interview conducted with a strategic IT manager with over 8 years of experience in the field of digitalizing and transforming the organization's logistics services and currently manages the digital transformation activities of the organization within The Netherlands. **Digital Awareness:** According to the research participant, the organization has noticed changes in the competitive landscape throughout the years of working for the organization, mentioning that "traditional logistics service providers (TLSPs) have the resources while digital natives have the IT systems". "Digital natives have the benefit over TLSPs that, with their strong IT capabilities, can offer 100% digitized and automated services." says the participant, but concludes that "Despite this advantage, TLSPs can offer something that digital natives more often do not possess, which is a strong logistical backbone. This backbone in combination with an established network has proven to be crucial, especially during COVID-19. ". **Digital Adoption:** A broad adoption of SMACIT-related technologies show that the organization is implementing new technologies within multiple fronts and are particularly active within the domain of social technologies. Social interactions in- and outside of the organization are facilitated with the use of a variety of social platforms. **Digital Endorsement:** The participant explains that the organization actively involves employees and management in the transformation activities. He says, "We try to involve employees from all levels of the organization, by introducing them to internal communication related to our DT activities, but also by offering them a digital platform to keep track of the progress we make. The organization thinks that the employees are the driving force behind the transformation.".

Organization B

Type: Family-owned 2PL – *Experience in logistics: 75-100* years - *Employees in The Netherlands:* > 3000 employees - *Net revenue in The Netherlands:* unknown

Interview conducted with a strategic manager with over 15 years of experience within TLSPs, of which the last 7 at the organization. Responsible for the management of the organization's logistics services and the supply chain, he is actively involved with the digital transformation activities of the organization for around 3 years. **Digital Awareness:** When asked about the changes in customer behaviour, the participant mentions that providing transparency with the use of digital technologies has become a unique selling point of the organization and provides customers with the necessary trust to do business with them. **Digital Adoption:** The strength of the digital transformation of the organization lies within the field of data analytics, as the participant mentions that "BI & Analytics is the engine behind the organization's success". **Digital Endorsement:** Although the organization has known success with their digital transformation journey, he sees challenges in the speed at the transformation is being adopted throughout the organization. "Changing the organization's existing culture is difficult, as it requires a lot of convincing that the activities we undertake have a purpose within the larger scheme of things. I usually describe it with the following metaphor: You throw a rock in a pond, which creates a ripple effect of small waves, then you need the wind to change the small waves to larger ones. That is also what is happening here. The introduction of the transformation is the rock, the multitude of DT related projects is the wind that is causing the change.".

Organization C

Type: Company-owned 2PL – *Experience in logistics:* 25-50 years - *Employees in The Netherlands:* 500-1500 - *Net revenue in The Netherlands: < €250 million*

The interview was conducted with a strategic business developer with over 20 years of experience within the field of logistics and in its current role focussed on developing existing logistics services more digitally. **Digital Awareness:** According to the participant, they have been able to increase the relationship with their customers and partners due to process automation and having data available to help with the decision making. He mentions that "The use of digital technologies has had a direct impact on the quality of the work we deliver and is making the life of our employees a lot easier. In addition, we see that these digital technologies lift the barriers to connect with our external organization from all over the world.". **Digital Adoption:** According to the participant, there are a lot of changes within the field of digital technology currently being adopted within the organization. After the implementation of a data analytics platform, the next step for the organization lies in moving the majority of the organization's infrastructure to the cloud. The strength of the organization lies in the fact they can collect and store data throughout their business processes, allowing for monitoring and analyses benefiting all business units. **Digital Endorsement:** When asked how the organization involves employees and management with the transformation activities, the participant replies: "All layers of the organization need to be involved, to ensure success throughout the organization. That is also why we offer digital courses and training sessions to embed this way of working more into our organization. You start with a big concept, and slowly break it down into smaller pieces of work".

Organization D

Type: Company-owned 2PL – *Experience in logistics:75-100* years - *Employees in The Netherlands:* 500-1500 employees - *Net revenue in The Netherlands: unknown*

The interview was conducted with an innovation manager who has been working for the organization for the last 7 years and is currently part of their innovation team. The team focuses on co-ordinating and implementing new business solutions and notices that more often the digital technologies have a leading role in development. **Digital Awareness:** The participant mentions that "Sustainability is becoming an increasingly more important measurement tool for our business solutions and is more often becoming a reason why we make certain decisions". Next to that, COVID-19 has also shown the importance of sustainability in relation to innovation. He says: "It is usually a disruptive event such as this one, that becomes a cataclysm for innovation.". **Digital Adoption:** The organization has taken the biggest steps within the field of data analytics. All relevant systems and applications have been linked to a centralized data warehouse. Here they transform data from these applications into valuable insights. For IoT appliances, there is still a lot to improve within the organization, and those technologies have become their focal point for the next few years. Another focus point for the organization has become sustainability. **Digital Endorsement:** The participant explains that the organization tries to use her employees as a "sounding board" to translate conceptual themes related to digital transformation into concrete activities. Despite these efforts, he does see some challenges regarding employees: "We try to look for effective ways to involve our employees, but the involvement varies per employee. Some people know enough with just one word, but others are not so technically minded and require more effort to get them involved.".

Organization E

Type: Company-owned 2PL – *Experience in logistics:* 25 - 50 years - *Employees in The Netherlands: >* 3000 employees - *Net revenue in The Netherlands: > €500 million*

The interview was conducted with an IT director who is responsible for the acceleration of the digital transformation of the organization. Their current focus is to accelerate their transformation throughout the organization. **Digital Awareness:** When asked about the level of competitiveness within the market, Person E mentions that this has drastically changed since the increased use of digital technologies. He says that "Our competitors are no longer just other TLSPs. Competitors are coming in from all different angles, focussing heavily on technology while keeping the customer experience at the centre.". The introduction of digital technologies has changed the relationship of the organization with its customers, but also with the suppliers: "A traditional supply and demand model is no longer something we actively look for with our suppliers. We need to shift from supplier to partner because otherwise, the benefits become smaller and smaller.". When asking about the differences, he mentions that "In a partnership, both parties take a risk. In a world where business models, products and services change, you need a partner that is willing to take those risks with you.". **Digital Adoption:** Looking at the use of digital technologies, the participant explains that the organization is a front runner within the field of cloud technology: "Around 99% of our storage is cloud-based. Our standard has become a cloud-native approach for all our applications.". **Digital Endorsement:** To enlarge the transformation participation of both employees and management the organization has set up a "digital academy". According to the participant, this academy is meant to speed up the organization's transformation process, by actively involving all kinds of employees throughout the organization.

Organization F

Type: Company-owned 2PL – *Experience in logistics:* 50-75 years - *Employees in The Netherlands:* < 500-1500 employees - *Net revenue in The Netherlands: 250-500 million*

The interview was conducted with the head of digital transformation, which is a newly created role within the organization for about a year. Before this role, he was head of IT of the organization for the last 8 years. Person F founded and leads the digital transformation department, which is a department that, as he mentions, "focuses on bringing the customer focus into play.". **Digital Awareness:** The birth of the new department related to digital transformation was originated due to an increasingly changing customer behaviour. According to the participant, the organization wants to move away from being reactive to customer pressure, and become proactive again to solve these kinds of issues. **Digital Adoption:** The current technologies used within the organization emphasize a lot on cloud technology. Since the start of the organization around 20 years ago, a cloud-native strategy that offers cloud infrastructure and services was one of the key strategic points. Where they initially started with a privately hosted cloud using their own data centres they are now migrating more services towards the public cloud. One of the technology areas where no real developments have taken place yet is within the field of IoT. Looking into better tracking options via IoT technologies is something they look into implementing. **Digital Endorsement:** The participant explains that especially the speed of adoption of the digital transformation is still a challenge, as he says: "It is easy to use new technologies, but it is really difficult to apply a cultural change within the organization. We need a mind shift in which we have an iterative experimental approach to test new things and challenge the status quo on an ongoing basis.". Despite the challenges, the participant is also optimistic: "We try to make the impossible possible, and the decisions we are taking with regards to the digital transformation also go into that direction.".

Organization G

Type: Public listed 3PL – *Experience in logistics:* > 100 years - *Employees in The Netherlands:* unknown *Net revenue in The Netherlands:* unknown

The interview was conducted with the head of the customer technology department of the organization. Within this department, his team manages the end-to-end product creation and implementation of technologies for their customers' supply chains. **Digital Awareness:** The participant talks about the impact that digital technologies and explains the impact it has on the relationship with their supplier: "Technology provides you with more transparency and this transparency gives you more visibility across the chain. The same logistics services have been developed for the past 100 years, but today, with the introduction of technology, the quality of these services becomes more transparent. The technologies give us more power and control over the relationship we have with our suppliers.". **Digital Adoption:** According to the participant, the organization has focussed heavily on cloud-based solutions, as it offers the scalability benefits that the organization is looking for. The participant explains that digital technologies are just a means to the organization's transformation. He says, "Companies need to transform their business, and a lot of the business requires technologies to stay competitive. However, organizations need to look at not just the development of new software, but rather the transformation of the entire organization. **Digital Endorsement:** When talking about the adoption pace, he explains that for the digital transformation the organization has quite some heavy processes put in place. He says, "Because of the heavy involvement of many high-level people, it can become a roadblock. A pretty big roadblock, which is not open for a lot of innovation and creativity".

Organization H

Type: Privately-owned 3PL – *Experience in logistics:* >50 years - *Employees in The Netherlands:* 500-1500 employees - *Net revenue in The Netherlands: 250-500 million*

The interview was conducted with the head of IT of the organization and within that role involved with the digital transformation strategy of the organization. His team focuses heavily on the automation and digitization of existing business processes and creating interlinked platforms to undergo this transition. **Digital Awareness:** When asked about the changes the organization is already noticing due to the increased use of digital technology, the participant mentions their relationship with customers: "Due to the interconnection with customers we no longer talk about a transaction, but about a partnership. The relationship evolves, as digitization allows us to be in a constant connection with one another. ". **Digital Adoption:** According to the participant, the organization's ambition is to further digitize on all fronts and this has also been embedded into a new digital strategy. No technology stands out in terms of increased adoption. However, he does mention that there is still a lot of ground to cover within the fields of data analytics and IoT specifically. **Digital Endorsement:** When asked about the digital transformation pace he is optimistic, as the organization has picked up the speed at which they want to implement strategic changes. However, the organization is still very early in its transformation process. The participant explains, "The organization's way of working is still very traditional. We have set a strategic milestone to fully digitize our services in the upcoming years and have divided this transformation into 9 levels. Currently, we are at level 2-3 as we are paving a path that can facilitate in a companywide adoption and transformation.".

Organization I

Type: Family-owned 3PL – *Experience in logistics:* > 100 years - *Employees in The Netherlands:* 1500-3000 employees - *Net revenue in The Netherlands: > €500 million*

The interview was conducted with a program manager leading a team responsible for the implementation of supply chain process optimizations and digitalisation. **Digital Awareness:** In the interview, the participant was asked to elaborate on changes that have been identified due to the ongoing transformation activities. He says that "The use of technologies allows us to be more transparent towards our customers and partners, resulting in new business that we would not have gotten without the use of these technologies. On the other hand, it is also noticeable that the market is expecting a lot more from us now that we digitally offer certain services. Customer expectations and behaviour is changing because of that, and we need to make sure we keep meeting those demands.". **Digital Adoption:** The organization is particularly active within the field of data analytics. Via a centralized data engineering team, the organization is capable to create data insights to support certain decision making. When asked about technologies that have yet to be adopted, Person I mentioned IoT technologies and considers this a technology that should be further investigated soon. **Digital Endorsement:** The speed at which data analytics technologies have been adopted also translates to the broader DT adoption pace of the organization. When asked about this, he says: "The digital transformation is part of our IT and automation strategy, in which individual projects, such as the data analytics implementation, contribute to the overall increased adoption of technologies within the organization.".

Organization J
Type: Public-listed 3PL – *Experience in logistics:* > 100 years - *Employees in The Netherlands:* 1500-3000 employees - *Net revenue in The Netherlands: > €500 million*

The interview was conducted with an IT & Change manager who has nearly 40 years of experience within the field of logistics and is in his current role responsible for the digitization, change management and overall transition of the organization. **Digital Awareness:** The participant talks about the ongoing pandemic, and mentions it as a prime example of how the organization managed to deal with this disruption and use it to further expand their transformation activities. He says, "Before COVID-19 our organization was already taking steps in transforming our business, but especially now we see that the platforms we have built allow us to connect everything and everyone in a digital way.". The integrated digital platforms have also changed the relationship with customers. He says, "Because organizations invest a lot of time and resources to connect their system to ours, we establish a relationship of higher quality that is also expected to last for a longer duration than before. Being interlinked with one and another can create a dependency and an incentive to do business again in the future.". **Digital Adoption:** Especially within the field of data analytics the participant has seen a lot of progress in terms of implementation projects. When asked which area still has room for improvement he mentioned mobile technology and says, "For a large organization such as ours the implementation of these technologies can be difficult, as most systems are already predefined and standardized. Not in all cases do these standardized services offer the flexibility we would like within the field of mobile technologies.". **Digital Endorsement:** When asked about where the organization currently stands with involving employees in the transformation activities, the participant responds "The employee's involvement is still in its infancy." The first project has started for some of the management teams, and will eventually also be shared with a bigger group of employees throughout the organization.

Organization K
Type: Company-owned 3PL – *Experience in logistics:* > 100 years - *Employees in The Netherlands:* 1500-3000 employees - *Net revenue in The Netherlands: 250-500 million*

The interview was conducted with a general manager who is involved with the roll-out of digitized solutions within the organization. The solutions focus on automation and customer focus. **Digital Awareness:** The participant notices the effect the digital transformation activities have on other employees within the organization, as the lack of a well-structured initiative is holding employees back to actively participate in activities related to the transformation. He says, "The organization expects employees to take on initiatives related to DT on their own, where I believe the coordination of the transformation should not be dependent on the initiative of individual employees, but be part of the organization's strategy.". **Digital Adoption:** The organization is currently mostly actively implementing data analytics solutions, and have been able to connect multiple sources to a centralized data warehouse which allows them to actively measure performance, and analyse trends on micro and macro level on the acquired data. The organization is least active within the field of mobile technologies, due to projects related to these technologies still being in a pilot phase. **Digital Endorsement:** The current DT adoption pace is according to the participant not at a level where he would expect it to be as quite a few projects are taking longer than expected. When asked about the reason behind the delay, he replied: "In my opinion, this is related to management not being on the same page. The higher-level management should be leading by example, but in some cases lack the personal belief in the effectiveness of the transformation.".

Type: Company-owned 3PL – *Experience in logistics:* 50-75 years - *Employees in The Netherlands:* > 3000 employees - *Net revenue in The Netherlands: 250-500 million*

The interview was conducted with the head of innovation within the organization and responsible for an innovation program focussing on robotics, data-driven supply chain, consumer-driven supply chain and digital DNA. **Digital Awareness:** The participant is realistic about their current position on digital transformation when looking at competitors, and believe that the organization "Has a lot of catching up to do". When asked how he believes that the involvement of employees should be expanded. He says, "People feel the possibility to actively participate and when you are enthusiastic about the changes you can, but the organization is not actively challenging employees to become a part of the change.". **Digital Adoption:** According to him, the big investments in digital technologies have only taken place in the last few years. That also shows in the level of adoption within the different technologies fields, where the majority is at an early stage waiting to be further explored. He does mention cloud technology as a technology that is becoming more of strategic importance. New applications and systems will, where possible, primarily be dependent on the cloud. **Digital Endorsement:** The participant also explains that the adoption pace of DT is still at a very early stage. He does however believe the organization acknowledges the importance. When asked how that is shown within the organization he says, "The budget that is being made available, the roadmaps that are put in place and the speed at which we are currently developing new solutions.". The organization is testing the adoption of technologies on a smaller scale to see how they can be implemented within the larger organization.

4.3 Data analysis

The fuzzy set Qualitative Comparative Analysis (fs/QCA) is conducted using the approach by Pappas & Woodside (2021) as explaining in the conceptual model of figure 3.1 in chapter 3. The fs/QCA software of Ragin & Davey (2016) was used to calibrate the constructs and outcome of all case organizations. The results of the calibration and the overview of all 10 configurations can be found in Appendix E, Table I and Table II. Despite some TLSPs scoring higher than others on DT CSFs and DT Success, the scores show that all factors and metrics that were identified in the literature review are also present at the case organizations of this study. There are none with a neglectable score across all TLSPs. Although this paragraph focusses on the fs/QCA results specifically, it is also important to identify the individual scores per case organization. A full overview of the individual DT CSF scores per case organization can be found in Appendix F. For the individual DT Success scores per case organization this can be found in Appendix G. There is one characteristic that particularly stands out when looking at the individual scores of these TLSPs: 4 out of 6 2PLs scores high on DT Success, while only 1 out of 6 3PLs score high on DT Success. Suggesting that the 2PLs that participated in this research score higher on DT Success than the 3PLs.

4.3.1 fs/QCA analysis

For the fs/QCA analysis, all 7 constructs and the outcome are calibrated to "high" (i.e. high awareness of digital triggers). After the calibration of all variables, the truth-table algorithm is run and shows the list of configurations. Out of that list, only 10 configurations have a frequency of at least 1. The other configurations are removed from the list. After applying the 0.75 threshold for the raw, PRI and SYM consistency, 4 configurations, with a frequency of 5 cases, remain and are eligible for the analysis. The fs/QCA analysis computes the three solutions; complex solution, parsimonious solution and intermediate solution. To identify the core conditions the results of the parsimonious solution is used, which shows the presence of a combination of *high adoption of a digital business*

model and *high endorsement of cross-functional collaboration.* The parsimonious solution is then combined with the intermediate solution to show a detailed and aggregated overview of both the core conditions and the peripheral conditions in the findings. An overview of both solutions can be found in Appendix E, Table III and Table IV, and can be translated into Table 7.

Table 7 - Fs/QCA findings: Format by (Pappas & Woodside, 2021)

	Solution			
Configuration	1	2	3	4
Digital Awareness				
Awareness of Digital Triggers	⊗	●	●	●
Awareness of Transformation Impacts	●	●	●	●
Digital Adoption				
Adoption of Digital Technologies	●	●	●	⊗
Adoption of a Digital Business Strategy	⊗	●	●	●
Adoption of a Digital Business Model	⬤	⬤	⬤	⬤
Digital Endorsement				
Endorsement of Cross-Functional Collaboration	⬤	⬤	⬤	⬤
Endorsement of a Supportive Organizational Culture	●	●	⊗	●
Consistency	0.976	0.982	0.979	0.966
Raw Coverage	0.320	0.427	0.369	0.478
Unique Coverage	0.034	0.043	0.046	0.075
Overall solution consistency	0.973			
Overall solution coverage	0.611			

Note: Black circle (●) indicate the presence of a condition, and circles with "x" (⊗) indicate its absence. Large circle; core condition, Small circle; peripheral condition.

4.3.2   fs/QCA results

The overall solution coverage is 0,611 and shows that close to two-thirds of the outcome, high digital transformation success, is covered by these four solutions. A high consistency score of 0.973 explains that configurations with a similar composition result in the same outcome value, backing up the empirical evidence of the cases. From the results displayed in the table, the following findings can be identified: **Result 1:** For a high digital transformation success to occur, all 4 configurations suggest the presence of high awareness of transformation impacts, high adoption of digital business model and high endorsement of cross-functional collaboration. **Result 2:** In those solutions, high adoption of digital business model and a high endorsement of cross-functional collaboration are core constructs that show the relevance of these specific factors. **Result 3:** In solution 1, the two core constructs are supported with the presence of high awareness of transformation impacts, high adoption of digital technologies and high endorsement of a supportive organizational culture in combination with the absence of high awareness of digital triggers and high adoption of a digital business strategy. **Result 4:** For solution 2 they are supported with the presence of all other peripheral conditions, including a high awareness of digital triggers and high adoption of a digital business strategy. **Result 5:** Solution 3 and 4 have only one difference in comparison to solution 2, which for solution 3 is the absence of a high endorsement of a supportive organizational culture and for solution 4 the absence of high adoption of digital technologies leads to high digital transformation success.

The results highlight a combination of constructs that lead to the outcome, high digital transformation success. They also show that all identified constructs from the literature review are also present in at least one solution. To see how many case organizations from the sample relate to the presence or absence of those specific constructs a model can be tested using a specific proposition. Looking at the results, the proposition that can be used for the model to be tested is the following: *TLSPs having a high awareness of transformation impacts, high adoption of a digital business model and high endorsement of cross-functional collaboration will have high digital transformation success.* The model is plotted against the outcome using the XY Plot of the fs/QCA software. The results are shown below. In the figure, the Y-Axis is the outcome and the X-Axis is the proposition:
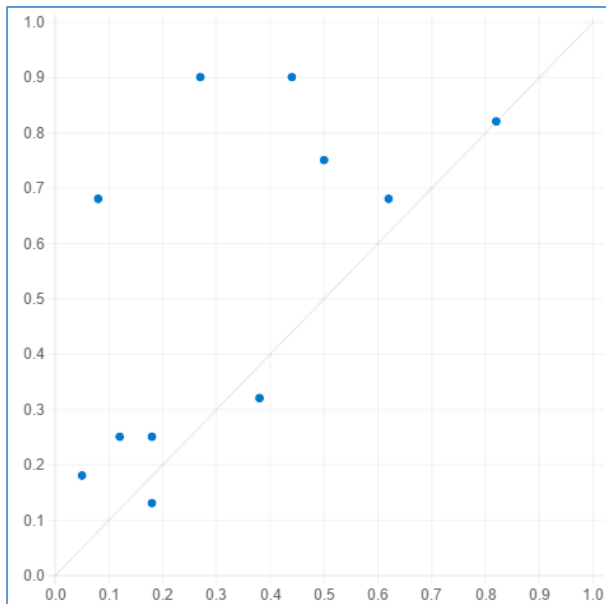
Figure 5.2: Plotting of the proposition

The results show that the proposition from the findings is supported by 8 cases, as the 3 cases in the top right corner show both a high presence of the proposition and a high presence of the outcome and the bottom left corner show that the organization with low digital transformation success also have a low presence of the proposition. The plot has a coverage of 0,608 and a high consistency of 0.973, which means that according to Pappas & Woodside (2021), it is high enough (> 0.80) to be useful and serve theory advancement.

4.3.3   Testing for predictive validity

An important step of the research is to test solutions for their predictive validity. The sample is randomly split into two sub samples. For the sub-sample the same fs/QCA analysis is performed as the original sample and the results can be found in Appendix E, Table V.

The findings of the fs/QCA for the sub-sample show three solutions, and each solution is regarded as a model in testing predictive validity; *m1*, *m2* and *m3*. As a next step, the holdout sample is used to model the presence and absence of variables identical to the three models of the sub-sample, creating one variable per model. Each variable(model) is plotted against the outcome variable, digital transformation success. The results are shown in three separate plots in figure 5.3, and the consistency and coverage per model are shown in table 8.
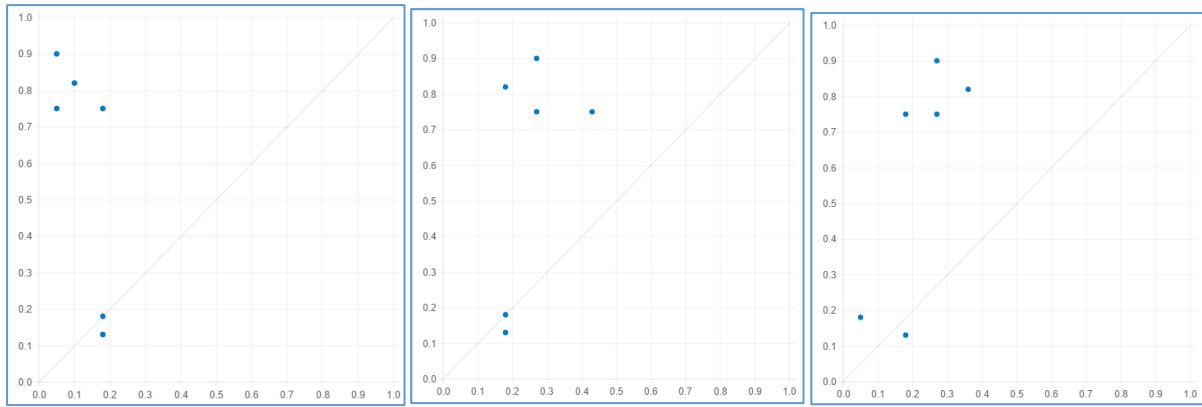
Figure 5.3: Plots model 1, model 2 and model 3 (left to right)

Table 8 - Consistency and coverage scores of sub-sample and holdout sample

	Sub-sample consistency	Holdout sample consistency	Sub-sample coverage	Holdout sample coverage
m1	0,978	0,933	0.421	0,195
m2	1	0,967	0.442	0,413
m3	1	0,962	0.383	0,356

The results of the model indicate that the models from the sub-sample have a high consistency (93,3%, 96,7% and 96,2%) in the holdout sample and the subset covers around 20%-40% of the sum of the memberships of the outcome. However, when comparing the scores of the holdout sample to the consistency and coverage scores of the sub-sample it shows a noticeable difference for *m1*. The results of *m1* are also not in line with the results of the full fs/QCA analysis. Model 1 and 2 suggest that the presence of nearly all DT CSFs are relevant and lead to high digital transformation success. For *m2* it only shows an absence of *awareness of transformation impacts* and for *m3* it shows the absence of *endorsement of a supportive organizational culture.* The consistency and coverage are similar enough for *m2* and *m3* to consider the models to have high predictive validity and means that those two models of the research can be further tested using a larger sample size.

5. Conclusions, discussion and recommendations

5.1 Conclusions

To answer the main research question "*What are Critical Success Factors of a Digital Transformation for Traditional Logistics Service Providers in The Netherlands?*" the fs/QCA results can be analysed. The results indicate four solutions that show that close to two-thirds of the outcome, high digital transformation success is covered by these solutions.

These solutions also have a high enough consistency score to prove that similar propositions lead to the same outcome. The results show a combination of constructs that lead to high digital transformation success. Furthermore, a specific proposition was plotted against this outcome to see if it was supported by the case organizations from this study. The proposition has similar coverage and consistency scores and can have proven to be useful for further theory advancement.

With that in mind, the following conclusion can be drawn from the fs/QCA analysis and can be used to answer the main research question of this study with:

TLSPs that have a high awareness of transformation impacts, high adoption of a digital business model and a high endorsement of cross-functional collaboration have high digital transformation success.

Lastly, the study has also tested the predictive validity of the models used in the fs/QCA analysis to ensure that the conclusions drawn from the analysis are valid and can be tested in future research using a larger sample size. To do so, three separate models were created and tested in a holdout sample and a sub-sample. After plotting each model against the outcome, it can be said that two out of the three models show a similar consistency and coverage score in both of the samples. This means that both models used in the fs/QCA analysis have high predictive validity and can be further tested using a larger sample size.

5.2   Discussion – reflection

The purpose of this research was to identify the critical success factors of a digital transformation for traditional logistics service providers in The Netherlands and compare those with their digital transformation success. To answer the sub research questions, a literature review on digital transformation was conducted. For the first sub research question, multiple researchers' meta-analyses were used to capture key concepts of the phenomenon of DT. The one that stood out, and captured the phenomenon on a broad scale, was the conceptual definition by Vial (2019). Although the conceptual definition was formulated by conducting a meta-analysis of 282 research papers related to DT, its definition is restricted to the IS domain, and not specifically tested in other domains. Vial (2019) does however deem it to be relevant for other domains as well. For the second sub research question, DT CSFs were derived from the meta-analyses of Osmundsen (2018) and Morakanyane (2020) and shaped around the inductive framework of Vial (2019), which lays at the centre of the CSF analysis. The CSFs of the two analyses of Osmundsen (2018) and Morakanyane (2020) were linked to the DT building blocks, or process steps, of the inductive framework of Vial (2019). The duplicate entries of CSFs consisting in all analyses were crossed out. Due to the constraint of the research being conducted for a master's thesis, and therefore having only a certain amount of time available, it was decided to cover the body of literature on DT CSFs with mainly these two meta-studies, while backing up some of their claims with additional research papers. To measure success, and answer the third sub research question, the DT success model of the McKinsey study of Bughin et al. (2017) was used, with the success metrics *rate of organic revenue growth, rate of EBIT growth and return on digital investment*. Besides the McKinsey model an additional metric was derived from the study of Kraus et al. (2018): *firm growth*. No other research was used to measure success metrics and the DT success model was completed using those 4 success metrics. The metrics used to capture the concept of DT success are mainly defined from a financial point of view, yet the concept of "success" can be interpreted from other angles as well.

For answering the main research question it was decided to conduct a fs/QCA analysis, using the conceptual model of Pappas & Woodside (2021). With the use of the model, the seven DT CSFs and DT success outcome could be calibrated into fuzzy sets to show to what extent these constructs were present for each TLSP. The results of the model identified findings, which relate to the presence and/or absence of a combination of certain CSFs that lead to the outcome, high DT success. It was decided to use fuzzy sets for this analysis because the DT constructs are not fully present or absent within organizations, but can be present or absent for a certain degree. With the use of a regular QCA, this nuance could not have been completely captured.

For the data gathering phase of the research, twelve different interviews were conducted. One per TLSP. During the interview, questions were asked related to both DT CSFs and DT success. In most cases, the answers to the questions were sufficient to score the scale items of each construct with. In some cases, the data was enriched using information that could be found online, such as financial statements. Finding research participants willing, and knowledgeable enough, to participate in the research proved to be difficult. Several organizations have been contacted without any success, and in some cases with an unfit participant. For the organizations that in the end did participate, the roles of each participant are somewhat different per organization. Where initially the aim was to have identical roles per case organization, it showed that this level of strictness resulted in too little response to be able to execute the research successfully. Due to time constraints, it was decided to proceed with finding participants not dedicated to one role, but an area of expertise. This helped speed up the data gathering phase and resulted in twelve interviews with similar respondents, which is the minimum amount necessary to be able to conduct an inductive analysis based on the results of the fs/QCA (Fainshmidt et al., 2020).

The conclusions of this research reflect on a comparison between multiple DT CSFs and how those combinations relate to the outcome, DT success. The scores of each construct for both the CSFs and success have been measured the same way, and each scale item that measures a construct is equally distributed over the construct score. Based on the literature, it could be decided to weigh in certain scale items more or less in comparison to others based on relevance for the specific constructs. To not overcomplex the analysis of the research, it was decided to proceed with evenly distributed scale items per construct. The findings of the study show a positive relationship between the presence of *high awareness of transformation impacts, high adoption of a digital business model* and *high endorsement of cross-functional collaboration* and the outcome of *high digital transformation success* for TLSPs in The Netherlands. However, with a sample of 12 case organizations, the study was conducted with the minimum number of needed organizations for the fs/QCA analysis to be able to generate theory based on the empirical observations. The significance of the relationships between the CSFs in combination with their relationship to the outcome DT success can therefore be further investigated. The conclusions drawn from this research apply to the 12 TLSPs, and despite the predictive validity scores successfully showing models that can be reused for future research, it is not guaranteed that the conclusions will hold for a different, and much larger, sample of TLSPs.

5.3   Recommendations for practice

There are recommendations for high digital transformation success that can be concluded from the findings of this study. TLSPs need to be aware of the transformation impacts, adopt a digital business model and endorse cross-functional collaboration. More specifically, this research suggests that a combination of these three success factors prove to have the most positive effect on digital transformation success. Therefore, the recommendations are a blend of digital awareness, digital adoption and digital endorsement for both the internal and external organization.

The findings of the research show that to have high success, TLSPs need to be **aware** of both the internal and external impacts of their digital transformation journey. Internally, they need to **adopt** a digital business strategy, supported with a digital business model, in which SMACIT technologies can support the transition the organization needs to make, ranging from data analytics to cloud-based solutions. A digital service platform can support this need in a centralized way, offering solutions for both the internal and external organization. Additionally, TLSPs need to address the importance of their journey to employees throughout the organization and **endorse** a structure in which employees can actively participate in the transformation activities in a cross-functional way. High-level coordination of those activities can support employees and make them feel engaged with the

transformation and allow them to become a part of the change. This digital mindset can contribute to the overall higher performance of the transformation activities within the internal organization. Externally, TLSPs need to be **aware** of the impact their DT activities have on customers and suppliers, while also being aware of the ever-changing competitive landscape. Upcoming digital natives cause a shift in the landscape, but TLSPs need to understand the strength and impact their existing logistical backbone and established logistics network has on the market. Towards customers, it is crucial to understand that constant changing customer behaviour requires flexibility in approaches. To have the most impact on the relationship with customers, TLSPs need to move away from single transactions and focus on establishing a long term relationship, in which both the TLSP and the customer are in constant connection with each other. The **adoption** of digital technologies is a method to become proactive towards the customer needs and can make the customer impact of the transformation more transparent. Lastly, from an external perspective towards suppliers, it is important to **endorse** a relationship that both organizations can benefit from it. Moving away from supply and demand towards a mutual partnership has proven to strengthen relationships and allows for an expansion of the impact both organizations can make.

5.4 Recommendations for further research

The results of the research show positive relationships between a combination of DT CSFs and DT success. However, it is important to stress that the results of a fs/QCA analysis become more accurate using a larger sample size. It is therefore recommended for future research to conduct the same analysis using a larger sample to validate the conclusions for this research. Besides a specific fs/QCA analysis, it could also be valuable to conduct a different type of analysis that focuses on DT CSFs and DT success for TLSPs.

It is also recommended to conduct future research on the distribution of scale items to the constructs, where in some cases it could generate different results if scale items are unevenly distributed based on importance within the context of a DT. Certain scale items having more influence on the score of a construct can change the overall dynamic of the different CSFs. Using an uneven distribution of scale items can therefore result in different conclusions. Next to the type of distribution of the scale items, future research can also investigate other scale items to formulate the constructs with. With the large body of literature on both critical success factors and success, a selection of different relevant scale items can be made. This can provide different insights related to a digital transformation that was not identified in this study.

Another recommendation is to conduct a similar study using similar case organizations at a different point in time. A factor that has had a lot of impact on the case organizations during the time the research was conducted, is the COVID-19 pandemic outbreak. For the majority of participated TLSPs the pandemic has given a big boost in business. This has also impacted their financial results and organizational growth. Because the outcome, digital transformation success, is constructed with financial and organizational growth metrics, and COVID-19 also having a drastic impact on those metrics, it can very well be that some organizations would have performed worse on the success scores under different external circumstances. By conducting additional research after the pandemic has ended can provide clarity on whether or not the conclusions of this study hold.

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Appendix A – Interview protocol

<u>1. Introduction</u>

Thank you for taking the time today to participate in my research. As explained, I am a Business Process Management & IT Masters student at the Open Universiteit and currently in the process of writing my thesis. The subject of my thesis is digital transformation in the context of logistics service providers. In this interview I would like to touch upon different themes regarding digital transformation within your organizations, and I have prepared several questions that can guide us through the different themes. Before we dive deeper into these questions I would first like to start by asking you if it is ok to record this interview? I will use the recordings for transcribing purposes. You can have me stop the recording at any time. All personal, and organization specific, information that you share will be completely anonymized. In my research paper there will be no reference found to you, or the organization. The professors at the university also do not know which organizations will participate in the research. With that, I would like to start with an introduction from your end.

<u>2. Main interview themes that are to be discussed during the interview</u>

Interview themes	Questions
I. **Introduction**	a. Could you please introduce yourself and tell me what position your fulfil within this organization? b. can you explain your own understanding of Digital Transformation? How would you define it? c. what is your personal experience with digital transformation within the organization?
II. **The use of digital technologies**	d. Does the organization make use of digital technologies within the field of social interactions? If so, could you share an example? Could you score the use of these technologies within your organization between 1-5? Why this score? e. Does the organization make use of digital technologies within the field of mobile devices? If so, could you share an example? Could you score the use of these technologies within your organization between 1-5? Why this score? f. Does the organization make use of digital technologies within the field of data analytics? If so, could you share an example? Could you score the use of these technologies within your organization between 1-5? Why this score? g. Does the organization make use of digital technologies within the field of cloud computing? If so, could you share an example? Could you score the use of these technologies within your organization between 1-5? Why this score? h. Does the organization make use of digital technologies within the field of Internet of Things (IoT)? If so, could you share an example? Could you score the use of these technologies within your organization between 1-5? Why this score? i. *O - When looking at the organization's DT ambitions, are there digital technologies within a certain field that require more attention for in the future? Why do you think that is?'*
III. **Digital triggers**	j. Have you experienced any changes in customer behavior due to your (increased) use of digital technologies? If so, can you elaborate with examples on what change you see, and what triggered this?

		k. *O – Have you also experienced change in the customer's expectations towards the products and services of the organization? Can you explain in what way?* l. *O – Would you say that the speed at which customer behavior changes has decreased, stayed the same or increased since before the growing use of digital technologies?* m. Do the digital technologies used by the organization offer the ability to store data? n. *O - If so, what kind of data is stored? Can you share examples?* o. *O - What is the stored data mainly used for?* p. Can you score the availability of data for the organization between 1-5? Why this score? q. Have you noticed any changes in the competitive landscape of the organization due to the increased use of digital technologies? If so, in what ways? r. If you compare the current level of competitiveness with the time technologies were not yet broadly adopted, would you say that this competitiveness has decreased, stayed the same or increased since that time?
IV.	**Digital business strategy**	s. Does the organization have a digital business strategy? If so, how did it come to exist? t. When looking at the business strategy and the IT strategy of the organization, would you say that these are in some ways connected to each other? If so, in what ways? u. On a scale from 1-5, how quickly is the organization adopting DT? Can you elaborate? v. *O – Can you tell something about the speed at which digital transformation activities are being handled, and how the organization deals with those activities?* w. How does your organization deal with allocating resources towards the DBS? x. How are the transformation activities within the organization managed? Is this done by a centralized team?
V.	**Digital business models**	y. Has the offer of products and services of the organization changed because of the increased use of digital technologies? If so, in what ways? Could you give an example? z. How would you describe the organization's relationship with customers? Has this changed (improved, stayed the same or worsened) since the increased use of digital technologies? Can you elaborate? aa. *O – Can you give an example of how the organization adds value to customers with the use of digital technologies?* bb. How would you describe the organization's relationship with suppliers? Has this changed (improved, stayed the same or worsened) since the increased use of digital technologies? Can you elaborate? cc. *O – Can you give an example of how the organization adds value to suppliers with the use of digital technologies?* dd. How does the organization deal with innovation? Do you have an example of how this is facilitated?

		ee. *O – How are new (digital) services developed? I.e. project based, or in an iterative way?*
		ff. *O – Do you think the organization is flexible enough to detect abrupt changes in the market and react to them? If so, do you have an example in which this happened?*
		gg.
VI.	**Cross-functional collaboration**	hh. Can you tell me something about the organization's structure? How do departments and teams work together?
		ii. Does the organization make use of multidisciplinary collaboration? If so, can you give an example of how that is done?
		jj. On a scale from 1-5, how well is this currently implemented within the organization?
		kk. *O – Are there parts within the organization where you notice this is more adopted? What do you think that the reason for this is?*
		ll. was addressed within that organizational structure?
VII.	**Supportive organizational culture**	mm. How does the organization involve employees in the transformative journey of the organization?
		nn. On a scale from 1-5, how actively are employees involved?
		oo. How does the organization involve management in the transformative journey of the organization?
		pp. On a scale from 1-5, how actively is management involved?
		qq. How does the organization stimulate the use of digital technologies for her employees?
		rr. Could you give an example of how the organization facilitates the use of digital technologies?
		ss. On a scale from 1-5, how digital savvy are the employees within the organization? Can you elaborate on this score?
		tt. When looking at the organization's culture, in what way do you think that digital transformation decisions have been made that are in line with this culture? Could you elaborate by providing a 1-5 score?
		uu. *O – To what extent do you think that the existing organization's culture was taken into account when making digital transformation decisions? Can you elaborate by providing a score between 1-5?*
		vv. *O – Have decisions regarding using, or not using, certain digital technologies been influenced due to the existing organization's culture?*
		ww. *O – Do you notice any employee resistance or barriers when talking about digital transformation change? Can you elaborate on how this resistance is expressed?*
		xx. resistance looks like?
VIII.	**Transformation impacts**	yy. Is the organization capable of assessing the impact that the digital transformation activities have on the internal organization? Can you mention specific areas within the organization as an example?
		zz. *O – Could you give an example of how digital transformation activities have had a positive impact on the internal organization?*
		aaa. *O – Could you give an example of how digital transformation activities have had a negative impact on the internal organization?*
		bbb. Could you score the impact of the digital transformation activities on the internal organization between 1-5? Where 1 is very negative, and 5 is very positive. Can you elaborate on that score?

		ccc. Is the organization capable of assessing the impact that the digital transformation activities has on the external organization? Can you mention specific areas outside of the organization as an example? *ddd.* O – Could you give an example of how digital transformation activities have had a positive impact on the external organization? *eee.* O – Could you give an example of how digital transformation activities have had a negative impact on the external organization? fff. Could you score the impact of the digital transformation activities on the external organization between 1-5? Where 1 is very negative, and 5 is very positive. Can you elaborate on that score? ggg.
IX.	**Business success of the digital transformation**	hhh. According to you, have the digital transformation activities had an impact on revenue? If so, can you explain in what way? Can you measure it in percentages? iii. When looking at the last few years, can you explain how the revenue growth of the organization has changes? Can you recognize a trend? jjj. In what way have the digital transformation activities contributed to this trend? Can you measure this with a percentage? *kkk.* O – Can you provide an example of revenue growth that is partially, or fully, caused by the digital transformation activities? *lll.* Can you elaborate on what kind of investments were made in relation to the digital transformation? In what way have they returned their investment? Can you give this a score between 1-5, where 1 is not at all and 5 is more than completely? Can you explain the score? *mmm.* When looking at the entire organization, do you consider it to be a growing business at the moment? If so, what part of that growth do you think can be associated with the digital transformation? Can you provide a percentage? Can you elaborate on that number? nnn.
X.	**Conclusion**	ooo. Are there any outstanding questions or remarks from your end on what we have discussed during the interview? ppp. Any of your earlier answers you want to further elaborate on now? qqq. Were there things unclear during the interview? Or were you missing certain elements? rrr. What did you think of the interview? Is there any feedback you would like to give to me on how I conducted the interview?

3. <u>Conclusion</u>

With that, we have discussed all topics and gone through the questions that I have written down beforehand. A lot of useful information has been shared during the interview, and I would like to thank you for that.

The entire interview of today is recorded, as you have agreed upon upfront. I will use this recordings to properly transcribe the entire interview. Is it ok if I send the transcription to you afterwards, so you can validate its content? My aim is to share the transcription within the next 5 days.

Before we conclude the interview, I will briefly explain the next steps of my research to you. After the data collection of this interview, there will be more interviews to conduct. Once these are completed, the data analysis phase can be completed. In this phase the data gathered from all interviews will be brought together, and used to answer the research questions of my thesis. Once the analysis is completed I will spend time on writing the results and findings of the data analysis, before I can finalize the writing of my thesis. In the end I aim to successfully defend my thesis and thereby also graduate. If you are interested, I can send over the end results of my thesis to you afterwards, so you can get an idea how the things we discussed in this interview came together in the thesis itself.

Once again, thank you for your time and we I will be in touch after the transcription of the interview is completed.

4. Introduction E-mail to (potential) interview participant

SUBJECT: Master thesis interview participation request – Digital Transformation in Logistics

Dear Mr/Ms <>,

I am a Business Process Management & IT Master's student at the Open Universiteit in The Netherlands. As a final hurdle to obtain my master's degree I am currently in the process of writing my thesis. The thesis is about Digital Transformation, and more specifically within the context of Logistics Service Providers in The Netherlands.

As part of the thesis I am conducting qualitative research to answer my research questions. For this research I am hoping that you can be of help to me. I am investigating the phenomenon of Digital Transformation within several logistics organizations, and I have identified <Company>, the organization you work for, as a potential case organization to be included in my research.

For you, and your organization, to become a part of my research, and help me get one step closer to graduating, I would like to invite you for an interview. The interview will approximately take 90 minutes, and with keeping COVID-19 in mind, can either be conducted virtually via Skype/Teams or physically while taking the appropriate precautions into account. During the interview I will ask you questions regarding several overarching digital transformation themes. If you agree on participating in my research then I will send over a list of these themes, so you have a better understanding of what kind of questions you can expect.

Hopefully this email is well received, and positively triggers you to willingly contribute to science and, hopefully, even to my personal graduation next year.

Thanks you, and should there be any questions regarding my research then please do not hesitate to contact me. This can either be done by replying to this e-mail, or by giving me a call on <phone_number>.

I hope to speak to you soon.

Kind regards,

Mark Coenen, OU Master Student

Appendix B – Interview questions scoring tables

II - The use of digital technologies

The use of Social Technologies			Questions – d, (i)		**Score:**
1 The organization does not make use of any of these technologies and has not made any plans to do so yet.	**2** The organization is not making use of any of these technologies yet, but is in the process of making a plan for future use of these technologies	**3** The organization has just begun with the use of these kind of technologies and still has a long way to go for a mature implementation	**4** The organization is using these technologies in a mature way in parts of the organization and is in the process of expanding it to the entire organization		**5** The organization is using these technologies in a mature way throughout the different business models and business units

The use of Mobile Technologies			Questions – e, (i)		**Score:**
1 The organization does not make use of any of these technologies and has not made any plans to do so yet.	**2** The organization is not making use of any of these technologies yet, but is in the process of making a plan for future use of these technologies	**3** The organization has just begun with the use of these kind of technologies and still has a long way to go for a mature implementation	**4** The organization is using these technologies in a mature way in parts of the organization and is in the process of expanding it to the entire organization		**5** The organization is using these technologies in a mature way throughout the different business models and business units

The use of Analytical Technologies			Questions – f, (i)		**Score:**
1 The organization does not make use of any of these technologies and has not made any plans to do so yet.	**2** The organization is not making use of any of these technologies yet, but is in the process of making a plan for future use of these technologies	**3** The organization has just begun with the use of these kind of technologies and still has a long way to go for a mature implementation	**4** The organization is using these technologies in a mature way in parts of the organization and is in the process of expanding it to the entire organization		**5** The organization is using these technologies in a mature way throughout the different business models and business units

The use of Cloud Technologies			Questions – g, (i)	**Score:**
1 The organization does not make use of any of these technologies and has not made any plans to do so yet.	**2** The organization is not making use of any of these technologies yet, but is in the process of making a plan for future use of these technologies	**3** The organization has just begun with the use of these kind of technologies and still has a long way to go for a mature implementation	**4** The organization is using these technologies in a mature way in parts of the organization and is in the process of expanding it to the entire organization	**5** The organization is using these technologies in a mature way throughout the different business models and business units

The use of Internet of Things (IoT) Technologies			Questions – h, (i)	**Score:**
1 The organization does not make use of any of these technologies and has not made any plans to do so yet.	**2** The organization is not making use of any of these technologies yet, but is in the process of making a plan for future use of these technologies	**3** The organization has just begun with the use of these kind of technologies and still has a long way to go for a mature implementation	**4** The organization is using these technologies in a mature way in parts of the organization and is in the process of expanding it to the entire organization	**5** The organization is using these technologies in a mature way throughout the different business models and business units

III - Digital Triggers

The presence of changing customer behavior			Questions – j, (k), (l)	**Score:**
1 The introduction of digital technologies has had no effect on our customer's behavior	**2** The introduction of digital technologies has had a slight effect on our customer's behavior, as their expectations towards our (digital) services are slightly increasing	**3** The customer behavior and expectations towards our services are changing due to the introduction of digital technologies, but it is not actively affecting our business model	**4** The customer behavior and expectations are drastically changing due to the introduction of digital technologies and the organization is required to make changes to their existing business models	**5** The customer behavior and expectations has completely changed since the introduction of digital technologies, and the organization is required to completely rework their existing business models.

The availability of data			Questions – m, (n), o, (p)		**Score:**
1 The organization is not generating any data due to the use of digital technologies	**2** The organization is, in a limited way, generating data with the use of a handful of digital technologies	**3** The organization is generating data with the use of digital technologies, but the availability cannot be fully utilized	**4** The organization is capable of generating large volumes of data, and is to some extent utilizing this data for personal benefits	**5** The organization is capable of generating nearly all the available data is is utilizing this data for personal benefits, by offering services that are driven by this data.

The level of competitiveness within the market			Questions – q, r, (s)		**Score:**
1 Digital technologies not affected the competitiveness of the market in any way	**2** Digital technologies have slightly affected the competitiveness of the market as competitors are starting to digitize their solutions	**3** Digital technologies have affected the competitiveness of the market as existing competitors have started to digitize their solutions and new digital competitors are entering the market	**4** Digital technologies has greatly affected the competitiveness of the markets as new and existing competitors are disrupting market share by creating new digital offerings towards the market	**5** Digital technologies are causing an existential treat, due to the fact that products and services are at risk due to an extremely competitive market.

IV - Digital business strategy (DBS)

The fusion between business & IT strategy			Questions – t, u		**Score:**
1 The business strategy and the IT strategy are completely separately organized, and decisions within one of them is not affecting the other	**2** The business strategy and the IT strategy are separately organized, but some decisions within one of them can affect the other.	**3** The business and IT strategy are aligned, but a part of the strategic decisions are still made separately	**4** The business and IT strategy is aligned and the majority of strategic decisions are made with taking both strategies into account	**5** The business and IT strategy have completely fused into one strategy and all decisions are made according to this one strategy

The DT adoption pace			Questions – v, (w)		**Score:**
1 There are no transformation activities being executed or planned to be executed	**2** There are no transformation activities being executed but a part of the organization is planning the initial activities	**3** The initial transformation activities are being executed, but at low pace due to most activities being exploratory.	**4** Transformation activities are being executed on multiple levels and in multiple areas of the organizations and step by step the organization is including more parts of the organization into the transformation	**5** A lot of transformation activities are being executed throughout the organizations and all levels within the organization are actively involved to include all of these parts of the organization in the transformation	

Degree of reconfiguration of organizational resources towards the DBS			Questions - x		**Score:**
1 No existing organizational resources are allocated towards the digital business strategy (DBS) of the organization	**2** Existing organizational resources are planned to allocated towards the DBS	**3** The first group of employees are allocating their time towards the DBS	**4** A growing group of people within the organization is actively engaged with the implementation of the DBS within the organization	**5** All neccesary resources that are needed for a successful implemtation of the DBS have been or are being allocated towards this cause**.**	

The level of management of transformation activities			Questions - y		**Score:**
1 No transformation activities determined by the DBS are being managed by anyone within the organization	**2** The initial transformation activities related to the DBS are managed by someone within the organization	**3** Transformation activities related to either the business or the IT strategy are managed by people within the organization	**4** Both IT and business strategy activities are being managed by people within the organization	**5** A combined effort is put in managing business and IT activities related to the DBS to ensure an as smooth of a transformation as possible	

V - Redefine business models into a digital one

Adoption of new value propositions			Questions - z		Score:
1 The organization is not adopting any new value propositions due to the use of digital technologies	**2** The organization is considering the use of new value propositions, but has not done so yet	**3** The organization has started with the adoption of a new value proposition, but in a limited way	**4** The organization is adopting new value propositions within a limited amount of areas within the organization		**5** The organization is adopting new value propositions throughout all possible areas within the organization that can be utilized by this

Adoption of new value networks			Questions – aa, (bb), cc, (dd)		Score:
1 The organization is not adopting any new value networks due to the use of digital technologies	**2** The organization is considering the use of new value networks, but has not done so yet	**3** The organization has started with the adoption of a new value networks, but in a limited way	**4** The organization is adopting new value networks within a limited amount of areas within the organization		**5** The organization is adopting new value networks throughout all possible areas within the organization that can be utilized by this

Adopt a digital service platform			Questions – ee, (ff), (gg)		Score:
1 The organization does not have any capabilities to rapidly implement digital innovations	**2** The organization has limited flexibility to innovate, but lacks the innovation speed to do so	**3** The organization has the flexibility to innovate, but lacks the capabilities to implement	**4** The organization has both the flexibility and the speed to develop and implement digital innovations, but only for certain areas within the organization		**5** The organization has implemented a digital (service) platform that allows them the flexibility and speed to rapidly develop and implement digital innovations

VI - Endorse cross-functional collaboration

The adoption of agile organizational structure		Questions – hh, ii, jj, (kk)		**Score:**
1 The organization has not adopted an agile organizational structure	**2** The organization is making plans to adopt an agile organizational structure	**3** The first stages of the adoption of the agile organization structure are being implemented	**4** Parts of te organization have adopted an agile organizational structure	**5** The entire organization has adopted an agile organizational structure

The extent of decentralized functions/teams		Questions – hh, ii, jj, (kk)		**Score:**
1 There are no decentralized and cross-functional teams present in the current organization structure	**2** The organization is making plans for decentralized functions/teams to stimulate cross-functional collaboration	**3** The organizations has redefined the structure of some of the teams/functions within the organization, but in a very limited scale	**4** The organization is creating decentralized and cross-functional teams throughout entire departments within the organization	**5** Throughout the organization a cross-functional teams structure has been applied where deemed relevant for the work to be done

VII - Create a supportive organizational culture

The level of employee engagement		Questions – ll, mm		**Score:**
1 Employees are not involved in the digital transformation journey of the organization	**2** Employees are not yet involved in the DT journey, but the organization is making plans to do so	**3** A initial group of employees is involved in the DT journey of the organization, but it is still in a focus group stage	**4** Multiple departments within the organization are actively involved in the DT journey of the organization	**5** All necessary employees within the organization that need to be involved with the DT journey are involved

The level of management engagement		Questions – nn, oo		**Score:**
1 Management is not involved in the digital transformation journey of the organization	**2** Management is not yet involved in the DT journey, but the organization is making plans to do so	**3** An initial group of management is involved in the DT journey of the organization, but it is still in a focus group stage	**4** Managers of multiple departments within the organization are actively involved in the DT journey of the organization	**5** All necessary management groups within the organization that need to be involved with the DT journey are involved

The degree of employees' digital mindsets			Questions – pp, qq, rr, (vv)		**Score:**
1 The organizational leaders do not endorse a digital mindset within their organization, nor do they facilitate or stimulate the adoption of digital technologies in employees' work	**2** The organizational leaders do endorse a digital mindset within their organization, however this is not facilitated in any way.	**3** The organizational leaders endorse a digital mindset and within parts of the organization the adoption of digital technologies is facilitated and stimulated for employees' work.		**4** The organizational leaders endorse a digital mindset within multiple departments within the organization and the adoption of digital technologies is facilitated and stimulated.	**5** Throughout the organization a digital mindset is endorsed and the adoption of digital technologies is facilitated and stimulated on all levels within the organization

Adopting technologies in line with existing organizational culture			Questions – ss, (tt), (uu)		**Score:**
1 For the adoption of new digital technologies within the organization there is no attention paid to the existing organizational culture	**2** For the adoption of new digital technologies the organization tries to pay attention to the existing organizational culture, but this is not critical for the decision making	**3** For the adoption of new digital technologies the organization pays attention to the organizational culture, but will only in some scenarios take action that is in line with this culture		**4** For the adoption of new digital technologies the organization pays attention to the organizational culture and in most occasions bases their decision on the adoption while taking the culture into account	**5** For the adoption of new digital technologies the organization always evaluates the impact it has on the organizational culture and, if needed, changes their plans accordingly

VIII - Well-determined transformation impacts

Determined internal impacts			Questions – ww, (xx), zz, aaa, bbb, ccc		**Score:**
1 The organization is to no extent capable of determining the internal impact that DT has had on the organization	**2** For a few aspects of the DT the organization is able to determine the internal impact it has on the internal organization	**3** The organization is for the most part capable of determining the internal impact that their DT activities have on the organization.		**4** The organization is well-capable of determining the internal impact that their DT activities have on the organization.	**5** The organization is well-capable of determining the internal that their DT activities have on the organization.

Determined external impacts			Questions – ww, (yy), zz, aaa, bbb, ccc		**Score:**
1 The organization is to no extent capable of determining the external impact that DT has had on the organization	**2** For a few aspects of the DT the organization is able to determine the external impact it has on the internal organization	**3** The organization is for the most part capable of determining the external impact that their DT activities have on the organization.	**4** The organization is well-capable of determining the external impact that their DT activities have on the organization.	**5** The organization is well-capable of determining the external that their DT activities have on the organization.

Determined impacted transformation areas			Questions – ww, (yy), (zz), aaa, bbb, ccc, (ddd)		**Score:**
1 The organization is to no extent capable of identifying the transformation areas that are impacted by the digital transformation	**2** For a few aspects of the DT the organization is able to identify the transformation areas that are impacted by the digital transformation, but cannot determine the impact that their DT actions have on those areas	**3** The organization is capable of identifying the impacted transformation areas, but is only in some cases able to determine the impacts they have had on it	**4** The organization is capable of determining the impact their DT activities have on the majority of transformation areas that are affected	**5** For all transformation areas affected by the DT activities of the organization, they are capable of determining the impact they have on those areas

VIII – DT Success

The rate of organic revenue growth			Questions – fff, ggg, (hhh)		**Score:**
1 The digital transformation activities are not showing any impact on the organic revenue growth	**2** The digital transformation activities have a slightly noticeable impact on the organic revenue growth of about 1% < 5% percent.	**3** The digital transformation activities have had a noticeable impact on the organic revenue growth of about 5% < 15% percent	**4** The digital transformation activities have had a good impact on the organic revenue growth of about 15% < 25% percent	**5** The digital transformation activities have had an great impact on the organic revenue growth of > 25% percent

The rate of EBIT growth			Questions – eee, fff		**Score:**
1 The digital transformation activities are not showing any impact on EBIT growth	**2 T**he digital transformation activities have a slightly noticeable impact on EBIT growth of about 1 to 5 percent.	**3** The digital transformation activities have had a noticeable impact on the EBIT growth of about 5 to 15 percent	**4** The digital transformation activities have had a good impact on the EBIT growth of about 15 to 25 percent	**5** The digital transformation activities have had an great impact on the EBIT growth of > 25 percent	

The return on digital investment			Questions – iii		**Score:**
1 The ROI of the digital transformation activities (return/cost*100 %) is < 25%	**2** The ROI of the digital transformation activities (return/cost*100 %) is 25% < 50%	**3** The ROI of the digital transformation activities (return/cost*100 %) is 50% < 75%	**4** The ROI of the digital transformation activities (return/cost*100 %) is 75% < 100%	**5** The ROI of the digital transformation activities (return/cost*100 %) is > 100%	

Firm growth			Questions – jjj		**Score:**
1 The organization business activities have shrank by >25% in comparison to 5 years ago	**2** The organization business activities have shrank by <25% in comparison to 5 years ago	**3** The organization business activities have roughly remained the same in comparison to 5 years ago	**4** The organization business activities have grown by <25% in comparison to 5 years ago	**5** The organization business activities have grown by >25% in comparison to 5 years ago	

Appendix C – List of causal combinations & conditions

Causal Combination	Combination Description	Causal Condition	Condition Description
I	Use of digital technologies	1	Social
I	Use of digital technologies	2	Mobile
I	Use of digital technologies	3	Analytical
I	Use of digital technologies	4	Cloud
I	Use of digital technologies	5	IoT
II	Digital triggers	1	Changing customer behavior
II	Digital triggers	2	Availability of data
II	Digital triggers	3	Level of competitiveness
III	Digital business strategy	1	Fusion business & IT strategy
III	Digital business strategy	2	DT adoption pace
III	Digital business strategy	3	Degree of reconfiguration of organizational resources towards the DBS
III	Digital business strategy	4	Level of management of transformation activities
IV	Digital business models	1	New value propositions
IV	Digital business models	2	New value networks
IV	Digital business models	3	Adopt a digital service platform
V	Cross-functional collaboration	1	Agile organizational structure
V	Cross-functional collaboration	2	Decentralized functions/teams
VI	Supportive organizational culture	1	Employee engagement
VI	Supportive organizational culture	2	Management engagement
VI	Supportive organizational culture	3	Employee's digital mindset
VI	Supportive organizational culture	4	Adopt technologies in line with existing culture
VII	Determine transformation impacts	1	Internal impacts
VII	Determine transformation impacts	2	External impacts
VII	Determine transformation impacts	3	Impacted transformation areas
VIII	DT Success	1	Organic revenue growth
VIII	DT Success	2	Rate of EBIT growth
VIII	DT Success	3	Return on digital investment
VIII	DT Success	4	Firm growth

Appendix D – Causal condition & causal combination scores per case organization

		Case Organizations											
		A	B	C	D	E	F	G	H	I	J	K	L
Causal Conditions of CSF 1: Use of digital technologies	Social	3	3,5	3	4	4	4	3,5	1	3	2	3	1
	Mobile	3	3,5	3	3	3	2,5	2,5	3	3	4,5	2	1
	Analytical	4	5	4	4	2	4	3	1,5	4	4,5	4	1
	Cloud	2	4,5	3	3	5	5	5	3	3,5	3,5	3	2
	IoT	3	2,5	1	1	3.5	1	4	1	1	4	1	1
CSF 1		**3**	**3,8**	**2,8**	**3**	**2,8**	**3,3**	**3,6**	**1,9**	**2,9**	**3,7**	**2,6**	**1,2**
Causal Conditions of CSF 2: Digital triggers	Changing customer behaviour	3,5	4	4	4	5	2	4	4	4	4	4	4
	Availability of data	3,5	2	5	2	3	3	2	3,5	4	4	5	4
	Level of competitiveness	3	1	1	3	5	5	4	2	3	4	5	3
CSF 2		**3,33**	**2,33**	**3,33**	**3,00**	**4,33**	**3,33**	**3,33**	**3,17**	**3,67**	**4,00**	**4,67**	**3,67**
Causal Conditions of CSF 3: Digital business strategy	Fusion business & IT strategy	4	3	5	3	4	3	4	3	2	2	2	4
	DT adoption pace	5	1	4	3	3	2	2	4	4	4	2	3
	Degree of reconfiguration of organizational resources towards the DBS	4	2	2	2	4	2	3	3	2	2	3	2
	Level of management of transformation activities	4	4	4	2	5	2	4	3	3	2	1	2
CSF 3		**4,25**	**2,50**	**3,75**	**2,50**	**4,00**	**2,25**	**3,25**	**3,25**	**2,75**	**2,50**	**2,00**	**2,75**
Causal Conditions of CSF 4: Digital business models	New value propositions	3	4	4	3	4	1	4	1	4	1	3	1
	New value networks	3	4	3	2	4	4	4	4	4	4	4	2
	Adopt a digital service platform	4	2	3	1	4	1	5	3	1	2	2	2
CSF 4		**3,33**	**3,33**	**3,33**	**2,00**	**4,00**	**2,00**	**4,33**	**2,67**	**3,00**	**2,33**	**3,00**	**1,67**
Causal Conditions of CSF 5: Cross-functional collaboration	Agile organizational structure	3	4	5	5	5	3	5	3,5	2	5	3	2
	Decentralized functions/teams	3	4	5	3	4	2	5	3	2	5	2	2
CSF 5		**3,00**	**4,00**	**5,00**	**4,00**	**4,50**	**2,50**	**5,00**	**3,25**	**2,00**	**5,00**	**2,50**	**2,00**
Causal Conditions of CSF 6: Supportive	Employee engagement	5	4	4	3	4	3	1	4	3	3	2	2
	Mangement engagement	5	4	4	4	4	4	3	4	4	4	2	2

organizational culture	Employee's digital mindset	3,5	2,5	4	2	2,5	4	2,5	3,5	3	4	3	2
	Adopt technologies in line with existing culture	4	4	4	3	3	5	3	2	4,5	3	4	4
CSF 6		**4,38**	**3,63**	**4,00**	**3,00**	**3,38**	**4,00**	**2,38**	**3,38**	**3,63**	**3,50**	**2,75**	**2,50**
Causal Conditions of CSF 7: Determine transformation impacts	Internal impacts	3,5	4	3	4	4	1	3	4	4	3	2	4
	External impacts	2	2	3	4	4	1	3	4	2	3	1	4
	Impacted transformation areas	3	3	3	3	4	1	4	3	3	3	1	3
CSF 7		**2,83**	**3,00**	**3,00**	**3,67**	**4,00**	**1,00**	**3,33**	**3,67**	**3,00**	**3,00**	**1,33**	**3,67**
Causal Conditions of Outcome DT Success	Organic revenue growth	5	3	2	2	4	1	2	2	1	5	4	1
	Rate of EBIT growth	4	4	5	1	5	1	5	2	1	4	4	1
	Return on digital investment	5	5	4	2	2	3	2	3	4	5	3	4
	Firm growth	4	3	4	2	5	3	5	3	3	4	3	3
Success 1		**4,50**	**3,75**	**3,75**	**1,75**	**4,00**	**2,00**	**3,50**	**2,50**	**2,25**	**4,50**	**3,50**	**2,25**

Appendix E – fs/QCA tables

Table I – Calibrated constructes per case organization

case_organization	Constructs							Outcome
	techC	triggersC	dbsC	dbmC	xcollabC	cultureC	impactsC	growthC
A	0.501	0.621	0.871	0.621	0.501	0.891	0.441	0.901
B	0.771	0.271	0.321	0.621	0.821	0.721	0.501	0.751
C	0.431	0.621	0.751	0.621	0.951	0.821	0.501	0.751
D	0.501	0.501	0.321	0.181	0.821	0.501	0.731	0.131
E	0.431	0.881	0.821	0.821	0.901	0.641	0.821	0.821
F	0.611	0.621	0.251	0.181	0.321	0.821	0.051	0.181
G	0.711	0.621	0.591	0.881	0.951	0.281	0.621	0.681
H	0.161	0.561	0.591	0.381	0.591	0.641	0.731	0.321
I	0.461	0.731	0.411	0.501	0.181	0.721	0.501	0.251
J	0.741	0.821	0.321	0.271	0.951	0.681	0.501	0.901
K	0.351	0.921	0.181	0.501	0.321	0.411	0.081	0.681
L	0.061	0.731	0.411	0.121	0.181	0.321	0.731	0.251

Table II – Overview of configuration in the truth-table algorithm of the fs/QCA software

techC	triggersC	dbsC	dbmC	xcollabC	cultureC	impactsC	number	growthC	raw consist.	PRI consist.	SYM consist
1	1	1	1	1	1	0	1	1	0.982639	0.939614	0.939614
1	1	1	1	1	0	1	1	1	0.979968	0.929178	0.929179
0	1	1	1	1	1	1	2	1	0.966422	0.912281	0.912281
1	0	0	1	1	1	1	1	1	0.97698	0.87864	0.878641
0	1	0	1	0	0	0	1	0	0.963143	0.716418	0.716418
0	1	1	0	1	1	1	1	0	0.85274	0.57	0.57
1	1	0	0	1	1	1	2	0	0.851047	0.550971	0.550971
1	1	0	0	0	1	0	1	0	0.710681	0.0826668	0.0826668
0	1	0	1	0	1	1	1	0	0.808351	0.0773195	0.0773195
0	1	0	0	0	0	1	1	0	0.781853	0.021645	0.021645

Table III & IV – Results of the parsimonious and intermediate solutions

--- PARSIMONIOUS SOLUTION ---			
frequency cutoff		1	
consistency cutoff		0.966422	
	raw coverage	unique coverage	consistency
dbmC*xcollabC	0.720628	0.720628	0.939
solution coverage	0.720628		
solution consistency	0.939		

The core conditions of the parsimonious solution are marked bold in the below intermediate solution table. The absence of a condition, or negation, is marked with a ~ in front of the condition. In the example "~techC", it means the absence of "high adoption of digital technologies". When there is no ~, it means that the condition is present.

```
                    --- INTERMEDIATE SOLUTION ---
                 frequency cutoff                                        1
                 consistency cutoff                                  0.966422

                                              raw        unique
                                              coverage   coverage   consistency
techC*~triggersC*~dbsC*dbmC*xcollabC*cultureC*impactsC    0.320447  0.0347327  0.97698
techC*triggersC*dbsC*dbmC*xcollabC*cultureC*~impactsC     0.427363  0.0437934  0.982639
techC*triggersC*dbsC*dbmC*xcollabC*~cultureC*impactsC     0.369375  0.0468137  0.979968
~techC*triggersC*dbsC*dbmC*xcollabC*cultureC*impactsC     0.478103  0.0755059  0.966422


solution coverage                             0.611598
solution consistency                          0.973558
```

Table V – fs/QCA findings of sub-sample

		Solution	
Configuration	1	2	3
Digital Awareness			
Awareness of Digital Triggers	●	●	●
Awareness of Transformation Impacts	⊗	⊗	●
Digital Adoption			
Adoption of Digital Technologies	⊗	●	●
Adoption of a Digital Business Strategy	⊗	●	●
Adoption of a Digital Business Model	●	●	●
Digital Endorsement			
Endorsement of Cross-Functional Collaboration	⊗	●	●
Endorsement of a Supportive Organizational Culture	⊗	●	⊗
Consistency	0,978	1	1
Raw Coverage	0.421	0.442	0.383
Unique Coverage	0.180	0.127	0.100
Overall solution consistency		0,987	
Overall solution coverage		0.723	

Note: Black circle (●) indicate the presence of a condition, and circles with "x" (⊗) indicate its absence.
Large circle; core condition, Small circle; peripheral condition, Blank space; "don't care" condition

Format by (Pappas & Woodside, 2021).

Appendix F – Overview of DT CSFs scores per case organization

All 12 case organizations have been measured on the presence of the DT CSFs within their organization as derived from the meta analyses of Osmundsen (2018) and Morakanyane (2020), and the conceptual framework of Vial (2019). The scoring tables of the scale items of each CSF are all measured on a 1 to 5 scale, where 1 is the lowest possible score and 5 is the highest possible score. To determine the score of each scale item, the average was taken of all interview questions associated to the scale item. To measure the score of a CSF the associated scale items were also averaged out. In the below figure an example is shown of the scale items of the CSF *the use of digital technologies* for case organization A.

Scale items

case_organization	A
social_tech	2
mobile_tech	4.5
analytical_tech	4.5
cloud_tech	3.5
iot_tech	4

Construct (causal condition)

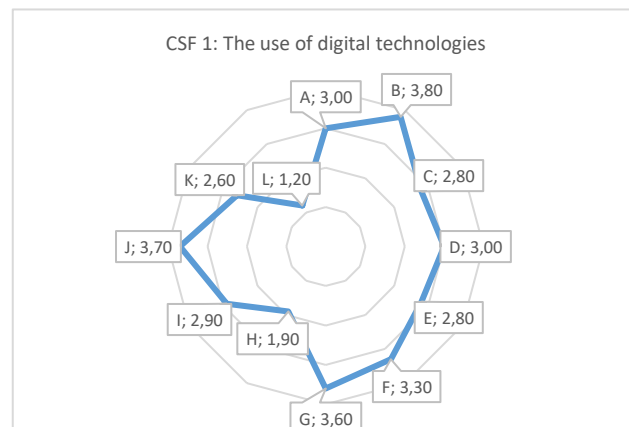| case_organization	A
tech_adoption	3,7

Figure 4.1: scale items and construct scores related to "adoption of digital technologies" of case organization A

The use of digital technologies

Associated scale items: The use of social technologies, the use of mobile technologies, the use of analytical technologies, the use of cloud technologies and the use of Internet of Things (IoT) technologies.

Organization B scores the highest on *the use of digital technologies*, which is mainly related to a high score on the use of analytical technologies (5) and cloud technologies (4.5). The organization uses a centralized, cloud-based, data warehouse to store all possible data to create analyses and dashboards throughout the organization.

CSF 1: The use of digital technologies
A; 3,00 B; 3,80 C; 2,80 D; 3,00 E; 2,80 F; 3,30 G; 3,60 H; 1,90 I; 2,90 J; 3,70 K; 2,60 L; 1,20

Organization L score the lowest on *the use of digital technologies,* which is related to a low score on all fronts. Only cloud technologies has a score of 2, all other technologies a score of 1. The organization is currently in a transition phase and are investing time and resources in digitalization. They are strongly focussing on accelerating their transformation journey in the next few years. However, at the moment they lack a high adoption level on all fronts, as shows in the results.
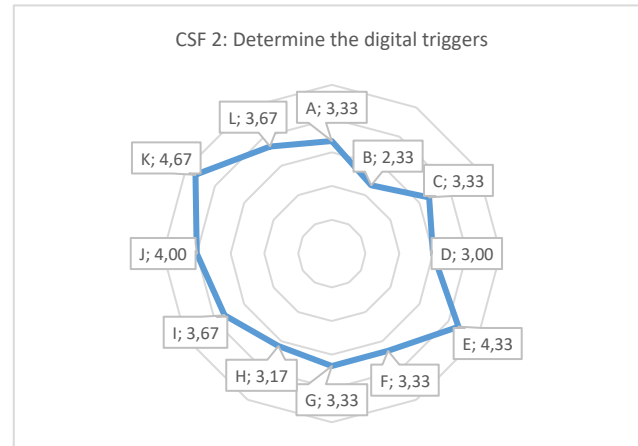
Determine the digital triggers

Associated scale items: Changing customer behaviour, availability of data, level of competitiveness.

Organization K scores the highest on *determine the digital triggers*. This is mainly related to a high score in availability of data (5) and awareness of competitive landscape (5). Within all modalities the organization has created a standardized way of making relevant data available both internally and externally, on a customer, shipments or supply chain level.

Organization B scores the lowest on *determine the digitale triggers.* The low score is related to the low score on competitive awareness (1) and availability of data (2). The organization notices that a lot of data potential is not being utilized and they want to unlock more sources to retrieve the data from.


CSF 2: Determine the digital triggers

L; 3,67 — A; 3,33 — K; 4,67 — B; 2,33 — C; 3,33 — J; 4,00 — D; 3,00 — I; 3,67 — E; 4,33 — H; 3,17 — F; 3,33 — G; 3,33

Develop a digital business strategy (DBS)

Associated scale items: Fusion business & IT strategy, digital transformation adoption pace, degree of reconfiguration of organization resources towards the DBS, level of management of transformation activities.

Organization A scores the highest on *develop a digital business strategy (DBS)*. The score relates to a high score on all four scale items, but especially on the transformation adoption pace (5). The organization has rolled out their digital business strategy last year and is already executing plans according to the roadmap of this strategy. One of their first focus points is a IT renewal program.
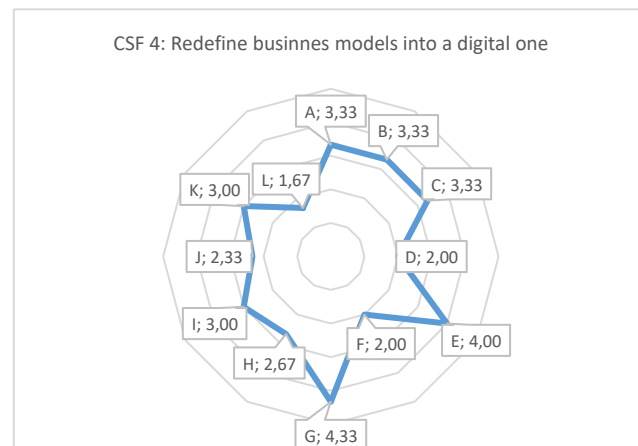

CSF 3: Develop a digital business strategy (DBS)

A; 4,25 — L; 2,75 — B; 2,50 — C; 3,75 — K; 2,00 — J; 2,50 — D; 2,50 — I; 2,75 — F; 2,25 — E; 4,00 — H; 3,25 — G; 3,25

Organization K scores the lowest on *develop a digital business strategy.* This relates mainly to a low score on the level of management of transformation activities (1) and is explained by the fact the organization is only involving a selected group of employees to be part of the transformation activities.
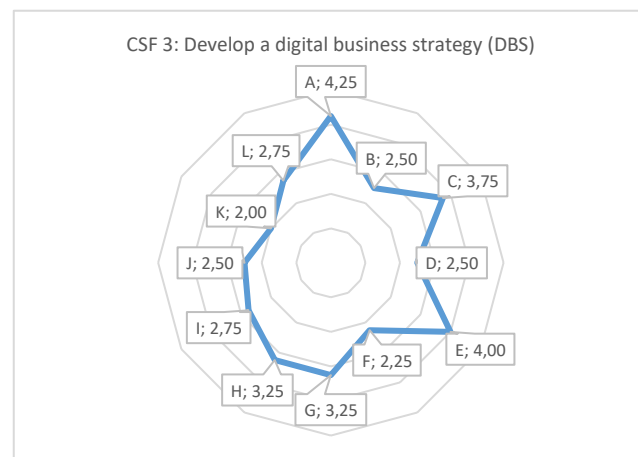
Redefine business models into a digital one

Associated scale items: New value propositions, new value networks, adoption of a digital service platform.

Organization G scores the highest on *redefine business models into a digital one*. The score is related to a high score on all three scale items, but specifically to a high score on the adoption of a digital service platform (5). One the examples mentioned by the participant is e-commerce, and the digital services that have been added to their products. Besides offering logistics services for e-commerce, the organization now also offers a service platform for their customers to get, for example, data visibility and network optimizations all powered through technology.

CSF 4: Redefine businnes models into a digital one

A; 3,33 — B; 3,33 — K; 3,00 — L; 1,67 — C; 3,33 — J; 2,33 — D; 2,00 — I; 3,00 — F; 2,00 — E; 4,00 — H; 2,67 — G; 4,33

Organization L scores the lowest on *redefine business models into a digital one* and is related to a low score on all three scale items; new value propositions (1), new value networks (2) and adoption of a digital service platform (2). Due to the organization still being in an early stage of digital adoption, there is no real benefits to be noticed yet when it comes down to their (digital) propositions and networks, nor is there a digital platform to support this yet.

Endorse cross-functional collaboration

Associated scale items : Agile organizational structure, decentralized functions and teams.

Organizations C, G and J all score the highest on *endorse cross functional collaboration* and is related to having the highest score (5) for both scale items. All three organizations have heavily invested into setting up multi-disciplinary teams that work on customer cases and developments using a combination of expertise. Within these organizations, the teams are given the freedom to organize their way of working in a way that they deem best fit for the case or development that they are working on.

CSF 5: Endorse cross-functional collaboration

A; 3,00 B; 4,00 C; 5,00 L; 2,00 K; 2,50 J; 5,00 D; 4,00 I; 2,00 F; 2,50 E; 4,50 H; 3,25 G; 5,00
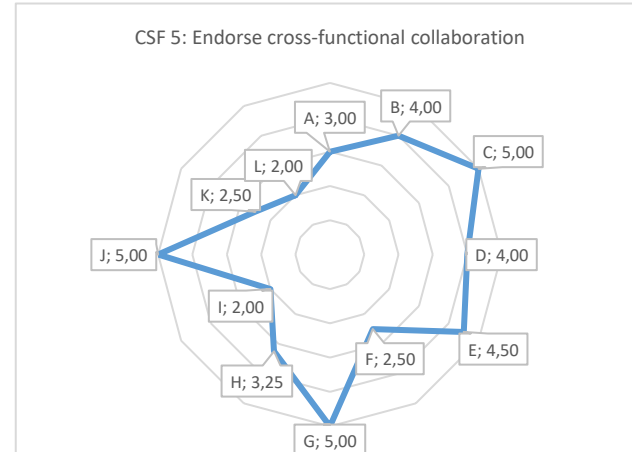
Organization I and L score the lowest on *endorse cross functional collaboration*. The organizations score a 2 on both scale items. The organizational structure is in both cases still quite traditional and each department offers their expertise in a somewhat isolated way. Expertise of multiple departments is often only brought together on a project-based level, not day-to-day activities.

Create a supportive organizational culture

Associated scale items: Employee engagement, management engagement, employee's digital mindset, adopting technologies in line with existing culture.

Organization A scores the highest on *create a supportive organizational culture*. This specifically relates to a high score on the scale items employee engagement (5) and management engagement (5). According to the participant, the strength of their transformation lies in the involvement of employees of all layers throughout the organization, but employees and management.


CSF 6: Create a supportive organizational culture

A; 4,38 B; 3,63 L; 2,50 C; 4,00 K; 2,75 J; 3,50 D; 3,00 I; 3,63 E; 3,38 H; 3,38 G; 2,38 F; 4,00
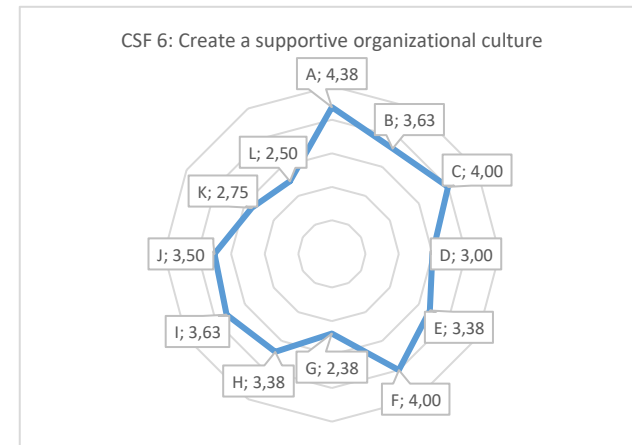
Organization G scores the lowest on *create a supportive organization culture.* The low score relates to the scale item employee engagement, which scores a 1. Very little within the organization is done to cascade the information regarding the transformative journey down to the employees and a lot of this information gets stuck at management level, creating bureaucratic issues and unnecessarily lengthy processes.

Determine the transformation impacts

Associated scale items: Internal impacts, external impacts, impacted transformation areas.

Organization E scores the highest on *determine the transformation impacts* with a score of 4 on all three scale items. By actively involving employees, the impact that the transformation activities have on the internal and external organization is very much noticeable. The larger use of digital technologies in combination with a different way of working shows the organization can take big steps in becoming more digital.

CSF 7: Determine the transformation impacts

L; 3,67 A; 2,83 B; 3,00 C; 3,00 D; 3,67 E; 4,00 F; 1,00 G; 3,33 H; 3,67 I; 3,00 J; 3,00 K; 1,33

Organization F scores the lowest on *determine the transformation impacts* with a score of 1 on the scale items external impacts and impacted transformation areas and a 2 on internal impacts. Due to the organization only recently shifting their attention to a digital transformation strategy the impacts inside and outside the organization cannot be measured yet. Additionally, no specific areas can be identified where any impact is already noticeable.
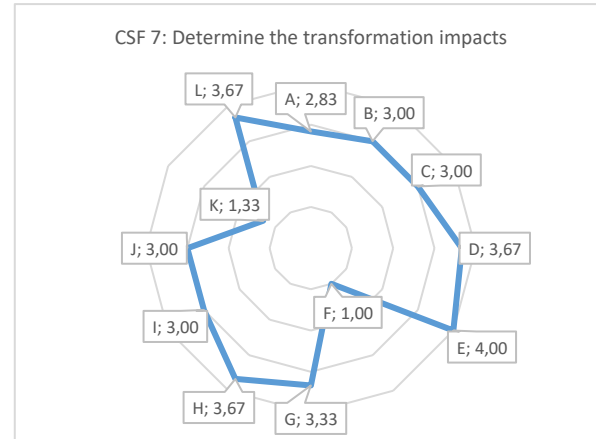
Cumulative overview of DT CSFs

Now that the scores of the individual CSFs have been identified and the highest and lowest scoring TLSPs per CSF have been highlighted, it is time to show a cumulative overview of CSFs scores of each case organization. This combined overview of CSFs is captured in the below figure.
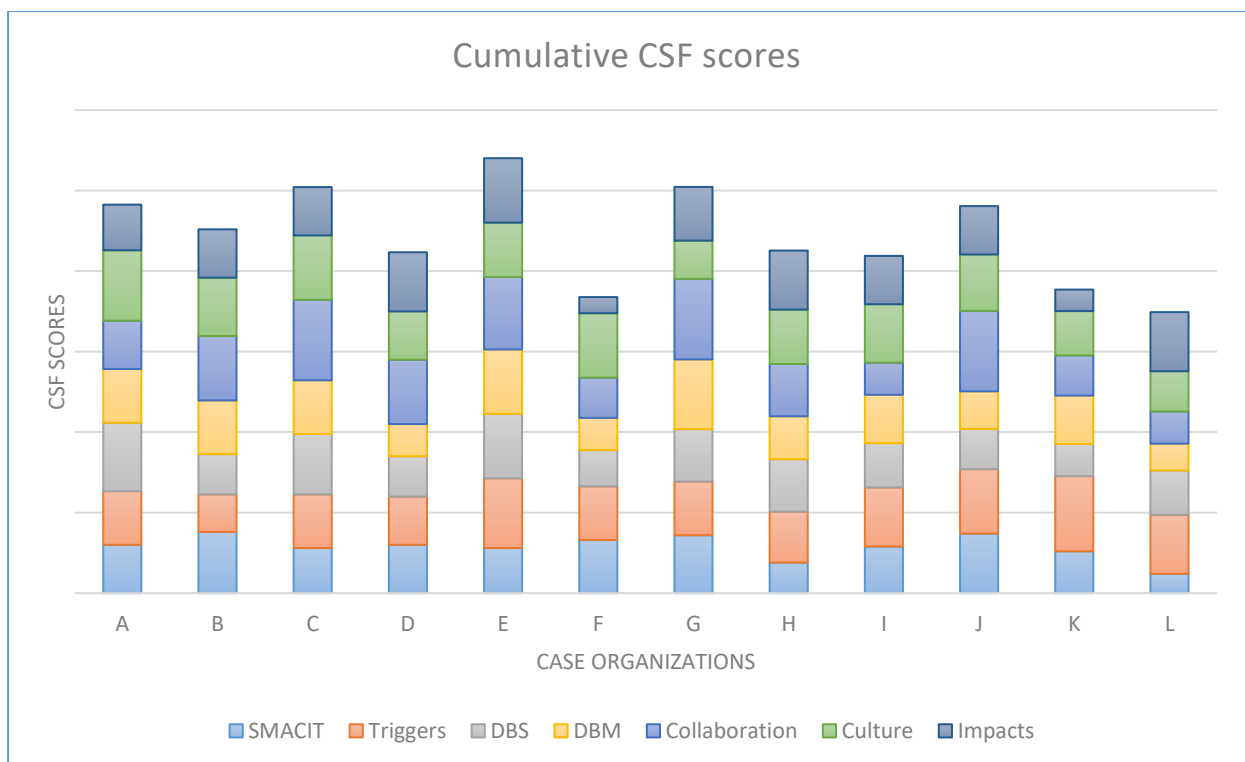
Cumulative CSF scores per case organization

All identified DT CSFs are present at the TLSPs

Despite some TLSPs scoring higher than others on the CSFs, the overview shows that all CSFs that were identified in the literature review are also present at the case organizations of this study. There is no CSF with a neglectable score within all TLSPs.

Overall high scoring case organizations score high on develop a DBS, redefine business models and endorse cross-functional collaboration

There are three TLSPs with a relatively high cumulative CSF score (>=25 cumulative CSFs score): Case organization C, E and G. Looking at the individual scores, the following CSFs jump out positively:

- *Develop a digital business strategy*: the TLSPs score high on the fusion of their business and IT strategy.
- *Redefine business models into a digital one*: the TLSPs score high on adopting a digital service platform.
- *Endorse cross-functional collaboration:* the TLSPs score high on the adoption of an agile organizational structure.

Overall high scoring case organizations core low on use of digital technologies

When looking at the low scoring CSFs, it can be concluded that one CSF jumps out, namely *the use of digital technologies*. The TLSPs score particularly low on the adoption of mobile and IoT technologies.

Overall low scoring case organizations score low on use of digital technologies, develop a DBS, redefine business models and determine transformation impacts

There are three, relatively, low scoring TLSPs (<20 cumulative CSFs score): Organization F, K and L. When zooming in on these three case organizations, the three CSFs that jump out negatively are the following:

- *Use of digital technologies*: the TLSPs score low on the adoption of IoT technologies.
- *Develop a digital business strategy*: the TLSPs score low on the level of management of the transformation activities.
- *Redefine business models into a digital one*: the TLSPs score low on adopting a digital service platform.
- *Determine transformation impacts*: the TLSPs score low on determining the impacted transformation areas.

Overall low scoring case organizations score high on determine digital triggers

When looking at the low scoring TLSPs, all three organizations (F, K and L) score high on the CSF *determine the digital triggers* scores. The case organizations score particularly high on the ability to determine and identify the competitive landscape.

# Appendix G – Overview of DT Success scores per case organization

Besides the DT CSFs, the research also measures the DT success of each TLSP. To measure success, the metrics of the McKinsey study of Bughin et al. (2017) and the metric of the study Kraus et al. (2018) are used. The financial metrics *rate of organic revenue growth, rate of EBIT growth, return on digital investment* in combination with the organizational metric *firm growth* will give insights in the DT success of each organization. Here, the scoring tables of the scale items related to the outcome DT success are measure on a 5-point scale, where 1 is the lowest possible score and 5 is the highest possible score. Similar to the measurement of CSFs, the score of the scale items are determined based on the average score of the associated interview questions and the score of the outcome, DT success, is also calculated by taking the average all combined success metrics. Next to the interview questions, the calculation of the scale items is enriched based on the information derived from the financial statements of each organization.

DT Success

Associated scale items: the rate of organic revenue growth, the rate of EBIT growth, the return on digital investment, firm growth


Outcome: DT Success
A; 4,50
B; 3,75
C; 3,75
D; 1,75
E; 4,00
F; 2,00
G; 3,50
H; 2,50
I; 2,25
J; 4,50
K; 3,50
L; 2,25

Organization A and J score the highest on *DT success.* The score is related to high score on all four scale items, but specifically due to the highest score on organic revenue growth (5) and return on digital investment (5). According to both participants, the DT journey of their organization has allowed them to offer services in an easier way, making it easier for customers to do business. That has allowed them to stay one step ahead of competitors and therefore generate additional revenue, resulting in an overall revenue growth. In addition, the figures of both organizations show a positive return on investment for investments related to the transformation activities.

Organization D scores the lowest on *DT success.* The score relates to an overall low score on all four scale items; the rate of organic revenue growth (2), the rate of EBIT growth (1), the return on digital investment (2) and firm growth (2). According to the participant, the low scores on all fronts can be explained by the impact COVID-19 has had on their business. In contrast to most logistics service providers, Organization D has seen a drastic decline in both revenue and firm growth over the last 12-18 months. This has also made it difficult for the organization to generate any return on digital investments for the transformation initiatives that have been executed. Up until now, the DT activities have mainly seen a negative effect on the organization's success, but the factor of COVID-19 should not be left out of the equation.
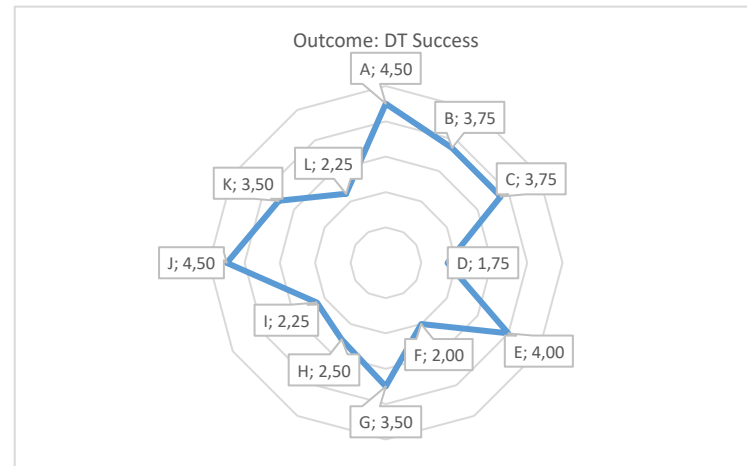
Cumulative overview of DT Success scores

The highest and lowest scoring TLSPs have been identified, but it is also relevant to display all other TLSPs to see how each case organization scores on the DT Success metrics. In figure 4.3 a cumulative overview of the DT Success metrics of each case organization is visualized.
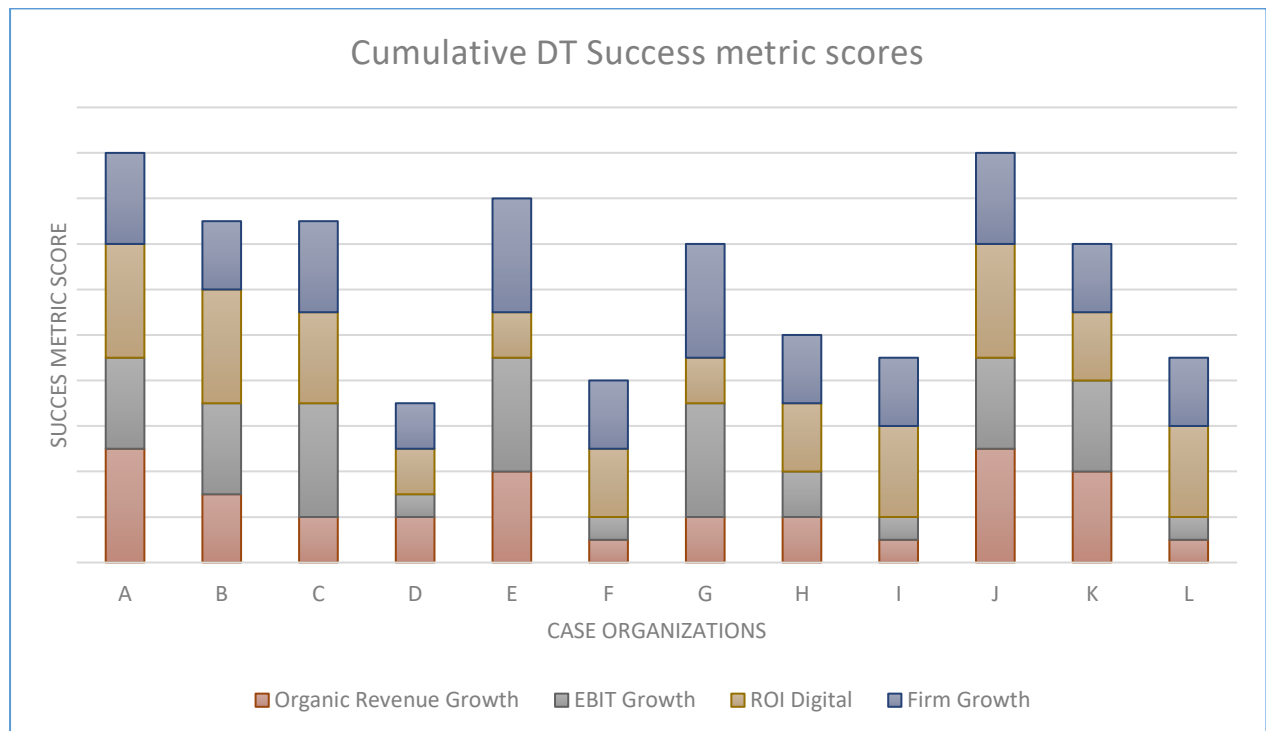
Cumulative DT Success metric scores per case organization

All identified success metrics are present at the TLSPs

Despite some TLSPs scoring higher than others on the success metrics, the overview shows that all metrics that were identified in the literature review are also present at the case organizations of this study. There is no success metric with a neglectable score within all organizations.

Overall high scoring case organizations score high on the rate of EBIT growth and the return on digital investment

There are five high scoring TLSPs (>=15 cumulative DT Success score): Case organization A, B, C, E and J. The organizations show an overall high score on the following DT success metrics:

- *The rate of EBIT growth:* the DT activities have shown a great impact on the EBIT growth of three of those TLSPs, with a percentage of <25% per organization. The two other TLSPs have a 15%-25% increased EBIT growth related to their DT activities.
- *The return on digital investment:* the ROI on the DT activities has been great for 3 TLSPs, all with an ROI of >100%. For one other TLSP the digital ROI is between 75%-100%.

Overall low scoring case organizations score low on the rate of organic revenue growth and the rate of EBIT growth

There are four low scoring TLSPs (<10 cumulative DT Success score): Case organization D, F, I and L. Those four organizations show an overall low score on the following DT success metrics:

- *The rate of organic revenue growth*: the DT activities have shown a neglectable impact on the organic revenue growth for 3 of the 4 TLSPs. One TLSP has a slightly noticeable impact of 1%-5%.
- *The rate of EBIT growth:* The DT activities of all four TLSPs have shown a neglectable impact on their EBIT growth.

Overall low scoring case organizations score high on the return on digital investment

When looking at the low scoring TLSPs, two (I and L) score high on the DT success metric *ROI Digital*. Both TLSPs have a ROI of 75% - 100% on their investments related to their digital transformation activities. However, for both organizations the digital transformation investments are limited.

2PLs score higher on overall DT success than 3PLs

There is one characteristic that particularly stands out when looking at the scores of these TLSPs; 4 out of 6 2PLs (Organization A to F) score high on DT success, while only 1 out of 6 3PLs (Organization G to L) score high on DT success.