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Logistics Platform Strategies for Freight Technology-enabled Smart Services

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Purpose: *In this paper, the authors investigate logistics platform strategies in the road freight market through the analysis of business models of logistics service providers (LSPs) and freight technology providers (FTPs). The purpose of this paper is to gain knowledge of emerging freight technologies and to explore logistics platform strategies between LSPs and FTPs enabling smart services.*

Methodology: *This paper follows an empirical analysis approach to study business models using the concept of Business Model DNA. To this end, the business models of 25 LSPs and 15 FTPs are investigated according to 55 business model patterns (BMPs). Subsequently, the authors conceptualize four logistics platform models to demonstrate how LSPs can manage nascent freight technologies.*

Findings: *The authors argue that freight technology-enabled smart services can promote digital forwarding by logistics platform strategies. LSPs can make use of complementary service capabilities while FTPs can benefit from profound customer access and physical logistics resources.*

Originality: *To the best of the authors' knowledge, no empirical research exists that consistently focuses on logistics platform strategies for freight technology-enabled smart services. The obtained insights in this study lead to the first contribution of digital platform strategies for road freight transportation in the sphere of digital logistics.*

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1 Introduction

Due to its cross-function between industries, the road freight market represents a vital element for global economies. While transportation costs account for a value of EUR 513 billion p. a. in Europe, EUR 246 billion account for road transportation by trucks (Schwemmer, 2019, p. 41 and p. 57). Despite its economical contribution, the forwarding business is yet characterized by the use of heterogeneous and proprietary information systems (IS) within a fragmented trucking sector (Backhaus et al., 2017). In lights of the digital transformation, logistics service providers (LSPs) have to manage a vast number of customized systems and operational information and communication technologies meet the digital requirements of their customers to remain competitive in an increasingly data-driven market (Wurst, 2021; Seifert, 2017).

At the same time, "smart" logistics platforms have been recently recognized as a key enabler to realize digital forwarding and achieve efficiency by integrated and connected road freight operations (Sucky and Asdecker, 2019) towards data-driven transport management (Heinbach et al., 2021). To achieve real-time transparency and enable data exchange within a fragmented industry with siloed data, the emergence of digital platforms driven by start-ups appear disruptively in the form of electronic marketplaces, digital freight exchanges, and digital freight forwarders (Göpfert and Seeßle, 2019; Elbert and Gleser, 2019; Mikl et al., 2020). Hence, digital business models are driven by venture capital investment in global transport and logistics that has increased remarkably from 3.5 USD billion to 13.8 USD billion between 2017 and 2019 (Oliver Wyman, 2020).

For instance, innovative logistics start-ups such as Cargonexx and RIO Cloud operate as a digital intermediary to aggregate and enrich data from transport orders and physical assets (e.g., trucks). Beyond, the providers develop data-driven services to enhance the order flow between shippers and carriers, support operational decision-making, increase visibility, and automate processes in both a vertical and a horizontal direction. The appearance of specialized enterprises focusing digital technologies in the forwarding industry is discussed in practice as "Freight Technologies" (Roland Berger GmbH, 2020) and addresses the phenomenon of freight technology providers (FTPs), which disrupt the traditional forwarding business through their cloud-based digital service capabilities in the road freight industry (Baron et al., 2017; Ortwein and Kuchinke, 2021). Thus, platform-enabled "smart" services from operational data by FTPs reveal new business opportunities to optimize road freight efficiency, to facilitate forwarding processes between stakeholders, and to promote collaboration by the utilization of siloed data within transport ecosystems in the digital age.

Against this backdrop, it becomes obvious that traditional logistics service providers (LSPs) risk becoming increasingly obsolete in light of FTP developments in the future (Kille, 2018) due to scalable transport platforms concepts fostering connected and automated platform ecosystems (Wagner et al., 2020). Hence, we raise the question of how LSPs can address freight technologies to extend their established business models and to develop data-based (smart) services in the digital platform age for transport stakeholders? To answer this question, this paper assumes the following options for LSPs to make use of freight technology-enabled smart services: (1) join an existing logistics platform, or (2) collaborate with existing FTPs. To explore the strategic options of relevant logistics platform strategies (FPSs) between LSPs and FTPs we aim at an analysis of their business models to identify the individual elements and to understand the benefits of freight technologies for LSPs. Our approach is the first contribution to the best of our knowledge, which strives for the conceptualization of FTPs in the road freight industry to guide practitioners and scholars towards platform strategies and future research.

Following this line of thinking, we apply the concept of Business Model DNA (Böhm et al., 2017) in this study to identify business model elements from LSPs and FTPs, which are further specified by the consideration of data-driven transport management. In addition, we derive four logistics platform strategies for freight technology-enabled smart services and further suggest a procedure to establish the logistics platform between LSPs and FTPs enabling digital forwarding.

2 Fundamentals

2.1 Logistics Platforms in Freight Forwarding

Logistics platforms in the road freight forwarding market have a tradition and can be determined as a digital marketplace between shippers, freight forwarders, and carriers (Bierwirth et al., 2002) to enable matchmaking of freight shipments and truckload capacities (Graser et al., 2017). Other platforms concepts exist that support the process of freight procurement (Wurst, 2020) and digital order management (Dietrich and Fiege, 2017). Beyond, logistics platforms for freight transportation realize connectivity of IT systems to facilitate end-to-end visibility (Riedl et al., 2018), as well as the service intermediation between shippers and carriers (Hentschel et al., 2019) to improve freight asset utilization and avoid empty runs of trucks (Hofmann and Osterwalder, 2017). A particular digital platform phenomenon has emerged in recent years and is discussed by scholars as “Digital Forwarder” or “Digital Freight Forwarder” (Elbert and Gleser, 2019; Göpfert, 2019, p. 267). Digital forwarders act as an intermediary between shippers and carriers and their unique selling proposition against other logistics platforms is the liability character in combination with fixed freight rates for shippers (Hentschel et al., 2019).

In essence, the new form of creating value from data by logistics platforms is founded on multi-sided marketplaces that allow interactions and transactions between several market participants (Hagiu and Wright, 2015). While providers facilitate platform-based transactions, the platform appearance in the road freight industry can be divided into three different types (Evans and Gawer, 2016): transaction platforms (e.g., Timocom), data-focusing platforms (e.g., Cargonexx), and integration platforms (e.g., RIO Cloud).

2.2 Freight Technology Providers

The road freight service industry is a fragmented market and composed by a variety of small and medium-sized transport operators (e.g., carriers). Since road carriers’ operational environment is characterized by limited resources, low margins, and missing standards, software vendors, enterprises with an IT-focus, and start-ups have noticed the vast potential to establish new digital platform concepts years ago. Based on the idea of "Uberization", IT and software vendors particularly succeed in the digital forwarding industry since they use platform and data technologies as the primary resource to realize service innovations for advanced transport management (Heinbach et al., 2021). In addition, technology providers remain a flexible and cost-competitive resource for traditional road freight providers (Roy and Fellenberg, 2020). The platform-based freight services by providers are discussed as "Freight Technology" (short FreightTech) in practice and promise a digital forwarding business towards intelligence, automation, and integration of freight transportation (Roland Berger GmbH, 2020). Thus, in this paper, we define freight technology providers (FTPs) by two attributes: (1) FTPs represent organizations from the software and IT sector, which make use of advanced (digital) technologies, and (2) FTPs realize smart services based on data from transport orders and assets to support digital forwarding. In essence, FTPs enable direct interactions between shippers and carriers based on "as-a-Service" offerings towards digital transport management (Figure 1).

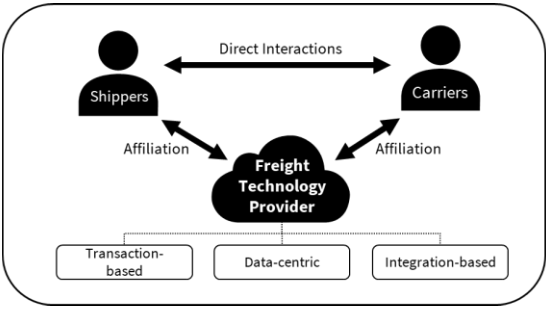

Figure 1: Concept of Platform-based Freight Technology Providers based on Evans and Gawer (2016)

The digitization of transport management activities allows FTPs to move established transport processes into the cloud-based environment (Dietrich and Fiege, 2017; Kille and Wagner, 2017). As a consequence, traditional LSPs risk losing their role as the former intermediary in the transport value chain (Kille, 2018). For this reason, we explore logistics platform strategies for LSPs to facilitate smart services in road freight transportation by FTPs.

2.3 Smart Services in Road Freight Transportation

Smart services have emerged significantly in the context of "Industry 4.0" and "Logistics 4.0" since they refer to individual services based on data that are mainly developed and offered by the use of internet-based communication and information technologies (acatech, 2015). Various benefits arise from data-driven services in contrast to traditional services. For instance, remote services enable product accompanying services for a remote-controlled output, such as repair (Remote Repair), diagnosis (Remote Diagnosis), or maintenance (Remote Maintenance) of assigned machinery across distances (Wünderlich and Wangenheim, 2007; Kammler et al., 2019). Consequently, smart services reveal various business opportunities in the logistics industry specifically for logistics service providers due to the cost-saving effects through the integration of data-based services and the adaption of their existing business model (e.g., Thomas et al., 2015).

Since the internet represents an open and standardized transport ecosystem, smart services can increase the efficiency of logistics chains and realize new business models through real-time processing of orders, improved decision-support from analyzed data, collaboration with transport resources, and the exploitation of innovative value creation potentials (Zsifkovits and Woschank, 2019). Due to the fragmented forwarding industry, the cloud indicates particular opportunities for the harmonization of IT applications and the development of smart services associated with digital business models leading to "smart forwarding" (Heinbach et al., 2020). For this reason, LSPs such as DB Schenker or Emons Gruppe should contemplate emerging freight technologies from innovative platform providers such as Freightos or Pamyra to realize smart services (e.g., ETA, real-time freight rate management) in a growingly digital and competitive business environment. In this context, we study logistics platform strategies of freight technology-enabled smart services to support the decision process collaboratively addressing both FTPs and LSPs. The methodology to answer our research questions will be presented in the following section.

3 Research Method and Data Collection

3.1 Research Method

A systematic literature review is a recommended method to summarize existing knowledge and to identify research gaps related to our topic. Although our topic represents an emerging research field that is a nascent phenomenon, we conducted literature research according to Vom Brocke et al. (2009). We defined the review scope of the last five years and established keywords, such as "logistics platforms", "digital forwarding", "business models", in combination with "freight technology". Subsequently, we queried scientific databases (EBSCO host, Springer Link, Emerald, Google Scholar) to search relevant literature. Surprisingly, no contribution we have identified does address freight technologies and smart service in the forwarding sector towards platform strategies indicating that our study presents the first contribution in this topic.

To investigate the structure of business models of existing LSPs and FTPs in the road freight transport sector, we apply the concept of Business Model DNA suggested by Böhm et al. (2017). The concept is based on the St. Gallen Business Model Navigator and covers 55 patterns, which represent 90 percent of the business models existing today (Gassmann et al., 2013). We aim to identify the business model structure and to understand the strengths and weaknesses from both perspectives of the traditional logistics market as well as the new digital logistics market. Furthermore, we seek to find complementary business model aspects between LSPs and FTPs to understand freight technology-enabled platform capabilities. Thus, we build the Business Model DNA according to the 55 patterns developed by Gassmann et al. (2013) and assign binary variables for each business model pattern (BMP), which indicates whether it is available or not (Figure 2).

Provider \ Pattern	**1**	**2**	**3**	**4**	**5**	**6**		**49**	**50**	**51**	**52**	**53**	**54**	**55**
LSP name 1	1	0	1	1	0	0		0	1	1	0	1	0	1
…	…						**…**	…						
FTP name 1	0	1	1	0	1	0		1	0	1	1	0	0	1
…	…							…						

Figure 2: Exemplary Business Model DNA adapted from Böhm et al. (2017)

3.2 Data Collection

To collect the data for the conduction of the Business Model DNA analysis, a selection of LSPs was made based on the work »TOP 100 in European Transport and Logistics Services« according to the English version of Schwemmer (2019). This comprehensive work represents the top-ranked logistics service providers across all multimodal business segments operating in Europe. We selected LSPs by two criteria to ensure our focus on road freight transport services. First, we selected LSPs providing Full Truck Load (FTL) services. Second, we refined our selection by selecting LSPs providing Less Than Truckload (LTL) services in addition. From the selection process, 25 LSPs were identified for further analysis in this study.

FTPs have been selected in the form of logistics start-ups from a database, which has been established by Schwemmer et al. (2021). The database was established starting in 2017 and contains start-ups and other new ventures that are active in logistics by providing logistics services, supporting logistics service providers, or establishing themselves as intermediaries between LSP and their customers from the industry and retail sectors. 15 companies were extracted by keyword search for the keyword platform in the database. The keyword could be found in several database entries in string variables with information about the companies' offerings. The final selection contains companies dubbed as platform providers, which remained active in Europe.

We collected the data by describing the business model of LSPs and FTPs and searching the web. Additional information sources included providers' websites, press reports, and interviews with founders or CEOs that were publicly available. This task was performed by the authors independently and separately for either LSPs or FTPs because of their professional experience and specific knowledge focus. After the assignment of the binary variable to the BMPs, the results from the empirical analysis were clustered and presented in network graphs to assess the networks of LSPs and FTPs. Based on the results, the authors derive freight technology-enabled smart services and further conceptualize logistics platform strategies for LSPs.

4 Analysis of Business Models and Smart Services in Road Freight Transportation

4.1 Business Model Cluster

The following data assessments were carried out with Gephi (Ver. 0.9.2) (Bastian et al., 2009), a software that enables network analyses. The software allows to draw network graphs and assess those networks in an explorative manner in terms of network density, the nodes, and their connections, and clusters within those networks. According to the aim of the assessments to identify clusters of LSPs and FTPs depending on their BMP, the following two visualizations contain two types of nodes. One type shows the companies assessed in the network. The other nodes depict the BMP that got assigned during the assessment phase of the project. Their labels are introduced with a hashtag symbol (#). The edges of the graph show the connections from each company node to the assigned BMP. Company nodes are not connected to each other.

The first visualization contains the network that represents the established field of LSP active in Europe (Figure 3). The network contains more than 500 edges that connect LSPs to the assigned BMP. From the 55 BMP a count of 33 could get assigned to the assessed 25 LSP. 11 BMP are matching the business models of all assessed LSPs and are appropriate to describe a general forwarding service. Plausibly, the most diverse among the assessed players got assigned to the highest numbers of BMP, i.e. 26 or more BMP were matched to the business models of Deutsche Post DHL, Deutsche Bahn AG, Dachser SE, DB Schenker (considered as part of Deutsche Bahn DB and assessed additionally), Kuehne + Nagel and Rhenus SE. These build a cluster in the center of the network graph with the most differentiated service offerings.

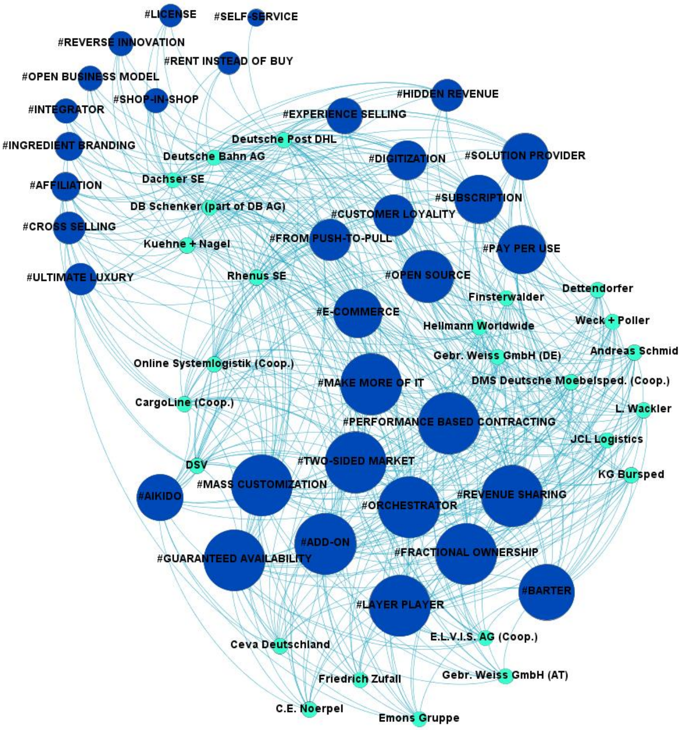

Figure 3: LSP Network graph

A second cluster contains LSPs that are connected to a mediocre number of 16 to 21 BMP in the right corner. A third cluster at the bottom of the graph contains LSPs offering more standardized services and are therefore connected to up to 15 BMPs. Three additional LSPs do not form a clear cluster in terms of how many BMPs are matching their business models. The assessment of the LSP-BMP-networks suggests that the more diversified and larger those LSPs are, the more differentiated are their business model compositions.

The second visualization shows the network that represents the result of the data assessment for logistics platforms operated by FTPs (Figure 4). 10 of the 55 BMP got assigned to those platforms. Compared to the assessed LSPs, the number of assigned BMP is lower by a palpable amount. For instance, the platform providers seem more focused.

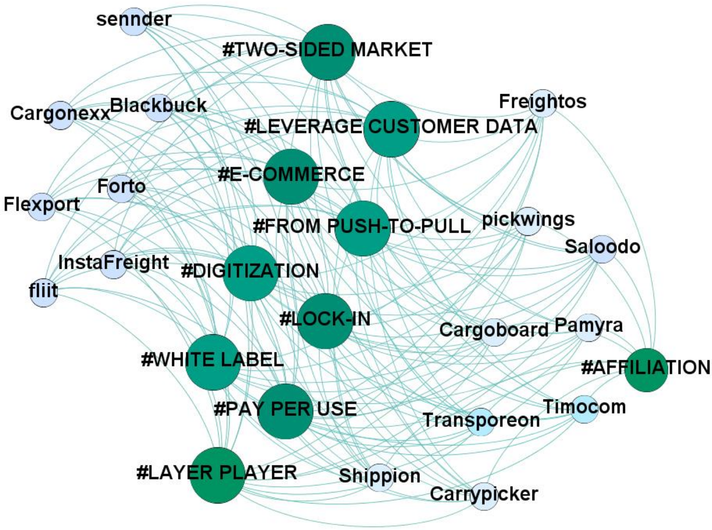

Figure 4: FTP Network graph

Located in the middle of the graph are those BMP that match the business models of all the included platforms. The companies in the graph are divided into two clusters. The BMP "affiliation" divides these clusters. In those cases that are connected to this BMP "…the focus lies in supporting others to successfully sell products and directly benefit from successful transactions." (Gassmann et al., 2013, p. 9). This BMP got assigned to those platforms that do not carry out transportation as a legal entity but connect customers to logistics service providers. The companies that did not get assigned to the "affiliation" node carry out logistics services as digital freight forwarders. These companies become legal partners of customers and do not only connect other parties of the logistics market. Digital freight forwarders also become competitors of the above-assessed LSPs, while the other clusters play a role in supporting established LSPs in their respective fields of activity.

For both of the assessed company types (LSP and FTP), Table 1 presents the BMPs that are assigned to our comprehensive sets of LSPs and FTPs as the least common multiple or backbone of the respective business models. The comparison in Table 1 indicates that the business models of the two company types differ vastly from each other. FTPs are by far more focused and therefore are more similar to each other in terms of their Business Model DNA.

Table 1: Comparison of Business Model Patterns: LSPs vs. FTPs

BMP Title	Explanation of BMP (Gassmann et al., 2013)	LSP	FTP
Add-on	Additional services are offered to a basic offer	x	
Barter	Goods exchange without immediate money transaction	x	
Fractional Ownership	…of a certain asset class	x	
Guaranteed Availability	…of the service provided	x	
Make more of it	Know-how and assets get shared with customers	x	
Mass Customization	Individualization of transportation services	x	
Orchestrator	…of transportation services, also with subcontractors	x	

BMP Title	Explanation of BMP (Gassmann et al., 2013)	LSP	FTP
Performance Based Contracting	According to individual service levels for customers	x	
Revenue Sharing	Strongly pronounced cooperation with competitors as partners or subcontractors	x	
Layer Player	Providing a special value adding-step (transport)	x	x
Two-Sided Market	Shippers are connected to freight service providers	x	x
Digitization	…of former physical products/services to digital variants		x
E-Commerce	…of transportation services		x
From Push-to-pull	High flexibility to respond to customer needs		x
Leverage Customer Data	…for value-adding		x
Lock-in	…to the service providers service realm		x
Pay Per Use	Payment based on what is consumed effectively		x
White Label	Customers are enabled to offer the companies service under their own brand		x

4.2 Freight Technology-enabled Smart Services

During our analysis, we have identified a variety of smart services from FTPs that support the process of road freight transport management. These services have shown an alignment to Transport Management Systems (TMSs) representing a standardized software for order handling, shipment execution, and administration of transports. Hence, we found that platform participants (e.g., shippers, carriers, forwarders) make use of freight technology-enabled smart services beyond their TMSs to enhance the order flow, support operational decision-making, increase visibility, and automate processes. In Figure 5 we illustrate examples of smart services assigned to the types of logistics platforms already introduced in section 2.1. The services are assigned to the dimensions of road freight transport management as the second level of systematization. Our findings are based on the results of Roy and Fellenberg (2020) as well as Heinbach et al. (2021) and provide a range of freight technology-enabled smart services throughout the road freight order lifecycle.

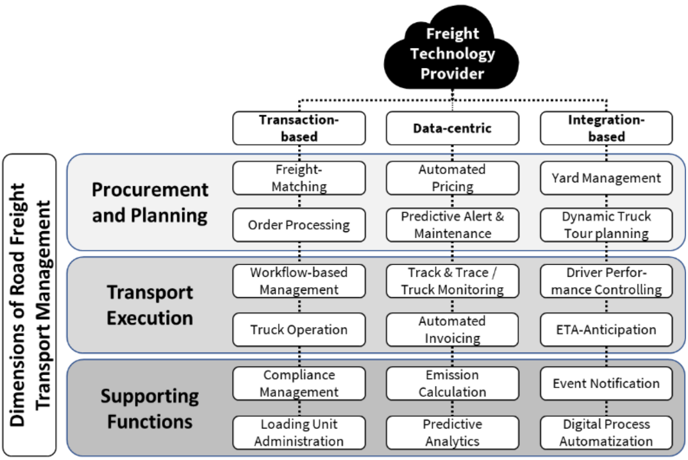

Figure 5: Examples of Freight Technology-enabled Smart Services based on Roy and Fellenberg (2020) and Heinbach et al. (2021)

5 Conceptualization of Freight Technology-enabled Logistics Platform Strategies

5.1 Objective

According to our analysis, FTPs provide complementary services for LSPs by realizing digital forwarding services for improved transport management. At the same time, FTPs are growingly in competition with traditional LSPs due to their digital bypass capabilities as the new intermediary between shippers and carriers (Kille, 2018). Their agile and flexible qualities to create data-based value employing logistics platforms represent unique selling propositions with disruptive potential in the fragmented road freight market. To decide on the position of LSPs in light of the new freight technology innovations for smart service realization, conceptual options provide systematic guidance for both LSPs and FTPs. For this reason, we propose logistics platform strategies aiming at the following objectives:

- Give orientation for the establishment of platform strategies for the integration of additional transport stakeholders
- Provide guidance for the allocation of duties within transport chains
- Increase transparency of FTP capabilities within LSP organizations towards digital business models
- Create a starting point for scholars and practitioners for further exploration or adaptions of logistics platform strategies

5.2 Logistics Platform Strategies

To address the logistics platform objectives based on the findings in this study, we propose four logistics platform strategies in this paper. For the first strategic option (Figure 6), LSPs can employ FTPs founded on multi-sided marketplaces that allow interactions and transactions between several market participants (Hagiu and Wright, 2015). For instance, the matchmaking of freight resources and related orders does increase asset utilization and optimize customer service levels. LSPs can make use of multiple logistics platforms to increase the matching results known as “multihoming” (Seiter et al., 2019). However, LSPs and FTPs operate separately according to their selling propositions and maintain individual business models. An FTP example for this strategic concept is presented by the enterprise Timocom.

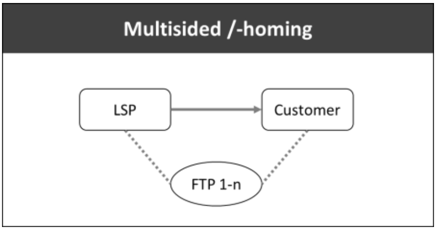

Figure 6: Proposed "Multisided / -homing" Logistics Platform Strategy

A second strategic option for LSPs and FTPs arrives through the collaboration of LSPs and FTPs by specific agreements leading to a "Smart Forwarding Provider" towards customers (Figure 7). This concept supports collaborative digital business models by a unified service provider through partnership programs. Accordingly, LSPs obtain exclusive smart service capabilities and the generated revenue is shared between LSPs and FTPs. Beyond, LSPs can use this option to increase their innovation competence and develop future road freight services based on data together with FTPs. For example, if LSPs organize full truckloads within complex transport networks, freight technologies are used to deliver ETA and manage yard operations for advanced transport efficiency collaboratively. The enterprise Pamyra is found as a corresponding example.

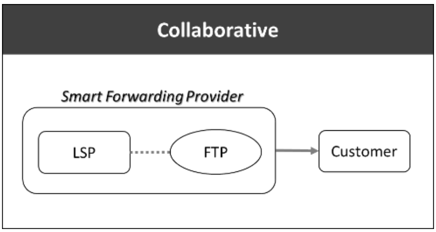

Figure 7: Proposed "Collaborative" Logistics Platform Strategy

The third proposed option refers to a modular-integrated logistics platform strategy (Figure 8). This concept engages data technology providers (e.g., provider of truck telematics systems) from an FTP perspective additionally to aggregate and streamline data offered to LSPs (e.g., transport operators managing their asset). As a result, LSPs are transformed into a "Smart Managed Fleet Provider" due to the enrichment of asset-based data for digital transport management. The newly generated services lead to the adoption of existing business models. To give an example, position and performance data from transport means can be used in real-time across mixed fleets to support ETA and the monitoring of fuel consumed for advanced emission tracking services for customers. Herein, we found Forto as a corresponding example in practice.

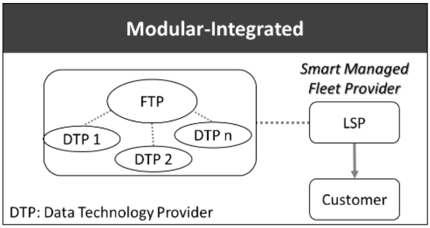

Figure 8: Proposed "Modular-integrated" Logistics Platform Strategy

In the fourth strategic option, a platform concept is formed by LSPs, which incorporate FTPs within their organizational business scope to promote advanced smart service innovations (Figure 9). This concept is founded particularly by start-ups that are acquired by medium-sized and large enterprises leading to a "Smart Freight Service Provider" due to the smart service capabilities beyond the transport activities. For instance, start-ups that develop technologies based on artificial intelligence can be of strategic importance for LSPs since the technology can be used for dynamic route planning in the transport field and warehouse management at the same time to predict capacity constraints and support planning activities jointly. Thus, incorporation of FTPs is considered as an effort with significant monetary investment for LSPs while the generated business model contributes to digital service innovations in logistics. A corresponding example for this platform strategy is found by Salodoo (DHL).

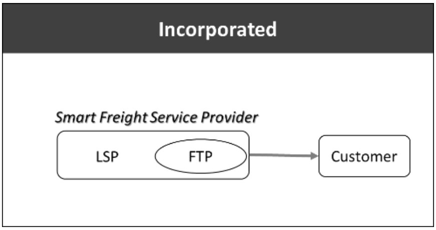

Figure 9: Proposed "Incorporated" Logistics Platform Strategy

5.3 Procedure to Establish Logistics Platform Strategies

The proposed logistics platform strategies reflect the paradigm of digital and connected freight transport systems and stress the traditional forwarding concept. This development is discussed in the context of supply chain visibility in theory and practice since freight technologies promote transparency while fostering the control of logistics chains (Möller et al., 2020; Roland Berger GmbH, 2020). Beyond, the value of data for road freight operations is not limited to digital platforms and marketplaces but rather provide further opportunities in the context of logistics ecosystems by integrating other relevant logistics stakeholder that can benefit from smart services, such as insurance companies or maintenance providers for trucks. Consequently, we see a high relevance for the proposed platform strategies in practice to facilitate technological collaboration in a complex industry. To achieve our objectives presented in this section, we suggest a four-step procedure and present actions for the establishment of logistics platform strategies between LSPs and FTPs (Figure 10). The procedure marks a starting point and logistics players receive orientation and guidance to develop their individual platform strategy.

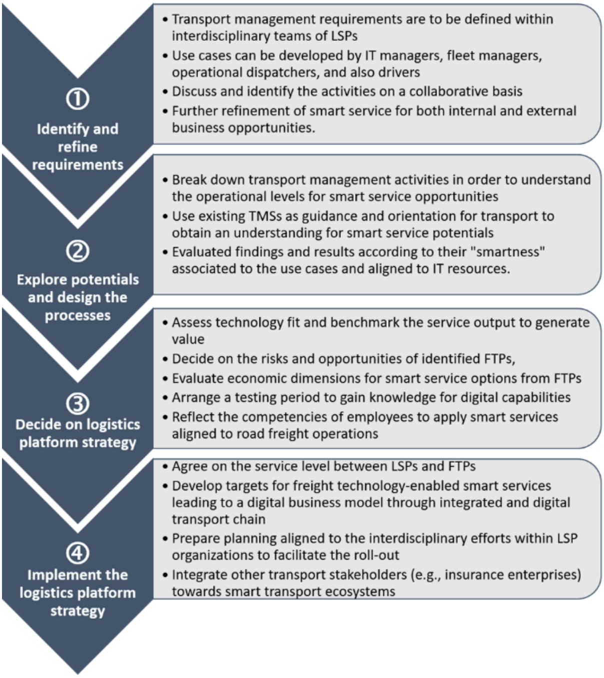

Figure 10: Suggested Procedure to establish Logistics Platform Strategies

The procedure constituted above suggests initial tasks to manage the proposed logistics platform strategies. The strategic concepts are based on freight technology-enabled smart services which operate within a cloud infrastructure supporting interconnected smart transport ecosystems.

6 Discussion and Limitations

Logistics platforms operate as the digital enabler to facilitate smart services within the fragmented road freight industry (Kille and Wagner, 2017). To this end, freight technology providers (FTPs) maintain cloud-based services along the process of road freight transport management while logistics service providers (LSPs) recognize the emerging trend of freight technologies towards the achievement of unique selling propositions.

Our study explores a new market of logistics platforms in a specific business context and we are convinced that it can also contribute to the broader picture of understanding digital transformation in logistics. FTPs use data as the primary resource to offer customers services (El Sawy and Pereira, 2013) based on the facilitation of transactions and the integration of IS between shippers, carriers, and forwarders. Particularly, our analysis of business models has shown the opportunities of complementary services by FTPs to digitize road freight lifecycle. The four platform strategies we have derived from the business models of LSPs and FTPs represent a blueprint for further development towards platform-based and collaborative "smart forwarding" (Heinbach et al., 2020). LSPs and FTPs in the digital age are guided to establish a common strategic ground for new joint business opportunities to strengthen road freight collaboration towards integrated freight operations by intelligent digital platforms (Yang et al., 2017). Hence, our investigation opens new research avenues for scholars to further explore the phenomenon of freight technologies in the realm of digital logistics. Managerial contributions arise in the context of TMSs for operational transport management since managers gain strategic knowledge of freight technologies and receive orientation for developing smart services in a yet complex road freight market.

The investigation has both practical and scientific value despite some limitations that are naturally given. First, our exploration is founded in data from 25 LSPs and 15 FTPs only. Even we considered a broad range of data, our coverage is neither comprehensive nor representative for LSPs and FTPs in the logistics sector in general. Additional providers to be involved might uncover further business model paradigms and smart services. Second, our examination is related to the road freight market and the consideration of other modes of transports may reveal other business specifications. Third, our conceptualization of logistics platform strategies remains simplified compared to the real-world environment since we draw the concepts on an abstracted level. Fourth, the four concepts are derived by individual interpretation from authors with professional experience related to the business sector. However, other researchers may have concluded other findings with minor differences to our results.

7 Conclusion and Outlook

Road freight transportation is increasingly transformed into a digital business through the emergence of freight technology-enabled smart services. In this paper, we study logistics platform strategies between logistics service providers (LSPs) and freight technology providers (FTPs) according to their business model structures. To this end, we apply the concept of Business Model DNA to evaluate 55 patterns for business models for 25 LSPs and 15 FTPs to cluster the aggregated structures. We present the results in network graphs, demonstrate relevant smart services assigned to the dimensions of transport management, and further derive four platform concepts.

The findings in this study serve as a starting point in an emerging digitally transformed business field with fruitful research opportunities. Further research should investigate the success factors and platform governance of the proposed platform strategies in more detail. Beyond, we see the opportunity to study the phenomenon of freight technology beyond visibility and optimization towards intelligent and automated transport ecosystems that may, at least to some extent, act autonomously in the future. More data is required to provide more evidence on Business Model DNA, smart services, and platform strategies within a fragmented business sector. Business models in the digital freight forwarding age should be investigated rigorously to engage the field of service engineering, platform design, and digital transport ecosystems in the technology-driven domain. These initiatives are beneficial for LSPs to navigate in the era of digital transformation and illuminate the ongoing evolution of digital ecosystems in a challenging business environment. We hope to motivate other scholars by our contribution to further study digital platform capabilities and data ecosystems in the sphere of digitalization that helps to enhance the understanding of smart service innovations through the use of freight technologies.

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