

ADVANCED TECHNOLOGIES IN IMPROVING THE MANAGEMENT OF LOGISTICS SERVICES: BIBLIOMETRIC NETWORK ANALYSIS

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Abstract: This paper provides a systematic review of the role of Information and Communication Technologies (ICT) in logistics services to analyze managerial implications for improving the logistics service quality. The literature review has been performed using two academic databases Scopus and Web of Science and spans the years 2008–2019. Bibliometric network analysis were used to highlight research areas for the study of current technologies in the logistics service industry. The paper highlights the classification of the information and communications technologies in the logistics service industry, new trends in logistics service in terms of Industry 4.0 and the impact of current technologies on management of logistics service quality.

Key words: management, logistics service quality, information and communications technologies, Industry 4.0, supply chain management

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Introduction

The rapid growth of the transport and logistics market, the formation of global supply chains, the increase in the volume of individual Internet orders and other factors have influenced the development of a service-oriented paradigm in logistics. Although quality management became popular in the 80's and 90's, 21st century enterprises in the era of Industry 4.0 are still struggling with the concept (Gunasekaran et al., 2019). Improving the management of logistics service is one of the primary tasks for logistics providers in supply chain (Vivaldini et al., 2012). In this case, Information and Communication Technologies (ICT) play a significant role in management of logistics processes (Lv et al., 2018).

Initial studies of ICT in management of logistics considered it how the use of technology influences on customer satisfaction and loyalty in the context of the provision of logistics services (Saura et al., 2008), the role of technology providers in the adoption process (Perego et al., 2011). Over time, the development of

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technological solutions for logistics, the authors investigated the role of certain technologies in supply chain management (Asdecker and Felch, 2018; Svazas et al., 2019; Pakurár et al., 2019; Kot et al., 2018). The last two years have seen a huge growth in the study of digitalization processes in business (Barinova et al., 2020; Ziyadin et al., 2018; Bilan et al., 2019; Bilan et al., 2019) and logistics industry (Philipp et al., 2020).

Management of logistics service quality is recognized as an important tool in modern markets (Andrejić, 2019). In this line of digital evolution, highlighting the research gaps of advanced technologies in improving management quality in logistics service is an important area for study. First of all, there is a need to analyse and classify the whole set of current ICT used in the management and provision of logistics services (first gap). The study of role of the information and communications technologies in logistics service quality has shown the need to analyse further the impact of the information and communications technologies on logistics service quality management, considering the whole set of performance parameters not analysed in the literature (second gap). Digitalization of logistics processes has highlighted the necessity to clarify new trends in providing logistics services in terms of Industry 4.0 (third gap). Given this study gaps, the paper aims to provide a comprehensive and updated overview of the topic of information and communication technologies in logistics and highlight the managerial implications for improving logistics service quality taking into account digitalization in terms of Industry 4.0.

Literature review

Technology in logistics is a mean of increasing the competitiveness and productivity of the supply chain management, therefore, choosing the right technology for various logistics operations is very important in order to gain a competitive advantage in today's competitive market (Bhandari, 2013). In this case, the digitalization of management of logistics processes is generating considerable interest in terms of Industry 4.0. Previous work has focused on the impact of digitalization in logistics management, implication of advanced digital technology applications in resource planning, warehouse management systems, transportation management systems, intelligent transportation systems and information security. (Grabara et al., 2014; Barreto et al., 2017; Kayikci, 2018; Oleskow-szlapka and Stachowiak, 2019)

The widespread use of new technologies in the provision of services has a significant impact on improving the quality of logistics services management. The results of empirical research show that logistics companies can be grouped according to the level of introduction and use of information technology and their perceptions on the level of service quality provided by the supplier (Saura et al., 2008; Servera-francés, 2010; Onaltayev et al., 2019). In this regard, the authors, while assessing the quality of the logistics service, pay special attention to the use

of advanced technologies in customer service availability of order information, shipment tracing capability (Thai, 2016; Moldabekova et al., 2020).

The issues of quality management practices in logistics services were investigated in previous studies. The most important component that identified quality in logistics was on-time delivery (Rahman, 2008). The proper functioning of the supply chain requires the presence of a quality capable of ensuring efficient transmission of information from upstream to downstream and vice versa (Benaissa et al., 2010). It clarifies that fundamental traditional Total Quality Management (TQM) principles must be a precursor to effectively utilise ICT as an enabler in delivering excellent business outcomes (Lobo et al., 2019). Understanding supply chain management and quality management frameworks with their characteristics can help managers improve implementation success and returns (Vanichchinchai, 2019).

Aiming to systematize the scientific literature on the study of ICT in logistics, the following parameters were investigated in the review papers: ICT for logistics and freight transportation (Perego et al., 2011), use of information technology in logistics and supply chain management to achieve a competitive advantage based on the linkages between 'adaption', 'alignment', 'agility' (Choy et al., 2014); Internet of things in supply chain management (Ben-daya et al., 2017); using data analytics on decision-making in cold chain logistics (Chaudhuri et al., 2018); applicability of lean and green concepts in Logistics 4.0 (Edirisuriya et al., 2018), Industry 4.0 and construction supply chains (Dallasega et al., 2018); technology transfer in the supply chain oriented to industry 4.0 (Luiz et al., 2018).

An analysis of previous works shows that in the study of ICT in logistics, the authors mainly focused on technological solutions in the formation of the supply chain. In the present work, the authors highlight the role of ICT in improving the quality of logistics services management; this approach distinguishes the research work from other studies.

The literature review has made it possible to outline the following research questions to be investigated:

RQ1: What modern information and communication technologies are widely used in the improvement of the management of services quality in the logistics industry?

RQ2: What challenges exist in the provision of logistics services in the conditions of Industry 4.0 and how to modernize the management of logistic services taking into account digitalization, big data, the Internet of things, etc.?

RQ3: What is the impact of the information and communications technologies on dimensions of logistics service quality management (e.g. time dimensions, dimension relates to operation and processes and other)?

These three research questions identify some possible managerial implications for improving the logistics service quality within the information and communications technologies.

Methodology

A systematic review approach is used for comprehensive analysis of scientific literature using quantitative and qualitative methods (Centobelli et al., 2017). The literature search was conducted using two databases – Scopus and Web of Science (WoS), covering the period from 2008 to 2019. The initial search string included the following keywords: "information and communication technologies (ICT)", "industry 4.0" and "logistics service quality", "logistics service".

The material search was conducted including the following subject areas: Business, Management and Accounting, Decision Sciences, Engineering, Environmental Science, and Social Sciences. While WoS extracted 350 documents, Scopus showed 1004 documents. The next step aims to provide an overview of the papers dealing with the issue of the information and communications technologies in logistics service quality. To achieve this aim, bibliometric network analysis were used. Bibliometric network consists of nodes and edges. The nodes can be for instance publications, journals, researchers, or keywords (Van Eck and Waltman, 2014). Furthermore, the papers with abstracts that were not devoted to information and communication technologies and the quality of logistics services were excluded. During the analysis of cited references in selected papers, we found 33 additional papers that have not been identified in keywords search. Since they are relevant to the topic and focus on the information and communications technologies in logistics service quality, we included them in the data set. Finally, we provided content analysis to outline a detailed picture of the issues covered by the literature on informational technologies in the logistics service quality and underline managerial implications for improving logistics service quality.

Results and Discussion

Research growth

As can be seen from the graph below (Figure 1), there is a noticeable increase in research publications in this area over the period. There has been a slow growth from 2008 to 2017 in both databases. The sharp increase of research interest on this topic since 2018 is associated with the Fourth Industrial Revolution – Industry 4.0.

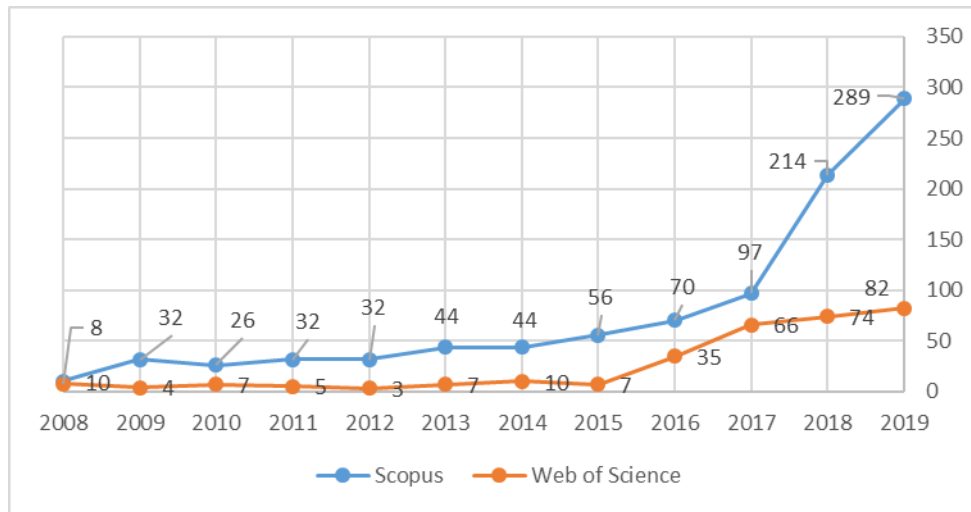


Figure 1: Total number of publications by ICT and logistics service quality
 Source: Compiled by the authors based on sources: <https://www.webofknowledge.com/>;
<https://www.scopus.com>

Topmost keywords in WoS and Scopus

Highlighting related keywords in databases gives a detailed study of the topic, revealing their research context, also helps to identify significant aspects. As we can see from the Figure 2, the literature database according to WoS identifies two significant areas: logistics and Industry 4.0. As this is clearly reflected in the network diagram, logistics is more related to keywords: management, supply chain management, impact, performance, adoption, implementation information and communication technologies, business and perspective. At the same time, the keywords that reveal the concept of Industry 4.0, which includes Internet of things (IoT), RFID, cloud manufacturing, smart factory, cloud computing, cyber-physical systems, and logistics 4.0. Additionally, other research keywords are highlighted between the keywords logistics and Industry 4.0 such as sustainability, future, digitalization, big data analytics, operation systems, networks, model, industry, transport, optimization, value chain, reserve logistics, drivers, etc.

management	38	178	internet of things	89	658
internet	31	151	decision making	73	544
supply chain management	25	141	supply chains	59	477
future	20	128	cyber physical system	59	477
systems	25	117	supply chain management	67	416
internet of things	31	116	sustainable development	45	376
big data	16	107	big data	43	321
supply chain	24	100	competition	32	276

Source: Authors' elaboration

The content analysis of selected articles makes it possible to single out the main new technologies in logistics in the conditions of Industry 4.0 and their aspects of influence in managing of logistics service are presented in the Table 2.

Table 2: The technologies of Industry 4.0 and their impact aspects on providing logistics service

Technologies	Impact aspects in logistics service	Authors
Internet of things, Big Data	Providing operational data on the location and monitoring of the condition of things Supply chain visibility Optimizing logistics processes	(Witkowski, 2017) (Barreto et al., 2017) (Liu et al., 2019)
Blockchain	The digital and flexibly connectivity of products and services Physical supply chain and digital data value chain dimensions	(Hofmann and Rüsçh, 2017)
The omni-channel	Impact on satisfaction and loyalty	(Murfield et al., 2017)
Cloud computing, cyber security	Real-time access to operational information across the supply chain Quicker interactions across the value chain Forecasting the demand Securing customer data, product and supply	(Ardito et al., 2018)
Web3.0 and social networking	Enabling the identification and optimisation of the distribution flow of unladen trucks or cargo ships in a particular location With social network sites could be used in the transport and logistics environment to facilitate instant communications between various stakeholders	(Harris et al., 2015)

Source: Authors' elaboration

The analysis of papers highlights the impact of the information and communications technologies on logistics service on the following main dimensions: competitive advantage in strategic management (Choy et al., 2014; Gunasekaran et al., 2017), operational and financial performance, delivery performance (Ruiz-torres, 2017), service quality, customer satisfaction and customer loyalty services (Evangalista et al., 2012; Servera-francés, 2010).

Managerial implications for improving logistics service quality

The deeply content-analysis show that information and communication technologies in terms of Industry 4.0 have moved to a whole new level – digitalization. Digitalization of logistics processes forms the 4th to 5th generation logistics and introduces new requirements in the management of logistics services. In this regard, in order to improve the quality of the logistics service, it is necessary to introduce new technological solutions into the activities of logical providers. The managerial implications for improving logistics service quality via current technologies are: integrate information systems and quality programs with corporate strategy management of logistics services; appropriate choice of technologies to planning and scheduling of logistics activities; automation the processes and operations (loading/unloading, warehousing, ordering, delivering); development and introduce the omni-chanel logistics; communication with clients using social networks to develop closer links with suppliers; acquire quality management skills through training and education.

To sum up, the appropriately using the information and communication technologies in management logistics improves service quality with improving customer satisfaction and loyalty; gives the competitive advantages in strategic management and develop operational and financial and delivery performances.

Conclusion

This paper proposes a systematic literature review using the bibliometric network and content analysis on the topic of the information and communications technologies (ICT) in improving the management of logistics services. In general, there is an increase in scientific interests in the study of ICT and the quality of logistics services. Especially, taking into account Industry 4.0, this trend is only increasing from year to year. This is evidenced by an increase in the number of published materials on databases like WoS and Scopus. Analysis of the relationships of keywords allows us to conclude that logistics, service, management, ICT, and Industry 4.0 are interrelated areas. This relationship is reflected in the formation of supply chain management, and service-oriented logistics. Also, the application of advanced technology enhances this relationship. The content analysis provides a summary overview of the selected papers. This analysis makes it possible to identify the classification of the information and communications technologies in the

logistics service industry, in which information technologies are categorized according to different criteria (e.g. internal, external, automatic identification, communication, customization); new technological trends in logistics services (Internet of things, Big Data, cloud computing, cyber-security, omni-channel logistics, E-commerce and etc.); the impact of information technologies on competitive advantage, strategic management; financial, operational, delivery performance; service quality; customer satisfaction and loyalty. Managerial implications to improve the quality of logistics services were proposed. The prospect of this study is to conduct empirical studies and collect data on the impact of the use of digital information and communication technologies on improving the management of logistics service quality.

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ZAAWANSOWANE TECHNOLOGIE ULEPSZANIA ZARZĄDZANIA USŁUGAMI LOGISTYCZNYMI: ANALIZA SIECI BIBLIOMETRYCZNEJ

Streszczenie: Niniejszy artykuł zawiera systematyczny przegląd roli technologii informacyjno-komunikacyjnych (ICT) w usługach logistycznych w celu przeanalizowania wpływu zarządzania na poprawę jakości usług logistycznych. Przegląd literatury został przeprowadzony przy użyciu dwóch akademickich baz danych Scopus i Web of Science i

obejmuje lata 2008–2019. Bibliometryczną analizę sieci wykorzystano do podkreślenia obszarów badawczych do badania aktualnych technologii w branży usług logistycznych. W artykule podkreślono klasyfikację technologii informacyjnych i komunikacyjnych w branży usług logistycznych, nowe trendy w usługach logistycznych w zakresie Przemysłu 4.0 oraz wpływ obecnych technologii na zarządzanie jakością usług logistycznych.

Słowa kluczowe: zarządzanie, jakość usług logistycznych, technologie informacyjne i komunikacyjne, Przemysł 4.0, zarządzanie łańcuchem dostaw

改進後勤服務管理的先進技術:文獻計量網絡分析

摘要: 本文對信息和通信技術 (ICT) 在物流服務中的作用進行了系統的綜述, 以分析管理對改善物流服務質量的影響。文獻綜述使用兩個學術數據庫 Scopus 和 Web of Science 進行, 涵蓋了 2008–2019 年。文獻計量網絡分析被用來突出研究領域, 以研究物流服務行業中的當前技術。本文重點介紹了物流服務行業中信息和通信技術的分類, 從工業 4.0 角度看物流服務的新趨勢以及當前技術對物流服務質量管理的影響。

關鍵詞: 管理, 物流服務質量, 信息通信技術, 工業 4.0, 供應鏈管理