

Digital transformation at logistics service providers: barriers, success factors and leading practices

Digital transformation at LSPs

209

Marzenna Cichosz

*Institute of Infrastructure, Transport and Mobility,
SGH Warsaw School of Economics, Warsaw, Poland*

Carl Marcus Wallenburg

*The Kühne-Foundation Chair of Logistics and Services Management,
WHU- Otto Beisheim School of Management, Duesseldorf, Germany, and*

A. Michael Knemeyer

Fisher College of Business, The Ohio State University, Columbus, Ohio, USA

Received 27 August 2019

Revised 20 January 2020

7 April 2020

Accepted 19 April 2020

Abstract

Purpose – The rapid advancement of digital technologies has fundamentally changed the competitive dynamics of the logistics service industry and forced incumbent logistics service providers (LSPs) to digitalize. As many LSPs still struggle in advancing their digital transformation (DT), the purpose of this study is to discover barriers and identify organizational elements and associated leading practices for DT success at LSPs.

Design/methodology/approach – This study utilizes a two-stage approach. Stage 1 is devoted to a literature review. Stage 2, based on multiple case studies, analyzes information collected across nine international and global LSPs.

Findings – This research derives a practice-based definition of DT in the logistics service industry, and it has identified five barriers, eight success factors and associated leading practices for DT. The main obstacles LSPs struggle with, are the complexity of the logistics network and lack of resources, while the main success factor is a leader having and executing a DT vision, and creating a supportive organizational culture.

Practical implications – The results contribute to the emerging field of DT within the logistics and supply chain management literature and provide insights for practitioners regarding how to effectively implement it in a complex industry.

Originality/value – The authors analyze DT from the perspective of LSPs, traditionally not viewed as innovative companies. This study compares their DT with that of other companies.

Keywords Technology, Digitalization, Digital innovation, Transformation success, Logistics service provider (LSP)

Paper type Research paper

© Marzenna Cichosz, Carl Marcus Wallenburg and A. Michael Knemeyer. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

The first version of this paper was presented at the 14th CSCMP European Research Seminar (ERS) in Warsaw (Poland) in 2019. The authors want to thank the participants for their valuable comments.

Funding: This study was financed by the Collegium of Management and Finance, SGH Warsaw School of Economics as a research project no. KZiF/S/05/18.



1. Introduction

The last decade, characterized as “the digital age” (Hirt and Willmott, 2014), has fundamentally changed the competitive dynamics of industries, including the logistics service industry (Hofmann and Osterwalder, 2017). A host of innovative newcomers such as Amazon and Alibaba – e-tailers, who invest in technology-supported warehouses and transport (Cichosz, 2018), or uShip, Delive, Cargonexx – digital startups with different types of intermediation platforms, including crowd logistics platforms (Castillo *et al.*, 2018), have entered the logistics market and challenged current business practices and future prospects of incumbent logistics service providers (LSPs).

To stay competitive and grow, LSPs need to improve their value proposition for shippers and their customers (Prockl *et al.*, 2012; Marchet *et al.*, 2017b). This includes increasing operational efficiency by addressing industry problems such as high fragmentation, low transparency, underutilized assets, costly manual processes and in many instances outdated customer interfaces (Riedl *et al.*, 2018), and offering a better customer experience with smarter, faster and more sustainable logistics (DP-DHL, 2018; Gruchmann and Seuring, 2018; Daugherty *et al.*, 2019). Technology plays a critical role in logistics value differentiation (Gunasekaran *et al.*, 2017). It triggers and enables innovations (Mathauer and Hofmann, 2019), and hereby moves logistics to a higher level of efficiency and responsiveness (Evangelista and Sweeney, 2006; Lin, 2008; Evangelista *et al.*, 2013; Gunasekaran *et al.*, 2017). Based on logistics innovations, supply chain members can adapt to market changes (Daugherty *et al.*, 2005), align to improve their performance (Fawcett *et al.*, 2011) and increase their agility (Christopher *et al.*, 2016).

As 50–70% of logistics activities are outsourced (Langley, 2019), a significant proportion of the digital transformation (DT) of logistics rests on LSPs’ shoulders. LSPs can serve as architects of the further development of flows within Industry 4.0 (Delfmann *et al.*, 2018) and backbones for e-commerce growth (Kembro *et al.*, 2018). In order to fully exploit the opportunities established by new technologies and transform digitally, LSPs need to evolve their strategies, cultures and business models.

According to the World Economic Forum (WEF, 2016), digitization in logistics could grow up to 1.5tn US\$ in value by 2025. However, the analyses show that logistics companies are now behind the DT curve compared to the media, telcom, banking and retail sectors (Riedl, 2018). The logistics service industry has struggled to adopt technologies (Gunasekaran *et al.*, 2017; Mathauer and Hofmann, 2019) and increase their innovativeness (Wagner, 2008; Busse, 2010; Bellingkrodt and Wallenburg, 2013). Literature points to a lack of technological know-how (Wagner, 2008), low educational levels of the workforce (Lai *et al.*, 2005) and difficulties with innovation transfer among various, dispersed LSP’s branches (Busse and Wallenburg, 2014; Cichosz *et al.*, 2017). This study focuses on LSPs which have a special position in supply chains, between shippers and their customers (Selviaridis and Spring, 2007). It aims to identify the underlying factors that hinder or stop their DT, and the essential organizational elements and leading practices that shape their DT success. Therefore, the following three research questions are investigated:

RQ1. What does DT mean to an LSP and to its value proposition for different stakeholders?

RQ2. What are the main barriers to DT at LSPs?

RQ3. What are success factors and associated leading practices for DT at LSPs?

To address these research questions, a two-stage approach was adopted with Stage 1 being a literature review, and Stage 2 a series of nine case study analyses of global LSPs. After introducing the key concepts of this research in the following section, the methodology is subsequently outlined. Next, the findings of this study are reported. The final section

provides a description of the study's contributions and outlines limitations and future research directions.

2. Literature review

2.1 Digital transformation

Although the concept of DT has recently gained strong interest in both academia and practice, it lacks consensus with respect to its definition (Morakanyane *et al.*, 2017; Osmundsen *et al.*, 2018). Scholars view it as a strategy (Bharadwaj *et al.*, 2013; Kane *et al.*, 2015), a process (Hansen *et al.*, 2011; Berman and Marshall, 2014; Morakanyane *et al.*, 2017; Cichosz, 2018; Hausberg *et al.*, 2018; EC, 2018) or a business model (Henriette *et al.*, 2016). Typically, they emphasize “the use of new digital technologies (..) to enable major business improvements” (Fitzgerald *et al.*, 2014, p. 1). It must be stressed that DT is not about a single technology, but major changes based on a “combination of information, computing, communication, and connectivity technologies” (Bharadwaj *et al.*, 2013, p. 471), i.e. “a fusion of advanced technologies” that are integrating physical and digital systems (EC, 2018). Importantly, not all technologies within DT have to be digital. In the context of DT, even technologies that themselves are not digital (i.e. delivery vans, forklift trucks and conveyers) can become an element of DT (Mathauer and Hofmann, 2019) when equipped with new technology components so that they, for example, can be tracked with regards to their location and speed. Morakanyane *et al.* (2017, p. 11) add the role of “leveraging digital capabilities” by people in DT.

Creating value is identified as a key output of DT. Value includes, but is not limited to: operational efficiencies, improved customer experiences, enhanced business models, strategic differentiation, competitive advantage, improved stakeholder relationships, costs savings, etc. (e.g. Berman and Marshall, 2014; Morakanyane *et al.*, 2017).

The DT is a continuous evolutionary process (Morakanyane *et al.*, 2017; Cichosz, 2018), which will differ depending on the digital maturity of the implementing organization, defined as “the degree to which organizations have adapted themselves to a digital business environment” (Kane *et al.*, 2017, p. 3). The term “digital maturity” has received attention in the work of Westerman *et al.* (2014), who suggests that firms with higher digital maturity exhibit superior corporate performance. Their research separates the concept of digital maturity into: (1) digital capabilities, which indicate the intensity of digital initiatives and (2) transformation management capabilities, which address managerial aspects that drive DT (i.e. leadership, culture, change management, governance). Companies with strong digital capabilities and weak transformation management capabilities are coined Fashionistas while companies with strong transformation management capabilities and weak digital capabilities are coined as Conservatives (see Figure 1). To advance digital maturity and achieve digital mastery, companies need to develop both capability dimensions. The word “advance” is critical, as even within the Digirati quadrant companies could present different levels of digital mastery.

“The phenomenon of DT is context-specific and can take an idiosyncratic path” (Remane *et al.*, 2017, p. 2). Thus, while “coming of age digitally” (Kane *et al.*, 2018), it is important to: (1) recognize the stage at which one's DT departs from, i.e. assess the firm's digital maturity using a digital framework (e.g. Westerman *et al.*, 2014; Kane *et al.*, 2018), (2) understand where one is going, i.e. the nature of digital disruption in terms of value for customers, employees and other stakeholders, (3) identify barriers and (4) implement success factors via leading practices to progress DT.

2.2 Barriers and success factors for digital transformation

The implementation of DT is a complex process accompanied by numerous barriers that may limit its success. Many firms still struggle to realize their DT potential due to different barriers, i.e. “those few things that can hinder or stop the successful implementation of DT”

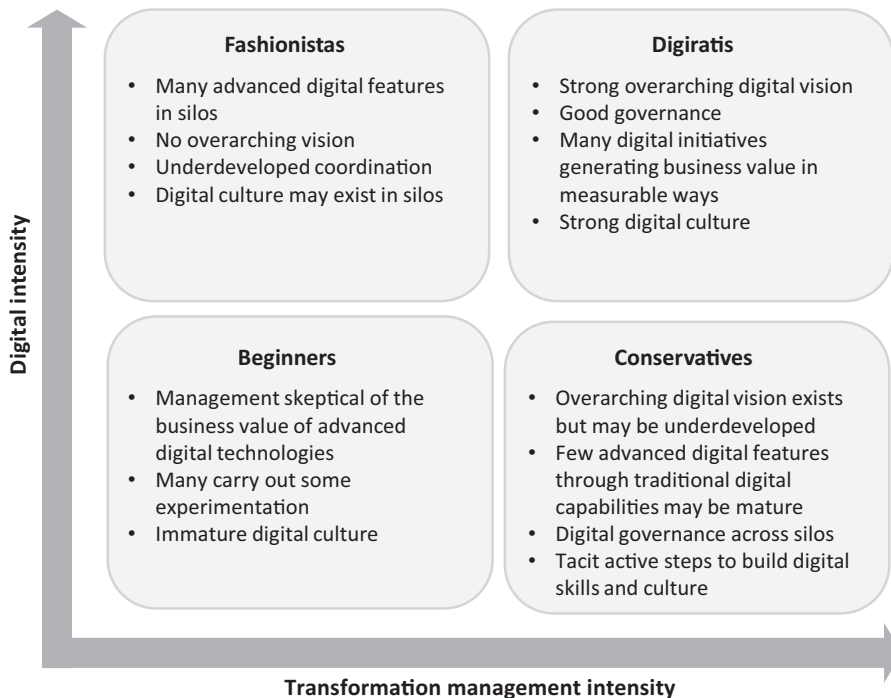


Figure 1.
Digital maturity matrix

Source(s): Adapted from Westerman *et al.* (2014)

(Vogelsang *et al.*, 2019a, p. 4938). Thus, identifying obstacles, understanding their nature and roots, is an important aspect of being able to counteract them. Additionally, it is worth recognizing success factors, i.e. “factors that enhance the probability of success” (Williams and Ramaprasad, 1996, p. 255) with related leading practices which are both enablers to superior DT implementation. However, Williams and Ramaprasad (1996, p. 255) emphasize, that, when a success factor is an enhancing factor, “the absence of a critical success factor would not necessarily be a critical failure factor.”

The topic of barriers and success factors for innovation implementation has already been studied within the information systems (e.g. King and Burgess, 2006; Ngai *et al.*, 2008; Nikpay *et al.*, 2013), innovation management (e.g. Oke, 2004) and change management literature (e.g. Oakland and Tanner, 2007; Oliveira *et al.*, 2018). However, the characteristics of DT (e.g. the simultaneous use of many technologies that have a significant impact on creating digital products/services, digital processes and digital business models), requires specific investigation (Pellathy *et al.*, 2018). Table 1 summarizes selected studies on barriers and success factors to DT, conducted in manufacturing and service settings. The list contains qualitative and quantitative research as well as a literature review paper. As DT is an emerging topic, most of the items listed in Table 1 are conference papers derived from the AIS eLibrary.

The analysis shows that prior studies identified people as both the biggest challenge and main source of success to DT. Kane *et al.* (2018) point out “competency traps” with employees being prisoners of their past successes. Toytari *et al.* (2017) report difficulties with changing people’s mindsets and beliefs, while Vogelsang *et al.* (2019a) focus on people’s IT capabilities. At

the same time the literature review demonstrates that digital leaders with a vision supported by empowered, knowledgeable and collaborative employees are critical to DT success.

2.3 Logistics service providers and digital transformation

The logistics industry spans a broad variety of players (LSPs) that perform logistics services on behalf of others (Delfmann *et al.*, 2002). With globalization, outsourcing and the development of technological innovations, the logistics service industry evolved from a commoditized industry, with hundreds of thousands of logistics companies performing just transport or warehousing services (Marquardt *et al.*, 2011), into an industry also embracing third-party LSPs (3PLs) offering bundled and more complex logistics services (Selviaridis and Spring, 2007; Wagner and Sutter, 2012) and fourth-party LSPs (4PLs) subcontracting and orchestrating other service providers (Win, 2008; Zacharia *et al.*, 2011). LSPs differ in size of the firm, ownership structure, scope of services they offer (Evangelista *et al.*, 2013), and how they add value to shippers' businesses, i.e. either through volume-, process- or innovation-oriented models (Marchet *et al.*, 2017b). They also differ in the way they deal with technologies.

Technology constitutes a precondition for DT. In the logistics service industry, Germain *et al.* (1994) distinguish between hardware and software technologies. Mathauer and Hofmann (2019, p. 419) notice that through digitalization "even hardware solutions are undergoing technologization and have gradually become high-tech products" (e.g. smart flexible conveyers following a warehouse worker). For the hardware and software solutions, whether standardized or customized ones, to be considered as technological innovations does not require them to be new to the market. In most cases they are only novel to the individual firm that decides to implement them. The technologies constitute the base for LSPs' innovations which span from incremental improvements to radical changes (Soosey *et al.*, 2008). Findings show that LSPs have traditionally been focused on incremental cost or service improvements to daily operations (Wagner, 2008), which are mostly "pulled" by the customer (Soosey and Hyland, 2004; Flint *et al.*, 2005). The range of possible LSP's advancements could be extended by proactive (LSP-initiated) improvements which are, according to Deepen *et al.* (2008) and Wallenburg's (2009) empirical research, beneficial to customer loyalty and LSP performance.

Proactive and reactive technological improvements transform an LSP. Researchers have argued that certain features of organizations will influence the adoption of innovation at an LSP. Soosey and Hyland (2004) on the one hand, point out internal organizational conditions such as employee and stakeholder orientations, financial reasons, quality, speed, efficiency and having a leading edge in the industry, and on the other hand, they emphasize external organizational conditions such as competition. The study by Lin (2008) suggests a significant positive influence of organizational encouragement and quality of human resources. Marchet *et al.* (2017a) point to the need of establishing partnerships with shippers and technology providers. Mathauer and Hofmann (2019) identify the importance of different technology access modes (i.e. make, buy or ally). These findings support Grawe's (2009) approach to LSP's innovativeness as a dynamic capability which requires the ability to integrate, build and reconfigure – not only internal but also external – resources and competences.

3. Research method

3.1 Research approach

The research adopts a two-stage approach. Within Stage 1, a literature review was conducted to identify potential barriers and success factors in order to isolate patterns and facilitate a more precise analysis within the qualitative part. The literature review was also used to prepare an interview protocol, perform coding and conduct the results' analysis in order to compare the differences regarding DT for LSPs and DT for other industries. In Stage 2, multiple case studies, utilizing semi-structured interviews with experts from LSPs, were

Authors	Research method	Objective of the study	Barriers/Challenges	Success factors
Kane et al. (2018)	Quantitative (4300 respondents from different industries)	To understand challenges and opportunities associated with the use of social and digital business	<ol style="list-style-type: none"> (1) Competency traps (2) Lack of experimentation and iteration (3) Dealing with ambiguity and constant change (4) Buying and implementing the right technology (5) Lack of org. support to develop employees skills 	<ol style="list-style-type: none"> (1) Developing digital leaders (2) Push decisions down (culture of distributed leadership) (3) A growth mindset (4) Being likely to experiment and iterate
Vogelsang et al. (2019a) , Vogelsang et al. (2019b)	Qualitative (manufacturing)	To identify and describe key barriers and success factors (in the second paper) to DT in manufacturing	<ol style="list-style-type: none"> (1) Missing skills (IT and process knowledge) (2) Technical barriers (3) Individual barriers (fear of job loss, transparency, loss of control) (4) Organizational and cultural barriers (keeping traditional roles, no clear vision, resistance to change, risk aversion, lack of financial resources, lack of time) (5) Environmental barriers (no standards and no laws) 	<ol style="list-style-type: none"> (1) Organizational success factors (pilot projects, prepare for future, customer needs, autonomy, employee qualifications, culture, (Big) Data use, management support) (2) Environment (connectivity, transparency, collaboration, hybrid value creation, standards) (3) Technology (infrastructure, reliability, relevance, adaptability, security)
Toytari et al. (2017)	Qualitative (service issues in industrial companies)	To explore barriers in adopting smart services	<ol style="list-style-type: none"> (1) Internal barriers and management practices (culture, change of mindset, beliefs, identity) (2) Lack of resources and capability gaps to provide smart services (3) External barriers (industrial buying culture and relationships, reputation and brand image, unwillingness to outsource, nonmatching solution visions) 	

Table 1.
Barriers and success factors for digital transformation

(continued)

Authors	Research method	Objective of the study	Barriers/Challenges	Success factors
Osmundsen <i>et al.</i> (2018)	Literature review	To understand how to accomplish DT and how DT affects organizations		<ol style="list-style-type: none"> (1) Supportive organizational culture (2) Well-managed transformation activities (3) Leveraging external and internal knowledge (4) Engagement of employees (5) IS capabilities (6) Dynamic capabilities (7) Digital business strategy (8) Aligned business and IS

Table 1.

conducted. The case study is an effective methodological fit for the current stage of DT conceptual development (Edmondson and McManus, 2007). It is recommended for exploratory and theory-building research (Eisenhardt, 1989; Gammelgaard, 2017). We analyzed multiple cases in order to provide a more robust and generalizable consensus (Yin, 2014).

3.2 Case selection

According to Yin (2014), a multicase study approach should follow a sampling logic. Therefore we decided to identify case firms by purposefully applying the following criteria. First, we decided to select LSPs who have introduced or are introducing at least a few digital initiatives. Second, we restricted the geographical scope to Poland – the biggest logistics market in Central Europe (BVL, 2017) and in the top 3 of Europe's most desirable logistics country location in terms of value proposition (ProLogis, 2017). Third, we focused on large LSPs, in the top 20 LSPs (Brdulak, 2018), who are global players with experience in digitalization. It was decided that these LSPs could provide comprehensive insight regarding barriers they experienced and how they can be overcome, as well as the most important success factors that helped achieve a particular stage of the DT. In order to increase theoretical generalizability, we selected case firms that differ by the level of their digital maturity from Fashionistas, through Conservatives, up to Digirati (Westerman *et al.*, 2014). Beginners were excluded because of their limited experience within DT. Our case firms embrace two groups of LSPs, i.e. (1) transport and logistics companies (T&L) which are working with business clients more on a time-contract basis and (2) couriers, express and parcel companies (CEP) which have more centralized structure and standardized solutions offered to either business customers (B2B) or final consumers (B2C). Within the nine case firms that made up our sample, we identified the digital experts primarily leading the organization's DT, i.e. CIO, IT Managers, Operating Managers, Managing Directors, Marketing Directors) as informants (Kane *et al.*, 2018). Initial e-mail or phone contact with potential informants confirmed their interest and expertise to take part in the study. Table 2 presents a description of case firms and interview participants.

3.3 Data collection and analysis

Based on the literature review, we developed an interview protocol that helped us structure our conversations with the subject matter experts (Bryman *et al.*, 2007). We organized interviews into four main parts: (1) Introduction, (2) Digital Business Strategy (DBS), (3) Digital Transformation – Barriers and Success Factors and (4) Conclusions (see Appendix 1). The instrument was pilot-tested with a Managing Director from a large LSP. The interview protocol was shared with interview participants in advance. In total, 17 interviews took place in 2019. Our interviewees were involved in coordination and implementation of DT, with operations in Poland being either a pilot or part of a roll-out. Interviews were conducted either face-to-face, via Skype or over the phone. The interviews lasted between 60 and 125 min (85 min on average). The interviews were recorded, transcribed and complemented with data from additional sources, like companies' websites, industrial and companies' reports and study visits.

In the data analysis stage, we analyzed each case individually and compiled a within-case description, concluding with a list of major findings (Eisenhardt, 1989), containing barriers, success factors and leading practices provided by interviewees from the case LSP. Then, we sent this summary to our informants requesting feedback and additional information on their individual case. When the feedback arrived, we discussed it and included it in the analysis. Next, we conducted a thematic analysis and coded the material for identifying cross-case patterns; firstly, within each digital maturity group, and then across them. Based on our findings, we were able to prepare a preliminary version of common barriers and success factors to DT. Then, we discussed the list for synthesis. When the shortened list of barriers and success factors was ready, we sent it out to our interviewees with a request to evaluate the importance of each element, using a 10-point scale from 1 (not important) to 10 (critical). This allowed us to confirm particular barriers and success factors and establish the final importance ranking (see Appendix 2).

4. Findings

The data analysis showed that leaders of the logistics industry are experiencing prevailing pressure from their customers, employees, business partners and competition, including entrance of new competitors, to pursue digital change. Leaders of the logistics service industry have already taken steps toward developing, implementing and diffusing different technologies, which helped them progress their digital maturity. The most digitally advanced LSPs, Digiraties, undertook a strategic approach to DT. Within the last five years, they have developed and introduced digital business strategies (DBS) as well as a chief digital officer role to their board of directors. Their strategies translate into several programs with up to 30 projects and initiatives. However, even LSPs without DBS have several digital projects and initiatives. The most common ones are as follows: standardization of operational systems in different country markets, eliminating paper documents from order management processes, introducing track and trace capabilities which provide an ability to estimate time of arrival (ETA), digitizing contacts with customers and partners (e.g. carriers/couriers) through platforms, utilizing predictive analytics to optimize the usage of their systems' capacity, automation of simple transport, warehousing and value-added logistics processes, and digitizing back-office operations such as HR and others.

4.1 Digital transformation notion and value in the logistics service industry

Managers across case companies exhibit a very similar understanding of DT at LSPs. They see it as the evolutionary process of "moving an LSP from analog to the digital world" (C1, C3). All interviewees emphasized the need for being technology-oriented. C1 explained: "Using digital technology changes our business, (i.e., services we offer, processes and business

Company code	Company profile	Company's digital maturity	Interview participants	Experience of interview participants
C2	CEP Publicly owned 8.000 EE (Poland)	Digirati	(1) Marketing Director Poland (2) IT Director Poland	(1) 10 years of experience in marketing; 6 years in CEP; engaged in many digital projects in Poland and in the region (2) 20 years of experience in IT project management; 8 years in CEP; supervising all digital projects in Poland in his division
C4	T&L Publicly owned 146.000 EE (worldwide)	Digirati	(1) CIO Central and Eastern Europe (2) Distribution and Production Center Manager	(1) 20+ years of experience in IT, incl. 15 in T&L; supervising all digital projects in Poland and in the region (2) 20 years of experience in CEP; 1 year of experience in T&L; engaged in all digital projects in his facility
C6	T&L Publicly owned 15.000 EE (worldwide)	Digirati	(1) Managing Director Poland (2) Supervisor IT Poland	(1) 20 years of experience in T&L; IT background; responsible for many digital projects in Poland (2) 15 years of experience in T&L; earlier IT Project Manager; responsible for many digital projects in Poland
C9	T&L Publicly owned 100.000 EE (worldwide)	Digirati	(1) General Manager Poland	(1) 20+ years of experience in T&L; supervising all digital projects in Poland
C1	T&L Family business 10.000 EE (Europe)	Fashionista	(1) Managing Director Poland (2) Innovation Center Manager Poland	(1) 20+ years of experience in T&L; supervising all digital projects in Poland in his division (2) 20+ years of experience in T&L; 3 years managing Innovation Center; responsible for all projects in Poland
C8	T&L Family business 1.400 EE (Europe)	Fashionista	(1) Head of Project Management Office (2) CEO Contract Logistics Domestic Distribution	(1) 15+ years of experience in T&L; supervising all digital projects in Poland in her division (2) 13 years of experience in T&L; last 2 years responsible for digital projects in contract logistics in Poland

(continued)

Table 2.
Description of case firms and interview participants

Company code	Company profile	Company's digital maturity	Interview participants	Experience of interview participants
C3	T&L Family business 30.000 EE (worldwide)	Conservative	(1) Managing Director of European Logistics Poland (2) IT Manager Poland	(1) 20+ years of experience in T&L; supervising all digital projects in Poland in his division (2) 15+ years of experience in T&L; engaged in most digital projects in Poland and many in the region
C5	T&L Publicly owned 72.000 EE (worldwide)	Conservative	(1) CIO NE Europe (2) European Head of Operational Excellence	(1) 20+ years of experience in IT project management; 1 year of experience in T&L; supervising many digital projects in the region (2) 15 year of experience in T&L; responsible for digital projects aimed at operational excellence in the region
C7	T&L Publicly owned 47.000 EE (worldwide)	Conservative	(1) Head of Innovation Services for Europe and Middle East (2) Sales and Marketing Director	(1) 20 years of experience in T&L; responsible for many digital projects in Poland and in the region (2) 20 years of experience in T&L; engaged in many digital projects in Poland

Table 2.

Note(s): EE – employees

models we operate), and our communication.” C9 stated: “Technology induces front- and back-office changes and makes sure that LSPs are no longer just logistics companies, they start being technology firms offering logistics services.” Technology innovations facilitate logistics capabilities such as logistics measurement, information exchange, integration with supply chain partners, serving customers and learning. They support LSPs in becoming more dynamic and adaptable to a fast-changing environment.

While describing the motivation behind DT, the respondents stressed creating value for different groups of stakeholders, i.e. customers, business partners, employees and society. According to case LSPs, technology helps innovate. That means to

- (1) increase operational efficiency (by tracking and tracing shipments and being able to ETA, applying robotic process automation in picking, palletizing, loading/unloading vehicles or (predictive) big data analytics and artificial intelligence systems that assist humans in making decisions) (C1); delivering social benefits related to eco-efficiency through process optimization and reducing fuel consumption and the movement of pallets (C8);
- (2) improve customer experience (by becoming faster, more flexible and responsive through robots and automation (C5); more reliable through sensors, geolocation and blockchain applied in monitoring of loads' status which provides an opportunity to react in case of any problems (C1 C2, C5) and easier to contact with through platforms (C1, C2, C5, C9);

- (3) introduce new services based on information about customers' demand, available capacity and end-to-end product visibility (C2, C6, C7);
- (4) introduce platform business models for customers and carriers (all case LSPs).

C8 emphasized visibility and “fair play” as a consequence of it. C9 – enhancing return on investment (ROI) by using technologies that better leverage capital expenditures in people and equipment. C4 and C6: “Growing faster than the market.” C5 admitted: “Thanks to technology, it is easier to scale the business up”. However, case LSPs had doubts whether digital technology could guarantee a competitive advantage and help with winning customers in the long run. As noticed by C1: “More and more often, digital technology becomes the standard which qualifies for a contract but does not win the contract.” In the context of value proposition, all case LSPs mentioned that technology innovations introduced within the DT of an LSP are an important element influencing their companies' image. As C1 and C4 explained: “Not only customers and business partners appreciate dealing with an innovative LSP, but it is critical for gaining and retaining young generations of employees with digital capabilities.”

Based on the review of literature and the views of our interview participants, we define DT at LSPs as *an evolutionary process of change that leverages technologies and digital capabilities of an LSP, its employees, partners and customers to enable major improvements within the LSP, regarding operational efficiency (including eco-efficiency), customer experience, as well as new services and digitally enabled business models to create value for its stakeholders.*

4.2 Barriers to digital transformation

The analysis of the case study data revealed five major barriers that LSPs face when implementing technological innovations within their companies: (1) complexity of the logistics system and underlying processes, (2) lack of resources including skilled resources, (3) technology adoption, (4) resistance to change and (5) data protection (Figure 2). The main difference between the impediments identified by our study compared with those from the general DT literature relates to the fact that people, and their resistance to change, are not the top barrier at the LSPs. This barrier is overtaken by other factors that stem from the characteristics of the logistics service industry and its processes. As stated by C2 IT Director: “DT in the logistics service industry is different from DT in, for example, the telecoms. It isn't taking place only in virtual reality, *but the flow of goods must be organized in the analog world.*”

4.2.1 Complexity of logistics network and underlying processes. Complexity was viewed as the main barrier to DT in the logistics industry with an overall score of 7.57. Our analysis shows this factor to have two dimensions. First, the complexity of the logistics industry, which consists of different types of LSPs that deal as an intermediary with shippers and customers of different sizes and types dispersed around the world along with the associated challenges of coordinating the network of contract- or spot transaction-carriers, warehouse operators and terminal operators. Therefore, DT of an LSP is a megaproject that influences multiple network members and requires coordination across different companies, countries, locations and departments. C1 called it “a big puzzle that requires enormous organizational effort.” We found that harmonizing different IT systems, standards and levels of knowledge among DT project partners is the biggest challenge for LSPs.

The second dimension of complexity that LSPs struggle with is the intricacy of the underlying processes and difficulties with their standardization. These, on the one hand, result from difficulties related to constraints from IT or legal systems specific to multinationals which grew in different markets by acquisitions. C3 reported an interesting example of legal constraints: “E-invoice or the equivalence of an electronic signature to the

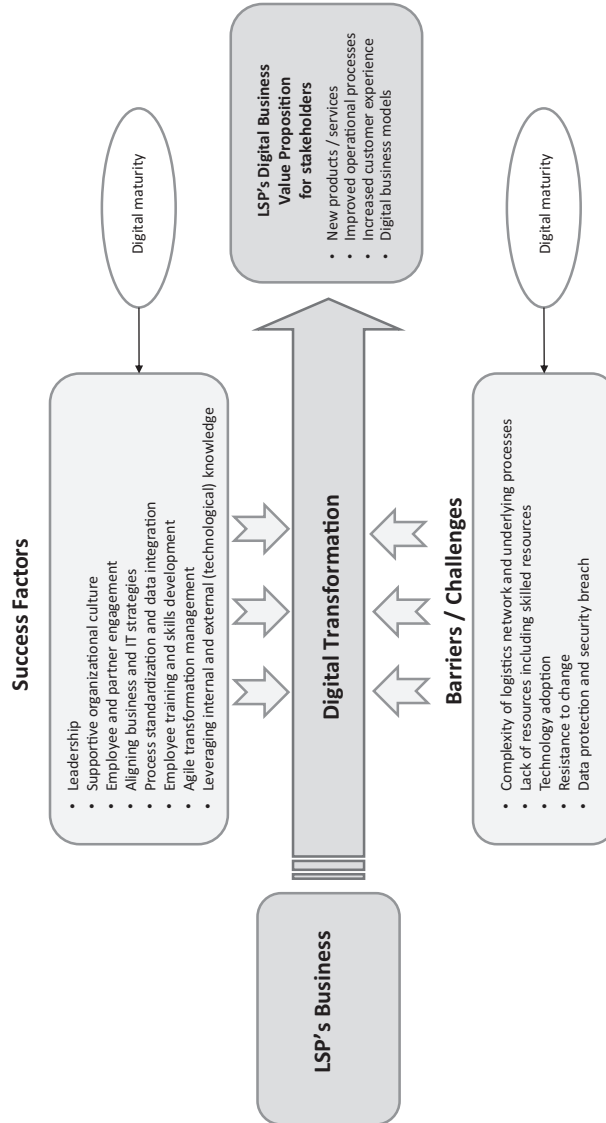


Figure 2. Model of barriers and success factors to digital transformation at LSPs

standard ‘stamped and signed paper’ is making digitalization easier, but certain countries may still require paper copies to be generated and handled. In some cases, while standard document digital flow ‘order-shipping document-delivery note-invoice’ is fully supported and legally compliant, it is the exception to the handling process that still requires not only paper documents but also the physical signature upon its receipt by the other party to be fully recognized as valid by an external authority (e.g. correction invoices in Poland, shipping documents in Hungary).” On the other hand, the intricacy of the underlying processes results from difficulties related to customization. C1 admitted: “When a company transforms digitally and works on its standards, it happens that pressure from big, powerful clients appears. All exceptions we agree on are later very difficult to manage.”

Besides the reasons above, much of the inefficiency in processes is the consequence of low labor cost in various countries across the globe, for example in Central Europe, which does not encourage LSPs to make an effort to simplify their business processes. “Some LSPs try to digitalize a mess. They think that digitalization is a Holy Grail that will resolve all their problems. However, ultimately, it does not work” (C1).

4.2.2 Lack of resources including skilled resources. Our findings show that the second biggest problem LSPs face during DT (with a 6.79 overall mean) is lack of different types of resources. Case LSPs reported to lack time and money, but foremost they struggle with shortages of digitally skilled employees. As revealed by C1: “It is quite common that digital projects to be implemented are waiting for available skilled IT people.” Moreover, LSPs lack drivers, couriers and warehouse employees. According to C2: “Nowadays, Courier, Express and Parcel companies compete for employees with Uber, Uber Eats and other last-mile delivery companies. Technology can help prepare the workplace in a way that makes it possible for a courier to be productive from the first day of his/her work.” C4, C5 and C7 perceive technology as supporting the automation of simple work in a warehouse, so that fewer people are needed for simple repetitive work. Thus, technologization, according to C9, is the way LSPs must take as it becomes more and more difficult to encourage people to work. However, C3 concluded: “Up to now, technology in logistics is still more of a marketing tool to show how innovative a company is, rather than solution to real problems.”

In terms of money, C5 and C7 explained that main problem relates to the fact that, in most cases, digital projects demand significant (up-front) investments in assets and that is why each time they consider launching a digital project, they prepare a business case and calculate the ROI. Lack of money or too long of a payback period bothers even large players. C4 clarified: “In most cases, the cost of DT is on each division’s P&L, which is a big burden for its budget and could make LSPs stop (if the decision is made at the local level) or postpone the change to the last possible moment”.

4.2.3 Technology adoption. C2, C4 and C5 stated: “It is not technology, but strategy, that drives DT.” Nevertheless, we found that case LSPs (especially Conservatives) consider picking the right technology at the right moment in time an important challenge (6.29 mean score). They even placed this barrier ahead of employees’ resistance to change. We noticed that in spite of LSPs having their IT competence centers supporting their technology adoption decisions, “it happens even to the best that technology turns out to be an unfortunate investment” (C2, C3, C9). This was the case for a global CEP operator, who, a few years ago, launched a European online marketplace “All you need” that, after two years of huge investments, had to be closed. C1 explained: “The decisions for a particular technology are quite often influenced by the hype from vendors and the media.” The reason behind this is often related to low operations engagement in the process of the right technology recognition and adoption, due to the perception that any project with the adjective “digital” should be the domain of IT. According to C5: “Very often DT projects are left to be led by IT organizations, without sufficient and quality contribution from the future business owners. It may lead to making choices between the hottest and novelty solutions from technological perspective, but

not necessarily the most effective and efficient ones from the perspective of satisfying and supporting the core operational needs of a company and its customers.” Moreover, Conservatives signaled a problem with huge investments in specific hardware and/or software technologies which are difficult to redeploy for alternative clients or locations. These investments must be secured against the client’s opportunism with long-term contracts.

4.2.4 Resistance to change. Resistance to change is the most frequently mentioned barrier to DT in the literature. It applies to the logistics service industry as well, after the barriers related to complexity, resources and technology. However, Fashionistas, with rather weak transformation management capabilities, ranked it higher (i.e. the second on their priority list).

Based on the interview analysis, we identified two dimensions of resistance: institutional and individual. The former one was more often signaled by Conservatives. C3 and C7 stated that one could hear the following in the boardroom: “We are successful. Why should we spend money to change something that works well?” It happens quite often, in the logistics service industry, that people think that the factors that led to past achievements will also be associated with future success what leads them to “competency trap”. Such a problem exists also at the individual level. To illustrate it, C2 gave an example of implementation of a courier routing system in her company some time ago. Based on data of delivery points to serve within a coming day, the algorithms calculated the best route for a courier. The findings of the new system challenged couriers’ previous work areas and suggested completely new areas and routes, which resulted in the couriers’ resistance to change. As C2 noted: “Couriers hadn’t understood why they should change their daily routines and they were trying to continue working applying old patterns.” Unfortunately, the system was integrated with another system informing addressees about the estimated time of delivery. Therefore, the couriers’ resistance to change was visible to management in terms of unmet key performance indicators (KPIs) and customers’ complaints.

We observed that the resistance to change at the individual level is less related to LSP’s digital maturity but more often is attributed to various types of fears. C1 and C2 gave an example of track and trace systems that could cause “fear of transparency and control” among carriers. C2 pointed out “fear of job loss” as a reaction to the implementation of a new sorting machine in a hub. C3, C4 and C5 named a “fear of failure”, or more often, “a fear of a significant decrease in operational performance and worsening customer experience” when implementing a new digital service or a new operational system. They stated: “We transform a company that is operating. We have agreements with our customers and we have to be very careful.” The Conservative risk mitigation culture they operate in leads to a cautious approach to DT. Nevertheless, their comments that “service laboratories” and pilots are solutions that limit this type of fear, can suggest that the real problem behind the fear of failure could be the inability to experiment. This is a significant problem in any service industry, including the logistics one.

4.2.5 Data protection and security breach. The final barrier on our list, that did not surface in the literature review, regards data protection. C6 stressed: “Successful DT implementation requires strong integration among various business applications and information stores supporting business processes.” All case LSPs stated that provision of more sophisticated and complex services to customers or carriers, with an increasing number of self-service functions and commercial data that is made available (e.g. full company data, history of transactions, online payments, invoices, etc.), imposes a particular focus on protecting such information. C3 noted: “Cloud solutions enabling ‘anytime, anywhere’ access to services that nowadays are required by more and more customers, puts an even bigger stress on data access security and prevention against data breaches or unauthorized access. If not managed properly, failure in securing company and customer data could turn into a nightmare, with negative consequences ranging from customer loss to legal lawsuits.”

4.3 Success factors and leading practices for digital transformation

The analysis of the LSPs case study data revealed eight success factors with related leading practices. Our list of success factors corresponds with the one derived from the literature review. However, it offers extra value through: (1) LSPs' perception of the importance of individual factors (see [Appendix 2](#)) and (2) examples of associated leading practices that worked well for large global LSPs within their DT (summarized in [Table 3](#)).

4.3.1 Leadership. Leadership, with a 9.36 mean score on a 10-point scale, is the number one factor for DT success according to our sample. Many interviewees ranked it as a critical factor with the highest possible score of 10. As stated by C5: "A good leader is crucial for any transformation, including digital one." C1 and C8 (both Fashionistas) emphasized the leaders' role in "constant monitoring market trends, sensing and seizing technological opportunities to translate them into business opportunities which allow to keep an LSP in 'A' league." case LSPs see a leader as an orchestrator of change (C3, C5), able to inspire (C9) and motivate people to be active part of DT process (C2, C4, C6). C4 called it "active leadership" and emphasized the importance of inclusive management, empowerment and cascading decisions down. C1 and C9 stated that leadership for DT is not only about creating conditions for change. "Leaders must also provide execution and a very strong governance to move transformation forward" (C1). C9 added that in large organizations leaders' execution must be supported with corporate governance system and procedures.

Leadership is also about providing stakeholders with a DT vision (C1) which clarifies the direction (C3) and helps guide employees, carriers/couriers and business partners (C2, C4). C4 stated: "If the objectives and the meaning of what DT signifies for the whole organization, in terms of its operations and customer service, are not clear from the beginning, the end outcome of technological innovation's implementation could be disappointing." According to C8: "DT vision is extremely important particularly in a highly distributed environment". From Digiraties experience, it should be not only developed, translated into goals but also communicated to stakeholders via different channels and tools.

To illustrate the importance of leadership and DT vision, C2 gave an example of Rafal Brzoska, the founder of InPost, who in 2009 started the first 24/7 self-service parcel locker business in Poland. Ten years later, InPost is present in more than 20 countries, with the Polish network of over 5,000 self-service parcel lockers being the largest business structure of this type in the world. C2 summed up: "Brzoska consistently waded into vision that brought him enormous business success in Poland and abroad. He transformed not only his company but last-mile logistics itself."

4.3.2 Organizational culture supporting customer centricity and openness to change. Developing a favorable organizational culture for DT is another key success factor (with an overall mean of 8.57) identified by our case companies. Organizational culture defines how a company operates and how it introduces changes. C8 clarified that it is based on a set of norms, values and attitudes that is clearly communicated and shared among all stakeholders. Case LSPs use interactive methods, embracing meetings, presentations and workshops to cascade those values and attitudes from the top down within the organization. Our cross-case study analysis showed that customer centricity and openness to change are the most prominent organizational culture components for successful DT in the logistics industry.

C2 explained that for them customer centricity means focusing on both business customers (B2B) and final consumers (B2C), and educating employees that whatever they do, they do it for customers. Important is not only recognizing customers' problems and addressing them with smarter, faster and more sustainable services developed in the company's innovation centers but also engaging employees of all levels in proactive continuous bottom-up initiatives which improve their workplace, operations and allow the company to perform better for its customers (C2, C4).

Success factors	Associated leading practices
Leadership	<ol style="list-style-type: none"> (1) Leaders monitor market trends, seize technological opportunities and translate them into business opportunities (2) Leaders develop and communicate the DT vision (3) Leaders inspire and motivate employees to be part of the DT (4) Leaders shape supportive organizational culture for the DT (5) Leaders empower employees and cascade DT decisions down (6) Leaders, supported by system and procedures, execute and govern the DT
Supportive organizational culture	<ol style="list-style-type: none"> (1) Communicating and sharing company's norms, values, beliefs and attitudes via meetings, presentations and workshops (2) Creating a supportive work environment with trust, empowerment (3) Building agile organization structure via project management, fluid teams, flexible processes, people's openness to collaboration and change (4) Bottom-up initiatives proactively improving processes and services (5) "Questioning attitude" of employees (6) Acceptance for mistakes
Employee and partner engagement	<ol style="list-style-type: none"> (1) Programs communicating DT vision and goals (2) Programs to get the right level of management sponsorship (3) Programs to bring-in new ideas (4) Programs encouraging cross-boundaries collaboration (5) Workshops building strengthening "growth mindset"
Aligning business and IT strategies	<ol style="list-style-type: none"> (1) DT vision and goals as a part of digital business strategy (2) Pursuing aligning actions to reconfigure resources and redefine the strategy (3) "Dynamic synchronization" of business and IT strategies and resources (4) Building agile organization for fast adaptation to changing environment (5) Communicating aligned strategy to the public in a comprehensive way
Process standardization and data integration	<ol style="list-style-type: none"> (1) PMO – Project Management and Organization (2) Lean management (3) Simplification and standardization programs (4) Best Practice Library (5) Establishing KPIs (6) Real-time data and applications integration
Employee training and skills development	<ol style="list-style-type: none"> (1) Workshops building digital awareness and enhancing digital skills (2) Workshops strengthening "growth mindset" (3) "Training the trainer" programs (4) Developing business cases to present reference practices (5) Creating environment for "on-the-job" learning
Agile transformation management	<ol style="list-style-type: none"> (1) Building agile organization for fast adaptation to changing environment (2) Small cross-functional teams (3) Iteration during innovation development process (4) Communication and collaboration with clients (5) Pilot projects for checking barriers and gaining know-how in innovation (6) Mixing methods if applying only agile method is impossible

Table 3.
Overview of success factors and leading practices at LSPs

(continued)

Table 3.

Success factors	Associated leading practices
Leveraging internal and external (technological) knowledge	<ol style="list-style-type: none"> (1) Using big data repositories as a source of knowledge (2) Programs stimulating collaboration with technological suppliers (3) Programs stimulating collaboration with startups, e.g. corporate accelerators, speed-dating summits (4) Pilot projects for checking barriers and gaining know-how in innovation

This requires openness to change. C9 stressed that, when operating in a volatile, uncertain, complex, ambiguous world, “Change is imprinted in our firm’s DNA and imposes LSP’s adaptability.” Building an agile organizational structure, based on fluid teams, organized around customers’ projects, with flexible processes, and people open to change is beneficial (C8, C5). To stimulate people’s openness, case LSPs created a supportive work environment with trust (C1, C8), empowerment (C3, C4, C5, C7), encouraging employees’ communication and collaboration within and across the business units, locations and even countries (C4, C6, C9). The innovation center manager of C1 and C8 emphasized the importance of proactive, continuous improvement via instilling “questioning attitude” among employees, to identify areas and propose solutions for more cost effective or higher quality services. Being supportive for employees also means allowing them to make mistakes when they try to innovate (C8).

4.3.3 Employee and partner engagement. Digiraties rated employee and partner engagement as the most critical factor to DT success (9.33 mean value), while Fashionistas and Conservatives ranked it the third. C9 stated: “DT is not a solo game.” In large, highly distributed organizations with several digital projects in different business areas, DT leaders must be supported by the company’s management team which can drive employee engagement (C1, C8). The list of powerful practices associated with employee commitment starts with engaging key managers in DT goals’ development. C2 and C4 explained: “This ensures managers’ early buy-in and focus on the DT.” All case LSPs applied regular meetings or conference calls updating top management on digital projects. At the lower organizational level, case LSPs use presentations, workshops and programs encouraging employees to bring-in new ideas, stimulating teamwork and strengthening the development of a “growth mindset”. All these practices instill a common understanding of the DT concept, while clarifying roles, responsibilities and procedures across different departments and locations. When established, they are highly effective because LSPs are very entrepreneurial (C1) and adaptive to customer needs and changes (C7, C9).

The engagement of employees and partners in the process of DT has one more advantage – it limits their resistance to change. To illustrate this, C1 gave an example of their close collaboration with carriers on the development of an order management system. “At an early stage we asked carriers about their expectations towards the new system. They told us that their preference is fast payment. Taking that into account, we developed a system with alerts about any missing documents, limiting situations of delay or halt of payments. We also added a ‘factoring’ button for super-fast payments reported by carriers in critical situations. This way, we brought in carriers and created extra value for them within DT.”

4.3.4 Aligning business and IT strategies. According to case LSPs, DT success also highly depends on building an LSP’s strategic capability related to developing a DBS that aligns DT goals and resources to complete the goals. Digiraties plus C5 and C8, which have already developed and implemented their DBS, have found it powerful. As noticed by the Chief

Information Officer (CIO) of C4: “With DBS, the separate and subordinate role of IT strategy to business strategy is given up for a joint approach to both.” Concluding, he explained that for his company, the introduction of DBS and establishing a CDO function in addition to an CIO as a part of the board of directors was a breakthrough in their transformation: “We moved from the pilot to roll-out phase.”

Case LSPs indicated that dynamism and complexity of the business and technology environment make it difficult to articulate their DBS upfront. Therefore, the alignment is a continuous process of targeting of emerging strategy as it dynamically evolves. It requires simultaneous development and reconfiguration of IT and business resources across multiple organizational processes. C8 called it “dynamic synchronization”. C5 stressed that DBS builds on the organizational agility to allow for fast adaptation by collaboration across functions and organizational boundaries. C9 concluded: “We are no longer just a logistics company. Now, we are a technology firm offering logistics services. When communicating our strategy, our global CEO and CIO do it hand in hand, using the language of GAFA (Google, Apple, Facebook, Amazon) companies.”

4.3.5 Process standardization and data integration. From the organizational perspective, the complex logistics systems with intricate processes constitute the biggest barrier for DT success at LSPs. Case LSPs reported that the solution for this could be efficient and effective operations and process management, particularly simplification (i.e. eliminating the non-value-added components) and standardization practices. We found that, by definition, simplification of the logistics system structure is quite problematic, whereas the complexity of underlying processes is manageable by LSPs. C1, C2, C5 and C7 reported on applying lean management philosophy and techniques to streamline logistics operations. They shared the experience that 5S, value stream mapping, measuring takt-time and other lean management techniques had helped their companies eliminate various types of waste, redesign processes to increase efficiency and offer better customer experience. C4 has developed a Best Practice Library containing practices, processes and KPIs that constitute their company’s class-standard, which can be replicated in other locations for other clients. C7 encourages customers to comply their process and IT standards with those of C7, by offering them a free-of-charge plug-in within seven days. Customization is possible; however, it usually takes up to 45 days and is a paid service. “We are competing in highly distributed service business. We cannot dictate terms, but we can encourage customers to standardize processes for their and our profit.”

Standardization also relates to systems, applications and data. It allows LSPs to combine data residing in different sources, such as online transaction processing systems, TMS, WMS, applications and mobile devices like handhelds or tablets. Data integration is the first step toward transforming data into meaningful and valuable information which provides LSPs with a unified real-time view of their business performance. Therefore, it could help improve the execution of the underlying processes and increase the utilization of logistics assets such as trucks, terminals or warehouses. C5, C8 and C9 perceived data integration as fundamental for understanding business results and making business decisions. C1 noted the possibility of creating innovative IT-based services such as synchromodality that they offer.

4.3.6 Employee training and skills development. We found that one of prerequisites for employee engagement is their training. Digitaries, Fashionistas and Conservatives reported arranging portfolios of different programs related to competencies management, managerial development, trainings and certification to help employees of all levels adapt to a digital business environment. Case LSPs reported most effective practices for developing their employees’ digital skills. C2, C3 and C4 described “training the trainer” method which consists of two phases. First, IT people train a few experts who are selected based on their digital but also social capabilities. Next, those expert trainers deliver appropriate trainings to other employees, also fulfilling the role of the first line of support and internal expertise. C4

and C5 reported developing business cases to present reference practices for training employees in different locations. All case LSPs apply pilot projects that allow employees testing innovative technologies.

Employee training is organized either by LSPs' internal academies (C1, C2, C3, C4, C5) or external education institutions (e.g. C1 hires Persolog to prepare employees' competence profiles and predefine their "learning curriculum"; C5 worked with Kaizen Institute on lean leadership project). More and more widely LSPs apply interactive methods of learning and skills development through workshops (all case LSPs) and interactive multidisciplinary simulation games (C1, C2, C4, C8). Those methods not only enable employees to leverage their skills and experience but also learn and understand key integration points between different functional areas or processes. Such interactions provide also for development of other critical soft skills, i.e. clear communication, team collaboration or team management. C1 stressed that, based on 70-20-10 rule and their experience, "around 70% of actual learning experience and skills are developed while 'on-the-job'".

4.3.7 Agile transformation management. To master their DT, firms are striving to become agile (C7, C8). Agility to reallocate resources and get reorganized rapidly, in order to respond to customers' volatile demands and increasing market dynamics, was recognized as a success factor also in our study, but our interviewees placed it behind many of the other success factors. Case Fashionistas and Digiraties confirmed applying agile methods in their DT projects. As stated by C6: "Digitalization rewards the first movers and super-fast followers. Thus, when introducing a new service based on a technological innovation, being agile helps." An agile approach, in contrast to plan-based methodology, which entails detailed upfront planning and extensive documentation, represents iterative development that embraces quick deployment, responsiveness to change and an emphasis on customer needs (C1, C4, C6, C8).

Our findings suggest that in the logistics industry, transformation relies heavily on teamwork, employee and client engagement, communication and feedback. C1 reported: "Due to high acceptance of feedback in agile methodology, we can easily respond to customer requests, as customers get to validate each iteration that enables us to deliver a high-quality service within the agreed time." C4 mentioned regular meetings, C9 small cross-functional teams, and all case LSPs pilot projects, as leading practices for agile transformation. Pilots are used for testing innovative software, hardware or services. Case LSPs admitted that pilots work very well for checking barriers and gaining know-how in innovation. In general, pilots start with a single client, a location or a country. Case LSPs highlighted that Poland is often selected for running pilots because of Polish employees' creativity, flexibility and a "growth mindset".

Case LSPs particularly appreciated agile methods when working with startups. However, according to C8, in some cases, obligation to comply with legal and regulatory requirements puts a constraint preventing the implementation of agile approach. She explained that in such situations, they try to mix methods and apply an agile approach in further stages if it is possible.

4.3.8 Leveraging internal and external (technological) knowledge. The final success factor to DT (with 5.93 total mean value) relates to enhancing LSPs' knowledge and technological capabilities to increase their innovativeness. Case LSPs reported on investing in their own R&D centers that are fueled with ideas coming from their employees (e.g. through Idea-to-Net, Genius Lab programs) and technological partners, also including technological startups. They collaborate with technological companies on: (1) one-to-one basis when introducing ERP, TMS, WMS, control tower, voice-picking, vision-picking, co-bots, etc. or (2) establishing multilateral cooperation within different initiatives working out industry standards for autonomous vehicles, block chain, Physical Internet, etc.

Our study proposes that LSPs only start using their suppliers and technological startups as partners in exploration. However, they realize that there is a perfect fit between large LSPs

with resources, routines, scale and power, and ambitious, agile startups with promising ideas and willingness to take risks. There are different methods of LSP-startup cooperation. C1 works with selected startups on a few pilot and regular projects (e.g. “Smart ID Card”). C8 follows this path as well. C2 and C4 operate corporate accelerators and run programs selecting startups they want to invest in. C5 and C7 collaborate with startups that have already achieved success. We observe that aligning with startups, incumbent LSPs increase both volume and quality of their technological innovations. C4 noticed that successful collaboration with a startup requires from a large company to restraint its desire to take full control of the startup.

Our case LSPs turned our attention to one more promising source of proactive improvement of logistics processes – big data repositories. They collect lots of data from thousands of sensors in their loads, means of transport and warehouses; however, until now they are not able to use the data they have and link it with their capacity for action. They expect this will change. C1: “In the long run, DT will enable us to have access to broad, reliable companies’ knowledge from data centers, which could be used for optimizing logistical processes, e.g. in buying centers of LSPs.”

5. Discussion and conclusions

5.1 Theoretical implications

To the best of our knowledge, there is no current stream in the logistics and supply chain literature that deals with barriers and success factors for DT in LSPs (Hausberg *et al.*, 2018). Addressing this gap, we reviewed current general business literature on the topic and combined it with findings from the case analysis in the logistics industry. The alignment of what literature reports and case LSPs perceive resulted in the definition of DT at LSPs, their value proposition for different stakeholders, and a list of five main barriers and eight success factors with associated leading practices for successful DT in the logistics service industry. This serves as the basis for our contribution to research on DT (Figure 2).

The analysis demonstrates that LSPs go through a technological revolution, but they change gradually. DT is led by the largest industry players for the profit of LSPs themselves and their stakeholders. With the technological innovations applied in logistics operations and IT management, LSPs are able to improve “seeing” via enhanced visibility, “thinking” via advanced analytics and “acting” (Stank *et al.*, 2019). They increase their operational efficiency and responsiveness, improve customer experience and introduce new services, or even innovative business model platforms. More and more often they point out environmental benefits that would not be possible without applying technological solutions.

What was particularly interesting, were the differences in barriers and success factors when comparing DT in LSPs to DT in other types of companies. The analysis revealed that an obstacle that LSPs primarily struggle with is *complexity of the logistics network and underlying processes*. It seems to be very specific for DT implementation in a multitier LSPs’ context, having not been mentioned by previous studies on DT. Interestingly, the digital maturity of our case LSPs did not seem to have an impact on the perceived importance of this barrier. Fashionistas with strong digital capabilities, Conservatives with substantial transformation management capabilities, as well as advanced in both categories Digiratics, find the complexity extremely challenging. Even those LSPs with just a few projects report on the complexity of their system and the challenges of managing the underlying processes. We assume that this barrier does not significantly differ across the size of the LSP, as even LSPs with 100 employees are exposed to a similar industry system complexity. However, in the case of the complexity of underlying processes, the LSP’s size could matter – the larger the LSP, the more standard operations and processes it has (or tries to have). C4 with their Best Practice Library, or other case LSPs disseminating efficient

standard processes across different locations, countries, regions and even customers, give the base to assume so.

The second identified barrier relates to *lack of resources*. LSPs suffer from shortages of human and financial resources. The impact of both mainly depends on the size of LSPs. Financial impediments are particularly difficult for small players with very limited financial budgets. Their biggest challenge stems from the fact that, while innovative technology often requires significant up-front investment, financial institutions are not willing to lend their money for risky projects involving technological solutions to a small company operating in a low-margin industry.

In terms of human resources, LSPs oftentimes suffer from insufficient number of people with digital capabilities (e.g. good computer and smartphone applications literacy). The problem has already been signaled by [Wagner \(2008\)](#). We found that, while it is typically a smaller issue within larger organizations which are able to invest in training programs, it becomes particularly visible in smaller companies or subcontractors operating on spot contract basis, e.g. small carriers employing experienced drivers close to their retirement, where investment in digital skills development is not applicable due to frequent changes of subcontractors.

The barrier related to lack of skilled employees highly correlates with the fourth identified one, i.e. *people's resistance to change*. This challenge, with all aspects addressed within it, such as openness to change, lack of a change of mindset, falling into the “competency trap”, having different types of fears, missing skills and the lack of support from the top management, is related to change. We found this resistance barrier important but manageable within a well-organized change management process. Our findings from the logistics service setting support previous research conducted in other industries ([Toytari et al., 2017](#); [Kane et al., 2018](#); [Vogelsang et al., 2019a](#)). In our analysis, this barrier is affected by the digital maturity of the LSPs. We observed that Fashionistas more often indicated the problem of their employees' resistance to change. This can be expected to be even stronger within companies that have just begun transitioning.

The third barrier pointed out by our case LSPs on the top of employees' resistance to change is *technology adoption*. Although the literature review shows that DT is more about transformation than technology ([Kane et al. 2018](#)), effective and efficient management of technological aspects has been reported to be a necessary, even though not a sufficient condition for successful DT. This has already been pointed out by [Kane et al. \(2018\)](#), IS literature (e.g. [Oliveira and Martins, 2011](#)), as well as in logistics research ([Mathauer and Hofmann, 2019](#)). Our case LSPs admitted that, in spite of having their IT competence centers, they struggle with decisions what technology and when they should invest in. Most often the problem lays down in the intra-firm collaboration between the IT department, which in most cases leads DT projects, and operations, which usually are the future owner of the solution. Respondents reported that lack of collaboration from the beginning of the technology adoption process can lead to implementation of solutions which are not the most efficient and effective in satisfying business needs. Intra-firm collaboration on technology adoption seems critical for successful DT and not dependent on the digital maturity of LSPs.

However, in terms of partnerships with external technology providers which enhance LSP's technological capability, we found that the propensity to take risk varies. Case Fashionistas and Digiratias are mostly willing to try digital innovations. They proactively look for technological partners (including young startups) that they can ally with or buy. Speed-dating with startups during startup summits was mentioned by C1 and C8 as a practice gaining on popularity. Corporate accelerators and partnership programs are examples of other leading practices enhancing LSPs' innovativeness which support [Marchet's et al. \(2017b\)](#) findings.

The final barrier on our list regards *data protection and security breach*. It is gaining importance with the growing volume of business sensitive data made available across distributed IT infrastructure, oftentimes based on cloud solutions. Respondents, regardless their digital maturity, ranked it at the lower end of the list, as it is considered to be typical domain of IT and Data Security departments, where proper implementation and management is strongly supported by already widely available sets of commercial tools, policies and protocols.

We also contribute to DT literature by providing a comprehensive list of success factors that synthesize and extend previous findings (Table 3). Our analysis shows that this list of success factors is consistent with our case LSPs; however, depending on what has already been achieved by an LSP in relation to its strategic, leadership, operational processes and technological knowledge capabilities, success factors are ranked slightly differently.

The analysis presented that, similar to the previous findings, an important for DT success in the logistics service industry are people – well-selected, trained, motivated and engaged. Our findings show that employees commitment starts with *a leader having and executing a DT vision and goals*. The leader, supported by managers, needs to create *organizational culture* – visible in overt behaviors and physical manifestation (Mello, 2006) – reinforcing *engaging employees of all levels and partners* in DT via training them, developing their digital capabilities, empowering them, encouraging their collaboration across boundaries, supporting their “questioning attitude”, bottom-up initiatives and experimentation. According to the experiences of our case LSPs, in order to get managers’, employees’ and partners’ support for DT, it is necessary to outline the benefits of DT and to show them their new role in the digital company. Workshops, presentations and pilots are just examples of the leading practices which, combined with entrepreneurship of LSPs’ employees and partners (Wagner, 2008), and their adaptability (Świtała et al., 2018) are highly effective. Our findings related to the success factors and leading practices responding to employees’ resistance to change overlap considerably with those from the other industries (Kane et al., 2018; Osmundsen et al., 2018). They have been discussed in change management (Oakland and Tanner, 2007; Oliveira et al., 2018), as well as in the logistics and supply chain management literature (Van Hoek et al., 2002). It is critical for LSPs of all digital maturity levels to guide employees toward the goal of DT in a distributed environment, such as the logistics service industry. We conclude that leadership, supportive organizational culture, and employee and partner engagement are success factors perceived as most important by LSPs of different sizes, ranging from small startups to large global players, with almost no difference in the maturity level.

Another very important group of factors to DT success in LSPs regards strategy and strategic capabilities. Our case LSPs pointed to *aligning business and IT strategies* which responds to the lack of resources’ barrier and is understood as the need for a continuous adjustment of business and IT strategies with resources within the DBS aligning process (Yeow et al., 2018). These aligning actions iteratively reconfigure organizational resources and refine strategy in order to respond to both changes in the environment and internal tensions within an LSP. We recognize them as a strategic dynamic capability which builds on the organizational agility, allowing for LSPs’ fast adaptation to changing situation. Our findings show that Digiraties, which have already developed DBS, see strong advantages of this approach. They consider aligning strategies brings them closer to technology companies’ management style and allows to limit different types of tensions. Interestingly, Conservatives ranked this success factor higher than Digiraties and Fashionistas as many of them aim to advance their DBS.

Next group of success factors relates to operational and process capabilities. They are critical in order to respond to the main DT barrier in LSPs, i.e. complexity of logistics system and underlying processes. Our analysis revealed the important role of *simplification and standardization*, regardless the digital maturity of company. This could be successfully achieved by applying lean management principles and techniques, such as value stream

mapping, measuring takt-time and 5S, as already reported in the literature (e.g. Hadid and Afshin, 2014). Similarly to Bortolotti and Romano's (2012) findings, our case LSPs follow the "lean first, then automate" rule which helps them optimize the resources they use, also human resources and streamline processes (including standard and customer-dedicated ones) before going digital. Moreover, simplification and standardization limit the number of mistakes and translate into better quality service. It is gaining importance when preparing the workplaces for new generations of fluctuating employees used to a simplified world.

Moreover, our analysis showed the emerging role of *agile management* in the DT of LSPs, particularly among Digiraties and Fashionistas. It is built on LSP's organizational agility which allows for fast adaptation to changing environment (Fuchs and Hess, 2018). In order to operationalize it within customer-specific solutions based on digital innovations, case LSPs organize small cross-functional teams to pursue alignment with their members. The teams include but are not limited to key account managers who identify clients' needs; operation people who define objectives and processes to satisfy these needs and drive the project and IT people who support sensing technological opportunities. Team members also mobilize and reconfigure resources. Fashionistas and Digiraties especially acknowledge agile management practices when working with startups.

The final success factor on our list relates to knowledge capability which is critical for any innovation (Busse and Wallenburg, 2014). In our study, this success factor is strongly related to technology capability. Our case LSPs of different maturity levels, aware of their and the whole logistics industry shortcomings in this area, open their innovation process to their suppliers, technological partners and startups. Digiraties and Fashionistas are most advanced in this. Conservatives see advantages of this approach and start following them.

5.2 Managerial implications

The identified barriers, success factors and associated leading practices provide a reference point for practitioners and are helpful in guiding managers from LSPs as well as from other complex industries. Based on the findings, we propose five recommendations for LSP managers who are undertaking DT.

First, the findings suggest that developing a DT vision and DT goals as a part of DBS is beneficial. Our case LSPs found that involving key stakeholders, who will be impacted and whose engagement will be critical for future DT efforts, is helpful. Their understanding of goals and objectives ensures early buy-in, focus and ongoing support in achieving the DT goals. At the same time, having a strong leader of DT, who will communicate the vision throughout the organization and provide its execution with strong governance, is critical. The leader, supported by management team, is also valuable for developing an organizational culture facilitating DT.

Second, a valuable step is to dedicate time and commitment to enhancing the engagement and training of people critical for DT success. Leading practices which helped our case LSPs in this process include communicating DT goals, encouraging employees to bring-in new ideas, organizing workshops that develop digital capabilities and strengthen a "growth mindset", establishing "training the trainer" programs, developing business cases and implementing pilot projects.

Third, from the beginning of a DT journey, it may be worthwhile to put significant attention and effort into the simplification and standardization of processes. Even though it is typically very difficult and time consuming, the subsequent digitalization of standardized processes provided our case companies advantages. LSPs in our sample indicated that these efforts focused on processes do pay off.

Fourth, LSPs are advised to consider selecting and adjusting relevant technological solutions for the specific purpose derived from their clear business objectives. This activity was recognized by our case companies as a critical layer that supported the integration of streamlined processes and underlying business applications and systems.

Finally, the case analysis suggests that it is beneficial to break DT implementation down into projects and stages, with the step-by-step application of the agile project management approach so that a business continuity of operations is assured and the impact on existing relationships with clients is minimized. It makes sense to consider DT as an ongoing and continuous process in order to be able to respond to the dynamic environment, tough competition and evolving clients' expectations, so it is important to regularly review and update the portfolio of digital projects, so as to be ready to implement it when and where (in case of multilocation LSPs) appropriate.

5.3 Limitations

Despite the applied methodical rigor, this study has some limitations that need to be taken into account when interpreting its findings and conducting future research. We conducted semi-structured interviews with top managers responsible for DT for large and advanced LSPs in terms of digitalization. Their organizations typically have the largest budgets and know-how in any transformation projects; however, they are operating in more complex networks.

Future studies could investigate if there are any differences in barriers and success factors with DT in medium- and small-sized companies. Scholars could also apply quantitative methods to examine the importance of each success factor and to test the identified contingencies (size and digital maturity) or other contingences such as owner structure, or scope of services. It could also be interesting to check success factors for DT at different stages of the process, i.e. preparation, implementation or diffusion.

Note

1. DBS understood as the fusion of digital strategy and business strategy.

References

- Bellingkrodt, S. and Wallenburg, C.M. (2013), "The role of external relationships for LSP innovativeness: a contingency approach", *Journal of Business Logistics*, Vol. 34 No. 3, pp. 209-21.
- Berman, S. and Marshall, A. (2014), "The next digital transformation: from an individual-centered to an everyone-to-everyone economy", *Strategy and Leadership*, Vol. 42 No. 5, pp. 9-17.
- Bharadwaj, A., El Sawy, O., Pavlou, P. and Venkatraman, N. (2013), "Digital business strategy: toward a next generation of insights", *MIS Quarterly*, Vol. 37 No. 2, pp. 471-482.
- Bortolotti, T. and Romano, P. (2012), "Lean first, then automate: a framework for process improvement in pure service companies. A case study", *Production Planning and Control*, Vol. 23 No. 7, pp. 513-522.
- Brdulak, H. (2018), "Ranking TSL", *Dziennik Gazeta Prawna*, Vol. 118 No. 4768, available at: http://g2.gazetaprawna.pl/p/_wspolne/pliki/3366000/3366929-tabele-tsl-2018.pdf (accessed 20 February 2019).
- Bryman, A. (2007), "Barriers to integrating quantitative and qualitative research", *Journal of Mixed Methods Research*, Vol. 1 No. 1, pp. 8-22.
- Busse, C. and Wallenburg, C.M. (2014), "Firm-level innovation management at logistics service providers: an exploration", *International Journal of Logistics Research and Applications*, Vol. 17 No. 5, pp. 396-419.
- Busse, C. (2010), "A procedure for secondary data analysis: innovation by logistics service providers", *Journal of Supply Chain Management*, Vol. 46 No. 4, pp. 44-58.
- BVL (2017), *TOP 100 in European Transport and Logistics Services 2017/2018*, in Schwemmer, M. and Pflaum, A. (eds), BVL and DVV Media, Bremen/Hamburg.
- Castillo, V.E., Bell, J.E., Rose, W.J. and Rodrigues, A.M. (2018), "Crowdsourcing last mile delivery: strategic implications and future research directions", *Journal of Business Logistics*, Vol. 39 No. 1, pp. 7-25.

-
- Christopher, M., Harrison, A. and van Hoek, R. (2016), "Creating the agile supply chain: issues and challenges", *Developments in Logistics and Supply Chain Management*, pp. 61-68, Palgrave Macmillan, London.
- Cichosz, M., Goldsby, T.J., Knemeyer, A.M. and Taylor, D.F. (2017), "Innovations in logistics outsourcing relationship – in the search of customer satisfaction", *LogForum*, Vol. 13 No. 2, pp. 209-219.
- Cichosz, M. (2018), "Digitalization and competitiveness in the logistics service industry", *E-mentor*, Vol. 77 No. 5, pp. 73-82.
- Daugherty, P.J., Richey, R.G., Genchev, S.E. and Chen, H. (2005), "Reverse logistics: superior performance through focused resource commitments to information technology", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 41 No. 2, pp. 77-92.
- Daugherty, P.J., Bolumole, Y. and Grawe, S.J. (2019), "The new age of customer impatience: an agenda for reawakening logistics customer service research", *International Journal of Physical Distribution and Logistics Management*, Vol. 49 No. 1, pp. 4-32.
- Deepen, J.M., Goldsby, T.J., Knemeyer, A.M. and Wallenburg, C.M. (2008), "Beyond expectations: an examination of logistics outsourcing goal achievement and goal exceedance", *Journal of Business Logistics*, Vol. 29 No. 2, pp. 75-105.
- Delfmann, W., Albers, S. and Gehring, M. (2002), "The impact of electronic commerce on logistics service providers", *International Journal of Physical Distribution and Logistics Management*, Vol. 32 No. 3, pp. 203-222.
- Delfmann, W., ten Hompel, M., Kersten, W., Schmidt, T. and Stolze, W. (2018), "Logistics as a science – central research questions in the era of the fourth industrial revolution", *Logistics Research*, Vol. 11 No. 9, pp. 1-13.
- DP-DHL (2018), "Logistics trend radar 2018", available at: <https://www.logistics.dhl/global-en/home/insights-and-innovation/thought-leadership/trend-reports/logistics-trend-radar.html> (accessed 20 February 2019).
- EC (2018), "Digital transformation", available at: https://ec.europa.eu/growth/industry/policy/digital-transformation_en (accessed 20 February 2019).
- Edmondson, A.C. and McManus, S.E. (2007), "Methodological fit in management field research", *Academy of Management Review*, Vol. 32 No. 4, pp. 1246-1264.
- Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.
- Evangelista, P. and Sweeney, E. (2006), "Technology usage in the supply chain: the case of small 3PLs", *International Journal of Logistics Management*, Vol. 17 No. 1, pp. 55-74.
- Evangelista, P., McKinnon, A. and Sweeney, E. (2013), "Technology adoption in small and medium-sized logistics providers", *Industrial Management and Data Systems*, Vol. 113 No. 7, pp. 967-989.
- Fawcett, S.E., Wallin, C., Allred, C., Fawcett, A.M. and Magnan, G.M. (2011), "Information technology as an enabler of supply chain collaboration: a dynamic-capabilities perspective", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 38-59.
- Fitzgerald, M., Kruschwitz, N., Bonnet, D. and Welch, M. (2014), "Embracing digital technology: a new strategic imperative", *MIT Sloan Management Review*, Vol. 55 No. 2, pp. 1-16.
- Flint, D.J., Larsson, E., Gammelgaard, B. and Mentzer, J.T. (2005), "Logistics innovation: a customer value-oriented social process", *Journal of Business Logistics*, Vol. 26 No. 1, pp. 113-147.
- Fuchs, C. and Hess, T. (2018), "Becoming agile in the digital transformation: the process of a large-scale agile transformation", *Proceeding of Thirty Ninth International Conference on Information Systems*, San Francisco, pp. 1-17.
- Gammelgaard, B. (2017), "Editorial: the qualitative case study", *International Journal of Logistics Management*, Vol. 28 No. 4, pp. 910-913.

- Germain, R., Droge, C. and Daugherty, P.J. (1994), "A cost and impact typology of logistics technology and the effect of its adoption on organizational practice", *Journal of Business Logistics*, Vol. 15 No. 2, pp. 227-240.
- Grawe, S.J. (2009), "Logistics innovation: a literature-based conceptual framework", *International Journal of Logistics Management*, Vol. 20 No. 3, pp. 360-377.
- Gruchmann, T. and Seuring, S. (2018), "Explaining logistics social responsibility from a dynamic capabilities perspective", *International Journal of Logistics Management*, Vol. 29 No. 4, pp. 1255-1278.
- Gunasekaran, A., Subramanian, N. and Papadopoulos, T. (2017), "Information technology for competitive advantage within logistics and supply chains: a review", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 99, pp. 14-33.
- Hadid, W. and Afshin Mansouri, S. (2014), "The lean-performance relationship in services: a theoretical model", *International Journal of Operations and Production Management*, Vol. 34 No. 6, pp. 750-785.
- Hansen, A.M., Kraemmergaard, P. and Mathiassen, L. (2011). "Rapid adaptation in digital transformation: a participatory process for engaging IS and business leaders", *MIS Quarterly Executive*, Vol. 10 No. 4, pp. 175-185.
- Hausberg, J., Liere-Netheler, K., Packmohr, S., Pakura, S. and Vogelsang, K. (2018), "Digital transformation in business research: a systematic literature review and analysis", *DRUID18 Conference*, Copenhagen Business School, Copenhagen.
- Henriette, E., Feki, M. and Boughzala, I. (2016), "Digital transformation challenges", *MCIS 2016 Proceedings*, AIS eLibrary, Paphos, available at: <https://aisel.laisnet.org/mcis2016/33> (accessed 20 February 2019).
- Hirt, M. and Willmott, P. (2014), "Strategic principles for competing in the digital age", *McKinsey Quarterly*, Vol. 5 No. 1, pp. 1-13.
- Hofmann, E. and Osterwalder, F. (2017), "Third-party logistics providers in the digital age: towards a new competitive arena?", *Logistics*, Vol. 1 No. 9, pp. 1-28.
- Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D. and Buckley, N. (2015), "Strategy, not technology, drives digital transformation", *MIT Sloan Management Review and Deloitte University Press*, Vol. 14, pp. 1-25.
- Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D. and Buckley, N. (2017), "Achieving digital maturity", *MIT Sloan Management Review and Deloitte University Press*, Vol. 59 No. 1, pp. 1-30.
- Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D. and Buckley, N. (2018), "Coming of age digitally", *MIT Sloan Management Review and Deloitte Insights*, June, pp. 1-33.
- Kembro, J., Norrman, A. and Eriksson, E. (2018), "Adapting warehouse operations and design to omnichannel logistics: a literature review and research agenda", *International Journal of Physical Distribution and Logistics Management*, Vol. 48 No. 9, pp. 890-912.
- King, S.F. and Burgess, T.F. (2006), "Beyond critical success factors: a dynamic model of enterprise system innovation", *International Journal of Information Management*, Vol. 26 No. 1, pp. 59-69.
- Lai, K.H., Ngai, E.W.T. and Cheng, T.C.E. (2005), "Information technology adoption in Hong Kong's logistics industry", *Transportation Journal*, Vol. 44 No. 4, pp. 1-9.
- Langley, C.J. Jr (2019), "2019 23rd annual third-party logistics study", The State of Logistics Outsourcing, Infosys, available at: <http://www.3plstudy.com/> (accessed 20 February 2019).
- Lin, C.-Y. (2008), "Determinants of the adoption of technological innovations by logistics service providers in China", *International Journal of Technology Management and Sustainable Development*, Vol. 7 No. 1, pp. 19-38.
- Marchet, G., Melacini, M., Sassi, C. and Tappia, E. (2017a), "Assessing efficiency and innovation in the 3PL industry: an empirical analysis", *International Journal of Logistics Research and Applications*, Vol. 20 No. 1, pp. 53-72.

- Marchet, G., Melacini, M., Perotti, S., Sassi, C. and Tappia, E. (2017b), "Value creation models in the 3PL industry: what 3PL providers do to cope with shipper requirements", *International Journal of Physical Distribution and Logistics Management*, Vol. 47 No. 6, pp. 472-494.
- Marquardt, A.J., Golicic, S.L. and Davis, D.F. (2011), "B2B services branding in the logistics services industry", *Journal of Services Marketing*, Vol. 25 No. 1, pp. 47-57.
- Mathauer, M. and Hofmann, E. (2019), "Technology adoption by logistics service providers", *International Journal of Physical Distribution and Logistics Management*, Vol. 49 No. 4, pp. 416-434.
- Mello, J. (2006), "An investigation into the nature of the relationship of corporate culture to logistics outsourcing", Ph.D. diss., University of Tennessee, Knoxville.
- Morakanyane, R., Grace, A.A. and O'Reilly, P. (2017), "Conceptualizing digital transformation in business organizations: a systematic review of literature", *Bled eConference*, pp. 427-443.
- Ngai, E.W., Law, C.C. and Wat, F.K. (2008), "Examining the critical success factors in the adoption of enterprise resource planning", *Computers in Industry*, Vol. 59 No. 6, pp. 548-564.
- Nikpay, F., Selamat, H., Rouhani, B.D. and Nikfard, P. (2013), "A review of critical success factors of enterprise architecture implementation", *2013 International Conference on Informatics and Creative Multimedia*, IEEE, pp. 38-42.
- Oakland, J.S. and Tanner, S. (2007), "Successful change management", *Total Quality Management and Business Excellence*, Vol. 18 Nos 1-2, pp. 1-19.
- Oke, A. (2004), "Barriers to innovation management in service companies", *Journal of Change Management*, Vol. 4 No. 1, pp. 31-44.
- Oliveira, T. and Martins, M.F. (2011), "Literature review of information technology adoption models at firm level", *Electronic Journal of Information Systems Evaluation*, Vol. 14 No. 1, pp. 110-121.
- Oliveira, L.S., Echeveste, M.E. and Cortimiglia, M.N. (2018), "Critical success factors for open innovation implementation", *Journal of Organizational Change Management*, Vol. 31 No. 6, pp. 1283-1294.
- Osmundsen, K., Iden, J. and Bygstad, B. (2018), "Digital transformation: drivers, success factors, and implications", *MCIS 2018 Proceedings*, AIS eLibrary, Corfu, available at: <https://aisel.laisnet.org/mcis2018/37> (accessed 20 February 2019).
- Pellathy, D.A., In, J., Mollenkopf, D.A. and Stank, T.P. (2018), "Middle-range theorizing on logistics customer service", *International Journal of Physical Distribution and Logistics Management*, Vol. 48 No. 1, pp. 2-18.
- Prockl, G., Pflaum, A. and Kotzab, H. (2012), "3PL factories or lernstatts? Value-creation models for 3PL service providers", *International Journal of Physical Distribution and Logistics Management* Vol. 42 No. 6, pp. 544-561.
- ProLogis (2017), "Customer growth strategies: europe's most desirable logistics locations", available at: <https://www.prologisgermany.de/en/logistics-industry-research/customer-growth-strategies-europes-most-desirable-logistics-locations> (accessed 15 August 2019).
- Remane, G., Hanelt, A., Nickerson, R.C. and Kolbe, L.M. (2017), "Discovering digital business models in traditional industries", *Journal of Business Strategy*, Vol. 38 No. 2, pp. 41-51.
- Riedl, J., Jentzsch, A., Melcher, N. Ch., Gildemeister, J., Schellong, D., Höfer, Ch. and Wiedenhoff, P. (2018), "Why road freight needs to go digital – fast", available at: <https://www.bcg.com/publications/2018/why-road-freight-needs-go-digital-fast.aspx> (accessed 20 February 2019).
- Riedl, J. (2018), "Digital transformation in the logistics industry", available at: <https://www.bcg.com/industries/transportation-travel-tourism/center-digital-transportation/logistics.aspx> (accessed 20 February 2019).
- Selviaridis, K. and Spring, M. (2007), "Third-party logistics: a literature review and research agenda", *International Journal of Logistics Management*, Vol. 18 No. 1, pp. 125-150.
- Soosay, C.A. and Hyland, P.W. (2004), "Driving innovation in logistics: case studies in distribution centres", *Creativity and Innovation Management*, Vol. 13 No. 1, pp. 41-51.

- Soosay, C.A., Hyland, P.W. and Ferrer, M. (2008), "Supply chain collaboration: capabilities for continuous innovation", *Supply Chain Management: International Journal*, Vol. 13 No. 2, pp. 160-169.
- Stank, T., Esper, T., Goldsby, T., Zinn, W. and Autry, C. (2019), "Toward a Digitally Dominant Paradigm for twenty-first century supply chain scholarship", *International Journal of Physical Distribution and Logistics Management*, Vol. 49 No. 10, pp. 956-971.
- Świtła, M., Niestrój, K. and Hanus, P. (2018), "Examining how logistics service providers' adaptability impacts logistics outsourcing performance, customers' satisfaction and loyalty", *LogForum*, Vol. 14 No. 4, pp. 449-465.
- Töytäri, P., Turunen, T., Klein, M., Eloranta, V., Biehl, S., Rajala, R. and Hakanen, E. (2017), "Overcoming institutional and capability barriers to smart services", *Proceedings of the 50th Hawaii International Conference on System Sciences*, pp. 1642-1651.
- Van Hoek, R.I., Chatham, R. and Wilding, R. (2002), "Managers in supply chain management, the critical dimension", *Supply Chain Management: International Journal*, Vol. 7 No. 3, pp. 119-125.
- Vogelsang, K., Liere-Netheler, K., Packmohr, S. and Hoppe, U. (2019a), "Barriers to digital transformation in manufacturing: development of a research agenda", *Proceedings of the 52nd Hawaii International Conference on System Sciences*, pp. 4937-4946.
- Vogelsang, K., Liere-Netheler, K., Packmohr, S. and Hoppe, U. (2019b), "Success factors for fostering a digital transformation in manufacturing companies", *Journal of Enterprise Transformation*, pp. 1-22.
- Wagner, S.M. and Sutter, R. (2012), "A qualitative investigation of innovation between third-party logistics providers and customers", *International Journal of Production Economics*, Vol. 140 No. 2, pp. 944-958.
- Wagner, S.M. (2008), "Innovation management in the German transportation industry", *Journal of Business Logistics* Vol. 45 No. 2, pp. 357-382.
- Wallenburg, C.M. (2009), "Innovation in logistics outsourcing relationships: proactive improvement by logistics service providers as a driver of customer loyalty", *Journal of Supply Chain Management*, Vol. 45 No. 2, pp. 75-93.
- WEF (2016), "World economic forum white paper. Digital transformation of Industries: logistics industry", in Spelman, M., Weinelt, B., Lehmacher, W., Padilla-Taylor, V., Shah, A., Pearson, M., Pinhack, M., Dittrich, M., Daberkow, J., Shroff, S. and Agrawal, P. (Eds), *World Economic Forum & Accenture*, available at: <http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-logisticswhitepaper-final-january-2016.pdf> (accessed 20 February 2019).
- Westerman, G., Bonnet, D. and McAfee, A. (2014), "The nine elements of digital transformation", *MIT Sloan Management Review*, No. 7, pp. 1-6.
- Williams, J.J. and Ramaprasad, A. (1996), "A taxonomy of critical success factors", *European Journal of Information Systems*, Vol. 5 No. 4, pp. 250-260.
- Win, A. (2008), "The value a 4PL provider can contribute to an organization", *International Journal of Physical Distribution and Logistics Management*, Vol. 38 No. 9, pp. 674-684.
- Yeow, A., Soh, C. and Hansen, R. (2018), "Aligning with new digital strategy: a dynamic capabilities approach", *The Journal of Strategic Information Systems*, Vol. 27 No. 1, pp. 43-58.
- Yin, R.K. (2014), *Case Study Research Design and Methods*, 5th ed., Sage Publications, Thousand Oaks, CA.
- Zacharia, Z.G., Sanders, N.R. and Nix, N.W. (2011), "The emerging role of the third-party logistics provider (3PL) as an orchestrator", *Journal of Business Logistics*, Vol. 32 No. 1, pp. 40-54.

Corresponding author

Marzenna Cichosz can be contacted at: marzenna.cichosz@sgh.waw.pl

Appendix 1

Interview instrument

1. Introduction

- (1) Could you please briefly introduce yourself and your current position. What is your experience with digital transformation (DT)?
- (2) What do you understand by DT? How would you define it?
- (3) How would you evaluate the digital maturity of your company using the digital maturity matrix (Figure 1)?
- (4) Is your company rather uniformly positioned in the matrix or different business units or country organizations are very different in their matrix positioning?

2. Digital Transformation – General Questions

- (1) Does your company have a digital business strategy (DBS) [1]? If not, does it plan to implement it? When?
- (2) What was your company's motivation behind DT implementation?
- (3) What are the objectives of the DT?
- (4) What is the value proposition of DT for clients/carriers/employees?

3. Digital transformation – Barriers and success factors

- (1) How does your company manage the DT?
- (2) What specific challenges and barriers did your company face during the DT process?
- (3) How did your company overcome these barriers?
- (4) Which factors were important for a successful DT?
- (5) What is the feedback from your employees about the DT?
- (6) What are the next steps for extending the DT?

4. Conclusion and outlook

- (1) Please draw a brief conclusion. What are the most important barriers and success factors for digital transformation of your company?
- (2) What were the major learnings for your firm and for your personnel from the DT?

Table A1.
Ranking of barriers
and success factors to
DT in the logistics
service industry

	Mean total <i>n</i> = 17	Mean Digitaries <i>D</i> <i>n</i> = 7	Mean Fashionistas <i>F</i> <i>n</i> = 4	Mean Conservatives <i>C</i> <i>n</i> = 6	Total	Digitaries	Ranking Fashionistas	Conservatives
<i>Barriers</i>								
Complexity of logistics network and underlying processes	7.57	7.17	8.00	7.80	1	1	1	2
Lack of resources including skilled resources	6.79	6.5 <i>F</i>	5.33	8.00 <i>DF</i>	2	2	4	1
Technology adoption	6.29	6.17	5.67	6.80 <i>F</i>	3	3	3	3
Resistance to change	5.71	5.00	6.00	6.40 <i>D</i>	4	4	2	4
Data protection and security breach	4.64	4.83	5.00	4.20	5	5	5	5
<i>Success factors</i>								
Leadership*	9.36	8.75	9.67	9.9	1	3	1	1
Supportive organizational culture	8.57	9.00 <i>C</i>	9.00 <i>C</i>	7.80	2	2	2	4
Employee and partner engagement	8.57	9.33 <i>FC</i>	7.67	8.20 <i>F</i>	2	1	3	3
Aligning business and IT strategies	8.14	8.17 <i>F</i>	7.00	8.80 <i>F</i>	4	5	5	2
Process standardization and data integration	7.14	8.83 <i>FC</i>	6.33	5.60	5	4	7	6
Employee knowledge and skills development	6.93	7.67 <i>C</i>	6.67	6.20	6	6	6	5
Agile transformation management	6.29	7.17 <i>C</i>	7.33 <i>C</i>	4.60	7	7	4	8
Leveraging internal and external knowledge	5.93	6.67 <i>C</i>	6.00	5.00	8	8	8	7

Note(s): Rating scale 1 (not important) – 10 (critical)
 *During the course of the research the success factors “leadership” and “DT vision and goals” were merged into one; the values are calculated as the mean of both
D, F, C, DF, FC – marking of mean difference in barriers and success factors” evaluation between Digitaries (*D*), Fashionistas (*F*) and Conservatives (*C*) only if absolute mean difference is higher than 1 (the threshold based on expert knowledge)