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Industry 4.0 Driven Supply Chains—Technological Advancements Regarding Logistics Service Providers

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Chapter Introduction

This chapter seeks to examine Industry 4.0-driven supply chains with specific focus on technological advancements relating to logistics service providers. The aim of this work is to identify the service characteristics of Logistics Service Providers (LSPs) and their technological advancement to satisfy their customer needs. Additionally, the chapter provides novel insights about Industry 4.0-driven Supplier Selection and Evaluation (SSE) processes and risks involved in changing LSPs, and how

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organisations can plan a seamless LSP transition. In order to achieve the above, the following 4 research objectives are set:

1. To examine the service characteristics of current and alternative logistics providers
2. To examine the LSP selection process
3. To investigate the risks and barriers in changing the current logistics model and logistics provider
4. To develop a detailed transition plan for organisations to migrate from the current logistics provider to the proposed logistics provider.

These research objectives are the basis of the key themes that will enable a deeper understanding of the research topic.

Outsourcing

Businesses strive to employ strategies that provide competitive advantage for the organisation. Understanding organisational competitive advantages is dependent on the discrete activities performed by firms including designing, manufacturing, marketing, logistics and product support function. Therefore, Michael Porter (1985) developed the concept of 'The Value Chain' (Christopher 2016).

Figure 5.1 displays the categorisation of value chain activities as primary and secondary activities. Therefore, the gain in competitive advantage depends upon how effectively and exceptionally companies perform these value chain activities over their rivals to deliver value to their customers. That is why porter suggests that the organisations assess each, individual activity in their value chain and gauge whether they experience a real competitive advantage in that activity. If not, the organisation should outsource the activity to a service provider to provide cost and/or value advantage.

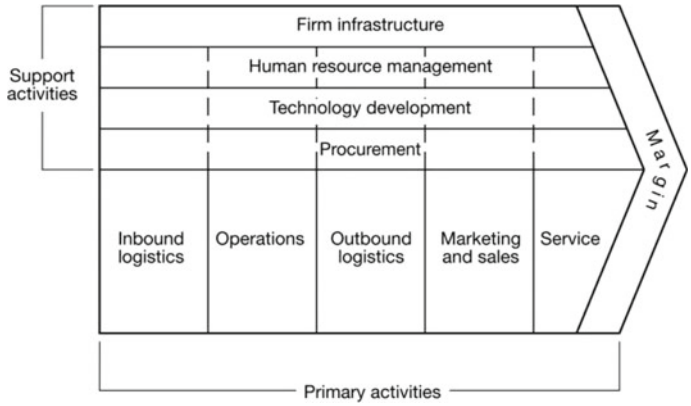

Fig. 5.1 The value chain (Porter 1985)

Logistics Outsourcing

A logistics function of an organisation includes all levels of management and involves tactical, operational, strategic and collaborative decisions (Bartolacci et al. 2012). Worldwide, logistics has emerged as an ever-growing multi-billion-dollar business. According to Langley and Infosys (Langley and Infosys 2019), the national expenditure for logistics business is 10% of GDP. As a result, the organisation has progressively perceived outsourcing logistics activities as a strategic decision to move products efficiently in today's increasingly complex supply chains. Similarly, the outsourcing level of logistics activities to LSPs has enhanced in recent years. According to the 2017 logistics outsourcing market reports, it has experienced revenues of $869 billion globally, and in upcoming years it might even exceed this (Prataviera et al. 2021).

Logistics outsourcing has become mainstream; almost 80% of supply chain professionals indicate that they increased their outsourcing budget in 2020 to support activities beyond warehousing and fulfilment to support complex logistics operations. According to Gartner's survey, 42% of businesses are looking to outsource their logistics functions to a 4PL service provider who can design, build, run and measure logistics functions (Bingelow 2019).

Logistics Service Providers

A big market is open to significant challenges; therefore, to maintain competitive advantages, businesses outsource their logistics functions to professional LSPs who have in-depth knowledge and expertise in carrying out complex logistics operations. There are plenty of LSPs available in the market who provide 1PL, 2PL, 3PL, 4PL and 5PL services. However, the focus of this thesis will be on 4PL LSPs (Christopher 2016; Ciemcioch 2018).

From 3PL to 4PL

The primary difference between the 3PL and 4PL service providers is shown in Fig. 5.2. The 3PL service provider often operates distribution centres, delivers product through fleets, and sometimes undertake value-adding services like packaging and re-packing. However, the 4PL service provider enables their customers with a control-tower view of their SCM function, for instance providing oversight of the mix of shipping industries, warehouses and freight forwarders under management. Due to changing nature of supply chain networks and increasing globalisation, it has become difficult for one organisation to manage such complex supply chains. Therefore, organisations need a service provider that can contract a focal firm through a joint venture, who can use its knowledge and 3PL service providers to manage the end-to-end supply chain (Christopher 2016; Ciemcioch 2018).

The 4PL assembles the best breed of service providers utilising IT capabilities to offer sustainable and cost-effective solutions. Figures 5.3 and 5.4 summarised the principle behind the 4PL.

Rise of 4PL

In 2020 when the whole world was undergoing the COVID-19 pandemic, many organisations such as Opel and Vauxhall realised that they lack the computing infrastructure, resources and personnel to deal with disruption. Therefore, these organisations appointed a 4PL

Fig. 5.2 Difference between 3PL and 4PL (Ciemcioch 2018)

provider offering sophisticated digital technologies (e.g. Big Data, cloud computing, GPS tracking) to streamline transportation, legal compliance, warehousing and supplier management (Logistics Bureau 2020).

Insight Partners states (2020) that in 2019 the global 4PL market was valued at $56,472.1 million, and by 2027 it is predicted to reach $78,981.5 million, and that this industry will grow at a CAGR of 4.5% between 2020 and 2027 (The Insight Partners 2020).

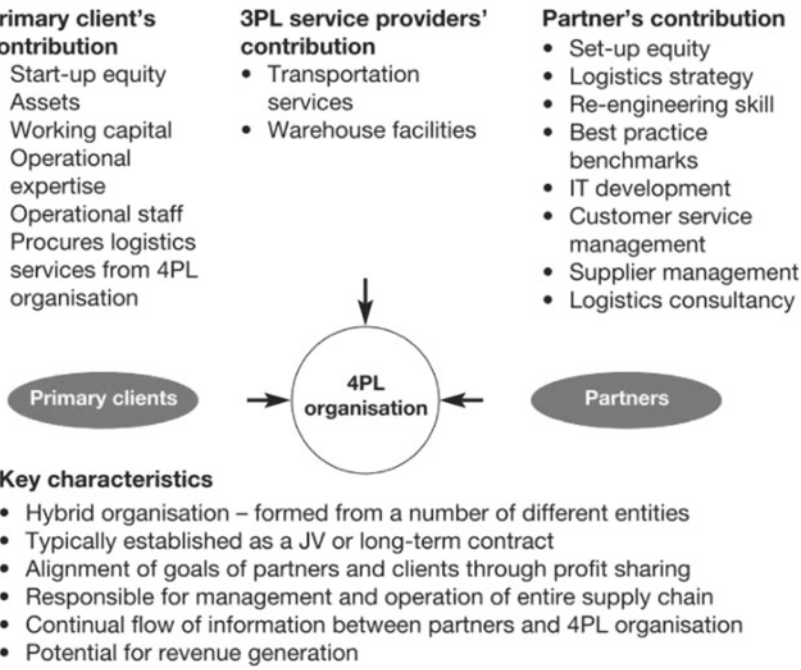

Fig. 5.3 The 4PL concept (Christopher 2016)

Service Characteristics of LSP Model and Service Provider

The chapter revolves around the logistical models in the automotive industry, as companies therein have been considered the most extensive and multinational of all industries. Therefore, it is essential to understand the automotive logistics model. The automotive logistics process has two primary functions: inbound logistics of raw materials, manufacturing equipment, spare parts, loading, unloading and storage. Secondly, there exist outbound logistics aimed to deliver vehicles (finished product) from the manufacturing plant to the customers (Sabadka 2015).

Industries now consider logistics as a critical pathway to achieving competitive advantages. Therefore, many automobile industries have started to outsource some or the entire logistics function of LSPs

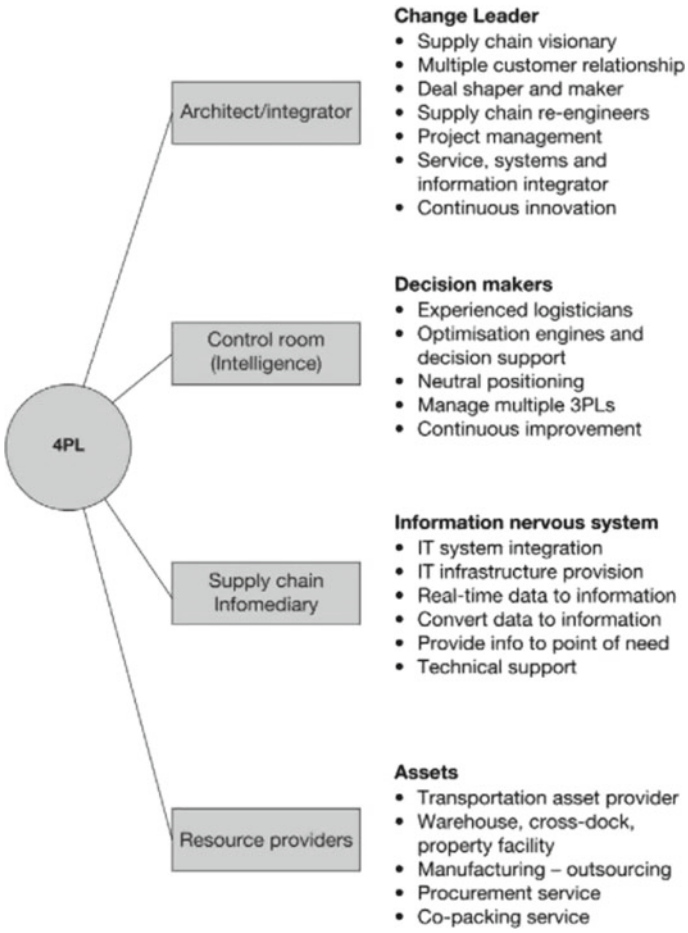

Fig. 5.4 Four key components of a 4PL (Christopher 2016)

(Zacharia et al. 2011a). For example, according to Rajahonka and Bask (2016), the Japanese car manufacturer Toyota has adopted a combination of in-house and outsourced logistics functions. As a Lead Logistics Provider (LLP), Toyota is responsible for logistics management. Similarly, Renault is also accountable for its logistics management but contracted 100 LSPs for transportation. However, Nissan has outsourced their entire logistics function between four LSPs. For the past two decades, services

and strategies offered by LSPs have been in transition, and their role in logistics operation is expanding. Now LSPs can provide various services according to the customer's logistics strategies and design service models related to 11.1.1.1.1.1.1.1 compile categorisations available in the LSP service strategies and service model in the literature.

Service Provided in Logistical Model by LSPs

The following are the services provided by LSPs to their customers (Fig. 5.5)

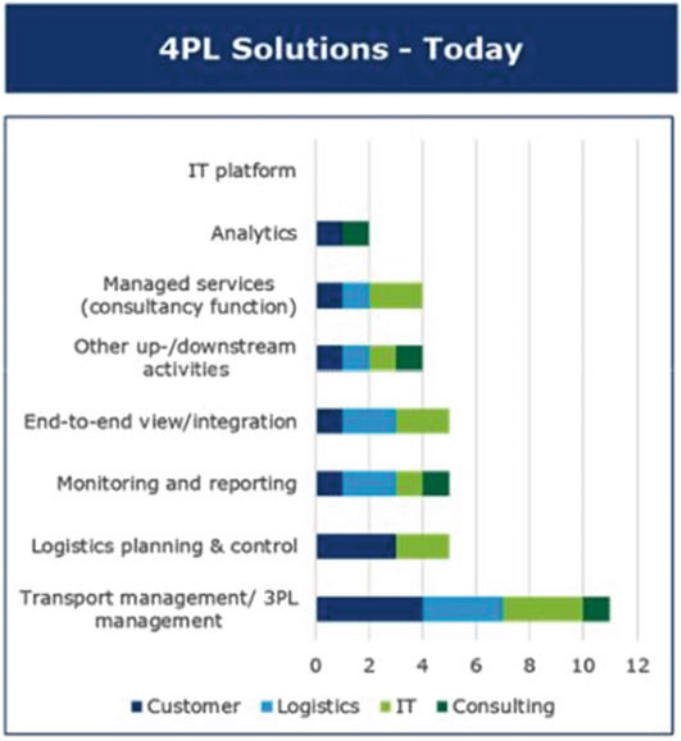

Fig. 5.5 4PL services (Çağlar Kalkan and Aydın 2020)

- The main objective of the LSPs is to enable the executive management of the buying organisation to focus on organisational core competencies (Çağlar Kalkan and Aydın 2020). Furthermore, LSPs integrate the needs of customers and resources by contacting the business process management, the IT providers and 3PL providers (Win 2008).
- Apart from playing the role of transactional centre, LSPs create values by managing information (Fulconis et al. 2006). Furthermore, LSPs build close relationships with stakeholders involved in the supply chain to initiate cost-cutting exercises and enhance flexibility to counter-balance the uncertainty in supply and demand (Çağlar Kalkan and Aydın 2020).
- LSPs are the supply chain service providers that participate in supply chain coordination by providing value-adding services, such as IT integration, order tracking and tracing, transport planning, financial services and logistics consulting (van Hoek and Chong 2001; Vasiliauskas and Jakubauskas 2007).
- LSPs provide global solutions to their customers by integrating the services and activities of diverse carriers, operations, storage, packaging companies and subcontractors. Furthermore, the service providers offer services related to continuous improvement of supply chain processes such as cost-optimisation, SLA and inbound-outbound delivery efficiency (Fulconis et al. 2006; Nowodziński 2010).
- Many LSPs offer sub-tier visibility to their customers. Hence, if an issue akin to the most recent Suez Canal crisis arises, the 4PL service provider can quickly assess the risk exposure and reroute the cargo or, in parallel, contact the alternative freight forwarder to deliver the critical products (Versed.AI 2021). During the Suez Canal crisis, the Kuehne + Nagel firm rerouted their shipments via services, combining sea, air and railroad, from China to Europe (Kuehne + Nagel 2021).

Table 5.1 summarises the service characteristics of the LSPs represented in the existing literature.

Table 5.1 Service characteristics of LSPs (Alvarez 2020; Grant 2019; Hofmann and Osterwalder 2017; Jurczak 2018; Kennedy 2020; Nailwal 2021)

Service characteristics of LSPs	LSPs				
	1PL	2PL	3PL	4PL	5PL
Self-management of logistics function (own assets)	✔☐	✔☐			
Lease of own transportation (asset-based logistics services)		✔☐	✔☐		
Transportation and freight forwarding			✔☐	✔☐	✔☐
Warehousing, including inventory management			✔☐	✔☐	✔☐
Picking, packing and labelling			✔☐	✔☐	✔☐
Reverse logistics (returns), customer relationship management			✔☐	✔☐	✔☐
Full truckload and less truckload shipping			✔☐		
Project management (PM), sourcing and negotiations				✔☐	✔☐
Consultancy function				✔☐	✔☐
End-to-end integration				✔☐	✔☐
Logistics planning and control				✔☐	✔☐
Transport management (3PL management)				✔☐	✔☐
Procurement of stock					✔☐
The flow of the capital needed for planning, delivery, tracking					✔☐
Provision of IT platforms					✔☐

Technologies Used by LSP

Freight Transport Logistics (FTL) is a critical function in automotive supply chains, which involves moving materials and finished goods. As a result, the FTL sector is experiencing a wave of digitalisation (Tipping and Kauschke 2016). The following describes key technologies that LSP use in the FTL sector:

Cloud Computing

The previously labelled 'on-demand computing' has become mainstream in the logistics industry. The technology allows LSPs to host an ICT system for their customers, usually using remote network servers via the internet to store, manage and process data. This technology offers

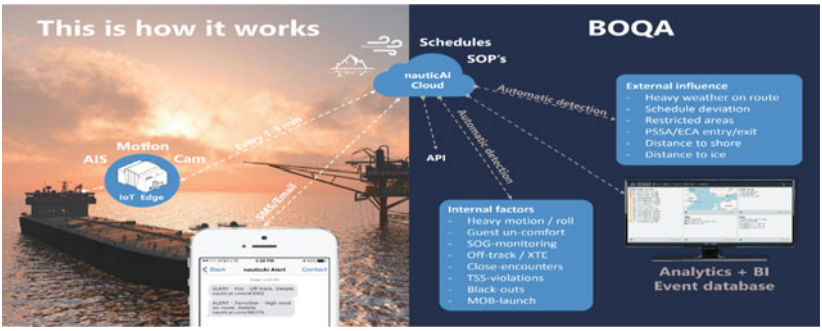

Fig. 5.6 Cloud computing (AWS 2019)

FTLs the capacity to forego building EDI links and providing services like SaaS and PaaS. It creates flexibility in the FTL industry (Wang and Sarkis 2021). Notably, 5G Technology, alongside cloud computing, will provide increased connectivity. For example, Port of Livorno uses 5G-based cloud computing technology that enhances efficiency, decreases the transit time of goods and generates real-time shipments data (Cavalli and Lizzi 2020). Edge computing complements cloud computing and helps LSPs resolve issues related to bandwidths and latency at the edge of upstream and downstream (Shi et al. 2016) (Fig. 5.6).

Digital Twins

IoT and edge computing enable LSPs to implement digital twins; a virtual representation of real-time data, objects, processes and complex ecosystems of connected objects. It is not yet a widespread application in logistics. However, critical technologies such as shipment tracking devices, API strategies and cloud computing that enable digital twins are already in place. DHL has a digital twin in practice where they offer their automotive customers container packaging strategies by implementing sensors in containers that then consolidate the data of temperature, shocks and vibration. Furthermore, DHL creates a virtual model of their entire logistics network, including data of logistical assets and oceans, air,

Fig. 5.7 Digital twins (Gesing and Kückelhaus 2020)

road freights and customers' homes and workplaces. This allows the LSPs to use real-time data on physical networks to plan for future disruptions and alternatives routes (Gesing and Kückelhaus 2020; Wang and Sarkis 2021) (Fig. 5.7).

IoT and Big-Data Analytics

IoT devices are perfectly embedded in transport networks, fleets and shipping containers; generating masses of structured and unstructured data. As a result of managing such massive amounts of data, LSPs use big-data analytics, which provides transformative, strategic-level impact. For example, dynamic time-tabling and transport planning, rooted in decision mathematics, use real-time data to simultaneously optimise carrier and cargo-tracking transport infrastructure capacity (Wang and Sarkis 2021). In addition, NAEKO Logistics uses bid-data analytics for route optimisation, which determines the best-suited route among the other options and helps organisations refine transportation in terms of cost and time (Feliu 2018).

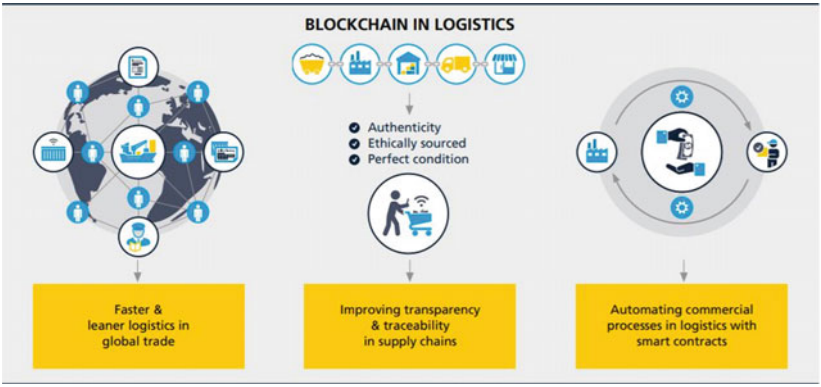

Fig. 5.8 Blockchain in logistics (Heutger and Kückelhaus 2018)

Blockchains

Every LSP considers logistics its lifeblood, though involving many parties with various priorities and diverse trade efficiencies. As a consequence, blockchain technology generates an attractive alternative—at its best, combining custom collaboration, transport management, trade finance and shipment tracking (Heutger and Kückelhaus 2018). For example, IBM and Maersk collaborated and established a blockchain system for end-to-end tracking and tracing shipments, and trade workflow, enabling all involved stakeholders to transparently track shipments in the deep sea (Armonk 2017) (Fig. 5.8).

Summary of the selected papers for the emerging Digitalisation Technologies in FTL adopted from Wang and Sarkis (2021) is shown in Table 5.2.

Table 5.2 Emerging digitalisation technology in FLT (Wang and Sarkis 2021)

Research papers	The focus of research paper	Research objective	Contribution to FLT sector
Choi (2020)	Technology that focuses on supply chain collaboration (Platform Ecosystem)	To resolve the issues related to optimal transportation selection with an internet-based Elastic Logistics Platform (ELP)	Researchers built a model that explores the value of ELP and concerning orders and optimises the transportation mode selection decisions
Xu et al. (2020)	Technology that focuses on supply chain collaboration (Platform Ecosystem)	This paper aims to resolve supply chain coordination problems of a manufacturer as they sell their products through an offline channel	The researchers have stated that the supply chain can still be coordinated irrespective of the platform power by cost-sharing contract when delivery sensitivity is high
Fazi et al. (2020)	Next-generation intelligent logistics operations (Metaheuristic, machine learning)	To resolve the issues involved in planning the transportation of containers between the sea terminals	The research paper has developed a local hybrid search Metaheuristic Algorithm combined through a branch-and-cut solver to resolve the issue. Therefore, the created framework contributes to developing the compressive set of decision support tools for planning transportation

Research papers	The focus of research paper	Research objective	Contribution to FLT sector
Miller et al. (2020)	Next-generation intelligent logistics operations (Bigdata Analytics, IoT)	To address inferring state-wide traffic patterns by using massive GPS trajectory data	Scholars have proposed that the generated model has approximately reduced the median station error in all test locations from 18 to 32%
Yavas and Ozkan-Ozen (2020)	Next-generation smart logistics	To investigate the essential criteria for logistics centres in Industry 4.0	The authors have introduced 12 crucial criteria which can shape the new logistics centre by developing a framework via Fuzzy Decision-Making Trial and Evaluation Laboratory DEMATEL
Orji et al. (2020)	New supply chain models	Evaluation of factors that influence the adoption of blockchain in the freight logistics industry	To provide a theoretical TOE (Technology-Organisations-Environment) framework of critical factors and prioritise them using ANP (Analytical Network Process)

Logistics Model for Multi-site Manufacturer

Kuehne + Nagel's Integrated Logistics Model

Kuehne + Nagel (KN) posited the following logistical model for leading construction original equipment manufacturers (OEMs) to overcome challenges related to decentralisation as they balanced the management work-load of multiple manufacturing plants across Europe.

Background

Due to the global footprint, the organisation had a massive logistical requirement—the OEM dealt with 1500 first-tier suppliers who shipped materials to multiple manufacturing plants across Europe. Thus, the company experienced fragmented inbound logistics. The increased number of suppliers significantly affected the organisation, in areas such as decentralised transportation data management (lack of visibility). Moreover, manufacturing plants in Europe preferred different LSPs which led to inconsistent operations and processes, and individual inventory management and inbound logistics management, thereby affecting the scale of the economies in procurement for LTL and FTL. These scenarios negatively impacted the organisation's Logistics Management Spend (LMS) and Logistics Operating Spend (LOS). Thus, the organisation wanted to implement a logistics model that would be variable, provide visibility across all the shipment flows, better SLA and service quality, and lower cost structure (Kuehne + Nagel 2017).

Solution

KN designed an integrated logistical model and provided construction equipment manufacturers with a dynamic European inbound network centrally managed by a single LSP that offered transitional pricing to mitigate the aforementioned issues. In the model, KN offered their KN Control Tower Suite services which empowered the manufacturer to rectify issues related to inadequate visibility. Instead of giving a

lump sum plan to ensure lower cost, KN gave a pricing model based on monthly orders. The pricing model was combined with centrally managed inbound logistics, giving construction equipment manufacturers higher visibility of Total Cost of Ownership (TCO).

The model also provided continuous transportation cost reduction through frequent route/freight optimisation, dynamic planning of multiple picking/dropping services and direct FTL/LTL. Furthermore, the model provided end-to-end shipment flow visibility and continuous shipment monitoring through KN's global IT platform, along with Enterprise-Resource-Planning (ERP) software. KN also included services such as customer-dedicated and business management teams, to act as a crucial point of contact ensuring improved financial and operational performance in the offered logistical model (Kuehne + Nagel 2017).

DHL's Logistical Model for Industrial Equipment Manufacturer

DHL provided the new logistical model for leading heavy industrial and construction equipment manufacturers that redesigned their global supply chain operations.

Background

Due to explosive growth in business in past years, the organisation now has multiple manufacturing plants and distribution centres on four continents. However, the global expansion and increasing demand added excessive pressure on the then-existing logistics and global supply chain model. Simultaneously, inbound logistics costs were constantly rising. Due to increased suppliers worldwide, organisations started global part sourcing, and investing in overseas production facilities. However, due to the fragmented supplier base and manufacturing plants, organisations struggled with real-time visibility of shipment flows. Organisations offering customised machinery to their customers, and due to the volatile economic climate organisation, were struggling to complete their orders.

Therefore, an overhaul was needed to design a robust, agile logistics model to better respond to customer demand (DHL 2016).

Solutions

After spending a few months embedded within its manufacturers' daily activities and global business units, DHL came up with a new logistics model, presenting significant supply chain improvements and cost-saving opportunities. DHL offered warehousing services, sea and air freight services and import/export centre management in the improved logistics model. For some UK manufacturing plants, DHL additionally offered in-plant logistics activities. DHL has now established logistics control towers in the UK, India, USA, Brazil and China for procurement and shipment management. This multinational control-tower setup and transportation management system provided the global manufacturer with premium freights solutions, a range of approved carriers and various delivery modes, such as motorcycle, van and charter aircraft. The improved model generated transport cost reductions of 16% for standard and 35% for expedited deliveries. This new model has cost-saving potential for diverse organisations. For instance, DHL has implemented the Ex-Works programme that provides a complete/delivered cost policy, with a staggering 75% cost reduction. DHL integrated their ERP, transport management and Red Prairie warehouse management systems with the manufacturer's supply chain operations to provide end-to-end shipment visibility from finished goods to individual parts. The transport management systems enabled route optimisation, efficient transportation planning and enhanced container fill rate (DHL 2016).

1. LSP Selection
   Industries, including automotives, outsource their logistics function to LSPs for seamless operations and generate direct–indirect profits. Due to increased globalisation coupled with marketplace threats, it is essential to have appropriate LSP selection criteria. The appropriate selection can ensure optimal service lead-time, increased flexibility,

reduced cost and concentration on core competencies, as stated by Tay and Aw (2021).

2. Supplier Selection and Evaluation Process (SSE)
According to Nair et al. (2015), supplier selection criterion configure a series of qualifying operational and strategic expectations employed by the buying organisation to balance external resources with internal stakeholder objectives. The strategic performance of LSPs is judged by their capacity to provide and develop state-of-art technologies, abilities of service development, route optimisation, risk mitigation and adaption to technological changes. In comparison, the judgement of operation capabilities concentrate on the LSPs' ability to provide low-cost, flexible and high-fidelity service and delivery efficiency (Monczka et al. 2016).

   Figure 5.9 demonstrates the supplier selection process. According to Tay and Aw (2021), organisations should clearly define all activities within the process before entering into the supplier selection process. The buying organisation generating its guidelines and supplier selection criteria should analyse the market condition. Furthermore, organisations should evaluate and select the best-suited LSP according to organisational, strategic and operational expectations, as well as pre-defined criteria and selection guidelines. The final step is establishing a formal supply chain cooperation agreement between the buying firm and LSP to finalise the working relationship. In later stages, the SSE's information can also be shared with the open market via feedback which often results in knowledge and information sharing that further enhance LSPs' abilities and capacities, as per Wu et al. (2008).

3. Supplier Evaluation Criteria
Nowadays, organisations are especially responsible for their internal practices and suppliers' working behaviour (Essien et al. 2019). Therefore, several industries have adopted supplier assessment schemes whose systematic approach, supplier evaluation criteria and practical framework enable organisations to make an adequate selection (Alkhatib et al. 2015; Winter and Lasch 2016). The standard criteria for supplier selection are cost, quality, technology, service, performance and intangibles (Baily et al. 2015).

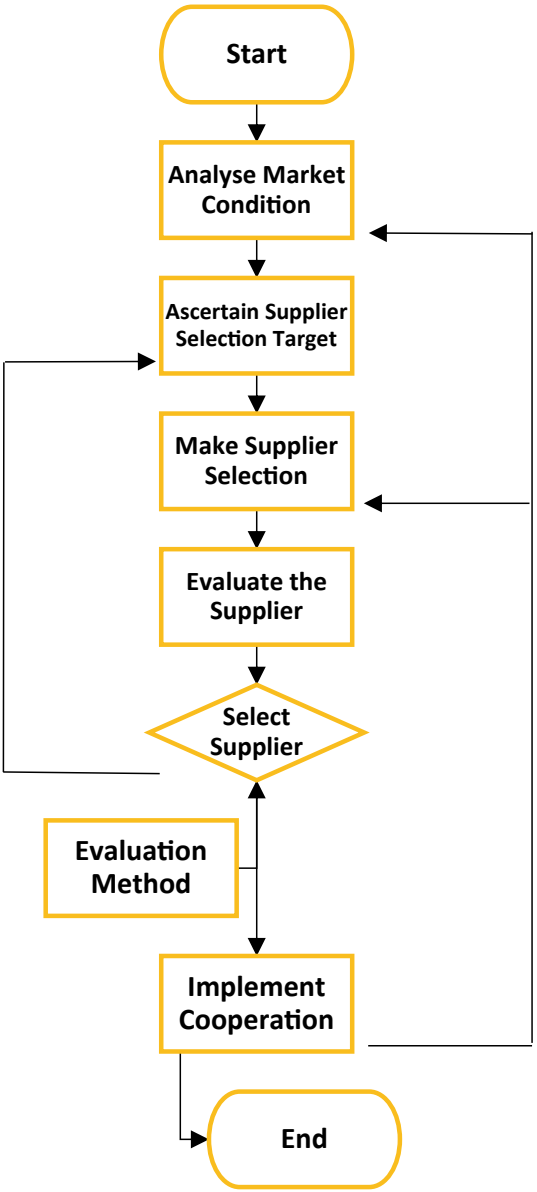

Fig. 5.9 Supplier selection process (Tay and Aw 2021)

Table 5.3 LSP evaluation criteria (Akman and Baynal 2014; Hwang et al. 2016)

Category	LSP evaluation criterion
Performance	Shipment error rate, responsiveness, document accuracy, effectiveness, delivery efficiency
Service	Customer support service, problem solving capacity, value-added services, assets/equipment, flexibility, capability, service scope
Cost	Price, cost control of value-added services, cost reduction
Quality assurance	Continuous improvement, regulations, KPI tracking, ISO compliance
Technology (IT)	IT systems, capability to adopt the technological changes, system reliability, system stability, system scope, system scalability
Intangible	Global scope, labour relationships, client relationship, firm background, customer orientation, financial stability, experience, global footprint, firm reputation

Table 5.3 consolidates the LSP selection criteria and further groups them into six major categories.

4. LSP Selection Criteria Two-Level Hierarchy Framework
   Hwang et al. (2016) performed the duties of external auditors and audited the six significant categories shown in Table 5.3 and developed a two-level LSP selection hierarchy framework with 21 sub-criteria, as shown in Fig. 5.10. Furthermore, definitions of this developed 21 sub-criteria are shown in Table 5.4.

5. Supplier Evaluation Scorecard
   Rajesh et al. (2012) believe that the scorecard is a high-profile supplier evaluation and performance measurement model that enables organisations to balance and link crucial perspectives, including the financial and non-financial, tangible and intangible, and internal and external. Scorecards help organisations to transform their visions and strategy into reality. Doolen et al. (2006) state that the supplier scorecard helps buying organisations in developing critical supplier metrics and evaluate diverse potential suppliers against them; thereby establishing an objective and quality-drive standard.

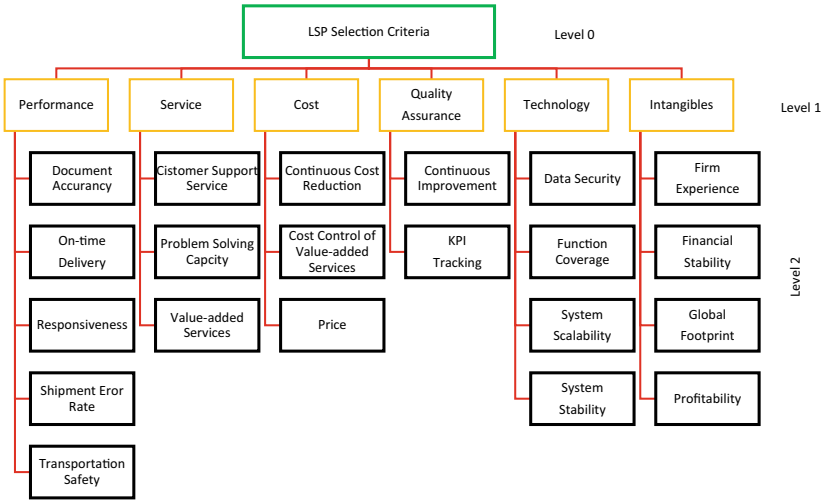

Fig. 5.10 Two-level hierarchy of LSP selection criteria (Hwang et al. 2016)

Moreover, the scorecard aligns buying firms' strategic objectives with their service providers' internal performance metrics. Therefore, a supplier scorecard is a document that stores the essential performance metrics and enables reliable decisions. Thus, supplier scorecards act as purchaser and supplier planning guides (Baily et al. 2015). The LSP selection and evaluation sample scorecard is shown in B.1, adopted from Purchasing Power Blog Procurement (2017). Table 5.5 shows the critical analysis of the scorecard system.

6. Supplier Selection Methods
   See Fig. 5.11.
7. Multicriteria Decision-Making (MCDM)
   Logistics outsourcing is receiving increased importance, and it has become essential for buying organisations to select an appropriate LSP. However, many factors might affect the selection of LSP. Therefore, selecting LSP is an MCDM problem. Various MCDM methods are available in the literature to choose the most suitable LSP (Hwang et al. 2016). Table 5.6 summarises the MCDM methods found in the literature. One of the MCDM methods is explained below:

Table 5.4 Definition of 21 sub-criteria (Hwang et al. 2016)

Criteria	Definition
Continuous cost reduction	Most of the automotive industries undergo the intense pressure of continuous cost reduction. Therefore, it is the measurement to request LSP to reduce the rates on some primary logistical services
Continuous improvement	The ability of LSP to provide high-value services such as route optimisation, risk mitigation planning and proactive process improvements
Cost control on value-added services	The ability of LSP to provide value-added services at the lowest possible rate
Customer support service	Customer support is given from pre-transaction to the post-transaction
Data security	LSP's ability to protect the data from theft and make it available to its stakeholders
Document accuracy	It is a parameter to measure accuracy, consistency and completeness of essential documents (bill of lading, packing lists, invoices, etc.) among the freight forwarders, shippers, customs agents and customers
Experience	LSP's experience in automotive logistics
Financial stability	Leverage ratios, operating profitability and liquidity to measure the financial situation of LSP

(continued)

Table 5.4 (continued)

Criteria	Definition
Function coverage	The functional scope of IT systems such as cloud computing, Bigdata Analytics, Digital twin and Blockchain
General reputation	The reputation of LSP in the FLT industry
Global footprint	Global footprint refers to the LSP ability of global coverage, market coverage, geographical coverage and shipment destinations and distances
KPI tracking	The ability of LSP to meet KPI regularly and tracking it continuously
On-time delivery	It is the parameter to measure the punctuality of shipments, i.e. time taken from pickup to delivery of the shipment
Price	Competitive charges on the services such as warehousing, inventory management, packaging and freights
Problem-solving capacity	The ability and flexibility of LSP to handle/solve unforeseen events and disruptions
Responsiveness	How quick the LSP responds to their customers logistical and business requirements
Shipment error rate	It is a parameter to measure the accuracy of degree shipment
System scalability	The LSP's ability to expand its IT systems without impacting the existing operations
System stability	The ability of the IT systems to work without any errors and technical difficulties
Transportation safety	The ability of the LSP to deliver the goods safely to its end destination
Value-added services	The ability of LSP to offer high-quality services that can enhance the customer's logistics function

Table 5.5 Critical analysis of scorecard system (Finch 2017; Ramos 2020)

Advantages	
Clarity	Scorecard provides a clear indication of metrics and KPIs which are essential to the buying firm. A well-balanced scorecard reflects the organisation's intention of forming long-term partnerships
Negotiation support and decision making	The data collected from the supplier scorecard provides an evidence-based platform for ongoing negotiations with existing or future suppliers and simplifies the decision-making process for buying organisations
Service provider justification	After assessing sets of scorecard documents, the buying organisation can quickly verify whether the shortlisted supplier is an asset or liability
Limitations	
Data collection and analysis	Training of employees is essential to understand how and when to analyse the data. The scorecard provides the required information; however, one should identify those indicators and implement them appropriately. If not, then the organisation is at risk of getting an inaccurate supplier selection
High resource investment	The scorecard demands significant time and financial cost investment as it is a long-term solution rather than short-term. Employees should understand the working of the system. Hence, it increases the employee training expenditure
Stakeholder acceptance	The stakeholders and purchasing team should be on the same page. If employees fail to understand the process, stakeholders will hesitate to invest. Those who are resistant to change will not accept the new system

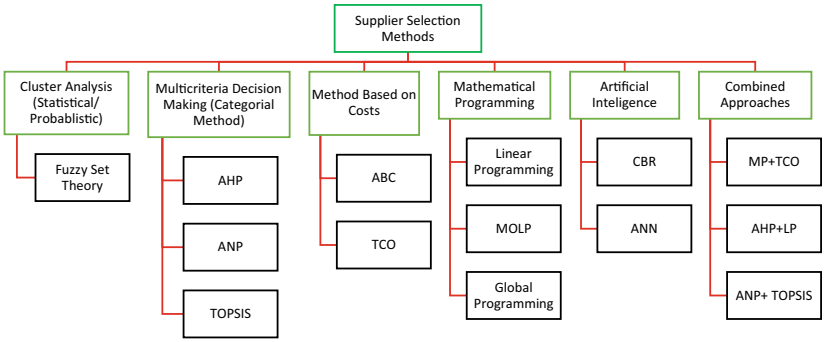

Fig. 5.11 Supplier selection methods (Taherdoost and Brard 2019)

- **Analytical Hierarchy Process (AHP)**

  AHP is one of the MCDM methods based on the additive weighting process. In AHP, all the relevant metrics are represented as per their importance. Decision-makers determine the relative weighting and rank of each metric. Further, the decision-maker uses the pairwise comparison matrix to select the best-suited supplier. AHP is a widely used method, owing to its simplicity, flexibility and ability to manage qualitative and quantitative criteria. Therefore, the AHP method is used to select the LSP and the global supplier selection, strategic sourcing, inventory management, KPI prioritisation capacity planning and supply chain risk analysis (Hwang et al. 2016; Kumar et al. 2019).

  A company operating in the Indian automobiles industry adopted AHP for supplier selection. The organisation established six main criteria, including quality, cost, delivery, longevity, service, flexibility and 22 further sub-criteria in the hierarchy. The industry then established a pairwise comparison with the more essential criteria. Further, the obtained combination was assessed against the numerical value concerning their parent criteria. In conclusion, managers found local weights by pairwise comparisons between the parent criteria and sub-criteria, thereby generating value-driven rankings to choose one out of three shortlisted suppliers. Figure 5.12 represents a multi-criteria supplier selection model using the AHP method.

Table 5.6 MCDM methods available in literature

MCDM methods	Authors							
	Datta et al. (2013)	Sharma and Kumar (2015)	Prakash and Barua (2016)	Govindan et al. (2016)	Haldar et al. (2017)	Ilgin (2017)	Raut et al. (2018)	Bianchini (2018)
Fuzzy decision-making	✔							
Grey decision-making trial and evaluation laboratory (DEMATEL)				✔				
Fuzzy technique for order preference by similarity to ideal solution (TOPSIS)						✔		
Fuzzy analytical network process (ANP)						✔		
Fuzzy analytic hierarchy process (FAHP)			✔					
Vlsekriterijumska Optimizacija I Kompromisno Resenje (VIKOR)			✔					

(continued)

Table 5.6 (continued)

MCDM methods	Authors							
	Datta et al. (2013)	Sharma and Kumar (2015)	Prakash and Barua (2016)	Govindan et al. (2016)	Haldar et al. (2017)	Ilgin (2017)	Raut et al. (2018)	Bianchini (2018)
AHP								✔
TOPSIS					✔			✔
Taguchi loss function		✔				✔		
ANP							✔	
Data envelopment analysis (DEA)					✔		✔	
Linear programming (LP)					✔			

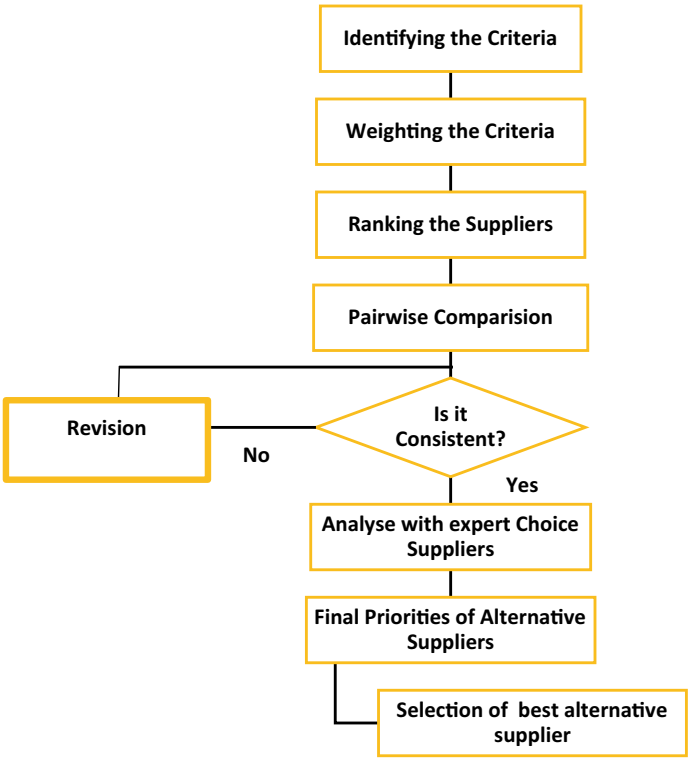

Fig. 5.12 Multicriteria supplier selection model (Yadav and Sharma 2016)

8. E-Procurement Tools

In the modern day, supply chain procurement is no longer considered a merely transactional, conventional and administrative activity. In truth, it has pivoted towards becoming a more strategic and value-additive role. E-procurement tool adoption is considered one of the fundamental drivers behind this transformation (Vanpoucke et al. 2017) (Fig. 5.13).

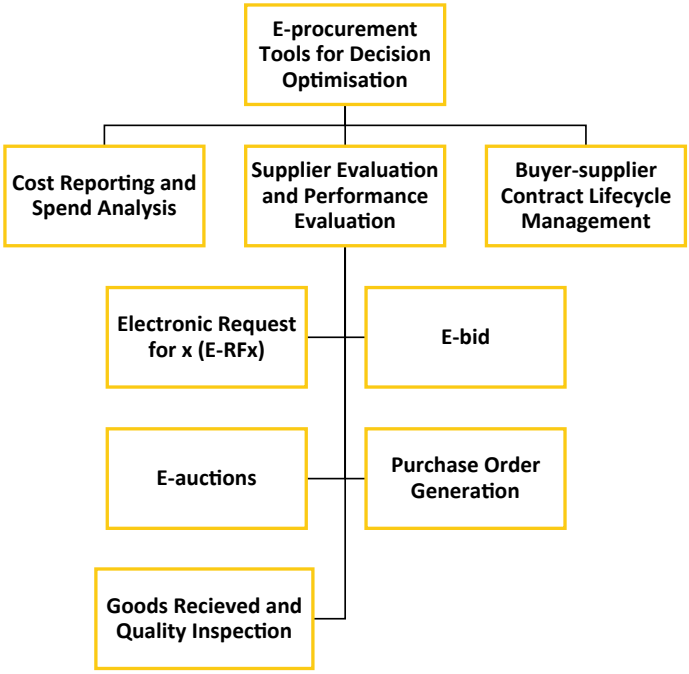

Fig. 5.13 E-procurement tools (Mena et al. 2018)

9. E-Auction

According to Qusa et al. (2020), e-auction is one of the often-used E-Procurement tools which eliminates the barriers involved in a traditional auction-like location, small target audience, geography and presence. Figure 5.14 shows the generalised framework of e-auction.

According to the buying organisation's strategic and operational expectations, the procurement team shortlists the best-matched supplier and evaluates them per the supplier selection criteria, such as the Balanced Scorecard (Kaplan and Norton 1995). Further, the organisation publishes the Pre-Qualification Questionnaire (PQQ).

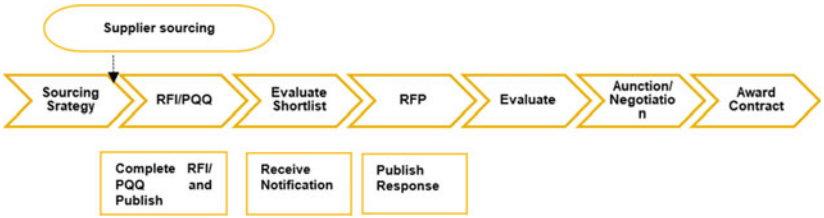

Fig. 5.14 General E-auction framework (Habib 2020)

Moving forward, buying organisations evaluate the PQQ response, operational and strategic performances. The successful candidates are further assessed by their Request for Proposal (RFP) and then called for an E-auction or negotiations (Habib 2020; Mena et al. 2018).

For instance, one of the global leaders in subsea systems provides the oil and gas sector with its services through e-auction for strategic sourcing, logistics and international shipping (Air, Ocean and Land freights) (ProcurePort 2021).

10. LSPs Information

Identifying reliable LSPs and aligning them with an organisation's strategic and operational goals is fundamental. Interconnectivity has certainly streamlined the LSP identifying process.

11.1.1.1.1.1.1.1. Foundation of LSP Strategies and related Models

Author	Foundations of LSP strategies	Related strategies and service models
Berglund et al. (1999)	1. LSPs offer basic services (low-cost) to the customers. The solution provider provides complex and customised services to premium customers 2. Organisations are offering essential services like warehousing and transportation, and the organisation providing value-added logistical services	1. Basic logistics service: Help customers being competitive 2. Value-added logistical services: Become value leaders by providing globally integrated logistics 3. Basic logistics solution: provide 3PL solutions in simple warehousing and transportation 4. Value-added solutions: consultancy services for customers
Persson and Virum (2001)	1. Service offering based on needs-based vs variety-based 2. Asset-based resources non-physical vs physical	1. LSP owns physical assets and provides various logistical services 2. 3PL provide needs-based services for unique customers through their assets 3. Many LSPs offer non-physical asset-based services to their customers. They are often termed logistics agents 4. Some non-physical asset LSPs offer need-based services from their targeted services. They are often known as logistics integrator

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Author	Foundations of LSP strategies	Related strategies and service models
Bolumole (2003)	1. Strategically outsourcing the organisation 2. The extent of outsourcing 3. 3PL relationship with the client 4. Customer's perception of 3PL	1. Functional service provider: Cost-based perception, operational-level functions, transactional relationships, internal focus 2. Inhouse logistics departments: cost-based perception, tactical-level function, bilateral relationship, internal focus 3. Logistical joint venture: Partnership-type relationship, cost-based perception, internal focus, strategic-level function 4. 3PL provider: resource-based perception, operational-level function, transactional relationships, external factors 5. Supply chain logistics provider: bilateral relationships, operational-level function, resource-based perceptions, tactical-level functions 6. Logistics process integrator: resource-based perception, strategic-level function, partnership-type relationships, external focus

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Author	Foundations of LSP strategies	Related strategies and service models
Hertz and Alfredsson (2003)	1. Problem-solving capacity 2. Customer adaptation	1. The 3PL provider provides general services such as distribution and warehousing 2. Service developers provide state-of-art value-added services 3. LSPs take over the clients entire logistics functions termed as customer adapters 4. LSPs take over entre logistics function by integrating themselves termed as customer developers
Stefansson (2006)	1. Service scope 2. Degree of customisation	1. Freight forwarders with the simple transport-related services 2. LSPs with extended administrative service offerings 3. Logistics service intermediaries administer the logistics activities without handling the goods physically
Waters and Rinsler (2014)	1. Increased cost advantages 2. Increased differentiation	1. Value and cost leadership provider 2. Cost leadership providers 3. Commodity provider 4. Added-value provider
Cui and Hertz (2011)	1. Network 2. Capabilities	1. 3PL firms 2. Logistics intermediary firms 3. Carriers

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Author	Foundations of LSP strategies	Related strategies and service models
Zacharia et al. (2011b)	Degree of scope outsourced to the logistics provider	Outsourcing engagements: 1. Out-tasking and standardisation of repetitive and specific tasks 2. Service management with shared responsibility for tasks and functions with the enormous scope 3. LSP takes the significant responsibility of function management, design and implementation 4. Complete outsourcing where LSP is entirely responsible for all outsourced tasks
Soinio et al. (2012)	Asset vs non-asset-based services, strategic, operational and tactical tasks, relationship-oriented vs transactional-based services	1. Consulting 2. Transportation of goods 3. The outsourced chief logistical officer model 4. 3PL with planning
Lampe (2014)	Asset intensity, global footprint and range of services, the scope of services, degree of customisation, types of goods handlings	Narrow/broad perspective carriers/2PL, 3PL, 4PL, LLP and freight forwarder

The following may be described as key resources useful for identifying viable LSPs (Baily et al. 2015; Monczka et al. 2016):

11. Online Supplier Database/Catalogues
Many websites or web portals store a particular file that consolidates LSPs' offered services, contact details and price lists. For example, Inbound Logistics provides detailed information about the LSP's geographic footprint, logistics, transportation, warehousing and a

list of secondary value-added services and technologies (Inbound Logistics 2021).

12. Trade Journals
    Trade journals provide information about the processes, services and technological advancements offered by LSPs—most of whom with a tendency to be affiliated with the publishing body. For example, Thigpen Library maintains articles and trade journals for logistics and supply chain management (Thigpen Library 2021).
13. Trade Dictionary
    Service providers tend to publish their company dictionary, which reflects key information about their services. For example, Logistics List provides information about logistics services, logistics technology, logistics sponsors and resources and value-added services (Logistics List 2021).
14. Trade Shows
    This is an especially effective means of generating massive exposure to diverse service providers in one setting. For example, Event Eye provides information relating to the logistics and transportation of engineering-handling-storage operations through its industry-leading trade shows in Europe, connecting a diversity of leaders and hopefuls under one roof (Event Eye 2021).
15. Risk and Barriers in Changing the LSP
16. Why Change LSP?
    The following points given by Jones (2018) might be helpful towards understanding why organisations change their existing LSP:
17. Changes in Order Quantity
    Suppose the organisation has achieved massive business growth; this would act as a highly visible, though not all-encompassing, indicator of the LSPs' capabilities. Similarly, if the organisation faces volatile demand because of business fluctuations or seasonal promotions, it may gain visibility of its existing LSPs' limitations (Jones 2018; Rushton et al. 2017).
18. Increased Complexity
    Order fulfilment has become much more complex for contemporary organisations. Companies now look for an LSP with integrated

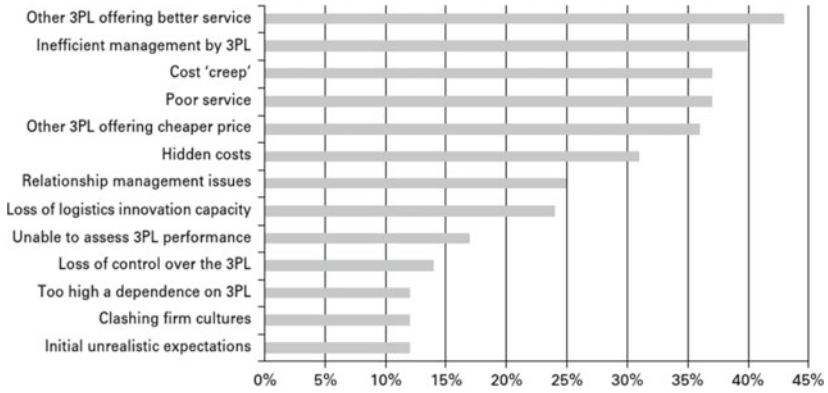

Fig. 5.15 Key reasons behind not renewing existing LSPs Contract (Rushton et al. 2017)

strategic global footprint, state-of-art order management technologies and various logistical services to streamline order fulfilment (Jones 2018; Rushton et al. 2017).

19. Increased Shipping and Fulfilment Cost
    If the freight, technological requirement, warehouse space and labour cost a fortune to the organisation, finding a new LSP can sometimes minimise the overhead cost and offer better transportation costs by leveraging competitor advantage (Jones 2018; Rushton et al. 2017).
20. Service Failures
    The preferred LSP should ensure customer satisfaction by providing on-time deliveries, accurate orders, excellent inbound, outbound services and inventory management. However, if the LSP fails to deliver these services, without good reason, this is an indicator that the organisation should scrutinise and adapt (Jones 2018; Rushton et al. 2017).

    Figure 5.15 shows the critical reasons behind the changing existing LSP.

21. Risks and Barriers
22. Dependency on Existing LSP
    To enhance supply chain efficiency and efficacy, and to gain competitive advantages, organisations depend on the LSPs. The vertical integration in the logistics industry happens through system integrations between buying organisations and LSPs. These integrations reduce the cost association with management processes, asset ownership and generally enhance financial performance (Zacharia et al. 2011b). The method and system of integration can sometimes prove prohibitive to the buying organisation. Therefore, many organisations do not risk shifting to a new LSP even if the existing LSP is not delivering the agreed service levels (Holt et al. 2010; Rushton et al. 2017).
23. Change in Management
    According to Holt et al. (2010), risk in changes to management is a combination of structural and psychological factors, indicative of the extent to which employees and organisations are willing to accept them. Therefore, if any organisation working with their LSP long-term, makes a sudden change, their employees might feel fear, uncertainty and frustration from this change, as they have to shift from their long-held practices, routine and working culture. Thus, senior management can be hesitant to make changes and risk losing spirit (Etokudoh et al. 2017; Rushton et al. 2017).
24. Supplier Switching Cost
    The overdependence on an existing LSP may generate fear within buying organisations in terms of losing pricing advantages. Therefore, senior management may be hesitant to lose a perceived advantage, especially against the backdrop of market complexity and risk-aversity (Baily et al. 2015; Monczka et al. 2016).
25. Supply Disruption
    Supply disruption is one of the potential risks which can occur while changing the LSP. While transitioning from a current service provider to another, the new LSP may not integrate processes, systems and technologies with the buying organisation until the hand-over time. This time lag can generate costly and scandalous supply distributions. Also, there are possibilities that the LSP may

not fully understand the intricacies of the business. Therefore, and at great cost, this situation can affect the manufacturing schedule and affect the shipments to end customers (Baily et al. 2015; Monczka et al. 2016).

26. Services Provider's Availability
    The unavailability of the most preferred LSP can be a potential risk. The whole process of SSE consumes massive organisational resources, including and beyond time and money. If the preferred service provider is unavailable, the entire process can be a costly failure, and the organisation may damage their relationship with their pre-existing supplier (Baily et al. 2015; Monczka et al. 2016).
27. LSP Transition Planning
28. When Should Change be Made?
    While changing the LSP, the organisation should carefully consider the timing of the transition. Often, the companies start searching for a new LSP at the start of the fiscal year, budgeting the change for the fourth quarter so that the newly appointed LSP may be operational at the start of the next year's first quarter. It is wise to start the transition during the operationally quiet period, such as the last days before manufacturing shuts down. Otherwise, there are risks of supply chain disruption and service failures (Harps 2003; Jones 2018).
29. Development of Effective RFP
    Developing an effective RFP is the next critical stage in transition planning (refer to 10). Developing an effective RFP provides a clear understanding of buyers' ability to communicate, identify, quantify and define its sourcing and technical requirements. The RFP gives an overview of the buying organisation and includes product specification, order volume data, promotional/seasonal discount fluctuations. Inbound-outbound logistics delivery requirement and shipping timelines. The following is a checklist of points included in the RFP (Jones 2018; Monczka et al. 2016) (Table 5.7).

    Buying organisations should identify and define operating variances and assumptions. There is a positive correlation between the detail provided in an RFP and the relevancy of proposals received.

Table 5.7 RFP checklist (Author 2021)

RFP checklist
Optimal network optimisation
Technological requirement (WMS, TMS, etc.)
Return logistics service
Delivery requirement
After sales market customer service
Service quality management

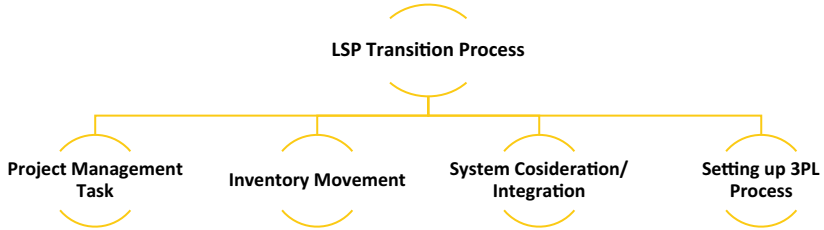

Fig. 5.16 LSP transition process (Barry 2019a)

30. Transitioning Process
    Once the buying organisation finalises the LSP, it is essential to develop a seamless transition plan. The buying organisation and LSP should spend some time understanding the requirements, project scope and assigning a qualified transition team that involves critical players from senior management, human resources and process engineering teams (Barry 2019a; Kao et al. 2019). The buying organisation can often involve a small team of the last LSP, handing over the process documents to the new LSP. Together this team should create a roadmap for the go-live date, identify necessary tools and available resources. While implementing the transition plan, both parties should keep track of the budget, construct and implement a contingency plan to ensure an easy and reliable transition. As shown in Fig. 5.16, four significant categories are critical for a smooth transition (Barry 2019a; Jones 2018).
31. Project Management Task
    Developing, managing and executing the transition plan requires massive resources like time, cost and energy. However, these efforts

and good PM practices will ensure on-time and within-budget project completion, and minimise commercial and reputational risks to the organisation (Barry 2019a; Elmar and Hall 2020).

32. Development of Project Plan
The project plan should include all the milestones and tasks that buying organisations expect from their LSP (Barry 2019a). The project schedule might include a brief meeting between the old and newly appointed LSPs for process hand-over procedures. Generally, project planning also involves start and end dates for each task, a list of responsible parties for completing each task, as well as a description of costs associated with each task. Furthermore, communication and coordination between all involved stakeholders is crucial to success (Elmar and Hall 2020; Kao et al. 2019; Maylor 2010).

    Often the work of developing and updating transition plans requires continuous communication between all involved stakeholders. Often, to save time, organisations delegate these processes to LSPs. However, it is advisable for an organisation to control, schedule and plan the transition project, rather than completely delegating outwards, as the LSP Logistics service providers (LSPs) might not be aware of all involved stakeholders. Furthermore, the LSP may not wish to involve itself in cost-control initiatives because these may give rise to conflicts of interest (Elmar and Hall 2020; Kao et al. 2019; Maylor 2010)

33. Go-Live Date
According to Barry (2018) Jones (2018), all involved stakeholders should ensure an easy transition to minimise business interruptions by planning around the go-live date. It should be kept at the end of the season or the year-end when there are generally low inventory levels. Moreover, it is advisable for the PM team to factor in longer lead times for tasks such as IT system integration and inventory migration.

34. Project Timeframe
The project's timeframe depends on the number of SKUs the buyer has and the inventory's movement from the previous LSP to the

newly appointed LSP's fulfilment centres. Furthermore, the project time frame is also dependent buyer's complex and unique fulfilment processes. It is worth noting that generally, in PM, the timeframe for a simple project is 90 days and four-five months for some complex projects (Barry 2019a; Elmar and Hall 2020).

35. Appointment of Project Manager
Shaukat et al. (2021) state that a project's success is a multidimensional, subjective, ambiguous and subtle concept. A project's sustainability, as well as integration of economic, social and environmental issues are critical in PM. Thus, according to Barry (2019a), due to competitive pressures, continuous technological advancements, size, costs and risks involved in PM, organisations need to appoint a full-time project manager. The breadth of the project manager's experience influences the on-time project completion, even under complex circumstances (Salvador et al. 2021).
36. Inventory Movements
The next step in the transitioning process is inventory movement.
37. Quantities to Move
Often, the organisation classifies their SKUs as per the ABC analysis, and 20% of the SKUs contribute towards 80% of the organisational revenue (Slack and Brandon-Jones 2019). Most of the time, while transitioning, some inventory is always available with the old LSP. Therefore, the organisation should evaluate their inventory at their old LSP before transferring it to the new LSP. Many researchers have advised that organisations should keep some inventory available at their fulfilment centre in case of unforeseen delays in the go-live date (Barry 2019a; Heizer 2020).
38. Movement of Dead-stock
Transitioning period is the ideal time for the organisation to assess their obsolete inventory and liquidate it. This is because slow, seller inventory-movement costs more money in terms of inventory preparation for transportation, monthly inventory storage costs and transportation cost (Barry 2019a).
39. Receipt of Inventory at 3PL
Inaccurate delivery of inventory to the LSP can cost a fortune to the organisation. Therefore, the organisation should discuss how LSP

wants to receive the inventory. It gives the organisation an opportunity to accurately count inventory and maintain documentation regarding it. Documenting all the procedures will be beneficial for the organisation in the future as it creates a system of accountability and reference (Barry 2019a).

40. Transport Arrangement and Scheduling
Arranging a transportation service is one of the expensive things in transition. Organisations should discuss with their new LSP responsible for transporting the inventory available with the old LSP. If an organisation is responsible for this task, they have to arrange the trucks, ships and fulfilment centres to store the inventory (Barry 2019a; Kao et al. 2019).
41. System Considerations
Newly on-board LSP comes with all new IT systems and functions, and this IT platform requires integration with the buyer's IT platform, and usually, this process has longer lead times. Therefore, all involved parties need good communication to make it accessible, simple and successful (Barry 2019a).
42. LSP Data Mapping
The buying organisation has to provide information about their SKUs and product line. With the provided information, LSP will map the product line on an excel sheet, and the service provider will assess the dimensions of the products so that they can arrange the packaging, loading and transportation of the product (Barry 2019a; Kao et al. 2019).
43. Technological Integration
Technological integration is one of the time-consuming processes in the LSP transition process. After the product mapping, often LSPs start implementing the track and trace and data-mapping technologies such as cloud computing, big-data analytics and blockchain-integration. However, before implementing these technological advancements, an organisation needs compliance certifications (Barry 2019b). Therefore, a project manager must plan related testing ahead of time so as to optimise the implementation cascade (Barry 2019a; Heutger and Kückelhaus 2018; Kao et al. 2019; Wang and Sarkis 2021).

44. LSP Processes Setup
45. Define Procedures and Processes
    The buying organisation and their LSP should arrange meetings to discuss the implementation process of transition projects. If an organisation has a training and procedure manual documented, it becomes easier to transition from one LSP to another. If their processes and procedures are not documented, this is then a fresh opportunity for buying organisations to document all the actions and decisions taken so that an organisation can replicate them in future/as needed (Barry 2019a; Kao et al. 2019).
46. Shipping Orders in Transition
    Even in the transition phase, the buying organisation must ensure that they satisfy their customers with on-time delivery, good service quality and downtime reduction. Failing this, there can be averse and lasting commercial and reputational consequences. Therefore, for a smooth transition, a buying organisation can either ship themselves or use the services of their old LSP until transitioned (Barry 2019a; Kao et al. 2019).

Transitioning from one LSP to other is a challenging task. Assigning a good project manager, with a well-developed plan, organisations can achieve seamless transitions. To ensure this, transparent and cross-stakeholder communication is critical (Barry 2019a; Kao et al. 2019; Maylor 2010).

Chapter Summary and Key Lessons

The chapter provides a thorough overview of relevant topics and ideas essential to achieving the research objectives. Therefore, the chapter has focused on the latest service characteristics and technological advancements that LSPs leverage for their customers. Further, the chapter emphasises the SSE as a vehicle for the seamless selection of new LSPs, as well as problems and pathways associated with making related changes.

This chapter contributes to several key theoretical areas in the operations, logistics and supply chain management industry; focusing on

Industry 4.0 in LSPs. This should supplement existing theoretical knowledge on industry 4.0 and its advancement in LSPs. It should also elevate the knowledge on 3PL, 4PL, LSP selection process and the technologies (i.e. IoT, Cloud computing, Big data Analytics) and their implications. As to practical consequence, this study should contribute to the understanding of contemporary managers on how Industry 4.0 technologies could help improve their operations, logistics and supply chain management. Given the impact of COVID-19, it is particularly important for companies to best utilise available technologies to make their supply chains more agile, resilient and future-ready. With a couple of case study examples (i.e. Kuehne-Nagel, DHL) this chapter provides some critical insights which could help cross-industry management achieve efficiency-optimised decisions. Future research could develop hypotheses/propositions and collect primary data to establish these empirical findings.

References

Akman, G. and Baynal, K. (2014) "Logistics Service Provider Selection through an Integrated Fuzzy Multicriteria Decision Making Approach," *Journal of Industrial Engineering*, 2014. Hindawi Limited, pp. 1–16.

Alkhatib, S.F., Darlington, R. and Nguyen, T.T. (2015) "Logistics Service Providers (LSPs) Evaluation and Selection Literature Review and Framework Development," *Strategic Outsourcing*, 8(1). Emerald Group Publishing Ltd., pp. 102–134. Available at: https://doi.org/10.1108/SO-12-2014-0028 (Accessed: June 24, 2021).

Alvarez (2020) *Types of Logistics Providers Explained in Plain English.*, *Shipping and Logistics Blog*. Available at: https://www.shiplilly.com/blog/types-of-logistics-providers-explained-in-plain-english/ (Accessed: July 5, 2021).

Armonk (2017) *Maersk and IBM Unveil First Industry-Wide Cross-Border Supply Chain Solution on Blockchain.*, *IBM News Rooms* Available at: https://newsroom.ibm.com/2017-03-05-Maersk-and-IBM-Unveil-First-Industry-Wide-Cross-Border-Supply-Chain-Solution-on-Blockchain (Accessed: June 20, 2021).

AWS (2019) *Maritime Operations—Automating Operational Quality Assurance with AWS and Open Data.*, *AWS Public Sector Blog*. Available at: https://aws.amazon.com/blogs/publicsector/maritime-operations-automating-operational-quality-assurance-with-aws-and-open-data/ (Accessed: June 20, 2021).

Baily, P., Farmer, D., Crocker, B., Jessop, D. and Jones, D. (2015) *Procurement Principles and Management*. 11th edn. Harlow: Pearson.

Barry, B. (2019a) *20 Critical Implementation Tasks When Moving Your Business to a 3PL.*, *F. Curtis Barry and Company.* Available at: https://www.fcbco.com/blog/moving-your-business-to-a-3pl (Accessed: July 24, 2021).

Barry, B. (2019b) *6 Requirements to Consider in Your Third-Party Logistics (3PL) Systems.*, *F. Curtis Barry and Company Blog.* Available at: https://www.fcbco.com/blog/requirements-third-party-logistics-systems (Accessed: July 25, 2021).

Bartolacci, M.R., Leblanc, L.J., Kayikci, Y. and Grossman, T.A. (2012) *Optimisation Modelling for Logistics: Options and Implementations*.

Berglund, M., Laarhoven, P.V., Sharman, G. and Wandel, S. (1999) "Third-Party Logistics: Is there a Future?," *The International Journal of Logistics Management*, 10(1), pp. 59–70.

Bianchini, A. (2018) "3PL Provider Selection by AHP and TOPSIS Methodology," *Benchmarking*, 25(1). Emerald Group Publishing Ltd., pp. 235–252. Available at: https://doi.org/10.1108/BIJ-08-2016-0125 (Accessed: July 4, 2021).

Bingelow (2019) *Logistics Outsourcing Trends in 2020.*, *Smarter with Gartner.* Available at: https://www.gartner.com/smarterwithgartner/logistics-outsourcing-trends-in-2020/ (Accessed: June 8, 2021).

Bolumole, Y.A. (2003) "Evaluating the Supply Chain Role Of Logistics Service Providers," *The International Journal of Logistics Management*, 14(2), pp. 93–107.

Çağlar Kalkan, M.B. and Aydın, K. (2020) "The Role of 4PL Provider as a Mediation and Supply Chain Agility," *Modern Supply Chain Research and Applications*, 2(2). Emerald, pp. 99–111.

Cavalli, L. and Lizzi, G. (2020) *Port of the Future—Addressing Efficiency and Sustainability at the Port of Livorno with 5G*. Milan. Available at: https://www.econstor.eu/bitstream/10419/223634/1/ndl2020-007.pdf (Accessed: June 19, 2021).

Choi, T.M. (2020) "Internet Based Elastic Logistics Platforms for Fashion Quick Response Systems in the Digital Era," *Transportation Research Part E:*

Logistics and Transportation Review, 143. Elsevier Ltd. Available at: https://doi.org/10.1016/j.tre.2020.102096 (Accessed: June 27, 2021).

Christopher, M. (2016) *Logistics and Supply Chain Management*. Harlow: Pearson Education Ltd.

Ciemcioch, S. (2018) *3PL vs. 4PL Logistics: Best Definition, Explanation and Comparison.*, *Warehouse Anywhere.* Available at: https://www.warehouseanywhere.com/resources/3pl-vs-4pl-logistics-definition-and-comparison/ (Accessed: June 9, 2021).

Cui, L. and Hertz, S. (2011) "Networks and Capabilities as Characteristics of Logistics Firms," *Industrial Marketing Management*, 40(6), pp. 1004–1011.

Datta, S., Samantra, C., Mahapatra, S.S., Mandal, G. and Majumdar, G. (2013) "Appraisement and Selection of Third-Party Logistics Service Providers in Fuzzy Environment," *Benchmarking*, 20(4), pp. 537–548. Available at: https://doi.org/10.1108/BIJ-11-2011-0087 (Accessed: July 4, 2021).

DHL (2016) Engineering and Manufacturing Case Study: Redesigning Global Supply Chain Operations, *DHL*. Available at: http://dhl.lookbookhq.com/ao_product_lead-logistics-partner/case-study_llp-redesigning-global-supply-chain-operations (Accessed: July 21, 2021).

Doolen, T., Traxler, M.M. and McBride, K. (2006) "Using Scorecards for Supplier Performance Improvement: Case Application in a Lean Manufacturing Organization," *Engineering Management Journal*, 18(2), pp. 26–34.

Elmar, K. and Hall, M. (2020) *Mindful Project Management: Resilient Performance Beyond the Risk Horizon*. 2nd edn. London: Routledge.

Essien, E.E., Kostopoulos, I., Konstantopoulou, A. and Lodorfos, G. (2019) "Do Ethical Work Climates Influence Supplier Selection Decisions in Public Organisations? The Moderating Roles of Party Politics and Personal Values," *International Journal of Public Sector Management*, 32(6). Emerald Group Holdings Ltd., pp. 653–670.

Etokudoh, E.P., Boolaky, M. and Gungaphul, M. (2017) "Third Party Logistics Outsourcing: An Exploratory Study of the Oil and Gas Industry in Nigeria," *SAGE Open*, 7(4). SAGE Publications Inc. Available at: https://doi.org/10.1177/2158244017735566 (Accessed: July 13, 2021).

Event Eye (2021) *Logistics & Transportation Engineering—Handling Operations—Storage Trade Shows in Europe 2021–2022.*, *Event Eye*. Available at: https://www.eventseye.com/fairs/zst1_trade-shows_europe_logistics-transportation-engineering-handling-operations-storage.html (Accessed: July 8, 2021).

Fazi, Stefano, Fransoo, J.C., Woensel, T. van and Dong Jing-Xin (2020) "A Variant of the Split Vehicle Routing Problem with Simultaneous Deliveries and Pickups for Inland Container Shipping in Dry-Port Based Systems," *Transportation Research Part E*, 142. Available at: https://www.sciencedirect.com/science/article/pii/S1366554520307080 (Accessed: June 27, 2021).

Feliu, C. (2018) *4 Relevant Big Data Case Studies in Logistics.*, *Datumize.* Available at: https://blog.datumize.com/4-relevant-big-data-case-studies-in-logistics (Accessed: June 20, 2021).

Finch, C. (2017) *The Disadvantages of Balanced Scorecard.*, *Biz Fluent.* Available at: https://bizfluent.com/list-6630586-disadvantages-balanced-scorecards.html (Accessed: June 30, 2021).

Fulconis, F., Saglietto, L. and Pache, G. (2006) "Exploring New Competences in the Logistics Industry: The Intermediation Role of 4PL," *Supply Chain Forum: An International Journal*, 7(2). Informa UK Limited, pp. 68–77.

Gesing, B. and Kückelhaus, D.M. (2020) *Digital Twin in Logistics*. Troisdorf. Available at: https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-digital-twins-in-logistics.pdf (Accessed: June 20, 2021).

Govindan, K., Khodaverdi, R. and Vafadarnikjoo, A. (2016) "A Grey DEMATEL Approach to Develop Third-Party Logistics Provider Selection Criteria," *Industrial Management and Data Systems*, 116(4) Emerald Group Publishing Ltd., pp. 690–722. Available at: https://doi.org/10.1108/IMDS-05-2015-0180 (Accessed: July 4, 2021).

Grant, D. (2019) "Outsourcing Integration and Third Party Logistics Services: An Appreciation of Two 'Classic' Articles in Industrial Marketing Management," *Industrial Marketing Management*, 79, pp. 21–26. Available at: https://reader.elsevier.com/reader/sd/pii/S0019850119302093?token=9DFCEAD07C452F7B23B53AED3BAA69A312D30795D762FAD45B0714024E4EF2B496F2A111B8B2E8F9260671EFC4D345B3&originRegion=eu-west-1&originCreation=20210705114141 (Accessed: July 5, 2021).

Habib, F. (2020) *Lecture 8: E-Procurement.*, *Cranfield University.* Available at: https://canvas.cranfield.ac.uk/courses/7702/files/437785?module_item_id=128196 (Accessed: July 6, 2021).

Haldar, A., Qamarudding, U., Raut, R., Kamble, S., Kharat, M. and Kamble, S. (2017) "3PL Evaluation and Selection Using Integrated Analytical Modelling," *Journal of Modelling in Management*, 12(2).

Harps, L. (2003) *Managing Logistics Change: Doing it Right*. Available at: https://www.inboundlogistics.com/cms/article/managing-logistics-change-doing-it-right/ (Accessed: July 22, 2021).

Heizer, J. (2020) *Principles of Operations Management: Sustainability and Supply Chain Management*. 11th edn. Harlow: Pearson Education, Limited.

Hertz, S. and Alfredsson, M. (2003) "Strategic Development of Third Party Logistics Providers," *Industrial Marketing Management*, 32(2), pp. 139–149.

Heutger, M. and Kückelhaus, D.M. (2018) *Blockchain in logistics*. Troisdorf. Available at: https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-blockchain-trend-report.pdf (Accessed: June 20, 2021).

van Hoek, R.I. and Chong, I. (2001) *Epilogue: UPS Logistics ± Practical Approaches to the E-supply Chain*. # MCB University Press.

Hofmann, E. and Osterwalder, F. (2017) "Third-Party Logistics Providers in the Digital Age: Towards a New Competitive Arena?," *Logistics*, 1(2) MDPI AG, p. 9. Available at: https://doi.org/10.3390/logistics1020009 (Accessed: July 5, 2021).

Holt, D.T., Helfrich, C.D., Hall, C.G. and Weiner, B.J. (2010) Are You Ready? How Health Professionals Can Comprehensively conceptualise readiness for change *Journal of General Internal Medicine*.

Hwang, B.N., Chen, T.T. and Lin, J.T. (2016) "3PL Selection Criteria in Integrated Circuit Manufacturing Industry in Taiwan," *Supply Chain Management*, 21(1) Emerald Group Publishing Ltd., pp. 103–124. Available at: https://doi.org/10.1108/SCM-03-2014-0089 (Accessed: June 26, 2021).

Ilgin, M.A. (2017) "An Integrated Methodology for the Used Product Selection Problem Faced by Third-Party Reverse Logistics Providers," *International Journal of Sustainable Engineering*, 10(6). Taylor and Francis Ltd., pp. 399–410. Available at: https://doi.org/10.1080/19397038.2017.1317873 (Accessed: July 4, 2021).

Inbound Logistics (2021) *Find a Third-Party Logistics (3PL) Provider.*, *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/search-tool/3pl/ (Accessed: July 8, 2021).

Jones, J. (2018) *What You Need to Know When Changing 3PL Providers*. Available at: https://multichannelmerchant.com/blog/need-know-changing-3pl-providers/ (Accessed: July 8, 2021).

Jurczak, M. (2018) *From 1PL to 5PL or… "secrets" of Logistics Services.*, *Trans Info.* Available at: https://trans.info/en/from-1pl-to-5pl-or-secrets-of-logistics-services-101158 (Accessed: July 5, 2021).

Kao, ching-K., Qian, M., Chang, T.-H. and Lin, P. (2019) "Strategic Planning for Transitioning from Third-Party to Fourth-Party Logistics Under

E-Commerce," *International Journal of Organisational Innovation*, 12(1). Available at: https://media.proquest.com/media/hms/PFT/1/Vdw4A?hl=&cit%3Aauth=Kao%2C+Ching-Kuei%3BQian%2C+Mingwei%3BChang%2C+Tang-Hsien%3BLin%2C+Peng-Jung&cit%3Atitle=STRATEGIC+PLANNING+FOR+TRANSITIONING+FROM+THIRD-+TO+FOURTH-PARTY+...&cit%3Apub=International+Journal+of+Organizational+Innovation+%28Online%29&cit%3Avol=12&cit%3Aiss=1&cit%3Apg=25&cit%3Adate=Jul+2019&ic=true&cit%3Aprod=ProQuest&_a=ChgyMDIxMDcyNDEyMjAyNjIxNzo4OTMxMTQSBjEwNjMwNBoKT05FX1NFQVJDSCIPMTM4LjI1MC4xODQuMTQzKgU1NTExODIKMjI1MTk5NTkyMjoNRG9jdW1lbnRJbWFnZUIBMFIGT25saW5lWgJGVGIDUEZUagoyMDE5LzA3LzAxcgoyMDE5LzA3LzMxegCCATJQLTEwMDAwMDEtMTAyOTctQ1VTVE9NRVItMTAwMDAyNDEvMTAwMDAwMDgtNTI0MzA4NZIBBk9ubGluZcoBTk1vemlsbGEvNS4wIChXaW5kb3dzIE5UIDEwLjA7IFdpbjY0OyB4NjQ7IHJ2OjkwLjApIEdlY2tvLzIwMTAwMTAxIEZpcmVmb3gvOTAuMNIBElNjaG9sYXJseSBKb3VybmFsc5oCB1ByZVBhaWSqAi5PUzpFTVMtRG9jVmlld1BkZlVybFNlcnZpY2UtZ2V0TWVkaWFVcmxGb3JJdGVtygIPQXJ0aWNsZXxGZWF0dXJl0gIBWeICAPICAPoCAU6CAwNXZWKKAxxDSUQ6MjAyMTA3MjQxMjIwMjYyMTg6Nzg4NDkx&_s=WSfBS%2B7%2FSSg2jXMb7H1InFCixT8%3D (Accessed: July 24, 2021).

Kaplan, R.S. and Norton, D.P. (1995) "Putting the Balanced Scorecard," *Performance Measurement, Management, and Appraisal Sourcebook*, 66, pp. 66–74.

Kennedy, A. (2020) *1PL 2PL 3PL 4PL 5PL 6PL—The Advancement of Party Logistics.*, *AK Logistics and Supply Chain* Available at: https://aklogisticsandsupplychain.com/2020/03/02/1pl-2pl-3pl-4pl-5pl-6pl-the-advancement-of-party-logistics/ (Accessed: July 5, 2021).

Kuehne + Nagel (2017) *Leading Manufacturer of Construction Equipment Overcomes Decentralisation Challenges*. Available at: https://home.kuehne-nagel.com/documents/20124/72132/knowledge-customer-story-inbound-supply-chain.pdf/bdf34b9c-f83d-e568-87e8-edd5ff7aa0ac?t=1588177125699 (Accessed: July 20, 2021).

Kuehne + Nagel (2021) *Customer Information: Suez Canal Gridlock*. Available at: https://uk.kuehne-nagel.com/-/news/customer-information-suez-canal-gridlock (Accessed: June 18, 2021).

Kumar, R., Padhi, S. and Sarkar, A. (2019) "Supplier Selection of an Indian Heavy Locomotive Manufacturer: An Integrated Approach Using Taguchi Loss Function, TOPSIS, and AHP," *IIMB Management Review*, 31,

pp. 78–90. Available at: https://reader.elsevier.com/reader/sd/pii/S0970389618304610?token=182FC8FAC62B64ABF36C61920C8F65E5B9F638C723554FF0A508E8AA346F15E9C0BABD43D2A51DB31E7FFB8E6D2AD051&originRegion=eu-west-1&originCreation=20210701205846 (Accessed: July 1, 2021).

Lampe, K. (2014) *Information Needs of Logistics Service Providers in Strategic Decisions*, 41. University of St. Gallen.

Langley, J. and Infosys (2019) "*23rd Annual Third-Party Logistics Study: The State of Logistics Outsourcing*," Atlanta: Georgia Institute of Technology.

Logistics Bureau (2020) *Why Large Companies Increasingly Opt for 4PL Services.*, *Logistics Bureau.* Available at: https://www.logisticsbureau.com/why-large-companies-increasingly-opt-for-4pl-services/ (Accessed: June 9, 2021).

Logistics List (2021) *Logistic List Information for Logistics Decision Makers.*, *Logistics List* Available at: https://www.logisticslist.com/logistics-publications.html (Accessed: July 8, 2021).

Maylor, H. (2010) *Project Management*. 4th edn. Harrow: Pearson Education Limited.

Mena, C., van Hoek, R. and Christopher, M. (2018) "Leading Procurement Strategy: Driving Value Through the Supply Chain," in Habib, F. and Christopher, M. (eds.) *Information Technology in Procurement*. 2nd edn. London: Kogan Page, pp. 193–194.

Miller, S., Laan, Z. vander and Marković, N. (2020) "Scaling GPS Trajectories to Match Point Traffic Counts: A Convex Programming Approach and Utah Case Study," *Transportation Research Part E: Logistics and Transportation Review*, 143 Elsevier Ltd Available at: https://doi.org/10.1016/j.tre.2020.102105 (Accessed: June 27, 2021).

Monczka, R., Handfield, R., Giunipero, L. and Patterson, J. (2016) *Purchasing and Supply Chain Management*. 6th edn. Boston: Cengage Learning.

Nailwal, M. (2021) *1PL to 10PL—Understanding the Various Models of Logistics Service Providers.*, *Shiprocket* Available at: https://www.shiprocket.in/blog/1pl-to-10pl-understanding-the-various-models-of-logistics-service-providers/ (Accessed: July 5, 2021).

Nair, A., Jayaram, J. and Das, A. (2015) "Strategic Purchasing Participation, Supplier Selection, Supplier Evaluation and Purchasing Performance," *International Journal of Production Research*, 53(20) Taylor and Francis Ltd., pp. 6263–6278.

Nowodziński, P. (2010) *Strategic Dimensions of Fourth Party Logistics*.

Orji, I.J., Kusi-Sarpong, S., Huang, S. and Vazquez-Brust, D. (2020) "Evaluating the Factors That Influence Blockchain Adoption in the Freight

Logistics Industry," *Transportation Research Part E: Logistics and Transportation Review*, 141 Elsevier Ltd Available at: https://doi.org/10.1016/j.tre.2020.102025 (Accessed: June 27, 2021).

Persson, G. and Virum, H. (2001) "Growth Strategies for Logistics Service Providers: A Case Study," *The International Journal of Logistics Management*, 12(1), pp. 53–64.

Porter, M. (1985) *Competitive Advantage*. 1st edn. New York: The Free Press.

Prakash, C. and Barua, M.K. (2016) "A Combined MCDM Approach for Evaluation and Selection of Third-Party Reverse Logistics Partner for Indian Electronics Industry," *Sustainable Production and Consumption*, 7 Elsevier, pp. 66–78. Available at: https://doi.org/10.1016/j.spc.2016.04.001 (Accessed: July 4, 2021).

Prataviera, L.B., Tappia, E., Perotti, S. and Perego, A. (2021) "Estimating the National Logistics Outsourcing Market Size: A Multi-Method Approach and an Application to the Italian Context," *International Journal of Physical Distribution & Logistics Management*, ahead-of-print(ahead-of-print) Emerald. Available at: https://doi.org/10.1108/ijpdlm-07-2020-0243 (Accessed: June 6, 2021).

ProcurePort (2021) *Global Market Leader in Subsea Systems Implements Procure Port eSourcing to Help Exploration & Production Customers to Improve Their Returns.*, *ProcurePort.* Available at: https://www.procureport.com/casestudy/FMCTI-Case-Study.pdf (Accessed: July 6, 2021).

Purchasing Power Blog Procurement (2017) *Flexible Supplier Scorecard Template.*, *Purchasing Power Blog Procurement.* Available at: https://blog.purchasingtoolpak.com/2017/04/28/flexible-supplier-scorecard-template/ (Accessed: June 29, 2021).

Qusa, H., Tarazi, J. and Akre, V. (2020) *2020 Advances in Science and Engineering Technology International Conferences (ASET).* Available at: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9118213 (Accessed: July 6, 2021).

Rajahonka, M. and Bask, A. (2016) "The Development of Outbound Logistics Services in the Automotive Industry: A Logistics Service Provider-s View," *International Journal of Logistics Management*, 27(3) Emerald Group Publishing Ltd., pp. 707–737. Available at: https://doi.org/10.1108/IJLM-08-2012-0082 (Accessed: June 17, 2021).

Rajesh, R., Pugazhendhi, S., Ganesh, K., Ducq, Y. and Lenny Koh, S.C. (2012) "Generic Balanced Scorecard Framework for Third Party Logistics Service

Provider," *International Journal of Production Economics*, 140(1), pp. 269–282. Available at: https://doi.org/10.1016/j.ijpe.2012.01.040 (Accessed: June 29, 2021).

Ramos, D. (2020) *Vendor Scorecard Criteria, Template and Advice.*, *Smartsheet.* Available at: https://www.smartsheet.com/content/vendor-scorecards#:~:text=A%20vendor%20scorecard%20(also%20called,to%20access%20insights%20for%20improvement (Accessed: June 30, 2021).

Raut, R., Kharat, M., Kamble, S. and Kumar, C.S. (2018) "Sustainable Evaluation and Selection of Potential Third-Party Logistics (3PL) Providers: An Integrated MCDM Approach," *Benchmarking*, 25(1) Emerald Group Publishing Ltd., pp. 76–97. Available at: https://doi.org/10.1108/BIJ-05-2016-0065 (Accessed: July 4, 2021).

Rushton, A., Croucher, P. and Baker, P. (2017) *The Handbook of Logistics Management*. 7th edn. London: Kogan Page.

Sabadka, D. (2015) "New Trends and Challenges in Automotive Industry Logistics Operations," *International Scientific Journal about Logistics*, 2(1), pp. 15–19.

Salvador, F., Alba, C., Pablo Madiedo, J., Tenhiälä, A., Bendoly, E. and Management, O. (2021) "*Project Managers' Breadth of Experience, Project Complexity, and Project Performance*". Available at: https://doi.org/10.13039/501100011033 (Accessed: July 25, 2021).

Sharma, S.K. and Kumar, V. (2015) "Optimal Selection of Third-Party Logistics Service Providers Using Quality Function Deployment and Taguchi Loss Function," *Benchmarking*, 22(7). Emerald Group Publishing Ltd., pp. 1281–1300. Available at: https://doi.org/10.1108/BIJ-02-2014-0016 (Accessed: July 4, 2021).

Shaukat, M.B., Latif, K.F., Sajjad, A. and Eweje, G. (2021) "Revisiting the Relationship Between Sustainable Project Management and Project Success: The Moderating Role of Stakeholder Engagement and Team Building," *Sustainable Development*, p. sd.2228.

Shi, W., Cao, J., Zhang, Q., Li, Y. and Xu, L. (2016) "Edge Computing: Vision and Challenges," *IEEE Internet of Things Journal*, 3(5). Institute of Electrical and Electronics Engineers Inc., pp. 637–646. Available at: https://doi.org/10.1109/JIOT.2016.2579198 (Accessed: June 20, 2021).

Slack, N. and Brandon-Jones, A. (2019) *Operations Management*. 9th edn. Harlow: Pearson Education.

Soinio, J., Tanskanen, K. and Finne, M. (2012) "How Logistics-Service Providers Can Develop Value-added Services for SMEs: A Dyadic Perspective," *The International Journal of Logistics Management*.

Stefansson, G. (2006) "Collaborative Logistics Management and the Role of Third-Party Service Providers," *International Journal of Physical Distribution & Logistics Management*.

Taherdoost, H. and Brard, A. (2019) "Analysing the Process of Supplier Selection Criteria and Methods," *Procedia Manufacturing*, 32. Elsevier B.V., pp. 1024–1034. Available at: https://doi.org/10.1016/j.promfg.2019.02.317 (Accessed: July 1, 2021).

Tay, H.L. and Aw, H. sen (2021) "Improving Logistics Supplier Selection Process Using Lean Six Sigma—An Action Research Case Study," *Journal of Global Operations and Strategic Sourcing*, ahead-of-print(ahead-of-print) Emerald. Available at: https://doi.org/10.1108/jgoss-05-2020-0025 (Accessed: June 21, 2021).

The Insight Partners (2020) *Fourth Party Logistics Market Forecast to 2027—COVID-19 Impact and Global Analysis by Type , and End User*., *The Insight Partners.* Available at: https://www.theinsightpartners.com/reports/fourth-party-logistics-market (Accessed: June 9, 2021).

Thigpen Library (2021) *Logistics & Supply Chain Management: Databases, Articles & Trade Journals*., *Thigpen Library*. Available at: https://libguides.volstate.edu/c.php?g=1064210&p=7741234 (Accessed: July 8, 2021).

Tipping, A. and Kauschke, P. (2016) *Shifting patterns: The Future of the Logistics Industry*. Available at: https://www.pwc.com/gx/en/transportation-logistics/pdf/the-future-of-the-logistics-industry.pdf (Accessed: June 19, 2021).

Vanpoucke, E., Vereecke, A. and Muylle, S. (2017) "Leveraging the Impact of Supply Chain Integration through Information Technology," *International Journal of Operations and Production Management*, 37(4). Emerald Group Publishing Ltd., pp. 510–530. Available at: https://doi.org/10.1108/IJOPM-07-2015-0441 (Accessed: July 5, 2021).

Vasiliauskas, A.V. and Jakubauskas, G. (2007) "Principle and benefits of third-party logistics approach when managing logistics supply chain," *Transport*, 22(2), pp. 68–72.

Versed.AI (2021) *Proactive Management: The Suez Canal Blockage*., *Versed.AI*. Available at: https://www.versed.ai/resource-centre/proactive-management-suez-canal-blockage/ (Accessed: June 18, 2021).

Wang, Y. and Sarkis, J. (2021) Emerging Digitalisation Technologies in Freight Transport and Logistics: Current Trends and Future Directions *Transportation Research Part E: Logistics and Transportation Review*. Elsevier Ltd. Available at: https://doi.org/10.1016/j.tre.2021.102291 (Accessed: June 19, 2021).

Waters, D. and Rinsler, S. (2014) *Global Logistics: New Directions in Supply Chain Management*. Kogan Page Publishers.

Win, A. (2008) "The value a 4PL provider can contribute to an organisation," *International Journal of Physical Distribution and Logistics Management*, 38(9), pp. 674–684.

Winter, S. and Lasch, R. (2016) "Environmental and Social Criteria in Supplier Evaluation—Lessons from the Fashion and Apparel Industry," *Journal of Cleaner Production*, 139 Elsevier Ltd, pp. 175–190. Available at: https://doi.org/10.1016/j.jclepro.2016.07.201 (Accessed: June 24, 2021).

Wu, J., Liu, G. and Xi, C. (2008) "The Study on Agile Supply Chain-Based Supplier Selection and Evaluation," *2008 International Symposium on Information Science and Engineering, ISISE 2008.*, Vol. 2, pp. 280–284.

Xu, X., Zhang, M. and He, P. (2020) "Coordination of a Supply Chain with Online Platform Considering Delivery Time Decision," *Transportation Research Part E: Logistics and Transportation Review*, 141. Elsevier Ltd Available at: https://doi.org/10.1016/j.tre.2020.101990 (Accessed: June 27, 2021).

Yadav, V. and Sharma, M.K. (2016) "Multi-criteria Supplier Selection Model Using the Analytic Hierarchy Process Approach," *Journal of Modelling in Management*, 11(1). Emerald Group Publishing Ltd., pp. 326–354.

Yavas, V. and Ozkan-Ozen, Y.D. (2020) "Logistics Centres in the New Industrial Era: A Proposed Framework for Logistics Centre 4.0," *Transportation Research Part E: Logistics and Transportation Review*, 135. Elsevier Ltd. Available at: https://doi.org/10.1016/j.tre.2020.101864 (Accessed: June 27, 2021).

Zacharia, Z.G., Sanders, N.R. and Nix, N.W. (2011a) "The Emerging Role of the Third-Party Logistics Provider (3PL) as an Orchestrator," *Journal of Business Logistics*, 32(1).

Zacharia, Z.G., Sanders, N.R. and Nix, N.W. (2011b) "The Emerging Role of the Third-Party Logistics Provider (3PL) as an Orchestrator," *Journal of Business Logistics*, 32(1), pp. 40–54. Available at: https://journals.sagepub.com/doi/10.1177/2158244017735566 (Accessed: July 13, 2021).