

A generic framework of an agile supply chain to confront the consequences of COVID-19

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Abstract: The outbreak of COVID-19 affected all business and supply chain is no exception. The objective of this article is to provide new insights into how logistics service providers (LSPs) managed to maintain supply chain agility and what priority areas were adjusted to keep operations functional and maintain financial stability in the aftermath of the COVID-19 pandemic. This study acquired primary data through semi structured interviews with informants from selected worldwide LSPs, using data-gathering approaches from interpretive research. The findings of this study shed light on how LSPs dealt with the negative aspects of the COVID-19 outbreak and devised creative solutions to operational and financial issues. This study categorizes the LSPs' reactions and gives a framework from a managerial perspective. It is one of the first studies to specifically focus on the involvement of LSPs during the COVID-19 pandemic. This work analyses the strategic function of LSPs in supply chain management from a theoretical standpoint, and so adds to the present supply chain literature by focusing on LSP agility.

Key words: Covid-19, Supply chain, Agility, Pandemic, logistics service provider

I. Introduction

The emergence of COVID-19 in early 2020 produced unprecedented supply chain disruptions, demonstrating the vulnerability of the worldwide economy, which is defined by intricate and interrelated product and material movements (Mahajan & Tomar, 2021; Nikolopoulos et al., 2021; Notteboom et al., 2021). Because a supply chain is defined as a network of organizations that work together to manage the flow of materials and information from suppliers to end users (Al-Mudimigh et al., 2004; Christopher, 2011; Ballou, 2016; Bhatti et al., 2016), it is important to note that global supply chains and their associated complex material flows rely heavily on logistics infrastructure (primarily transportation and warehouse services) provided by logistics service providers (LSPs).

Companies have increasingly outsourced their logistics functions for transport and warehousing efficiency, flexibility, and capacity (Giri & Sarker, 2017; Tsai et al., 2021). LSPs have played an increasingly important role in recent decades as companies have focused on their core competencies and outsourced their logistics functions. According to Rosar (2017), logistics outsourcing accounts for 53 percent of shippers' transportation and 34 percent of warehouse operations spending, with supply chain consultancy forecasting more budget rises for logistics outsourcing in the future years. More crucially, by coordinating and regulating material flows, LSPs improve supply chain agility by reducing or even eliminating risks that may arise as a result of fluctuating demand, supply, or in emergency situations.

However, during the early stages of the COVID-19 pandemic, LSPs were severely damaged by global chain disruptions, as material production and flows halted, decreased dramatically, or were delayed (Shaharudin et al., 2021; Song et al., 2020). The outbreak's consequences created uncertainty for LSPs on multiple levels, including unprecedented volatility in logistics infrastructure demand and supply, and hence operational and staff capacity requirements. Furthermore, LSPs soon felt the financial impact of the downturn and transportation difficulties at the start of the pandemic and had to make quick operational modifications to survive (Tsai et al., 2021).

Despite the critical role of LSPs in supply chain management, there appears to be little research that specifically investigates how LSPs built agility within supply chains and responded to the unprecedented disruption caused by

COVID-19. In other words, there is a lack of understanding about how LSPs have responded to disruptions and what specific measures have been taken to ensure the company's operational functioning and survival, and thus the supply chain. We argue in the paper that supply chains were able to continue operating due to the actions taken by LSPs that contributed to supply chain agility. We specifically ask the following research questions:

RQ1. What were the effects of the COVID-19 pandemic on the business and operations of LSPs in order to maintain or improve supply chain agility?

RQ2. How did LSPs respond to the COVID-19 outbreak, and what lessons can be drawn from these responses to ensure supply chain agility now and in the future?

We attempted to share insights into the responses regarding the COVID-19 pandemic in this article by interviewing LSPs with a global footprint. So far, there are just a few clues as to how LSPs managed to keep supply chains agile and what priority areas were changed to keep operations running and retain financial stability. This work makes a fourfold contribution by providing insights into this topic: To begin with, as far as the authors are aware, this is the first study to investigate the implications of COVID-19 from an LSP standpoint. Even during the COVID-19 (Agrawal et al., 2020; Nikolopoulos et al., 2021), existing literature on supply chain survivability (Choi, 2021) or supply chain agility (Dohale et al., 2021; Mahajan & Tomar, 2021) has not specifically investigated or even neglected the role of LSPs. Second, the study illustrates and analyses the immediate consequences of LSPs' primarily operational decisions, offering an overview of LSP response in the real world and their impact on supply chain agility. Third, our research reveals how LSPs have dealt with the pandemic's negative effects as well as creative solutions to operational and financial issues, allowing us to not only categorize the LSPs' responses but also to provide an overview of framework from a managerial standpoint. Fourth, we augment current LSP and supply chain literature with a notion that is more suited to capture the rapid reactions and activities during an external shock of high impact and low probability by recalibrating the concept of supply chain agility to LSP agility.

The rest of the paper is organized as follows: In Section 2, we establish our LSP agility framework, which will be used to classify the LSP response. The technique is then described, as well as the data collecting and analysis that follows. In Section 4, we provide our findings in accordance with the data analysis' identified themes, and we introduce responses that combines the findings from the interviews. We wrap up by summarizing the important findings and pointing out the study's shortcomings, as well as making recommendations for future research.

II. The agility of logistics service providers

Through the integration and collaboration of logistical activities along global supply chains, LSPs play a critical role in supply chain agility (Brusset, 2016). Outsourcing to LSPs gives shippers exactly the carrier capacity they need while also providing flexibility in the supply chain (Kumar & Mishra, 2017). With companies focusing more on their core competencies, outsourcing to LSPs gives shippers exactly the carrier capacity they need while also providing flexibility in the supply chain (Giri & Sarker, 2017). LSPs are strategically important for a company's daily operations because of their on-demand capacity, flexibility, and innovations (Asian et al., 2019). They should also help companies mitigate negative effects arising from an emergency, such as a supply chain disruption (Mahajan & Tomar, 2021; Nikolopoulos et al., 2021; S. Singh et al., 2021). As a result, LSPs can be considered a critical component of supply chain agility, as their assets and associated logistical infrastructure (mostly transportation) give them a strategic edge in meeting client demands (Demchenko et al., 2016). However, the unprecedented and unique scenario of the COVID-19 pandemic and its disruption of global supply chains clearly demonstrated that LSPs were overwhelmed: LSPs, relying on global material flows, were suddenly confronted with critical item shortages and delays, causing a ripple effect within operations and leading to a decline in productivity, revenues, and profits (Christopher, 2005; Giri & Sarker, 2017).

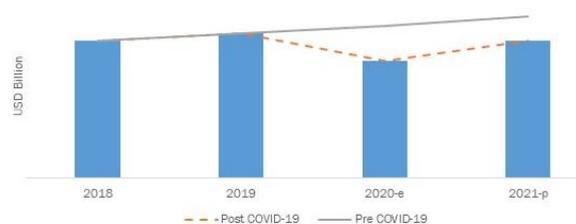


Figure 1 : Impact of COVID – 19 on logistics market

From 2020 to 2021, the global logistics and supply chain industry market size is expected to expand at a Y-O-Y rate of 17.6%, from USD 2,734 billion in 2020 to USD 3,215 billion in 2021. In comparison to pre-COVID-19 estimates, the projection for 2021 is expected to be decreased by over 10-15%. Increased supply of critical commodities, the formation of a supply chain stability task force to combat COVID-19, and rising demand for and distribution of personal protection equipment are the main drivers of this sector.

As a result, the pandemic's unprecedented and massive impact posed a threat to the long-term viability of LSPs and, by extension, global supply chains (Shaharudin et al., 2021). Academics and practitioners have called for study on strengthening supply chain agility on a global and local scale in response to supply chain survival concerns (Shen et al., 2017). The literature on supply chain agility has exploded in the recent decade, and it is quickly becoming a popular topic among academics (Brusset, 2016; Ivanov, 2020; Shen et al., 2017). Supply chain agility is also the most popular theme for researching the logistics and supply chain implications of COVID-19 (Durugbo et al., 2021; Nayal et al., 2021; Russell et al., 2020; Saarinen et al., 2020).

Interestingly, only a little amount of research has been done on how LSPs can aid supply chains maintain or increase agility, particularly in the case of the COVID-19 pandemic. Scholars have lately looked at vulnerability in logistics outsourcing (Tsai et al., 2021), LSP security design (Wagner & Sutter, 2012), and LSP integration and agility (Liu and Lee, 2018). To put it another way, it's still unclear how LSPs reacted to the COVID-19 interruptions and what precise actions they took to maintain operational functioning and survival – both for themselves and for global supply chains. Furthermore, we argue that relying solely on supply chain agility literature to understand these behaviours will provide an insufficient solution. That's because, while different definitions of supply chain agility exist (Saarinen et al., 2020; Shen et al., 2017), these concepts of supply chain agility all focus on strategic planning, which aims to determine the supply chain network's required operational flexibility (Kumar & Mishra, 2017).

These definitions emphasize the supply chain's ability to adapt to unforeseen events, respond to disruptions, and recover from them while maintaining operational continuity (Elsubbaugh et al., 2004). A resilient supply chain can thus adapt to unforeseeable events and either return to its original state (Khan et al., 2021) or transform to a different configuration (Emelogu et al., 2019). It may also be advantageous for the supply chain to learn from the disruption and adapt into a new configuration rather than returning to its original shape following a disruption or change impact (S. Singh et al., 2021). According to these two approaches, the agile supply chain has on the one hand the ability of simple and reactive adaptation, allowing for easy correction of disturbances or a preventive response to unexpected changes, but on the other hand the ability to dynamically react to undefined changes through pre-adaptation (Saarinen et al., 2020).

The COVID-19 pandemic clearly demonstrated that global supply chain agility planning appears to have worked only partially: in some supply chains, demand increased dramatically, and supply was unable to meet the demand (such as hand sanitizer, facial masks, disinfection spray), or demand dropped dramatically, resulting in production halts, bankruptcies, and government intervention (Durugbo et al., 2021). As a result, we contend that supply chain agility is dependent on the agility of LSPs. To put it another way, the basic premise of our argument is that supply chain agility has been developed and can be built by involving more robust LSPs. The COVID-19 pandemic proved that LSPs' strategic role in the supply chain has an impact on not just supply chain performance but also can provide a competitive advantage in emergency situations (Ivanov, 2020; Dohale et al., 2021; Tsai et al., 2021). To put it another way, the COVID-19 crisis highlighted the importance of flexible reconfiguration of logistical infrastructure and resources in order to maintain flows and, as a result, keep supply chains moving. LSPs are in a unique position since they not only have operational expertise, but also have access to a variety of ad hoc logistics resources and can quickly deploy creative solutions in complex supply chain environments.

As a result, LSP must be robust for the supply chain and logistics activities to function correctly, i.e., their operational and financial capabilities must be preserved. LSP agility, in the context of our study, refers to the actions taken by an LSP to survive in the near term, with a focus on financial stability so that the LSP has the operational and financial strength to contribute to overall supply chain agility. We propose that the LSP agility notion has two crucial aspects in particular: First, LSP agility includes the ability to adapt to the pandemic with new business concepts. The recovery phase provided possibilities for LSPs to build extra logistical infrastructure – primarily transportation capacity – and reap possible additional revenue streams (Becker et al., 2021; Choi, 2021; Shaharudin et al., 2021), and LSPs took advantage of the opportunity. More particularly, by integrating the financial aspect as a basic aspect, this point stresses the innovative character and the transformation of the focus from pure efficiency to agility. Financial stability and alternative revenue sources are rarely highlighted in the literature on supply chain agility, and they appear to have been

overlooked thus far. Given the financial difficulties, prospective bankruptcies, and LSP survivability worries posed by the pandemic, this is somewhat remarkable.

Second, LSP agility includes the steps that must be taken to manage the negative consequences of a disruption. It appears that, particularly at the start of the pandemic, companies did not rely solely on their strategic agility measures, but rather responded quickly or ad hoc on an operational level. These modifications can be linked to the concept of adaptive management in supply chain agility (Ivanov, 2020; Saarinen et al., 2020). The goal of adaptive management is to make supply chain responsive, cost-effective, and competitive in order to increase customer satisfaction and decrease costs, resulting in increased supply chain profitability (Ivanov, 2020). The emphasis here is unmistakably on optimizing operational and logistical resources and personnel. In the context of COVID-19 disruptions and the resulting shortages and production halts, adaptive management would necessitate downsizing operations and minimizing losses, i.e. managing the pandemic's downsides and their implications for the organization.

As a result, we contend that LSPs survived the pandemic not only because they relied on their pure operational agility measures, but also because they took a more holistic view of LSP agility, which we define as the LSPs' capability during a high-impact and low-probability external shock to adapt, reallocate, and introduce operational measures to protect their core operational capacity as well as to create business opportunities to return to normal operations. These two essential aspects of LSP agility will next be used to investigate LSP responses. The research design and how we collected and analysed data from selected LSPs with a global footprint are described in the next section.

III. Research methodology

3.1. Research approach

The overall goal of the study is to categorize and understand how LSPs reacted throughout the pandemic in order to survive, as well as what efforts were done to ensure LSP agility. We use an interpretive research approach to classify the reactions and activities. The interpretive method allows us to develop meaning and broaden boundaries more as a process than as an explanation of a finished result obtained by demonstrating variable associations (Adams et al., 2014). As a result, the interpretive approach investigates a specific occurrence in a specific location, and specific reasons, meanings, and experiences are investigated to provide 'thick descriptions' that are time- and context-bound (Ketchen Jr & Bergh, 2006; Y. K. Singh, 2006).

The research method used in this study is interpretive research with a part-to-whole process, which is represented by a hermeneutic cycle (Singh, 2006). The orienting frame-of-references that describes the context's self-relevance is presented at the start of the cycle (Kothari, 2004). The following two LSP agility qualities serve as the orienting frame-of-reference in this paper:

- Capitalize on the positive aspects, such as how innovation assisted LSPs in surviving operationally and financially; and
- Mitigate the negative aspects, such as how LSPs dealt with the detrimental effects of COVID-19 on their operations and business.

The drawbacks and upsides, as well as the behaviours and emotions that go with them, are classified using these two reference points.

3.2. Context and sample selection

Opposite to the positivist paradigm, which seeks to generalize findings, context selection in the interpretive approach is motivated by comprehension rather than generalization (Baker, 2000). Because interpretive research approaches emphasize in-depth understanding of the context, the number of informant cases chosen is always small, ranging between 3 and 20 (Singh, 2006). As a result, the context in this paper is the LSPs, based on the orienting frame-of-references. Because the interpretive approach employs a judgment sample strategy, i.e. the samples are based on the expert's opinion (Goddard & Melville, 2004), we chose four LSPs in Morocco based on the following criteria: First, LSPs must have a global presence (that is, they must operate in an international/global market) and thus rely on global supply chains. Second, LSPs must provide all modes of transportation (land, rail, sea, and air) so that similarities and differences between modes of transportation can be revealed. Third, it was decided to concentrate on two major LSPs as well as two small and medium LSPs in order to gain a better understanding of how firm size influences (re)actions to the pandemic. Even though Moroccan's LSP competition includes numerous small LSPs as well as all major European and international LSPs, we were confident that these four LSPs represent an adequate cross section of the LSPs in Morocco.

Four informants, each representing one of the four LSPs, were purposefully chosen for the interviews to ensure that the respondents had an in-depth understanding and rich experience of the operational impacts and their underlying processes from an LSP perspective. Senior operations managers and global sales executives with international experience in logistics and supply chain management, as well as strategic and operational management experience, were among the informants. We ensured anonymity to the informants because the goal of the interpretive research is to gain in-depth knowledge and the information was received with the promise of confidentiality. *Table 1* provides general information about the companies.

<i>Company</i>	<i>Description</i>	<i>Year of experience</i>	<i>Field</i>
<i>A</i>	a transport and Logistics division, it manages terminals and provides integrated cargo and inland services.	30	container terminal
<i>B</i>	specializing in the international transport of goods in Morocco, the priority of this group is to listen to customers and to satisfy them through a service approach but also by a perfect mastery of the regulatory workings.	25	freight and logistics service
<i>C</i>	a global leader in integrated logistics and transportation services International and domestic express delivery, freight forwarding, logistics and storage, document management, and online shopping services are among the services provided.	10	courier and package delivery
<i>D</i>	a transportation, e-commerce, and services-focused American multinational conglomerate holding corporation	35	transportation

Table 1 : Research sample. Source: Author`s illustration

3.3. Data collection

Primary data was collected through semi-structured interviews with informants from the selected companies described above, using data-gathering techniques from interpretive research. Semi-structured interviews were chosen because they ensure that the interview content is focused on the issues that are central to the research question, but the type of questioning and discussion allows for greater flexibility than the survey interview(Chawla & Sodhi, 2011). Although we used the orienting frame-of-reference as a guide, our questions were not strictly scripted(Flick, 2015), and we used a conversational mode to encourage a two-way interaction in order to better understand the specific actions and reactions of the LSPs during the COVID-19 pandemic. As a result, the questions centered on the COVID-19 impact and covered four major topics:

- Operational performance,
- Sales activity,
- Personnel capacity, and
- Upper management decisions.

The interview questions were short and open-ended, with the goal of creating a circular dialogue influenced by the recurring interaction between interviewee and researcher(Tennis, 2008), in order to understand the informantson their own terms and how they make meaning of their own lives, experiences, and cognitive processes(Chawla & Sodhi, 2011).We used probes and follow-up questions to keep the conversation going, not just to encourage the informant to expand on original statements(Goddard & Melville, 2004), but also to hear the significance of what is being said(Kothari, 2004).

We gathered data from secondary data sources to supplement the information from the interviews. Secondary data provides certain distinct advantages, according toBrink et al. (2006), such as being less vulnerable to biases, having higher internal validity, and being available in large quantities, all of which are beneficial for gaining deep insights into logistics phenomena. As a result, we used internal (e.g., documentations, digital records, archival records) and external data sources (articles, agency reports, industry reports) of the companies (Adams et al., 2014)to learn more about the COVID-19 pandemic's ramifications and LSPs' (re)actions. We used the most up-to-date data to ensure that the COVID-19 pandemic's consequences were the center of attention at the start of 2020.

3.4. Data analysis

We initially assessed each example intertextually (Walker, 1997) for interpretation, utilizing the orienting frame-of-references (i.e. the two LSP agility key qualities (a) leverage the upsides, and (b) manage the downsides). We analysed the text in context for each of the LSPs by reading and rereading the transcripts independently (Flick, 2015). This intertextual analysis was wrapped up with a detailed summary that included a list of the primary findings for each LSP in order to highlight recurring and main themes. This level of analysis sought to offer all information in context and develop deep descriptions (Baker, 2000).

Following that, we analysed the LSPs intertextual meaning across each other to identify common themes (Kothari, 2004). In this step, we looked for shared storylines about reactions and actions in order to achieve a higher level of abstraction (Brink et al., 2006). To put it another way, we conducted a thematic analysis and coded the material in order to identify commonalities or intertextual patterns. This step enabled us to compile a list of LSP actions and reactions during the COVID-19 pandemic and identify overarching themes. Following Chawla & Sodhi's (2011) approach, we repeated the thematic analysis process until the orienting frame-of-references, i.e. the reactions and actions, were contextualized.

IV. Logistics service providers' response to the COVID-19 pandemic

The analysis of the interviews revealed the five main themes under which the reactions and actions can be classified, leading to the development of an LSPs agility framework based on the two LSP agility key characteristics (Figure 1):

- Generating cash flow
- Boost business agility.
- Implementing developed technologies and information flow management
- Improving logistics network

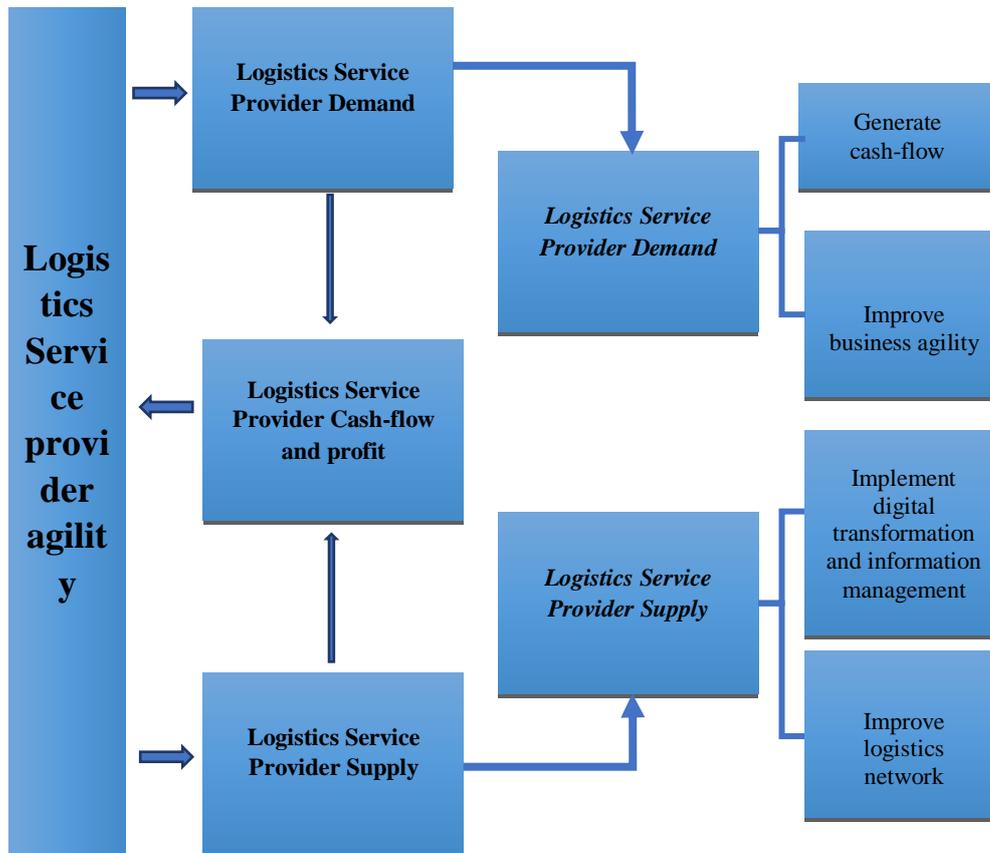


Figure 2 : Logistics Service Providers Agility framework. Source : Author's illustration

Whereas the first two themes are concerned with capitalizing on opportunities, the latter two are concerned with controlling risks. The issue implementing digitization and data management has been mentioned as a (re)action in both the negative and positive aspects, including both perspectives. Below, the acts (actions) of LSPs are provided in accordance with the specified themes.

4.1. Generate cash flow

Because of the overall lack of transport capacity, particularly in the air cargo sector, the disruption of global supply chains created an opportunity for LSPs to generate additional revenue streams, according to the interviewees and secondary data. In April 2020, all trade lanes across the world saw double-digit air cargo capacity declines compared to last year with transatlantic air cargo capacity down 44 percent from the US into Europe, and 58 percent in the reverse direction (Russell et al., 2020). The disruption resulted in a drastic reduction in aircraft belly cargo capacity, which accounts for roughly half of all air cargo (Becker et al., 2021).

Air freight charges soared up to six times higher than normal as a result of this bottleneck, and LSPs were in a unique position to take use of their transportation network and offer clients transport capacity via their own or chartered planes. Major freight integrators with large capacity, such as FedEx, DHL, or UPS, were able to compensate for the lack of aircraft belly space, as D confirmed: "With China returning to the new normal and starting to produce again, we experienced an incredible uptick in demand on our Asian routes." This demand generated other revenue streams and masked the pandemic's impact on LSPs, according to C, who stated, "The Asia business saved us financially." The need of national governments to acquire health supplies was a major factor, resulting in record yields, with spot rates out of China reaching US\$18 per kg and a 747 charter selling for US\$1.5 million by the end of April (Al-Omouh et al., 2020).

"I was suddenly confronted with requests for airfreight rates and charter deals, an industry I wasn't really familiar with" (B), and "My attention turned from my typical client requests and transport demands to this impromptu, massive one-off shipments for health supplies" (B) (A). Nonetheless, all the interviewees agree that the shift to more immediate, pandemic-related activity not only partially compensated for the decline in "business-as-usual" volumes, but also helped the LSPs create much-needed money. COVID-19 had an influence on revenues and profitability, but no losses were observed, according to the results of global freight integrators and LSPs. Our results were better than we expected, driven in part by the shifts in demand that developed from the pandemic, notably COVID-19 related healthcare shipments and strong outbound demand from Asia, UPS announced in their second quarter earnings on July 30, 2020 (UPS, 2020). Similarly, on July 30, 2020, DB Schenker, a large German-Austrian logistics service provider, declared that DB Schenker has done well in the crisis, despite dropping revenues, and boosted adjusted earnings before interest and taxes to EUR 278 million, an increase of 16.8% year on year" (DB Schenker, 2020).

These responses point to a framework that can help the LSP become more agile. During a pandemic, it appears that John Adam's phrase every difficulty is an opportunity disguised also applies to LSPs. Following an initial shock caused by a drastic drop in volumes due to supply chain disruptions, our interview data suggests that strategic transportation assets and associated transport capacity played a significant role in quickly generating revenue through new transport requests for pandemic-related shipments such as healthcare shipments and food equipment. The fast availability of transportation assets and capacity, as well as their sales, considerably reduced revenue losses at the start of the COVID-19 pandemic. However, our interview data suggests that not all sales, admin, and operations employees were fully prepared to handle the various transportation requests, so contingency training or contingency manuals may be useful in driving business and better understanding the opportunities associated with a crisis.

4.2. Boost business agility

With its highly fluctuating transportation demands, the LSP sector was challenged by global supply chain disruption (Singh et al., 2021). LSPs had to substantially reduce transport capacity at the start of the pandemic, when global manufacturing ceased, and fleets and trucks were grounded. LSPs had to contend with a mix of a scarcity of aircraft belly capacity and urgent requests for food equipment during the recovery phase, reversing the situation as clients, governments, and other essential stakeholders requested transport capacity that was not available on the market (Russell et al., 2020).

"It was wild," one candidate said. "At first, we thought we'd all lose our jobs because there's nothing to carry there, but then business exploded, and we couldn't keep up with all the requests." We understood we needed to provide solutions for our customers" (A). Due to a lack of capacity, some passenger airlines began offering regular cargo flights

in mid- to late-April. For example, Virgin Atlantic offered a 787-passenger aircraft solely for the UK Department of Health and Social Care, which flew health supplies for hospital employees three times a week between London and Shanghai. Even further, Air Canada was the first passenger airline to remove seats in order to deal with the surge in cargo shipment requests (Barabari & Moharamzadeh, 2020). LSPs, on the other hand, exploited passenger airlines to expand their transportation capacity. For example, for frequent cargo shipments from Asia to Europe and the United States, DB Schenker removed the seats from three Iceland Air 767s (DVZ, 2020).

As a result of this "unusual scenario" (B), LSPs had to swiftly adjust to the new environment, putting a strain on an existing system and requiring more transportation flexibility in the shipping network. Our interviews suggest that the adjustment was successful on a short-term operational level, with B commenting, "I was rather astonished how quickly management chose to generate more capacity." "I'm sure they saw a profit opportunity, but it was also about proving themselves as a trustworthy partner in a crisis." "In sales, we adjusted the indirect reporting lines," C explained, "which means we connected directly with our charter division and hired employees to handle the requests as our 'regular' product demand plummeted."

From a professional viewpoint, the LSPs appeared to have examined current and future network requirements and scheduled calls with their primary partners/service providers. According to C, "it was sometimes really hard to get an overview about today's network, the changes are really drastic, and the usual providers and shippers may no longer be valid," leading to network uncertainty regarding shipper reliability. As a result, management scheduled strategic calls with the major shippers: "We made a list, even with shippers who aren't currently shipping with us, to talk to them and get a realistic idea about their capacity, problems, and also what the plan for the rest of the year is" (D).

Based on these findings, we can draw three conclusions about how LSPs can improve their LSP agility through transportation flexibility. First, the deal must be closed: the interviewees indicate that sales alignment is critical, i.e. it is possible that sales people with different products receive requests for a product that they do not initially have in their portfolio, but it is critical that this request be handled. As a result, establishing new direct and indirect lines helps to secure business. Second, the transaction must be handled: because of the long-term change in product demand, such as a shift from B2B express shipments to air cargo belly freight, operational resources must be reallocated to meet these demands, i.e. trained personnel must be added quickly, and organizational changes must be made if necessary. Third, the deal must be transported: in order to have transport capacity available, management must examine network needs and then consult with strategic partners and providers to forecast volumes and demands.

4.3. Implementing developed technologies and information flow management

According to the interviews, the pandemic was a major driver behind IT solutions and a major driver for digitalization, i.e. for LSPs to find ways to digitize certain processes in order to maintain business critical functions. According to studies, LSP operations, particularly in sea-, rail-, and airfreight, continue to be characterized by limited innovation capabilities and low levels of digitalization (Zhuckovskaya et al., 2020). As a result, the circumstances and protective measures that had to be implemented and affected operations and workforce not only posed a challenge to existing processes but could also be viewed as an opportunity to drive digitalization in their respective organizations (Anthony Jnr & Abbas Petersen, 2021; Döhning et al., 2021; Horgan et al., 2020; Jnr & Petersen, 2021). We discovered that our interviewees saw digitalization as an opportunity to address the downsides of disruptions while also pushing digitalization for additional growth opportunities.

To respond to setbacks and use digitalization to implement basic protective measures in order to continue operations, two key elements were required: operations and the workforce. Overall, all interviewees have seen an acceleration of process digitalization, both for customers and employees, as well as within the operations of the companies. "Instead of phone and in-person meetings, customers and employees are increasingly using Zoom or other video conference tools," according to D. "We saw customers who were originally expecting a handwritten POD [Proof of Delivery] moving to digital PODs and even digital invoicing," D added. Digitalization was also sometimes forced due to restrictions, as A states: "When our truck driver arrives in Italy, he is not allowed to exit the truck cabin, so all his paperwork is with him in digital form." However, the interviewee added, "although most EU countries have adopted the use of digital freight documents, some, including Germany, have not," emphasizing the European Union's fragmentation and the need for a more holistic approach.

However, all interviewees see digitalization and the associated data management as a chance to better understand market volatility and plan more effectively on a purely operational level. "At the moment, we don't have any specific tools that can help us predict volumes during disruptions or crises." We get our yearly volume target at the

start of the fiscal year, but it's very static and too complicated to incorporate dynamic volume changes like COVID-19" (D). "Although we can get sufficient information about shipments, primarily from customer entries," the interviewee continues, "our legacy system is quite old, and I cannot imagine how it can be digitalized." Two interviewees specifically addressed the lack of digitalization, stating, "In our warehouse, we can't digitally measure the dimensions of packages and pallets, which may result in a revenue loss" (B) and "from a strategic standpoint, I hardly receive reliable updates from our management about the change in volumes, but when I look at, for example, Amazon and its data management and their approach to anticipatory shipping, we need to catch up to plan better" (A).

As a result of these findings, we can conclude with two management lessons learned for improving supply chain agility via LSPs. First, the adoption and implementation of digitalization for the workforce and on the operational level appear to be closely related to organizational unwillingness or resistance to change. However, LSPs were under pressure to digitize critical processes as a result of COVID-19; it appears that COVID-19 raised awareness and thus accelerated the digital transformation. We observed discrepancies between large and small businesses: large businesses appear to have reacted more rapidly, whilst small businesses appear to be lagging in terms of digitalization. Second, investments in digitalization for (big) data management appear to be more of a "when" question than a "if." On a practical level, LSPs appear to recognize that better data management can aid in the consolidation of shipments and the planning of last-mile delivery. On a strategic level, the use of data and precise tracking systems might, for example, aid in the adaptation of shipping transportation pace (e.g. slow steaming) so that 'floating storage' arrives at warehouses when it is needed. Three out of four interviewees said that digitalization is a challenge in their company, and Amazon and Alibaba have already filed patents for anticipatory shipping (UNCTAD, 2020), which predicts when a customer will make a purchase and begins shipping the product to the nearest hub before the customer places the orders online (Doubbia-Henry, 2020).

4.4. Improve logistics network

The major factor affecting LSPs as a result of COVID19 was transportation capacity and its drastic reduction as a result of global supply chain disruption (Ivanov & Dolgui, 2020). Global LSPs rely on global supply chains, and the disruption resulted in two major changes in transportation. First, the abrupt drop-in supply chain activity caused by COVID-19 created strategic uncertainty, as LSPs could not predict which of their strategic customers would continue shipping, nor how much flexibility strategic transport partners or providers could provide in geographical and quantity terms. Second, the abrupt decline created operational uncertainty because less material and goods were shipped and/or other materials than planned needed to be transported.

To deal with the reduced volume, the LSPs relied primarily on standard savings and consolidation measures, which can be summarized in three points. First, trucks that were not operating at full capacity were consolidated, as stated by Interviewee A: "When the shipping volume dropped, the first thing we did was use only half of our trucks." Second, for last-mile deliveries, the use of subcontractors who typically transport excess packages was reduced: "We kept all of our main transport lines but made significant changes in last-mile delivery." We not only drastically reduced the number of subcontractors, but we also restructured our route planning in order to balance the utilization of vehicles and drivers" (C). Third, operations management collaborated with sales to forecast volume and incorporate special requests, as stated by D: "The most important thing for us was to make sure that we knew where volume was going to come from and to find out which big customers were affected." According to the interviews, collaboration with sales was critical not only for special pick-up and delivery requests, but also for overall transportation planning. C also stated that inventory management needs to change on a strategic level, stating, "The crisis demonstrated clearly that inventory management is not designed for a situation like this." Previously, an ideal warehouse operation would have been a 24-hour operation with no excess inventory, but I am convinced that redundant inventory and lights-out warehousing will become the norm."

These findings provide two major management frameworks for the agility of LSPs. To begin, in order to respond quickly to low volumes that must be transported, the selection of subcontractors should be approached in a more strategic manner. Our interviews indicate that this is not always the case, as B stated, "The drop in volumes happened quite quickly and was somewhat expected, so we still had too many delivery vans for too few packages," implying that a more strategic approach to outsource transport capacity is advised. Second, it was critical for sales and operations to communicate and collaborate in order to forecast quantities and plan transportation capacity accordingly. "I know the sales folks very well," C said, "so I had no difficulty bothering them numerous times a day to find out what I need to prepare for today or tomorrow," implying that more mandatory and regular communication between sales and operations can help to better organize transportation operations.

V. Discussion and contribution

The findings enable us to synthesize information from interviewees in order to derive key lessons learned from LSP reactions and actions in response to the COVID-19 pandemic. More specifically, we discovered that the reactions and actions to the Covid-19 outbreak can be grouped into three categories:

- [1] Transportation (logistics infrastructure),
- [2] Personnel, and
- [3] Overall organizational response.

First, it appears that transportation is the most important pillar, as it refers to three of the five themes identified in the findings: "create revenue streams," "enhance operational flexibility," and "optimize logistics infrastructure capacity," emphasizing the importance of operations agility in a crisis. The interviews stated that reducing transportation capacity saved money and helped to bring down costs, but that at the same time, transportation capacity was manufactured to meet urgent needs that may not fit well into the usual services supplied by LSPs. Furthermore, the crisis demonstrated that the volatility of transportation demand and supply should be better balanced, i.e. a more strategic approach to subcontractors' flexibility is recommended, and that lights-out warehousing and redundant inventory may help to keep the supply chain resilient. While the first approach from LSPs to outsource transport capacity or to demand more flexibility from subcontractors is a common approach in logistics operations (Russell et al., 2020), the return to excess inventory and lights-out warehouses can be regarded as a fundamental change that contradicts JIT concepts and the pursuit of efficiency in inventory management in previous decades (Amarakoon et al., 2020; Ivanov, 2020; Maemunah & Cuaca, 2021). However, the findings suggest that LSPs may be in a good position to take over inventory management for critical supplies and thus contribute to greater supply chain agility. The findings, however, raise concerns about the future of work for administrative and office workers about productivity issues when working from home do not appear to be confirmed (Nayal et al., 2021). In particular, as the use of digital products and services grows, LSPs may adopt more flexible working models in order to retain critical employees or attract high potentials.

Third, the overarching theme from an organizational standpoint was to advance digitalization across the corporation, not just for safety and greater flexibility, but also on an operational level to obtain real-time data and more accurate forecasts for better planning. According to the interviewees' perspectives on digitalization, LSP should strive for what (Anthony Jnr & Abbas Petersen, 2021) refers to as the "digitally dominating paradigm" and its implementation in supply chain management. Although digitalization research in the logistics and supply chain area has only lately increased, the prospects provided by big data, predictive analysis, and blockchain can be considered game changers for the entire industry. It was also suggested that, in the event of a contingency situation such as a pandemic, greater focus be placed on communication between operations and sales in order to secure and drive commercial prospects. The synchronization of operations and sales appears to be a current topic that has been discussed by academics and practitioners (Horgan et al., 2020; Xiong et al., 2021; Zhuckovskaya et al., 2020). The epidemic, on the other hand, brought challenges about how operations and sales may effectively collaborate in a crisis, and how reporting lines can be adjusted to respond to new business prospects.

It is important to note that some of the lessons learnt are context-specific, meaning they can only be implemented in an Austrian setting, but others can be applied globally and to the entire LSP sector. The adoption and use of short-term work, for example, is strongly linked to the Austrian social system and country-specific government support, whereas the growing role of digitalization and a better sales operations relationship within organizations addresses a broader management issue that is not country-specific. Lessons learnt in transportation and associated logistics infrastructure can be considered more of an industry-specific issue than an Austrian issue. Overall, these lessons learned provide a picture of Austrian LSPs' actions and reactions during the COVID-19 pandemic, and while some of these findings are exclusive to Austria, this article provides insight into how LSPs kept their supply chains resilient.

VI. Conclusion

The goal of this study was to get insight into LSPs' reactions and lessons learnt as a result of the COVID-19 pandemic's interruptions. We created an LSP agility framework to categorize the reactions, which covers areas for mitigating the downsides as well as utilizing the upsides during a pandemic. We used an interpretive research

technique to analyse the reactions, combining primary data from interviews with LSPs with secondary data to highlight operational decisions and particular actions based on our LSP agility framework.

The findings suggest that LSPs' reactions and efforts have been organized around five primary themes: "generate cash-flow," "improve business agility," "Implementing developed technologies and information flow management," and "improving logistics network". The analysis revealed that most LSPs took similar actions in terms of handling transport capacity and personnel capacity, but that larger LSPs were able to generate additional revenue streams by purchasing airplanes to provide extra transport capacity for medical equipment requested by governments, for example.

From a personnel standpoint, redundancies could be avoided by utilizing "short-time work," a subsidized temporary reduction in working hours for employees that assisted in quickly bringing the organization up to speed when the recovery phase began. It was also discovered that larger LSPs were quicker to integrate digital services, but that legacy LSP systems still face challenges with digitization. These findings shed light on the dynamics that led to the Covid-19 reactions, as well as attempting to answer the unanswered question of how LSPs managed to keep supply chains resilient and what steps they took to maintain operations and financial stability. As a result, the study adds to the corpus of knowledge in four different ways: First, the study contributes to a deeper understanding of Covid-19's impact on the supply chain from the perspective of an LSP, which has hitherto been limited. Second, the study describes and analyses the immediate consequences of LSPs' primarily operational decisions, providing an overview of the ramifications for LSPs and supply chains. Second, our research sheds light on how LSPs dealt with the pandemic's negative effects as well as creative solutions to operational and financial issues, not only categorizing the LSPs' responses but also offering an overview of the frameworks from a managerial standpoint. Third, we augment current LSP and supply chain literature with a framework that is better suited to characterize the rapid reactions and actions of LSPs during a high-impact, low-probability external shock by recalibrating the idea of supply chain agility to LSP agility.

However, the findings must be interpreted in the context of their limitations. We are convinced that our interpretive method yielded intriguing and valid results in the context of COVID-19, but we are hesitant to generalize our findings. Not only is our sample of four LSPs tiny, but we also limited our investigation to one country. As a result, generalization of the findings is neither requested nor desired; rather, this study presents a snapshot of the COVID-19 situation in Austria and its implications for LSPs, resulting in context-specific findings. Future researchers are encouraged to look beyond one country to find geographical and contextual parallels and variances. Furthermore, while we have built a special LSP agility framework with two important characteristics, alternative theoretical views such as supply chain security or supply chain vulnerability may be more appropriate for investigating LSP reactions. Although our LSP agility framework has aided us in classifying and understanding the (re) actions of LSPs, future study could expand on the similarities and differences between supply chain agility and further refine our framework.

Thus, could infer that study into the consequences of the COVID-19 pandemic from an LSP perspective is still in its early stages. We've taken a first step toward a better understanding of supply chain agility through LSPs by looking at their reactions and behaviours. We hope that the conclusions and approach offered in this study will encourage LSP-related conversations and projects.

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