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Review

Logistics Service Provider Lifecycle Model in Industry 4.0: A Review

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Abstract: Supply chain and logistics management is of tremendous importance for multinational organizations. Logistics Service Providers (LSPs) provide logistics services and smooth logistics operations between suppliers, manufacturers, distributors, and customers. This paper uses a Systematic Literature Review (SLR) to identify the current trends and future developments of LSPs and the underlying (smart) logistics operations connected to the concept of lifecycle management. An SLR review was conducted to identify relevant research papers in the areas of LSPs and logistics lifecycle management. Out of 288 papers analyzed, 81 were identified as highly appropriate for in-depth analysis. The LSP Lifecycle Model (LSLM) was then developed by combining logistics service characteristics and the lifecycle management concept, including Product Lifecycle Management (PLM), Service Lifecycle Management (SLM), and Product Service System (PSS). The LSLM consists of three phases: The Beginning of Life (BOL), the Middle of Life (MOL), and the End of Life (EOL). The LSLM is characterized by three phases, eight criteria, and seventeen sub-criteria. This paper aims to fulfil customer requirements through a product or service in the whole lifecycle of the logistics service provider. The findings further present an adaptable LSLM by focusing on various logistics services and integrating sustainability factors to meet market trends. Logistics cost factors can also be used to evaluate logistics services in the MOL stage. The EOL shows the trend of risk management, evaluation, and decomposition, which is determined by new or re-designed logistics products and services.

Keywords: systematic literature review; Logistics 4.0; smart logistics; lifecycle model; logistics service provider; Industry 4.0

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1. Introduction

Supply chain and logistics management play significant roles throughout business and economic growth at different levels. Managing and improving logistics efficiency and performance can increase a company's competitiveness and supply chain performance [1,2]. Logistics Service Providers (LSPs) are the key drivers within a typical supply chain, providing logistics services and smoothing the necessary activities between suppliers, manufacturing companies, distribution channels, and customers [3–5]. Managing and improving logistics efficiency and performance can increase a company's competitiveness and supply chain performance [1,2]. In the enormously competitive global fragmentation era, one needs to accommodate logistical operations and serve the customer to expand value and confront market forces [6,7]. Customer satisfaction is related to quick customer responses in logistics activities along the supply chain [8–10]. LSPs can be categorized by application, for example, managing inventory and cost, optimizing transportation and distribution, freight forwarding, etc. [11]. With the advancement of today's technology, for example, RFID, Big Data, Cloud technology, and Machine Learning, LSPs further serve the customer with more value-adding activities such as on-demand delivery, data analytics, market understanding, and real-time tracking and tracing, etc. [12–14].

Life Cycle Management (LCM) is a tool assuring that any product or service development and implementation can satisfy customer satisfaction along the closed-loop cycle [6]. This closed-loop management is comprehensive in creating ideas, designing, launching a product, operating, reusing, recycling, and declining products [15,16]. The concept of lifecycle management can further be separated into three concepts, namely: Product Lifecycle Management (PLM), Service Lifecycle Management (SLM), and Product Service System (PSS) [17]. PLM is a crucial way to improve and manage all the steps of a product's lifecycle, which smoothly creates new value by using ICT technologies that achieve economic growth and quick responses to customer needs [18–20]. On the other hand, SLM concerns servitization to improve and quickly respond in the service industry [6,21,22]. PSS has been integrated from product and service to observe customer requirements to competitiveness in the manufacturing industry [8,23–26]. PLM, SLM, and PSS successfully achieve customer satisfaction and create new products or services designed to assist in manufacturing for tangible and intangible value-added activities [3,5,21,25].

The first industrial revolution (Industry 1.0) started in 1784, which created steam and waterpower in industry, and the second industrial revolution (Industry 2.0) increased the efficiency of production, which included task time, operation production, and line production [27] by using the concept of "Mass Production". Industry 3.0 was defined in 1969, and it involved electronics and information technologies in the production process. Industry 4.0 is a new era of autonomous systems in the supply chain, addressing customer satisfaction using Cyber-Physical Systems (CPS), Internet of Things (IoT), Internet of Service (IoS), Blockchain Technology, Big Data Analytics, Autonomous Systems, Virtual Technology, and Digital Twins, etc. [9,11,28,29]. The concept of Industry 4.0 (I4.0) was established in Germany, in November 2011, to progress high technology to advance the competitiveness of manufacturing and improve quality, cost, and risk management. The fourth industrial revolution incorporates the implementation and integration of information technology and networking from the third industrial revolution to develop intelligent production and services [30] to support customer satisfaction, improve operations, and connect production and logistics processes smoothly along the entire supply chain [31]. These technologies have been adopted in various applications, including logistics activities, advancing traditional logistics to become "Smart Logistics (Logistics 4.0)" [32–37].

A literature review is essential to systematically analyze a new field of research and subsequently develop a framework for action, for example [15,38,39]. The Systematic Literature Review (SLR) is a systematic tool to avoid bias that focuses on identifying the scope of focus by analyzing the trend areas of research [28,40]. This paper aims to integrate the concepts of lifecycle management and Logistics 4.0 into LSPs to generate innovation or re-design logistics services for encouraging customer needs with many levels of logistics operation by minimizing investment and resources in a company. The authors formulated the research questions as follows:

1. How has the literature developed on the subjects of logistics service providers, logistics operations, smart logistics operations, and the concept of lifecycle management?
2. How many stages and criteria to assess LSPs exist in the current literature?
3. What kind of innovation in LSPs is discussed in the scientific papers?

To answer the research questions, this paper provides a comprehensive review of Industry 4.0, Logistics 4.0, 3 Party Logistics (3PL), Logistics Operations, and Lifecycle Management to summarize the gaps in the research field and outline further directions for this topic. This paper is structured as follows. Section 2 describes the systematic literature review to develop the LSP Lifecycle Model (LSLM) and the results. Section 3 presents a detailed review of the criteria and sub-criteria of the LSLM model. Finally, Section 4 presents the conclusion of the review and research limitations.

2. Systematic Literature Review (SLR)

For two decades, Systematic Literature Reviews (SLR) have been widely used for reviewing the current literature to identify and evaluate the state of the art and present

future topics regarding the field of research [41–44]. SLR further assists researchers in the generation of a systematic contribution based on secondary-data-based findings [15,39]. The Google Scholar website shows results of more than 300,000 papers based on researchers using SLR [45]. Denyer and Tranfield [46] described a systematic review as "a specific methodology that locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known". The SLR method has been evaluated by studies in the ACM Digital Library, Taylor & Francis, Emerald, Google Scholar, Elsevier, IEEE Xplore, Inform, Springer, and the ISI Web of Science [9,43,47]. The quality of SLR has been discussed in various journals, conference proceedings, and book chapters [15,28,42,48]. Thereby, bibliometric reviews are often used as a visualization tool to study research trends and other related fields, regions, and publications, whilst SLR is applied to search and summarize the systematic research area, which can solve specific problems [15]. The SLR process can be separated into five steps: (1) formulation of the research question, (2) identification of studies, (3) selection and evaluation of studies, (4) analysis and synthesis, and (5) reporting of results.

Step 1: Formulation of the Research Question

Step 1 is to create the scope of research by formulating the research question and/or problem. The question step can verify the utilization discovered from the systematic review. This step is to define the scope of the research area and set the data collection to find the solutions to problems to formulate a new model. Denyer and Tranfield [46] determined the structure of a systematic review as contexts, interventions, mechanisms, and outcomes.

Step 2: Identification of Studies

Locating studies is related to the question and formulated in locating, picking up, and evaluating. This step is for searching for research on databases such as Google Scholar, ACM Digital Library, Emerald, Elsevier, IEEE Xplore, Springer, and Taylor & Francis [28]. The initial search string for the SLR can be formulated as follows: "(TITLE-ABS-KEY ("artificial intelligence" OR "machine learning" OR "deep learning") AND TITLE-ABS-KEY ("smart logistics" OR "smart production" OR "industry4.0").

Step 3: Selection and Evaluation of Studies

The step of study selection and evaluation defines the inclusion and exclusion criteria to search in the pre-defined area. The authors define the inclusion and exclusion criteria based on similar papers in the field of research.

Step 4: Analysis and Synthesis

This step discusses the data extracted from the systematic literature review. The papers identified are classified into six categories: survey, interview, case study, content analysis, literature review, and modelling.

Step 5: Reporting of Results

The last step shows the results of the SLR and identifies trends in the area of research.

3. The Systematic Literature Review for LSP Lifecycle Model

To explore the role of the logistics service lifecycle to achieve a quick customer response, an SLR on Industry 4.0 in the logistics, smart logistics, and lifecycle management concepts, including PLM, SLM, and PSS, is used. The systematic literature review is a research methodology to identify and evaluate the extensive gap in the various fields of research [28,39,40]. The SLR was also chosen because the research methodology aims to minimize bias and skillfulness by using a systematic approach [9,44,48]. The process of SLR consists of five stages, which can be formulated as follows:

3.1. Formulation of the Research Question

This paper aims to evaluate new research trends in logistics services, including Industry 4.0, Smart Logistics, Logistics 4.0, Logistics, Logistics Service Provider, Third-Party

Logistics, Logistics Operators, (Smart) Supply Chain Management, (Smart) Transportation, and Supply Chain Management throughout the entire logistics service lifecycle.

3.2. Identification of Studies

The research field interests are lifecycle management concepts, namely, Product Lifecycle Management (PLM), Service Lifecycle Management (SLM), and Product Service System (PSS) to adopt in Logistics 4.0 or Smart Logistics. Moreover, research is required to define the above concepts of "Lifecycle Management", "Product Lifecycle Management", "Service Lifecycle Management", and "Product Service System".

3.3. Selection and Evaluation of Studies

For the data selection, the data source in Scopus was selected for the central reviews. The keywords were defined as Lifecycle Management or Product Lifecycle Management, Service Lifecycle Management, and Product Service System in the subject areas of engineering, computer science, business, management and accounting, decision sciences, mathematics, environmental science, social science, material science, economics, econometrics, and finance, and multidisciplinary areas by searching the article title, abstract, and keywords. In this step, only papers in the English language were included. The period was from January 2010 to December 2023. As a result, 6623 document papers were found. In the next step, these 6623 papers were scoped for Logistics, Smart Logistics, Logistics 4.0, Logistics Service Provider, Third-Party Logistics, Logistics Operators, Smart Supply Chain Management, Smart Transportation, and Supply Chain Management (Table 1). This process resulted in 288 documents.

Table 1. The definition and selection of the criteria for searching data.

Keywords (1)	Keywords (2)	Language	Time Interval	Source Type
Lifecycle Management	Logistics	English	2010–2023	Article and reviews
	Logistics 4.0			
Product Lifecycle Management	Supply Chain Management,			Conference papers, article titles, conference reviews, reviews, book chapters, and books
	Logistics Service Provider			
Service Lifecycle Management	Third-Party Logistics			
	Logistics Operators			
Product Service System	Smart Logistics			
	Smart Transportation			
	Smart Supply Chain Management			

In the last step, the review was limited to conference papers, article titles, conference reviews, reviews, book series, and books. The final search was formulated as follows; TITLE-ABS-KEY ("Lifecycle management" OR "Product Lifecycle Management" OR "Service Lifecycle Management" OR "Product Service System") AND TITLE-ABS-KEY ("Logistics" OR "Supply Chain Management" OR "Logistics 4.0" OR "Smart Logistics" OR "Smart Transportation" OR "3PL" OR "Smart Supply Chain Management" OR "Logistics Service Providers" OR "Logistics Operator") AND PUBYEAR > 2009 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA, "ENGI") OR LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "DECI") OR LIMIT-TO (SUBJAREA, "ENVI") OR LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "MATH") OR LIMIT-TO (SUBJAREA, "MATE") OR LIMIT-TO (SUBJAREA, "ECON") OR LIMIT-TO (SUBJAREA, "MULT")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "cr") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "bk")).

3.4. Analysis and Synthesis

In total, 288 documents were selected and evaluated to identify articles focused on logistics lifecycle management by searching the title and abstract. The quality of the papers can be separated into three types, high appropriateness, medium appropriateness, and low appropriateness. The first step was searching and scanning the articles and abstracts to estimate the literature with high appropriateness, which could be used in the next step. The results of searching for studies with high appropriateness produced a final total of 81 papers to evaluate in the next step. In step 2, the authors reviewed and analyzed the full research papers to identify and evaluate the manuscripts' contribution, methodology approaches, management parts, and operation/technology level.

When identifying and evaluating the level of the documents in the area of logistics lifecycle management, a total of 288 papers were analyzed by reviewing the title and abstract; the author identified 81 documents with a high appropriateness, 101 documents with a medium appropriateness, and 106 documents with a low appropriateness. The results of the systematic literature review are shown in Table 2.

Table 2. The results of the Systematic Literature Review (SLR).

No./Appropriate	Logistics 4.0/Smart Logistics
Total	288
High	81
Medium	101
Low	106

3.5. Reporting of Results

In this part, we describe the results of the SLR conducted to identify and analyze the resources by reviewing the full texts in the logistics service lifecycle management area. The period of papers from 2010 to 2023 is presented in Figure 1. Paper publications from 2010 to 2023 fluctuated, peaking in 2022. In 2023, 33 papers were published. The results of the papers published over ten years show the increasing trend of the study area of lifecycle management by implementing Industry 4.0 or Smart Logistics.

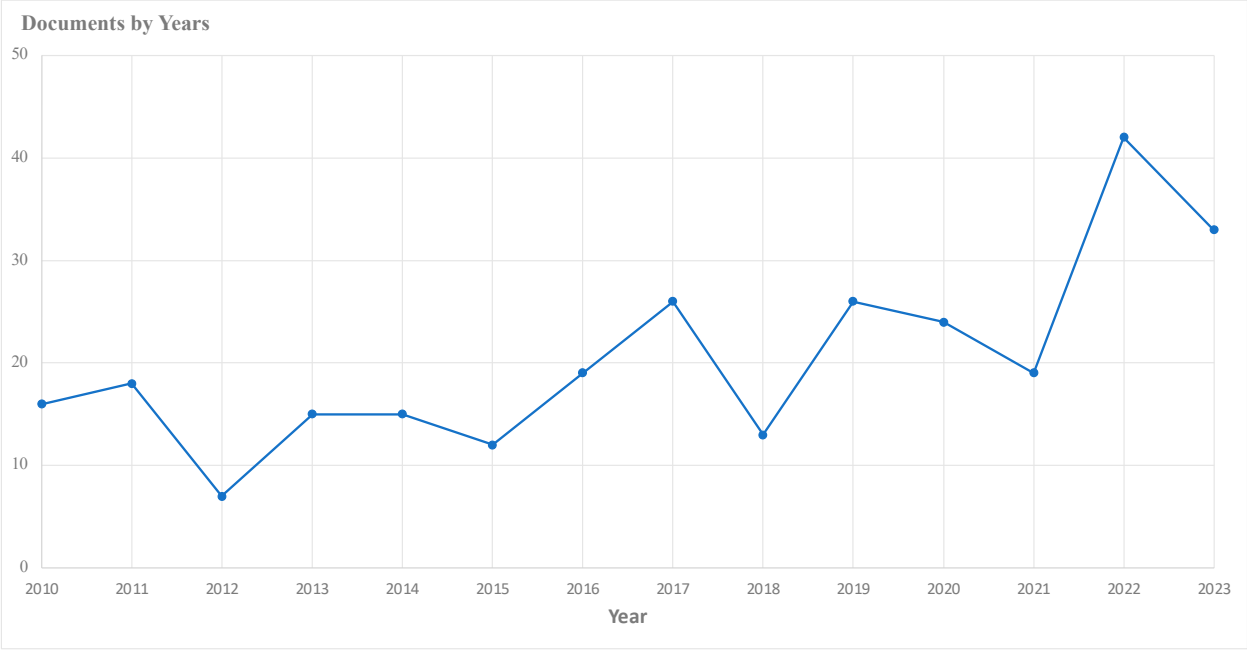

Figure 1. Number of papers published in Scopus from 2010 to 2024.

Table 3 presents summaries of the sources of the identified studies; the documents are widespread between journals, conference papers, and book series. Most contributing papers were found in IFIP Advances in Information and Communication Technology, Procedia CIRP, Sustainability, International Journal of Product Lifecycle Management, International Journal of Production Research, Journal of Cleaner Production, Business Strategy and The Environment, IEEE Access, International Journal of Advanced Manufacturing Technology, and Computer Integrated Manufacturing Systems CIMS Journal. The others were published in conferences and books.

Table 3. Main sources of the identified literature.

Source	Documents	Type of Document
IFIP Advances in Information and Communication Technology	16	Book Series
Procedia CIRP	14	Conferences
Sustainability	12	Journals
International Journal of Product Lifecycle Management	7	Journals
International Journal of Production Research	6	Journals
Journal Of Cleaner Production	6	Journals
Business Strategy and The Environment	4	Journals
IEEE Access	4	Journals
International Journal of Advanced Manufacturing Technology	4	Journals
Computer Integrated Manufacturing Systems CIMS	4	Journals

Figure 2 shows the details of the document types. The countries publishing the most papers were China (44 papers), the European Union (72 papers), the United States (29 papers), and the United Kingdom (25 papers). The most common forms of literature were articles (43.0%) followed by conference papers (37.0%), conference reviews (10.0%), reviews (5.0%), book chapters (3.0%) and books (2.0%).

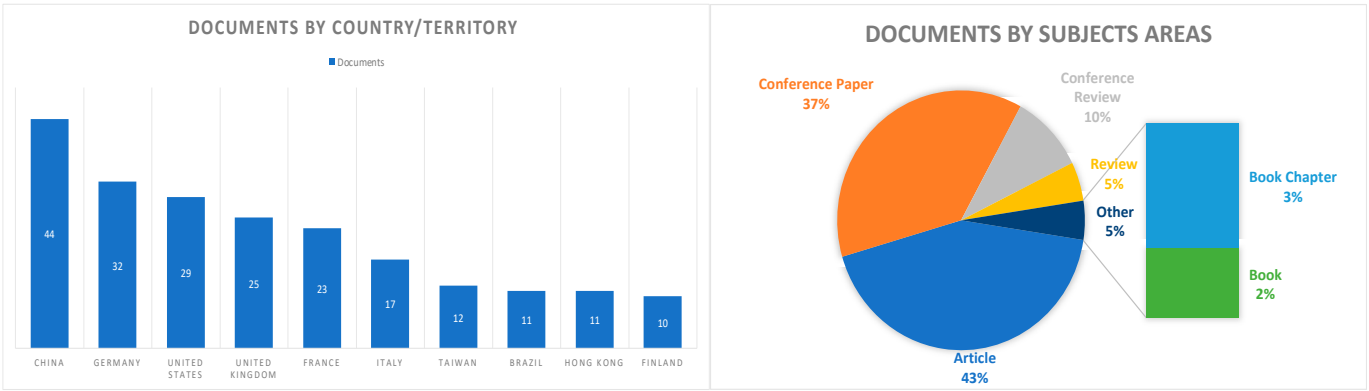

Figure 2. The details of the identified literature by country/territory and subject areas.

The distribution of the 288 documents is presented in the methodological procedures, case study, review, model studies, and management model. As the data show the importance of lifecycle management, PSS and PLM will be connected, and a new concept will be created to implement LSP, 3PL, and logistics operators linked in smart logistics. The next step presents the analysis identification of high appropriateness in 81 documents. The ideas and concepts of the logistics lifecycle adopted in Logistics 4.0 or Smart Logistics can be grouped from the identification. Logistics operations are needed to improve efficiency and cost, connecting the whole lifecycle of logistics products and services. Lifecycle cost control is adapted in manufacturing and supply chains to serve this. Service Level Agreement (SLA), product service systems, and product lifecycle management are the main points for improvement in the industry. Primarily in the manufacturing sector, a multitude of companies have implemented smart technologies to improve logistics operations, which

include digital twins, machine learning, deep learning, cloud computing, and blockchain technology. Efficient logistics operations are crucial for improving quality and flexibility and reducing cost and time. Subsequently, a new Logistics Service Provider Lifecycle Model (LSLM) will be created to improve logistics service operations.

4. Concept of Logistic Service Provider Lifecycle Model (LSLM)

For the definition of LSLM, we will describe the stages, criteria, and sub-criteria. Lifecycle Management is not only a concept for accomplishing customer satisfaction, but also for maintaining the creation, design, production, and decomposition of products and services in companies. PSS, SLM, and PLM are concerned with activities of the whole lifecycle to attain customer acceptance, for instance, quick responses to customers, quick delivery, after-sale service, maintenance, reuse, and recycling. LSLM covers the whole concept of lifecycle management, which associates all stages with improving performance efficiency and services. The LSP Lifecycle Model (LSLM) consists of three phases, eight criteria, and seventeen sub-criteria for customer satisfaction, as shown in Figure 3.

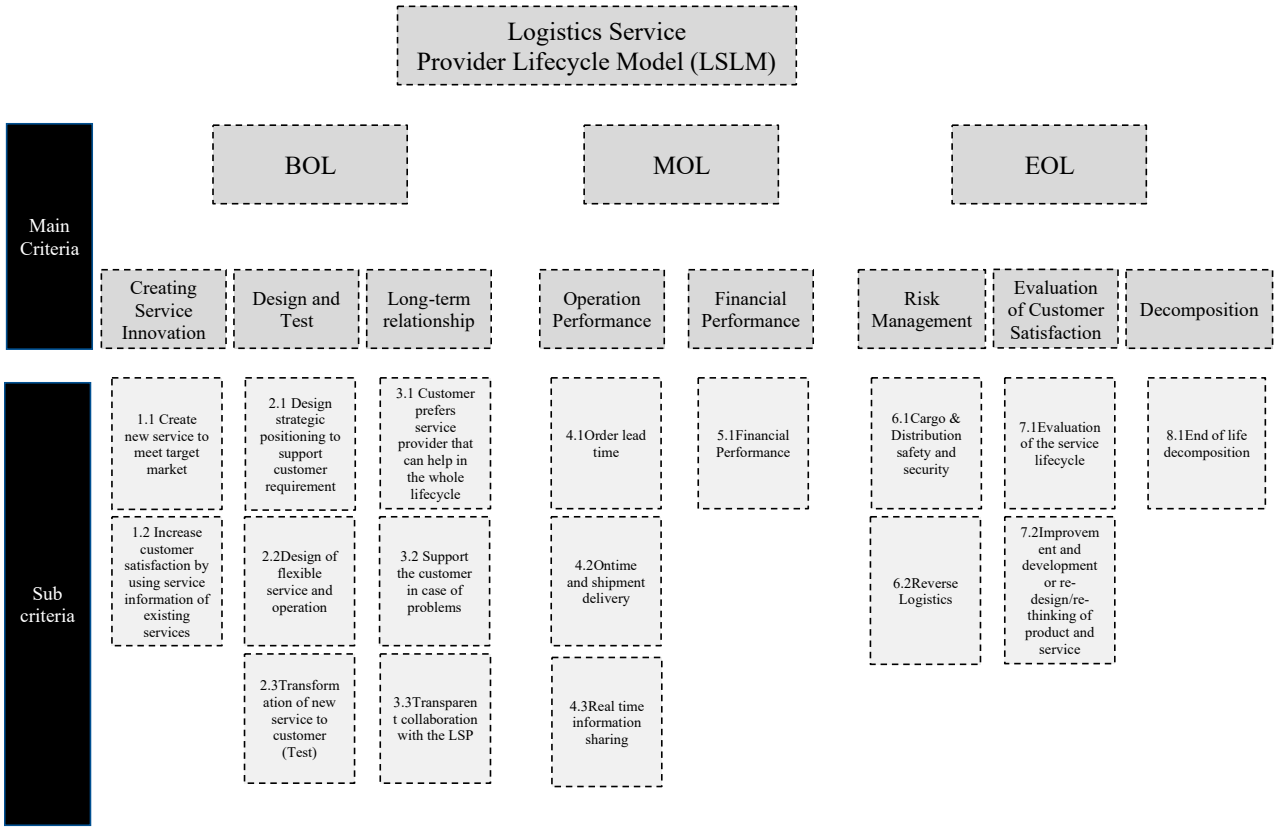

Figure 3. The LSLM criteria and sub-criteria.

Figure 3 shows the LSP Lifecycle Model, which consists of three main phases, namely the Beginning of Life (BOL), the Middle of Life (MOL), and the End of Life (EOL). The LSP Lifecycle Model focuses on both, physical flows (material flows) and information flows throughout every phase of LSLM. BOL focuses on creating service innovation, design and testing and long-term relationships. MOL emphasizes operational performance and financial performance. EOL prioritizes risk management, evaluation of customer satisfaction and decomposition.

4.1. The Beginning of Life (BOL) Phase

The beginning of life or BOL is the first phase in the LSP Lifecycle Model (LSLM) and the first stage of the management of resources to create and develop strategies for service

innovation to encourage customer requirements [49,50]. New products and services will be created from this phase, which concerns the opportunity to produce products such as policy, demand forecasting, value, cost, and customer perspective [51]. The BOL phase is a highly attractive phase to improve logistics operations [52], increase the customer market, and quickly respond to customer needs [53]. The BOL phase uses feedback from customer request data, customer use data, and customer satisfaction data for implementation in the BOL phase.

4.1.1. Creating Innovation Service

The first criteria at the beginning of life are research and idea creation, to summarize and analyze possibilities to improve or launch new products or services. Research and ideas have three sub-criteria, consisting of creating innovation, identifying customer requirements, and improving new services.

Sub-Criteria of Creating New Service to Meet Target Market

Creating innovation needs sufficient criteria to generate new ideas to create and develop products and services [25,54,55]. Servitization entails offering customer requirements that support all activities in logistics operations and will be connected through customer loyalty and trust [53,56–58]. IoT and data analytics are improvement criteria to internally assist with company achievement (e.g., transport operation, fleet management, warehouse management, operation cost, procurement, distribution, customer service, and IT Tools) [59–61] and external criteria (e.g., customer trend, logistics literature, and supply chain relationships) [52,62]. Data analytics have been successfully collected to summarize marketing trends [3] to optimize the opportunity for creating or improving products or services, namely, cost, facility, marketing trends, value, IT infrastructure, policy, and environment [51,60].

Sub-Criteria of Increasing Customer Satisfaction by Using Service Information of Existing Services

Identifying customer requirements is a connecting step from creating innovation to checking and confirming the idea or service innovation that has an opportunity to produce a new product or service [50,56,63,64] and increase value to create customer loyalty to a brand [65]. Customer requirement data are simulated customer information data that can enable companies to support customer needs, such as demand forecasting, marketing trends, marketing information, and cost-effectiveness [62,66,67]. Historical data, maintenance data, and complaint data can be used to classify a client's needs [68]. Idea evaluation and forecasting demand critical thinking to predict marketing demand or trends in supporting the project manager or R&D team to authorize new services [69,70].

4.1.2. Design and Test

These factors can be specifications for the success or failure of products or services to afford customer targets. Finally, the lifecycle management, design, and test phases show the strategies, activities, and operations for producing innovative products or services. Design and testing have three sub-criteria to offer customer demand: strategic design positioning, flexible design services, and the operation, development, and testing of new services.

Sub-Criteria of Design Strategic Positioning to Support Customer Requirements

This sub-criteria phase of strategic design positioning emphasizes innovation services relying on customer needs from the sub-criteria phase of identifying customer requirements and improving new services [25,71]. The data analysis and evaluation of new services influence R&D, and the development and operation team choose the appropriate way to conduct a new service innovation to fulfil customer satisfaction [49,63,72,73]. This phase applies sale logistics research, marketing trend customer requirements, and after-sales history from client complaints and suggestions about old products to execute new innovative products

and services [51,65,67]. PSS, PLM, and SLM only concern products or services and maintain the lifecycle of innovative products and services [50,64,74,75]. PSS will be maintained in creatively designing products and services to find the best way to support customer needs [8,25,76–78]. PLM is adopted and implemented for evaluation throughout the whole lifecycle of logistics services for responding to customer satisfaction [79,80]. Many methodologies will be evaluated and classified to create and develop new services and products, namely, QFD, TRIZ, GA, ANN, modeling techniques, MCDM techniques, and fuzzy techniques [58,67,74,81]. Design techniques usually transform qualitative to quantitative [82]. Logistics services have a complexity of operations and supply chains, with a variety of services to execute customer requirements, for example, transportation, warehouse and distribution, shipping, and online delivery [3,83,84]. Accordingly, methodologies to classify customer requirements will be suitable for logistics services.

Sub-Criteria of Design of Flexible Service and Operation

The concepts of design are the creation and fulfillment of customer needs and satisfaction by considering input and output resources in the logistics and supply chain [26,60,67]. Strategic positioning will enable cost reduction, logistics performance, IT monitoring, virtual technology, and value creation to increase the value of products and services [52,83]. Industry 4.0 has become a strategy and tactic to offer customer satisfaction in logistics services [28,71,79,85]. Industry 4.0 has adopted a crucial infrastructure to control and implement the logistics process and customer fulfilment [8,71,85–87]. ERP, IoT, and IoS are used to operate and implement from along the supply chain to the customer [77,88] to obtain customer respect [55,85,89]. Information technology will be included in physical and information technology in the logistics supply chain [80] to control and manage logistics activities, for example, RFID, GPS, ERP, and digital image processing [31,59].

Sub-Criteria of Transformation of New Service to Customer (Test)

These sub-criteria entail transparent activities for a new product to check and confirm the risk and opportunity for launch through producing the new product or service in the market [8]. Simulation of virtual realities is utilized in this phase to transform the product or service design, which ultimately offers customer satisfaction and finds the risk of gaps in the logistics operation [21,90]. Internal and external logistics activities include simulation to present the actual situation [91]. The test phase has validity and is evaluated to confirm readiness for distribution to customers [25,56,72].

4.1.3. Long-Term Relationship

A long-term relationship fulfils strategy and tactics in the logistics function to cover customer requests that progress sustainable LSP companies in the marketplace [89], addressing customer satisfaction by logistics companies [8,92]. Relation criteria are focused on reliance on clients to develop consideration and brand loyalty [54,93]. Legal and government contracts lead suppliers and buyers into long-term relationships [76,92].

Sub-Criteria of Customer Preference for Service Providers in the Whole Lifecycle

Fulfilling customer responses has a substantial value creation to sustain companies in creating long-term horizontal relationships to support customer fulfilment, and has three parts, namely, strategy, tactics, and operations, which ultimately result in customer satisfaction [94]. PSS can be improved by a flexible service or a quick response, a crucial key success factor for LSPs to expedite customer needs [73,95]. Customer satisfaction has been accomplished in supply chain activities (after-sale service and maintaining service maintenance) by using a Digital Supply Chain Network (DSN), Internet of Things (IoT), and E-Supply chain [76]. Moreover, service providers' logistics performance and excellent service skills play crucial roles in responding to customer needs [96]. Real-time data information, autonomous responses, information sharing, and responses to social networks,

e.g., GPS, RFID, censorship, cloud computing, and artificial intelligence, are effective tools to tackle customer needs [26,28,34,55,85,97,98].

Sub-Criteria of Supporting the Customer in Case of a Problem

Customer satisfaction is an emphasis criterion in logistics services to satisfy the customer. Professional customer service is concerned with LSPs maintaining long-term relationships in the global market to generate trust and loyalty [26,54,91]. Short-term relationships will be formed by quickly responding to a customer who is concerned with comparing the lowest cost [26]. By auto-responding, the E-Supply chain is quick to respond to customer demand [31,53]. Commitment is meaningfully concentrated in a service market to establish customer trust and loyalty [8,94]. A balance needs to be achieved between logistics costs and logistics performance [8,26,96].

Sub-Criteria of Transparent Collaboration with the LSP

In global market economies, supply chain collaboration is a necessary success factor to improve customer trust and commitment [99]. LSPs are a crucial part of supply chain management to add value to supply chain collaborations. Transparent collaboration with LSPs has a high potential to fulfil customer satisfaction to maintain efficiency and effectiveness for long-term relationships throughout the supply chain [74,100]. Levels of supply chain collaboration can be separated into three parts, basic, developing, and advanced, which conclude an excellent relationship between buyer and supplier for contact [100]. Supply chain collaboration involves sharing compelling information and needs to analyze data information, customer suggestion data, value performance, release cost effect data, risk information, and customer satisfaction data [26,31,97,101]. Also, inter-information sharing is an integral part of sharing information through supply chains [102], using intra-information data to acknowledge skill learning experience, joint performance [80], and long contracts. Efficiency should be improved to operate supply chain information skills to manage each operational performance [66], such as forecasting production planning, reducing the bullwhip effect in inventory, and managing route transfer transportation.

4.2. The Middle of Life (MOL) Phase

MOL is generally called "the phase of manufacture." This is part of the efficient operation and management of daily life in logistics operations. In the central relation to logistics, the performance consists of time, cost, and reliability. The middle-of-life phase is in two parts, namely, operational performance and financial performance. Operational and financial performance are vital factors that require extensive knowledge to enable a company to thrive.

4.2.1. Operation Performance

Operational performance is the leading part of logistics operations to lead to growth or decline in customer satisfaction to be globally competitive. Artificial intelligence, CPS, and autonomous manufacturing enable effective operational performance. This factor consists of three time aspects, namely, order lead time, on-time shipment delivery, and real-time information sharing. Time is a quantitative performance in which companies need to enhance their efficiency, reducing time and cost in the supply chain [103]. Reducing time is an excellent point to use in lean methodology to reduce NPV in the activities along the supply chain.

Sub-Criteria of Order Lead Time

Order lead time in logistics operations can be separated into two parts, the period of the order confirmation from sales acceptance, order confirmation by sales, and sending the product or service to the customer [68]. The order lead time is an intermediate criterion that relates to the improvement of the process, where time can have a direct impact on performance. An improved order lead time confirms the order and reduces planning

along the supply chain to analyze the stock of products sent directly to the customer [26]. Cooperation in the supply chain immensely impacts investigating the demand for products. Order lead time is a complexity of logistics operations that involve transport and warehouse management [76,104], analyze the forecasting and planning of products in manufacturing, and manage information sharing through the same conditions along the supply chain [105]. Therefore, reducing cost and improving efficiency are the first strategies for companies to improve by reducing order lead time, thereby improving customer expectations.

Sub-Criteria of On-Time Shipment Delivery

On-time shipment delivery is the central part of logistics operations to deliver products and services to serve clients [68]. Blockchain will pick up logistics performance to manage it throughout the supply chain [106]. Real-time information can be adopted in blockchain technology to increase the efficiency of traceability, in part to increase customer satisfaction. On-time delivery is about improving fleet management and reducing inventory and cost for implementation along the supply chain [107,108]. The capability of fleet management is relative to confirming the lead time for delivery to the customer, and information sharing can solve the problem of analyzing the actual demand from suppliers and buyer [104,106,109]. OTD is a frequency factor of selection to measure logistics performance and select LSPs to work together in the supply chain [76,78]. The LSP Lifecycle Model emphasizes customer satisfaction in logistics services to reply to customer requirements first.

Sub-Criteria of Real-Time Information Sharing

Real-time information sharing has been performed to operate and manage the activities of logistics services [3,26]. Improving lead times on-time delivery, reducing cost, and fulfilling customer satisfaction afford a client trust that the activities along the supply chain can satisfy their customer requirements [30,110,111]. Infrastructure will be important to implement information sharing such as ERP systems, RFID, cloud technology, blockchain, and GPS [85,105,106]. The linkage interaction in the supply chain with information sharing increases customer conviction and obligation (trust and commitment). Tambo and Zhang demonstrated that three aspects of information sharing are significant for improving efficiency in the supply chain [26,55]. In high-level management in companies, information sharing, tracking and traceability, real-time automation, monitoring, cloud technology, and big data have been used through implementing logistics operation management, which is relevant in the vertical and horizontal management of strategies, tactics, and operations [26,84,110]. Hence, the effect of information sharing is a phenomenon to satisfy customers to sustain their alignment; high investment in infrastructure to fulfil customers is a gap of a break-even point between cost and reliability [76,112].

4.2.2. Financial Performance

For more than two decades, financial performance has been an effective strategy to improve the effectiveness and efficiency of logistics service companies [3,109]. Reducing costs and improving logistics performance efficiency are success factors in enabling companies to sustain their economy in a highly competitive market [6,110,113]. The level of financial performance will recompense the complexity of logistics operations in their supply chain by PSS and PLM [75,76]. A high financial performance reduces cost, high revenue, and the permeation of effectiveness and efficiency [3]. Therefore, financial performance improves logistics performance and reduces cost; investments into reducing cost can be analyzed to check the feasibility of the investment throughout the supply chain, such as rate of return (ROR), Activities-Based costing (ABC), Return of Investment (ROI), and Return of Asset (ROA).

4.3. The End of Life (EOL) Phase

The EOL phase evaluates products or services to understand the situation and determine the competitive market's proper direction [114,115]. A summary of historical data

and customer complaint suggestions will be applied at the beginning of the life stage. The whole LSP lifecycle collaborates in each stage to offer the LSPs' clients improvements to improve their logistics operations. Analyses of feedback on customer requirements and customer satisfaction provide information from the middle-of-life stage, and evaluation of operation/activities from the end-of-life stage is applied to the beginning of life stage to re-design and form strategies in the new lifecycle [17]. Finally, the EOL will transform customer requirements into a KPI set to measure logistics performance.

4.3.1. Risk Management

In logistics performance, the total coverage to satisfy customer acceptance involves risk management. Sustainability in the new revolution is needed to innovate new services to support customer response. Trust and commitment are significant to guarantee sales volume competitiveness in markets. Risk management is necessary for logistics operations in the supply chain and increases sustainability to create customer satisfaction [95]. Strategic companies will implement risk management to find how to operate in bad situations that are obstacles to a company, such as competitive markets, operational risks, human risks, and disasters [97,107]. Disruption risk is a significant risk to success or failure in the economy; a disruption crisis will reduce size and cause collapse [73,115]. The LSP lifecycle model will consider two factors, cargo and distribution safety, and security and warranty return.

Sub-Criteria of Cargo and Distribution Safety and Security

Logistics operations are concerned with improving the effectiveness of cargo and distribution. The central part of the logistics operation consists of warehouse, transportation, and IT support [107]. The risks of transportation and warehouse can be separated in the supply chain and consist of two main types, intra-organization and inter-organization. Intra-organization shows the process activities that can happen in a company, such as employee resourcing, policy and rules, information systems, and operational logistics. Inter-organization has two parts, supply chain collaboration and environmental aspects, such as law and policy from the government, financial performance in the supply chain, IT system, and natural disasters. Cargo and distribution show the risk of raising the price when these situations happen, such as car accidents, lack of information about delivery, lack of storage data, employee strikes, shortage of storage and workers, delay in payment, and calamity of nature [97]. The risk of cargo and transportation can be checked from a percentage of higher revenue, or many processes can be used, such as raw material and finishing proper storage, information technology in transporting and warehousing, and lack of spare parts for trucks and containers [107].

Sub-Criteria of Reverse Logistics

In the 2000s, reverse logistics were utilized as part of logistics operations. Companies must serve their customers [17]. Reverse logistics are represented at the end-of-life stage (after-sales service) [116]. After-sales service is essential to respond to customers needing to exchange a product [117]. Warranty claims are widespread in every company, supporting after-sales service to maintain customer satisfaction [17,71]. Reverse logistics are adapted to develop the problem of logistics operation from a client to receive the right product at the right time by the right person [118]. E-commerce has been booming worldwide in every economy, with a market margin of more than USD 1 trillion. In the fourth revolution (Industry 4.0), reverse logistics have been substantial in e-commerce to induce customer acceptance to buy products or services when online shopping. Rules and policies in every online shop are guaranteed by government policy. Quality and an extended lead time of reverse logistics can be acceptable to achieve customer satisfaction, which will enable trust and loyalty to a company.

4.3.2. Evaluation of Customer Satisfaction

The evaluation of customer satisfaction is very important for the logistics lifecycle in a new market economy [105]. First, sales trends are modified to analyze market trend strategies as to whether customer targets can be maintained or not. In addition, while sales trends can predict sales forecasts and demand marketing, they cannot know customer satisfaction or respond to customer needs [68,77]. Then, the evaluation is reviewed to offer service requirements to improve customer acceptance. Therefore, the factor of evaluation of the service lifecycle reviews the service lifecycle and another lifecycle management model such as product lifecycle management, product–service system, and close-loop management [15,101,119].

Sub-Criteria of Evaluation of the Service Lifecycle

The evaluation of the service lifecycle is an excellent factor for improving and satisfying customers to maintain customer trust and loyalty to a company [73,82]. Service applies through every stage in logistics operations, such as an idea, design, logistics operation, cross-docking, warehouse management, maintenance, and disposal [73,82]. Full service in all lifecycles is a substantial factor in logistics management. Lifecycle management has four separate parts, namely, introduction, growth, maturity, and decline state [21,22,120].

Sub-Criteria of Improvement and Development or Re-Design/Re-Thinking of Product and Service

Re-design and re-thinking are adapted to respond to customer requirements in this situation to rapidly change and extend products and services throughout a new lifecycle [68]. The evaluation criterion is a factor to improve or develop a product and service to re-design logistics lifecycle management [86]. Product Service Systems and Product Lifecycle Management effectively improve manufacturer operations to implement a closed-loop lifecycle and satisfy customer requirements [17,67]. Thus, improving information technology is increasing for supporting logistics operations in the supply chain, and maintaining customer responses [30,75,76]. A cloud system is adopted to implement the efficiency of logistics operations, which reduces cost, provides faster sharing of tangible/intangible information, and improves customer trust and loyalty in the e-commerce economy [26].

4.3.3. End-of-Life Decomposition

The strategy and tactics of end-of-life decomposition are to justify and support the decline stage in the product and service lifecycle [117]. This stage will be to check and operate products, and linkage to other products can be used. Reuse, reduce, and recycle is a concept to manage the decline stage of the product lifecycle and product–service system [15]. Reverse logistics can adopt an end-of-life decomposition for managing physical flow [20]. The product's historical data and decomposition plan are vital to activate the declining service and product to eliminate the end-of-life stage.

5. Discussion and Future Work

This review originated from logistics service characteristics, such as logistics service provider, logistics operation, smart logistics operation, and the concept of lifecycle management, namely, PLM, PSS, and SLM. SLR is a research methodology to gather and analyze secondary databases to answer the objective of searching in Scopus, which is a limitation of the literature review. Moreover, the author evaluated the journals, conference papers, and books as having a low, medium, or high impact. From 288 documents in total, 81 documents had a high impact. Smart Logistics or Logistics 4.0 are applied in the model for quick responses and agility in logistics services. The eight steps of LSLM are generated to cover fulfilling not only customers but also operating the efficiency of logistics performance in LSPs. LSLM is characterized by three phases, eight criteria, and seventeen sub-criteria. The criterion of the BOL and EOL phases can be applied by disruptive economics to challenge global logistics companies.

The BOL phase, which involves creating innovation, design, and testing, is connected to the state of evaluation and re-design criteria in the EOL phase, which includes improving the effectiveness of logistics operations and increasing the added value for their customers. Regarding the whole LSP lifecycle phases, these need to be coordinated to realize LSPs' client enhancements. Although LSLM covers all levels of party logistics for the main activities, some limitations exist. A lack of logistics activities can be found in LSLM; the suggestion of LSLM is to create separate models for small, medium, and large logistics companies. LSLM can be adapted for each logistics service, for example, LSLM-Small LSP, LSLM-Medium LSP, and Large LSLM LSP. Also, the LSLM can be combined with sustainability, which concerns three parts, namely, social, economic, and environmental, to fulfil the environmental trends of customer requirements. The economic factor can be identified and used to evaluate logistics services, showing the success or failure of a logistics company. Estimating economics will help the company understand market trends, specifying the logistics service lifecycle management strategy. Economic factors, which consist of the MOL and the EOL phases, are implemented into the risk management criteria and evaluation of the whole lifecycle criteria to manage the fundamental economic markets concerning the innovation of logistics services. Economic trends can estimate the scope of investment to invest appropriately in new or re-designed logistics services.

Lastly, future research will include other databases to increase several impact factors in each LSLM stage. LSLM will identify the level of LSP, which involves five levels, 1PL, 2PL, 3PL, 4PL, and 6PL of LSP, and select the tools, machines, or applications to improve each stage to move to the next stage. Overall, it can increase the operations and services in the whole stage of the LSP lifecycle of each service and product, which can help LSP companies to sustain in the logistics industry.

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