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VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

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Abstract

Business-to-Consumer (B2C) e-commerce business has been growing tremendously due to the technological advancements in e-logistics' processes. B2C e-commerce has several benefits, such as saving costs by decreasing the use of resources, increasing profits, and enhancing competitive advantage, especially in the pandemic context, thus creating an opportunity for firms in the B2C e-commerce field. However, such an opportunity comes with challenges, and one is related to a significant number of products that are returned to the vendor or manufacturer. Consequently, reverse e-logistics' (REL) is indispensable for e-commerce transactions. Therefore, modelling REL factors is crucial for e-commerce companies. REL is an inevitable procedure for organisations performing B2C e-commerce. When implemented correctly, REL has proven to have a high significance in terms of decreasing costs, increasing customer satisfaction, and obtaining higher performance efficiencies. However, B2C e-commerce firms, especially in developing countries such as the Middle East, often neglect REL's importance. The lack of scientific knowledge in REL activities is due to the scarcity of studies in the REL field discussing the importance of emphasising specific factors that affect REL performance. Therefore, this dissertation focuses on identifying the most important factors that impact REL performance and discusses how REL can, in turn, affect the company's performance.

The methodology used is a literature review, synthesis, survey methods, multi-criteria assessment (DELPHI), multi-criteria scoring, and structural equation modelling (SEM). This study is done in Lebanon and Syria.

The results showed that out of the ten factors identified during the literature review, eight factors (management, employees, IT, return policy and guarantee, infrastructure, organisational structure and culture, customer satisfaction, and quality management) have a positive correlation with REL performance. The business research model was created based on B2C e-commerce companies involved in REL performance in Lebanon and Syria, and this gives new scientific insights and knowledge about REL's specificity in developing countries.

Reziumė

Elektroninės prekybos modelis „verslas vartotojui“ (B2C) labai išsiplėtė dėl elektroninės logistikos procesų technologinės pažangos. B2C elektroninė prekyba turi keletą pranašumų – taupo sąnaudas mažindama išteklių naudojimo apimtį, didina pelną ir stiprina konkurencinį pranašumą, ypač pandemijos sąlygomis. Todėl B2C elektroninės prekybos įmonėms atsiranda galimybių. Tokios galimybės susijusios su iššūkiais. Vienas jų susijęs su dideliu pardavėjui ar gamintojui grąžinamų prekių skaičiumi, todėl reversinė elektroninė logistika (REL) yra būtinas elektroninės prekybos sandorių aspektas. Elektroninės prekybos įmonėms tampa labai svarbu modeliuoti REL veiksnius. REL yra neišvengiama procedūra B2C elektroninės prekybos įmonių veikloje. Įrodyta, kad tinkamai įgyvendinta REL turi didelę reikšmę mažinant sąnaudas, didinant klientų pasitenkinimą ir užtikrinant geresnius įmonės veiklos rezultatus. Tačiau B2C elektroninės prekybos įmonės, ypač besivystančiose šalyse, pavyzdžiui, Artimuosiuose Rytuose, dažnai neatsižvelgia į REL svarbą. Mokslinių žinių apie REL efektyvumą trūksta todėl, kad REL srityje trūksta tyrimų, kuriais būtų aptarta, kaip svarbu pabrėžti konkrečių veiksnių, turinčių įtakos REL efektyvumui, svarbą. Todėl šiame darbe daugiausia dėmesio skiriama svarbiausiems veiksniams, darantiems įtaką REL efektyvumui, nustatyti ir aptariama, kaip REL gali turėti įtakos įmonės veiklos rezultatams.

Darbe taikyti literatūros apžvalgos, sintezės, apklausos, daugiakriterio vertinimo (DELPHI), daugiakriterio vertinimo balais ir struktūrinių lygčių modelavimo (SEM) metodai. Šis tyrimas atliktas Libane ir Sirijoje.

Rezultatai parodė, kad iš dešimties literatūros apžvalgoje nustatytų veiksnių aštuoni veiksniai (vadovybė, darbuotojai, IT, grąžinimo politika ir garantija, infrastruktūra, organizacinė struktūra ir kultūra, klientų pasitenkinimas ir kokybės valdymas) yra teigiamai susiję su REL efektyvumu. Verslo tyrimo modelis buvo sukurtas remiantis B2C elektroninės prekybos įmonėmis, dalyvaujančiomis REL veikloje Libane ir Sirijoje. Tai suteikia naujų mokslinių įžvalgų ir žinių apie REL specifiką besivystančiose šalyse.

Notations

Abbreviations

APAC – Asia-Pacific;
AVE – average variance extracted;
B2C – business-to-consumer;
CFI – comparative-fit index;
CSR – corporate social responsibility;
DC – distribution centre;
DF – degree of freedom;
EMEA – Europe, Middle East, Africa;
GDP – gross domestic product;
GFI – goodness-of-fit index;
HRM – human resources management;
ICT – information and communications technology;
IT – information technology;
KMO – Kaiser–Meyer–Olkin;
KPI – key performance indicator;
R&D – research and development;
REL – reverse e-logistics;
RLSR – reverse logistics social responsibility;
RL – reverse logistics;

RMSEA – root mean square error of approximation;
ROI – return on investment;
SD – standard deviation;
SEM – structural equation modelling;
SRMR – standardised root mean square residual.

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Introduction

Formulation of the Problem

The presence of well-specialised e-logistics chains added several benefits to B2C e-commerce businesses, such as increased profits due to saving costs through the efficient use of resources and enhanced customer satisfaction (Mahindroo, Samalia & Verma, 2018). Nevertheless, e-logistics is faced with challenges of returned products that necessitated the existence of a new form of e-logistics, which is the reverse e-logistics (REL). The success of e-logistics depends on the presence of effective REL performance; however, currently, gaps in REL performance still exist, especially in developing countries such as the Middle East. This is not just a practical problem, as the lack of a scientific approach and clear methodologies are also observed. Several studies and tools have been performed in developed countries, yet very few have been performed in developing countries such as the Middle East, especially in the REL field. As REL processes seem to be easily defined, they are faced with many obstacles. Many scientists agree that the continuous improvement of REL is a must to ensure increased interaction and, eventually, the survival of the firm (Wu & Lin, 2018).

Currently, companies are trapped in unresolved REL performance problems. Due to very few published studies and articles about REL performance in the Middle East, there is still a lack of scientific knowledge about REL performance peculiarities and a relatively low presence of models for evaluating and improving

REL performance. The problem is that no firm can completely prevent REL from happening, yet REL performance can be significantly improved (Euchi, Bouzidi & Bouzid, 2019). To do so, researchers discussed several factors that might be affecting REL performance. These factors are considered for further analysis in this dissertation. Therefore, filling this research gap would suggest new ways to improve REL performance for B2C e-commerce companies.

Relevance of the Dissertation

B2C e-commerce is growing rapidly at an exponential rate due to its several benefits, such as increasing profits, enhancing customer satisfaction, and reducing costs. In 2016, there were more than 2.5 billion B2C e-commerce consumers in the world, and the number raised to 3.4 billion in 2020 (36% increase from 2016), whereas, in the Asia-Pacific (APAC) alone, 2.15 billion people used e-commerce in 2020, giving it a top position among other regions (Sabanoglu, 2020).

The APAC region, which includes the Middle East, witnessed a significant increase in terms of retail e-commerce. Actually, this region is considered the leader in e-commerce sales. For instance, in 2018, its e-commerce retail sales registered \$ 0.4473 trillion, 15% of the total GREC that year. In 2019, it was \$ 0.6367 trillion, 17% of GREC. In 2020, it was \$ 0.8921 trillion, 21% of GREC. In 2021, it was \$ 1.1986 trillion, 23% of GREC. In 2022, it was \$ 1.429 trillion, 25% of GREC. In 2024 it is expected to reach 27% of GREC.

To benefit from e-commerce, e-logistics must be considered since it is an essential factor in improving e-commerce. E-logistics opened the door widely for the effective implementation of B2C e-commerce. However, the effective implementation of e-logistics can hardly be achieved without effective reverse e-logistics' (REL) performance. The international reverse logistics market registered an amount of about \$ 415.2 billion in 2017, and this is expected to grow exponentially, reaching \$ 603.9 billion by 2025 (Mazareanu, 2021). All these figures highlight the importance of exploiting the opportunity in the APAC region since it is the leading region in e-commerce business. As improving e-commerce is related to e-logistics, and e-logistics is directly correlated to REL, enhancing REL performance is a must.

The Object of Research

The object is reverse e-logistics' factors for e-business in the Middle East.

Aim of the Dissertation

The aim of this dissertation is to form a model for reverse e-logistics' factors for B2C e-business in the Middle East.

Formulation of Tasks of the Dissertation

The tasks are as follows:

1. To analyse studies in the field of B2C e-commerce, supply chain, e-logistics, and reverse e-logistics to investigate REL performance problems and develop a theoretical framework.
2. Identifying key factors for research and constructing a model that suggests solutions for REL performance for B2C e-commerce in the Middle East.
3. To evaluate the most significant factors that impact REL performance for constructing and approving a model that enhances REL performance for B2C e-commerce firms in the Middle East.

Research Methodology

The methodology implemented in the first chapter is the analysis (systematic and comparative) of a scientific literature review to formulate the theoretical framework.

A survey was disseminated to collect data from 412 B2C e-commerce companies faced with reverse e-logistics' problems, followed by structural equation modelling, multi-criteria assessment, and multi-criteria scoring for seven REL experts.

Validity and reliability tests of the constructs were performed using Cronbach's alpha, Kaiser–Meyer–Olkin (KMO) test, Bartlett's test, average variance extracted (AVE) test, correlation matrix, and factor loadings. The analysis of results and hypotheses was performed through the SPSS (Statistical Package for the Social Sciences) version 27 software and AMOS 26.

Scientific Novelty of the Dissertation

The dissertation offers the following theoretical contribution to the existing scientific knowledge:

1. The development of a model with determined factors having a significant correlation with REL performance, thereby contributing to the expanding knowledge of existing models and enriching REL literature by closing scientific gaps on improving REL performance.

2. Contributions to two main management theories, i.e., the resource-based view (Wernerfelt, 1984) and sustainable development (Wcd, 1987), by expanding the current knowledge on resource management and sustainable development through developing a new concept of managing resources and REL performance using the created model.
3. The model was created based on REL performance of B2C e-commerce companies in the electronic industry in Lebanon and Syria, and this gives new scientific value and accurate knowledge about REL's specificity in developing countries.

Practical Value of the Research Findings

The proposed model and yielded results can be used by B2C e-commerce companies operating in developing countries, such as some countries in the Middle East, which still suffer from certain political conflicts and economic instabilities.

The suggested research model emphasises the significance of analysed factors for improving REL performance for firms operating in the B2C e-commerce field, thereby creating opportunities in developing countries facing scarcity of resources, technology, and experience in B2C e-commerce.

From a theoretical point of view, only a few studies have investigated REL in the context of sustainability and the interrelationship. While product disposition is a key REL component, little attention is given to the disposition decisions in REL and their potential impact on sustainability performance. Making an appropriate disposition of decisions leads to extending the product's life and can achieve sustainable development goals.

The Defended Statements

The defended statements are:

1. Eight factors and solutions are most effective and relevant for enhancing REL performance for electronic B2C e-commerce companies operating in the Middle East and facing REL problems, i.e., management, employees, IT, return policy and guarantee, infrastructure, organisational structure and culture, customer satisfaction, and quality management.
2. The proposed REL model contributes to management theories in resource management and sustainable development and the theory of resource-based view (RBV). Therefore, management research can be carried out using the results of this study.
3. Due to highlighted gaps and the absence of scientific knowledge in the REL field in developing countries, the created model is significant for

improving REL performance and, thus, B2C e-commerce companies' performance in Lebanon and Syria, as the results indicated.

4. B2C e-commerce companies should use the developed model to enhance their REL performance since it will help reduce the waste of resources by increasing their efficiency and allow for acquiring resource sustainability, enhancing customer satisfaction, and increasing profits, thereby solving REL inefficiencies and unsustainability.

Approval of the Research Findings

The following scientific articles on the topic of the dissertation were published: three articles in peer-reviewed scientific journals (Al Majzoub et al., 2020; Davidavičienė & Al Majzoub, 2021 a; Al Majzoub & Davidavičienė 2021 b) and three articles in conference proceedings (Al Majzoub & Davidavičienė, 2018, 2019 a; Al Majzoub 2019 b).

The results of the dissertation were published in three scientific conferences:

Multi-Layered Model of E-Logistic. 10th International Scientific Conference, BUSINESS AND MANAGEMENT 2018, 3–4 May 2018, Vilnius Gediminas Technical University, Lithuania.

Comparative analysis of reverse e-logistics' solution in Asia and Europe. International Scientific Conference, Contemporary issues in business, management and economics engineering 2019, 9–10 May 2019, Vilnius Gediminas Technical University, Lithuania.

Meta-analysis of diverse factors affecting reverse e-logistics performance and its efficiency. Academics World International Conference, International Conference on Management and Information Technology 2019, 6–7 December 2019, Beirut, Lebanon.

Structure of the Dissertation

The dissertation consists of an introduction, three chapters and a general conclusion. It has eight annexes (A-B-C-D-E-F-G-H) (enclosed in CD). The dissertation consists of 182 pages and contains 12 figures and charts in addition to 14 tables. Moreover, there are 187 literature sources referenced in the literature part of the dissertation.

Transformation of Logistics in the Digital Age

This chapter reviews the important elements that comprise e-logistics and its progression that necessitated the presence of reverse e-logistics. It starts with a brief description of e-logistics' basic components and then focuses on gaps in reverse e-logistics to seek solutions for better REL performance. Finally, a basic theoretical framework is issued at the end to see if reverse e-logistics and other fields are correlated and how such defined elements can impact the B2C e-commerce companies' performance by formulating research hypotheses. Synthesis and comparison analysis are employed. The summarized research results of this chapter are published in the author's two publications (Al Majzoub & Davidavičienė, 2018, Al Majzoub & Davidavičienė, 2019).

1.1. E-commerce Types and Development

Electronic commerce, also known as e-commerce, refers to the transactions' processing like purchasing and vending products and/or services via computer networks such as the Internet (Al Majzoub & Davidavičienė, 2018). Upon analysing the aspects of e-logistics, four main e-business communication models were considered the most important and relevant models in all e-commerce processes,

i.e., business-to-consumer (B2C), business-to-government (B2G), business-to-business (B2B), consumer-to-consumer (C2C). Nonetheless, mobile commerce (m-commerce) has recently been included because of consumer behaviour trends (Chen, Li & Zhai, 2016).

B2B transactions bring numerous benefits to interacting firms. In such transactions, firms are physically absent, and one firm is the consumer of the other firm's products. Besides, they exchange information (Leung et al., 2018). The B2B model is nowadays run using several specialised trading platforms. However, the personal behaviour and needs of employees working with e-commerce in these firms should also be considered (Jia, Xue, Fu & Xu, 2018). The B2B e-commerce business comprises two major constituents: e-frastructure and e-markets. The e-frastructure deals mainly with logistics, applications, service providers, outsourcing and content management software, whereas the e-markets part is the websites where buyers and sellers interact and conduct transactions.

As e-commerce progressed, B2C became one of the most important business approaches to improve competitive advantages (Pilinkiene, Kurschus, Auskalnyte, 2013). In the B2C model, the firms interact directly with their end consumers. The B2C model is the most extensively used and explored. However, more attention and scientific studies should be applied in the area of consumer satisfaction in regard to e-logistics (Zhu, 2015). B2C includes gathering information about customers and buying tangible or informational products through an electronic network. The main advantage of B2C e-commerce is the reduction of transaction costs due to ease of access to information of competitive prices. Another advantage is that B2C decreases entry barriers because managing virtual firms saves costs compared to physical ones. B2C e-commerce is especially attractive for information goods because it eliminates the need for physical distribution networks and their associated costs.

In the C2C model, both parties are physically present. In other words, people interact with each other. This interaction process is facilitated by several communication methods and advanced technology (Liu & Luo, 2019). A good example would be C2C processes occurring in Internet auctions. Electronic marketplaces and online auctions are a hallmark of this type of e-commerce, particularly in vertical industries with multiple suppliers bidding for the goods/services they need. In the B2G model, the firm directly interacts with the national government (Qiu, Pang & Lim, 2012). Business-to-government, or B2G, refers to business conducted between private sector firms and governments. Here, the interaction is also known as "state procurement via the Internet" (Leung et al., 2018). A public sector pilot/leading role in e-commerce is one of the key characteristics of this type of e-commerce. The second feature is that improving the effectiveness of the procu-

urement system is the most important function of the public sector. The main advantage is that B2G enables the use of web-based purchasing policies, and this reduces the risk of fraud and irregularities in the procurement process.

Mobile commerce, which is also known as “m-commerce”, is the application and utilisation of wireless devices, such as mobile phones, and a specific aspect of the four previously discussed models should be considered (Tang, 2019). Other models, such as C2B, G2B, C2G, B2E, and G2E, are considered irrelevant and will not be analysed further or applied in future e-logistics research.

Table 1.1 summarises the major advantages and disadvantages of diverse e-commerce types.

To buy products online, purchasers can pay by credit or debit, considered the best shared online payment means, yet online payment is rather complex and requires trust. Many people attempting to learn online shopping quit because of online payment difficulties and security issues (Nisar & Prabhakar, 2017).

Table 1.1. Comparison of advantages and disadvantages of e-commerce elements
(Source: elaborated by the author, 2022)

E-commerce Type	Advantages	Disadvantages
B2C	• No time constraints • No location constraints • Less investment for better returns. • Easy and convenient shopping • No intermediaries. • Global reach	• Security Hacking threats • Increased competition • Low conversion rates • Technical breakdowns • Increased returned products which leads to high costs
B2G	• Compared to equivalent employment in the private sector, government contracts are typically larger and more stable • It is a federal regulation that small firms must be given specific amounts of money to spend on contracts, thereby covering contractual expenses.	• The approval and start of a project by government agencies usually takes longer than those of private companies do. • Inefficient contracting process.

End of Table 1.1

E-commerce Type	Advantages	Disadvantages
B2B	• Expansion of targeted market • Word-wide expansion • Real-time transaction • Decrease risk of stock depreciation • Decreased costs of transactions • Increased cost savings • Market for second-hand products • Efficient pricing • Decrease the probability of complicity	• Increased competition • Absence of face-to-face contact • Probability of stock shortage • Expensive intermediary expenses • Unexperienced suppliers • Removing intermediaries • Decreased profits • Necessitates prequalification
C2C	• Omnipresent • Bank account or credit cards are unnecessary • Cheap, safe, prompt, and convenient • Anonymity of user • Safe, trusted method • available to all •	• Both buyers and sellers must meet in person • Disposed to counterfeits • Expensive cashing checks • High set-up fees • Incompetent for international transactions • Necessitates a credit card and/or a bank account • Registration to same service is required by both parties • Not available for services

Such a demand-driven delivery type in the age of e-commerce adds to the complication of order-picking operations, as the order arrival array is more difficult to predict compared to traditional huge lot-sized logistics orders for stock replenishment of chosen retail stores (Accorsi, Manzini & Maranesi, 2014). Therefore, the importance of logistics capability and outsourcing is likely to increase, requiring an entirely new fulfilment infrastructure to handle e-commerce shipments. The demand for a low-cost shipment of products has always been existing. Numerous firms attempt to construct or reform the logistics networks to remove superfluous postponements in their shipment and also decrease costs, yet this still remains an issue (Rajabalipour Cheshmehgaz, Islam & Desa, 2014). Plentiful bright systems and methods for explaining order-handling decision support in warehouses have been established. Nevertheless, the literature is scarce on B2C

e-commerce order fulfilment in distribution centres, which considers the e-order handling process and requirements (Leung et al., 2018). To handle the tight delivery necessities of e-commerce orders, e-logistics applications via the e-order fulfilment process must be done resourcefully (Lang & Bressolles, 2013). This necessitates warehouse process reengineering by the logistics service workers. Consequently, a cloud-based e-fulfilment planning system (CEPS) is proposed for rearrangement and reassessing the stream of e-order fulfilment operations (Leung et al., 2018). That means that instead of performing e-order fulfilment operations immediately after orders are received online, the placed e-orders are combined in a cloud database for additional order assemblage and consideration. The cloud database system necessitates the development of a good ICT (Evangelista & Sweeney 2006). All of which can't be achieved without strong ICT development. The ICT sector is becoming stronger in the economic sector. ICT development has many advantages for firms and consumers that will aid the e-commerce process (Islam & Zunder, 2013).

Among the different types of e-commerce mentioned above, B2C and C2C deal directly with consumers and consider them as their transaction objectives. However, the only difference is that B2C involves a business organisation in transactions with consumers, whereas C2C involves only consumer transactions without intermediaries (Leung et al., 2018). B2C transactions are growing tremendously because of convenience. Thus, customers utilise B2C e-commerce more while transacting (Vakeel, Das, Udo & Bagchi, 2017).

A typical order fulfilment process in the B2C e-commerce business environment is done through several steps (Jia, Xue, Fu & Xu, 2018). First, customers place their orders online, and then e-retailers receive orders from various sources. Then, e-retailers launch their products on multiple sales platforms. Next, the order fulfilment starts by making sure that the e-retailers link their operations to the logistics service providers, which are also known as the "LSP" (Leung et al., 2016). Once customer orders are received, internal order processing starts. This is done by ensuring first that order picking from storage is transferred to individual order packing into parcels. Then, the order consolidation into pallets continues, which are then processed for delivery scheduling and planning. After the complete e-fulfilment, the products are in the final stage, which is the outbound delivery (Leung et al., 2018).

To maintain effective transactions, organisations must be aware of how to apply their knowledge-sharing processes. Knowledge is the foundation of exclusivity and a feature of uniqueness. Every firm tries to share pertinent information at the right time via the most suitable methods aiming to meet the needs of its customers. The need for qualified personnel capable of sharing specific knowledge is important (Raudeliūnienė, Meidutė-Kavaliauskienė & Vileikis, 2016). Moreover, every resource in the organisation counts. Resources must be

combined in new ways to create something of value, and this is entrepreneurship in its classical sense (Paredes, Barrutia & Echebarria, 2014).

Furthermore, it is worth mentioning that the development of social media networks leads to novel marketing communication methods and also poses new scientific challenges. The rising importance of B2B and B2C communication and the relationships with consumers are affected by dynamic changes in the e-marketplace (Al-Somali, Gholami & Clegg, 2015). Thus, it is important to comprehend the importance of social media and apply innovative communication tools to increase interaction (Davidavičienė, Pabedinskaite & Davidavicius, 2017).

Despite the attention given to e-commerce in developed countries, e-commerce adoption in developing countries, such as the Middle East, is still lagging behind. E-commerce is more complex in such countries due to such challenges as insufficient regulatory environments and inadequate infrastructure (Han & Trimi, 2018). This, in turn, increasingly causes a bad e-commerce experience among residents of such countries, exacerbating the problem.

Therefore, there is a particular need to study e-commerce peculiarities in more detail in the Middle East to create a model that gives insight into B2C e-commerce specificities in this region. The dissertation contributes mainly to B2C e-commerce companies, particularly in enhancing the last disadvantage point, which explains that returned products increase the company's expenses. The goal is to enhance REL performance for B2C e-commerce companies in the electronic field by constructing a model that tackles such obstacles and gaps in returned products.

1.2. Changing Logistics Processes

Presently, plenty of definitions exist for the term “logistics”, among which is that logistics is a procedure of planning, implementing, and observing the efficiency of movement and storage of materials, managing different kinds of resources, as well as manufacturing stocks (Gavrilina & Bondar, 2017). Logistics is accountable for the resource transportation between manufacturers and customers and storage (Euchi, Bouzidi & Bouzid, 2019). Logistics is a part of the supply chain, representing strong, effective and efficient planning and implementation, in addition to regulating forward and reverse flows and storage of products, services, and information between the starting point and the final destination to satisfy consumer requirements (Jabeur, Al-Belushi, Mbarki & Gharrad, 2017). Logistics can be defined as well as an operational design of physical, managerial and informational systems required to overcome space and time (Daly & Cui, 2003). Moreover, it is unanimously agreed that logistics refers to the flow of materials in the supply chain. This material flow is managed through several sorts of logistics,

such as purchasing, warehousing, the flow of information, and other processes (Skitsko, 2016). As a matter of fact, logistics deals with planning, organising and controlling the flow of materials and related information channels. It focuses on acquiring the right materials at the right place at the right time. This can be done by ensuring the right strategic, tactical, and operational decisions (Zhang, Jia, Tian & Li, 2007).

The success of logistics is highly dependent on the success of supply chain management (SCM), which is the management of the whole movement of a distribution channel starting from suppliers, passing through production and distribution, and finally, reaching the end customer (Tarn, Yen & Beaumont, 2002). The target is to attain objectives related to increasing the efficiency of the total system. This can be achieved by enhancing productivity reducing total stock levels and improving order delivery time (Onoyama, Maekawa, Kubota, Tsuruta & Komoda, 2009). Moreover, business activities should be improved in terms of material handling, information processing and the efficient use of scarce resources (Helo & Szekely, 2005).

Performing logistical processes in the same way as before, especially in the e-commerce market, won't be helpful due to advancements in information and communication technologies (ICT). Companies are trying to implement ICT in their logistics processes to improve their services and adapt to the demands of the e-commerce market. Even established companies are sometimes weeded out of the market due to inefficiencies in their logistics system. This is due to inefficiencies translated as incompetency in e-commerce companies, thus leading to the loss of competitive advantage (Richnak, 2016).

The development of ICT generated new possibilities for organisations by applying it in their business activities. In addition to buying and selling products through the Internet, the exchange of information has become common in today's business transactions. Nowadays, the number of devices connected to the Internet surpasses that of people (Witkowski, 2017). This enormous quantity of information exchanged every day necessitates the processing and analysing of exceptionally improved technology and equipment. People join virtual groups, organisations, and networks for business development reasons and utilise such opportunities a lot. Thus, ICT development is a must (Merkevičius, Davidavičienė, Raudeliūnienė & Buleca, 2015). The current widespread Internet access allows companies to communicate better and stay closely connected to their customers by using different devices, including smartphones, laptops, iPads, etc. Therefore, it is possible to order nearly everything online (Saskia, Marei & Blanquart, 2016). Companies are trying to implement ICT in their logistics processes to improve their services and adapt to the demands of the e-commerce market (Richnak, 2016).

As a result of this Internet and ICT progress and the wide utilisation of electronic information presentation within information logistics, a new and improved concept of “logistics” was created, namely, “e-logistics” (Skitsko, 2016). E-logistics is known as the movement of goods and/or services utilising the Internet communication technologies like the world wide web (WWW), electronic data interchange (EDI), and e-mail (Marri, Irani & Gunasekaran, 2006). In practice, e-logistics is known as “Internet-enabled logistics”. E-logistics is defined as the utilisation of ICT in diverse logistics processes of internal and external supply chains. In other words, it is the data stream in the main and supporting logistics processes among supply chain associates outside and inside the firm (Wu & Lin, 2018). Thus, it is a group of business activities built on using ICT systems through the Internet, so that communication can occur to increase the efficiency of logistics processes (Islam & Zunder, 2013). Hence, e-logistics refers to the application of logistics with the utilisation of the Internet. Even though this sounds simple, the utilisation of the Internet in logistical processes does not necessarily mean that logistics can be considered electronic (Skitsko, 2016). E-logistics is fundamentally a complex system which comprises manufacturers, distributors, logistics hubs, as well as consumers, among which an electronic exchange of data occurs through the Internet with the aid of communication technologies, such as websites, mobile phones, and computers (Jiang, Xiong & Cao, 2017). The aim of this digital communication is to decrease data errors and increase progress efficiency in decision-making.

Overall, the value of the global e-logistics’ market was \$ 4 trillion in 2013, or about 10 per cent of the global GDP (Wu, Goh, Yuan & Huang, 2017). In 2018, it reached \$ 6.4 trillion, out of which \$ 2.8 trillion was registered for the Asia-Pacific region alone, making it the largest global e-logistics market. Moreover, scientists in the e-logistics field expect the e-logistics market to reach \$ 15.5 trillion by 2023 (Denktaş-Şakar & Sürücü, 2020). This shows the significance of e-logistics in the e-commerce business.

The key benefit of e-logistics is to aid in several matters, such as easing the burden of logistical operations, increasing and rationalising demand forecasting procedures, planning, decision-making, and controlling different existing physical logistics. Briefly speaking, e-logistics is a contemporary extension of traditional logistics and can be categorised into diverse subcategories, such as those of electronic procurement (e-procurement), digitalised manufacturing (e-manufacturing) and electronic distribution (e-distribution), which are all vital for the success of the supply chain (Richnak, 2016).

Profits from trade and investments in the US and Europe promoted the shift of attention to e-logistics activities in Asia. In 2014, the percentage of the transport and warehousing sector in Asia alone accounted for 21% of the global market (Wu, Goh, Yuan & Huang, 2017). The e-fulfilment operations are nearly the same

in warehousing and distribution in classical order fulfilment processes. Yet, in this case, the order-picking operations within e-fulfilment are triggered by end consumers placing their orders online and necessitating the logistics service providers or e-retailers to fulfil the orders consequently (Choi & Mai, 2018). Such a process is complex since it is hard to predict the lot-sized orders that sometimes need time to be delivered and to replenish stocks. Thus, it is very important to provide e-logistics with complete new fulfilment processes to manage e-commerce shipments (Richnak, 2016).

In e-commerce, vital transactional elements of e-logistics services are the readiness of products and services, communication speed between the performers of commercial operations, the scope of the activity, lead time, trust, flexibility, and reliability of suppliers (Skitsko, 2016). In an old-style supply chain model, products are processed on several levels so that products are transported from the industry to the required retail stores (Molinillo, Liébana-Cabanillas & Anaya-Sánchez, 2018). Then, the end consumer who makes the purchase transaction can receive the goods at physical stores. Today, thanks to e-logistics, the purchasing process of end consumer orders can be received anytime and anywhere by e-retailers (Saridakis, Benson, Ezingard & Ten-nakoon, 2016). When orders are placed online, the downstream of the e-commerce B2C supply chain starts. It comprises a huge number of unidentified endpoints that are spread worldwide, necessitating consumer-direct transport (Leung et al., 2018).

A crucial driver of e-commerce growth is e-fulfilment, or the fundamental completion operations for e-commerce shipments. In case the e-fulfilment is absent, the B2C process is paralysed (Agatz, Fleischmann & van Nunen, 2008). Although e-logistics play vital roles in the e-commerce industry, e-logistics participants have been fronted with a diversity of obstacles in fulfilling B2C orders (Esper, Jensen, Turnipseed & Burton, 2003). This is due to the e-fulfilment process being dissimilar from the traditional shipment treatment process, such as in handling requirements, last-mile delivery, inventory management, returns, and warehouse management (Xianglian & Hua, 2013).

E-logistics service is a crucial aspect of daily transactions in the e-commerce industry. To satisfy customer needs better and meet companies' objectives, e-logistics should be efficiently present (Rossi, Colicchia, Cozzolino & Christopher, 2013). The Asia-Pacific area showed a significant increase in the use of e-commerce at an extremely fast rate. For instance, as of 2013, e-commerce registered a growth rate of 23% on average, whereas China and Indonesia were considered to have the most rapid increase in e-commerce utilisation. China registered a growth rate of 65%, and Indonesia's growth rate was 71%. E-commerce customers in the Asia-Pacific region spent \$ 22 billion in 2016, and this amount is expected to reach \$ 40.2 billion in 2022 (Chen & Zhang, 2015). This indicates the

opportunity in this region for implementing e-commerce efficiently and effectively. Furthermore, the use of e-commerce has increased customer satisfaction due to the customisation feasibility, ease of check-out and use, and security assurance (Pham & Ahammad, 2017). Customer satisfaction will yield a high rate of customer loyalty which will eventually generate larger amounts of revenues and profits. Moreover, integrating transaction costs by using e-logistics results in significant cost savings for the seller in the logistics chain, in addition to higher profitability (Xu, Cheng & Huang, 2015).

Today, it is completely impossible for a business to survive or compete without effective e-logistics systems (Nisar & Prabhakar, 2017). Neglecting e-commerce will result in dire consequences for the firm as a whole. Studies have shown that e-commerce application and development for firms significantly increased their operating income and resulted in the growth of the business income by approximately 1.25 times more than those firms that do not participate in e-commerce (Chen & Zhang, 2015). In addition to e-commerce, e-logistics should neither be neglected because it is considered an essential factor for the success of e-business, including all types of e-commerce (Scholz-Reiter & Höhns, 2003). E-commerce and e-logistics comprise several dimensions that are important for consideration. Briefly speaking, e-logistics is an indispensable part of the e-commerce development context (Kadłubek, 2015).

When done efficiently, e-logistics can enormously improve the performance, productivity, and profitability of business activities. Moreover, it will lead to lower material costs by reducing such problems as stealing, misuse, and breakage (Fontaine, Crainic, Jabali & Rei, 2017). E-logistics can also yield a reduction in labour costs by decreasing the time spent searching for and recovering onsite materials (Dakhli & Lafhaj, 2017). There are such dynamic changes as customer demands and market globalisation, all of which firms must cope with (Hsu & Lin, 2016). This can be achieved only by being aware of the importance of e-logistics' effective implementation since logistics is an integral part of business activities (Richnak, 2016).

1.2.1. Logistics as an E-commerce Success Factor

The e-commerce market has been tremendously expanding at an ever-increasing rate, with diverse goods and services provided online (Beysenbaev & Dus, 2020). For instance, in 2016 alone, the sales of e-commerce globally accounted for \$ 1.76 trillion, and these sales figures are forecasted to grow to more than \$ 4.48 trillion in 2022. This dramatic increase drives the need to give attention to direct-to-consumer deliveries and, thus, to supply chains. This success was due to the significant importance of logistics (Deutsch & Golany, 2018).

Logistics plays an important role in e-commerce by linking suppliers, manufacturers, and customers at a relatively reasonable cost. Due to the increased use of e-commerce, logistics is now interconnected with e-commerce, and it is today known as the “advanced form of logistics”. Logistics, if applied efficiently and effectively, yields a potent and sustainable competitive advantage in e-commerce (Erceg, 2018).

The progress of logistics inside the supply chain started in the 1970s. At that time, the distribution of goods from manufacturers was continuous, driven by the replenishment of stores. Then, in 1980 the centralisation of stores occurred, and deliveries commenced with the emergence of the distribution centres that were monitored by the stores. In 1990, the emergence of global sourcing occurred, and several retailers developed their import centres for the delivery of goods. In the early 2000s, the development of e-commerce was rapid, which necessitated new logistical methods for the e-fulfilment process (Kayikci, 2018). Fig. 1.1 below shows the development of logistics and supply chains.

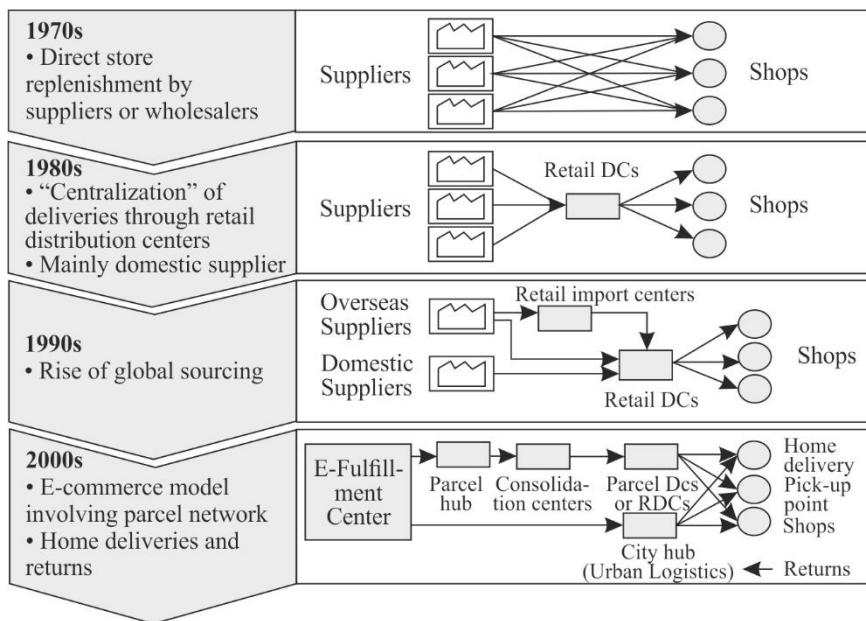


Fig. 1.1. Evolution of logistics and the supply chain (Source: Kayikci, 2018)

In turn, the development of e-commerce formed several opportunities as well as challenges for logistic companies. Fig. 1.2 explains that upon the introduction of e-commerce, logistical processes changed from traditional methods to modern ones. E-commerce firms that acquire strong logistics performance have a potent

competitive advantage compared to their respective competitors since they can always enhance their supply chains' performances (Erceg, 2018). Today, the success of e-commerce is related to enhanced logistical performance. In other words, without the existence of logistics in its diverse forms, the existence of e-commerce would be out of the question. Moreover, the logistical improvement witnessed throughout these recent years led to the improvement of e-commerce markets in all in its forms. This is due to the indispensable and crucial role that logistics plays in e-commerce. Every e-commerce system should be linked with good logistical activities to ensure success; otherwise, it would be just a mere e-commerce system linked to poor organisational performance.

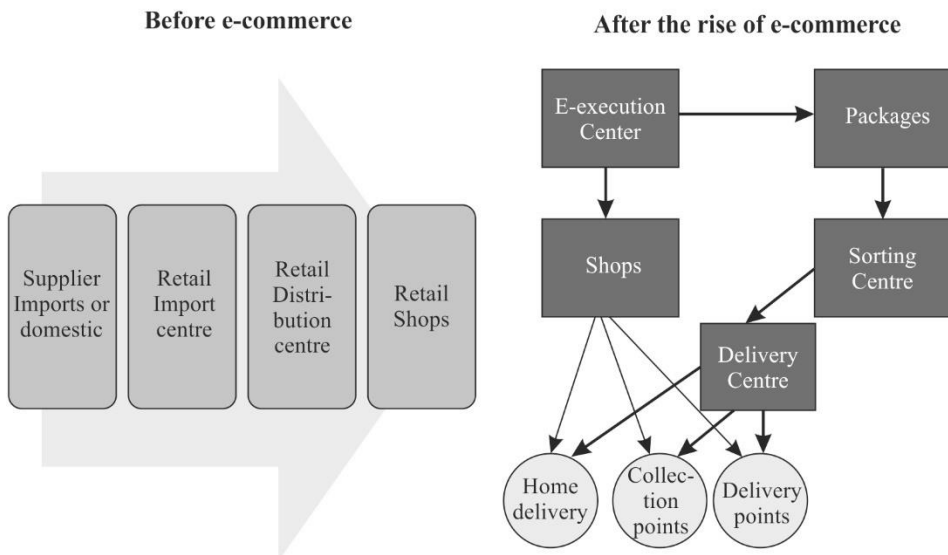


Fig. 1.2. Logistics before and after the progress of e-commerce
(Source: Euromonitor, 2018)

Despite the importance of e-commerce in today's business activities, the absence of effective e-logistics systems will hinder the presence of effective e-commerce activities in turn. Hence, this requires the search for specific factors that affect the e-logistics process and performance, which, in turn, affect diverse e-commerce activities.

The emergence of e-logistics is, no doubt, an added value to logistics and e-commerce. However, e-logistics alone could hardly sustain good e-commerce performance because e-logistics activities alone are incomplete without the activities related to returning products, whether due to wrong orders, defective products, or recycling. Scholars of the REL field suggested that the improvement in

REL performance would translate into an enhancement in e-logistics performance as well. Despite this, literature on REL is scarce. Therefore, further analysis and studies should be performed regarding reverse logistics processes.

1.3. Reverse Logistics Peculiarities

A manufacturing company's extensive supply chain allows it to fulfil orders from remote customers. The customer may need to return an order after its fulfilment for various reasons. Reverse logistics (RL) involves moving the finished product from the customer to the manufacturer using the supply chain (Panghal et al., 2022). Typically, RL refers to the activities carried out by the organisation to reduce waste, recycle, substitute, reuse, and dispose of hazardous materials. A broader view of RL includes all logistics activities involving waste management or waste disposal (Melo et al., 2022). Nowadays, there has been a growing interest in reverse logistics in both theory and practice due to ecological benefits, and this term refers to green logistics. The latter is all activities related to the environmentally efficient management of direct and reverse flows of products and information between origin and destination to meet the needs of consumers, and green logistics activities include assessing the environmental impact of different distribution strategies, reducing the resources required to carry out logistics activities, reducing pollution. In reverse logistics, material recovery is performed in a way that reduces the environmental impact (Ivanova et al., 2022). Modern manufacturing enterprises can benefit from reverse logistics strategies by improving their competitiveness. To successfully implement reverse logistics, an organisation must identify and utilise its unique resources efficiently to build a comparative advantage. Reverse logistics is responsible for connecting the returned items in the chain to possible value recovery activities and disposed waste at the end of the chain (Cristiano et al., 2022). A company's strategy plays a critical role in reverse logistics implementation. Moreover, reverse logistics implementation and product return and recovery cannot be separated. Improving RL is the responsibility of diverse stakeholders and not only the supply chain management (Wardani et al., 2022). RL can only be implemented successfully with the support of industry stakeholders (Zhang et al., 2022). RL can be used to solve the problem of wasted and non-renewable resources. Some firms categorise their RL activities into four main groups: direct reprocessing, reproduction, recycling, and landfilling (Chinda, 2017). RL has to deal with everything linked to goods assembled from consumers for recovery after reaching their end-life time (Batarfi, Jaber & Aljazzar, 2017). REL is responsible for the movement of materials against the main flow, that is, from the customers who order their products online to the producers. RL's domain is to deal with the return of goods, reduce their sources, reuse the products, repair

and manufacture them through renovation and remodelling, and finally return them for recycling (Da Silveira Guimarães & Salomon, 2015). RL analyses the movements of goods from the customers' consumption point to the manufacturers' origin point (Pandian & Abdul-Kader, 2017).

Reverse logistics is an alternative that reduces negative environmental impacts associated with the recovery of materials. Reverse logistics also includes an ecological benefit by increasing product recycling and recovery, leading to a lower use of resources. The efficient use of resources is also translated into improved economic performance (Ivanova et al., 2022). RL is the management of the inflow, storage, and disposal of secondary goods and related information using the traditional supply chain to restore value or their appropriate disposal. Reverse logistics (RL) is the process of handling returned goods that are either recovered through re-utilisation, fixation, renovation, recycling, and prefabrication or completely discarded (Euchi, Bouzidi & Bouzid, 2019). RL is the arrangement, execution, and monitoring of the efficient and cost-effective movement of different resources, i.e., in-process inventory, finished products, and movement of information from consumers to the manufacturers to either recapture or generate value or discard the products (Smith, 2005).

RL is divided into five main perspectives: RL inputs (choosing factors of production, reserve, and forecasting inventory), RL processes (taking goods apart, procedures for returning the goods, modelling structures, reproduction management, infrastructure, manufacturing capabilities, and other elements in the supply chain), structure in the Republic of Lithuania (place and distribution planning) and RL outputs (pricing, sales management, good competition, and information about services), RL social and organisational factors (stakeholders, competition, third party logistics, return policies, and decision-making processes), all of which are crucial for considering (Pulansari, Sukma Donoriyanto & Masruroh, 2016). RL is seen from different perspectives according to different authors, and this is manifested in different RL definitions. For instance, RL is known as the process of planning, employing, and adjusting the efficient, cost-effective movement of raw materials, in-process inventory, finished goods, and linked information from the consumer to the origin's site in an attempt to recollect products or to dispose of them (Sirisawat & Kiatcharoenpol, 2018). Moreover, RL is also considered to be not only these steps mentioned above but perceived as the whole procedure for effectively handling the material, information, and money stream so as to renew value from the end-of-use (EOU) and end-of-life (EOL) products via repairing, reutilising, remanufacturing, recycling and reinstatement to the marketplace. Furthermore, RL comprises the suitable handling of non-reusable and non-recyclable components (Yu & Solvang, 2017). Reverse logistics contains activities

linked to product recovery containing returned product acquisition, product disassembly, remanufacturing, and remarketing (Tosarkani & Amin, 2018). The main basic definitions of reverse logistics are summarised in Table 1.2.

Table 1.2. Main definitions of reverse logistics (Source: elaborated by the author)

Author, Year	Definition of Reverse Logistics
Ivanova et al., 2022	RL is a different approach that lessens the environmental harm caused by material recovery.
Melo et al., 2022	RL stands for waste reduction, recycling, substitution, reuse, and disposal. These are all actions taken by the organization to lessen waste.
Panghal et al., 2022	RL entails transferring the finished product along the supply chain from the manufacturer to the client.
Chileshe et al., 2018	RL refers to the operations and procedures for returning post-sale and post-consumption goods back into the productive cycle by means such as reversing distribution channels.
Panigrahi, Kar, Fen, Hoe, & Wong, 2018	RL is defined as returning defective, damaged or unused products to the retail outlets. It encompasses all the processes described in the supply chain, but in reverse manner from customers to retailers. RL in retail industry includes recalled products, end of life products, season returns, and disposals.
Sirisawat & Kiatcharoenpol, 2018	RL is known as the process of planning, employing, and adjusting the flow of raw materials from the consumers to the origin site in an attempt to recollect products or to dispose them.
Tosarkani & Amin, 2018	RL includes all activities associated with products' recovery such as: repairing, recycling, remanufacturing, and disposing. Several partners are required to collaborate efficiently in order to obtain optimal outcomes. RL contains activities linked to products' recovery containing returned products' acquisition, products' disassembly, remanufacturing, and remarketing.

End of Table 1.2

Author, Year	Definition of Reverse Logistics
Sun, 2017	The reverse logistics' system is a system whereby a product, that is coming from the reuse of materials and embedded into wastes returns to the manufacturer after use, can be repaired or remanufactured to be delivered again to make new products with secondary raw materials to the end consumers. The key processes identified are: products' acquisition, collection, inspection and sorting, and disposition.
Yu & Solvang, 2017	Reverse logistics is the whole procedure for effectively handling the material, information and money stream so as to renew value from the end-of-use (EOU) and end-of-life (EOL) products via repairing, reutilizing, remanufacturing, recycling and reinstatement to the marketplace..
Agarwal, Govindan, Darbari, & Jha, 2016	RL is the summation of processes of gathering, examination, categorization, fixing, refurbishing, remanufacturing, recycling, as well as clearance of the products to take them back from their current source of consumption to their original source of manufacturing or delivering.

RL includes products manifested into one of two categories. The first is concerned with goods returned by consumers to their corresponding point-of-origin, either due to the failure to function as intended and designed or because of a lack of customer satisfaction (Tosarkani & Amin, 2018). Regardless of the real reason, goods returned in such conditions are vented to a secondary market either as a repaired or refurbished item (Tosarkani & Amin, 2018). The second category has to do with everything related to products gathered from their perspective consumers to process recovery after the end of their useful lives (Batarfi, Jaber & Aljazzar, 2017).

RL as a concept was very beneficial for the traditional logistical processes. However, today, and with the emergence of ICT, e-commerce, and e-logistics, RL cannot function in the electronic era. Therefore, an improved form linked to ICT is required to facilitate further the activities of e-commerce, i.e., reverse e-logistics, that should be further analysed to understand its impact on e-logistics systems.

1.3.1. Reverse E-logistics as a New Concept

The principle of reverse e-logistics (REL) is derived from reverse logistics. REL is considered to be the ICT-activated reverse logistics. REL refers to performing reverse logistics processes electronically or virtually. REL is stated to be a reversed flow of products starting from the consumption stage to the stage of production (Morgan, Tokman, Richey, 2018). REL is part of the logistics that handles sold products through e-commerce returning and decreasing resource utilisation by effectively managing recycling, waste discarding, re-establishing and also re-fabrication (Mahindroo, Samalia & Verma, 2018). REL has the function of keeping effective and efficient supply chain procedures for e-commerce firms. In other words, concentrating on the reverse flow of materials is the representation of the REL goal by maximising the supply chain's value (Han & Trimi, 2018). Nevertheless, the REL design changes from conveying and transferring logistics to reversed processes. Advanced logistics are comprised of a series of operations, such as the conversion of raw materials into finished products, that are not always present in reverse e-logistics processes (Vlachos, 2016). The main divergences between both kinds of logistics depend on the qualities of products and conveyance in addition to the packaging and pricing (Sangwan, 2017). The objective of REL is to ensure that products are returned easily to the business cycle to which one can note the addition of economic, environmental and legal services. Briefly, REL is the modern and most utilised form of reverse logistics. Reverse logistics and reverse e-logistics differ, as shown in Fig. 1.3 below.

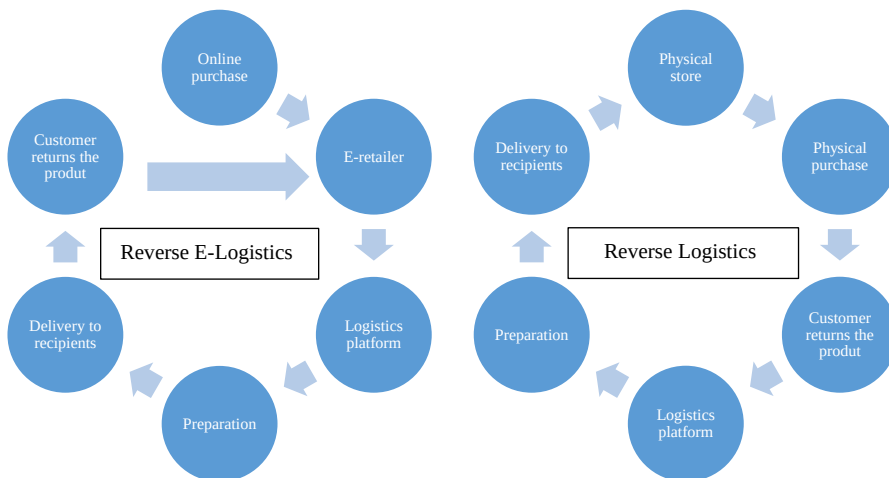


Fig. 1.3. Difference between reverse logistics and reverse e-logistics
(source: compiled by the author, 2021)

The COVID-19 epidemic has increased Internet sales, which typically results in increased reverse logistics. REL is the study of how obligations or objective systems that cover social, economic, and environmental factors have developed through time from a reverse flow of products alone. REL seeks to give consumers a value-added service by attending to their needs, whether they are for product returns or recycling. It begins by minimising waste by reusing and recycling as much as feasible (Lai et al., 2022). When a product can no longer be used for economic gain or can no longer be reused, recycled, or recycled in a new production cycle, REL is concerned with its recovery (Lingaitienė et al., 2022). REL is responsible for the movement of materials against the main flow, that is, from the customers who order their products online to the producers. REL's domain is to deal with the return of goods, reducing their sources, reusing the products, repairing and manufacturing them through renovation and remodelling and, finally, returning them for recycling (Da Silveira Guimarães & Salomon, 2015).

REL analyses the movement of goods from the customers' consumption point to the manufacturers' origin point (Pandian & Abdul-Kader, 2017). RL can be used to solve the problem of wasted and non-renewable resources (Wardani et al., 2022). Some firms categorise their REL activities into four main groups: direct reprocessing, reproduction, recycling, and landfilling (Chinda, 2017). REL has to deal with everything linked to goods assembled from consumers for recovery after reaching their end-life time (Batarfi, Jaber & Aljazzar, 2017). REL analyses the movement of goods from the customers' consumption point to the manufacturers' origin point (Pandian & Abdul-Kader, 2017).

REL comprises processes relevant to returning products, such as the disassembly of their parts, reproduction, and remarketing (Tosarkani & Amin, 2018). REL is the planning, executing, and evaluating of the flow of all raw and finished materials from consumers to manufacturers in a cost-effective and efficient way to recapture value or to dispose of the products properly (Sri Yogi, 2015). REL commences from the consumption point, where it concentrates on a cost-efficiency plan (Yu & Solvang, 2016). REL is the inverse stream of products from the consumption location to the origin (Morgan, Tokman, Richey & Defee, 2018). REL activities comprise gathering, examination and categorisation, disposition (re-utilisation, overhaul, remanufacture and recycling), and relocation of returned goods (Agrawal, Singh & Murtaza, 2016). Table 3 below summarises the main basic definitions of reverse logistics.

Table 1.3 shows how REL can be differentiated from other processes in a B2C e-commerce company. REL functions are identified and detached from other types of operations of the supply chain in e-commerce. The modern REL principle has been tackled by several authors, and it was linked to the function of institutional operations. Concentrating on enhancing REL has been suggested by them to occur in some specific manners and results in considerable enhancement in the

company's performance. Annex A recapitulates the major outcomes of the authors in the REL field. Figure 1.4 presents the global supply chain of e-commerce and RL and REL as its parts.

Table 1.3. Different definitions of reverse e-logistics (Source: elaborated by the author, 2021)

Author, Year	Definition of Reverse e-Logistics
Wardani et al., 2022	To preserve value or dispose of secondary items properly, REL involves controlling the intake, storage, and disposal of such goods and accompanying information utilising the conventional supply chain.
Lingaitienė et al., 2022	REL is concerned with a product's recovery when it can no longer be used for commercial purposes or be reused, re-cycled, or recycled in a new manufacturing cycle.
Lai et al., 2022	REL seeks to reduce waste by recycling and reusing materials as much as possible. In turn, it seeks to give clients a value-added service by attending to their needs, such as product returns or recycling.
Han & Trimi, 2018	The reverse flow of materials through the maximisation of their value.
Morgan, Tokman, Richey & Defee, 2018	The inverse stream of products from the consumption's location to the original location.
Pandian & Abdul-Kader, 2017	The movement of goods from the customers' consumption point to the manufacturers' origin point.
Cannella, Bruccoleri & Framinan, 2016	The management of the flows of materials relies on assessing their performance effectively.
Vlachos, 2016	A set of activities concerned with converting raw materials into finished goods.
Agrawal, Singh & Murata, 2016	Gathering, examination, categorisation, disposition, and re-location of returned products.
Da Silveira Guimarães & Salomon, 2015	The return of goods and reducing their sources, reusing the products, repairing and manufacturing products through renovation and remodelling, and, finally, returning them for recycling.
Sri Yogi, 2015	The flow of all raw and finished materials from consumers to manufacturers cost-effectively and efficiently.

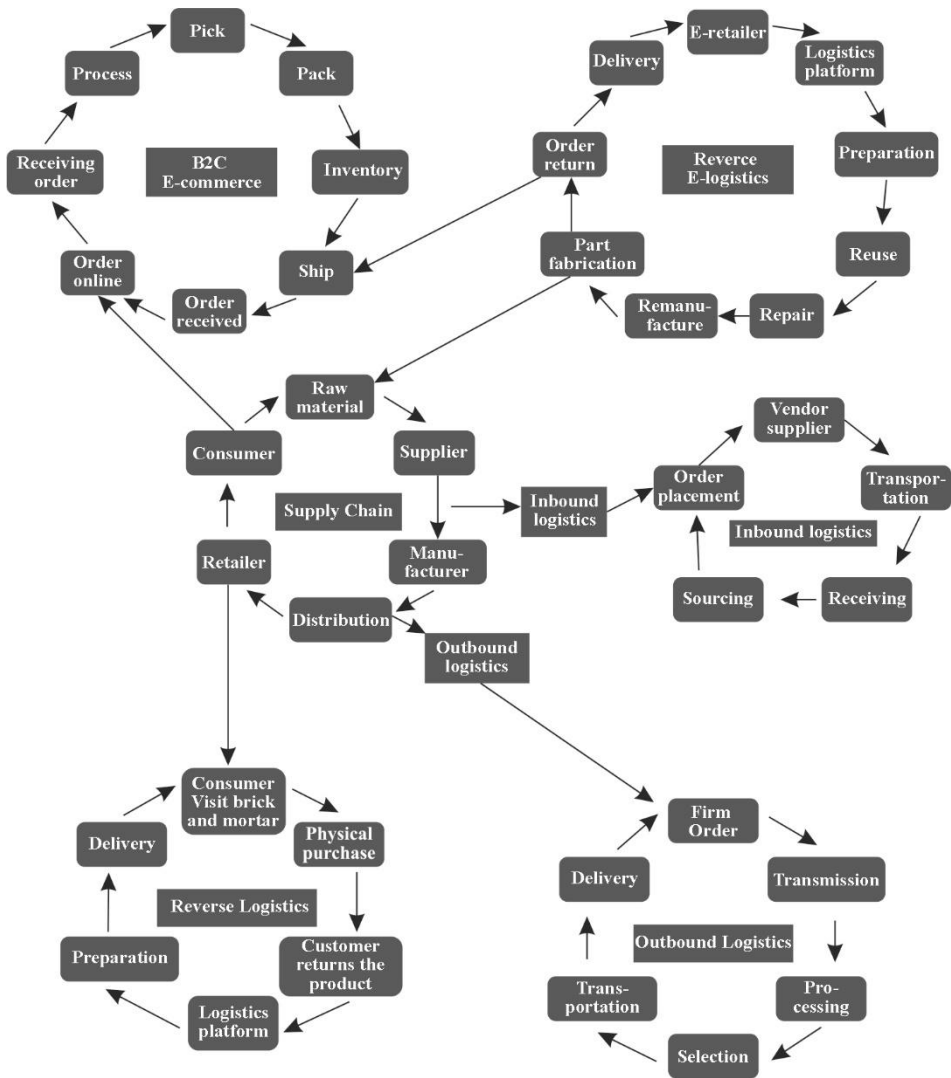


Fig. 1.4. Global supply chain with RL and REL
(Source: elaborated by the author, 2021)

This graphical illustration clarifies the correlation between RL and REL in supply chain activities. A supply chain is a complete system of manufacturing and delivering a product/service from the start phase of obtaining the raw materials to the last stage, which is the delivery of the product/service to customers. First, the raw materials are acquired by the supplier from a logistics provider, and, in turn, the supplier delivers the raw materials to the manufacturer, which converts them

into finished products. Next, a distributor wholesales the finished products by delivering them to a retailer, which, in turn, sells the products to consumers. The cycle is completed once the product is bought, yet the demand reinitiates, leading to more production, and the cycle continues.

Inbound logistics activities in the supply chain comprise the flow of raw materials, finished goods, and supplies from the manufacturer to the fulfilment centres. Inbound logistics is concerned with every supply-chain activity within the firm. It entails purchasing raw materials or inventory and tackles reverse logistics activities. Inbound logistics concentrates on the storage and transportation of the products.

The liability of transportation contracts should be clearly understood in addition to the cost of any damages upon delivery. Outbound logistics is the shipping out of finished goods to the consumers from the manufacturer, specific distribution centres, or warehouses. Its main activity is the order fulfilment process which comprises picking, packing, shipping, and delivery of goods.

For an e-commerce firm that sells its products through websites, when a consumer orders a product online, it is handled by technological tools, such as third-party products, order systems, or checkout carts. Then, the imbursement processors manage the payment transactions. Upon placing the order, it will be received by the warehouse, which will ensure that the right product is ready to be delivered. Then, the warehouse sends the order to the shipping firm, which will deliver the package to the customer.

The B2C e-commerce activities comprise several steps. The first is receiving an order. A customer places an order online to be received by the manufacturer, making sure that their online sales channels are operating effectively and the required inventory is available.

If the manufacturer chooses to fulfil orders in-house, they must be sure that their inventory is on-hand. However, if the manufacturer decides to outsource fulfilment, then their inventory should be delivered to the third party to fulfil the order on their behalf. Then, there is inventory storage or warehousing, where the manufacturer keeps the products. Each product has a distinct devoted storage location, and more complex operations have more organised shelves and pallets. Caution should be made concerning shortage or surplus of stock. Both are harmful to the firm; thus, a proper balance should be made regarding this issue. Moreover, proper, neat, and organised inventory storage keeps the products secure and visible to determine the proper match between supply and demand. The next step is order processing. When a customer places an order online, it goes into processing. Processing comprises picking or the reclamation of products from their storage location and then packing them to make the order ready for shipment. Here, the manufacturer uses a packing slip, which indicates the required quantities and directs toward the correct location of the ordered products. It is important that the

package should include a shipping label. Finally, the manufacturer has to ship the products. This may involve a run to the local post office or UPS Store or having a carrier pick up the orders from the fulfilment location. Once shipped, the customer starts receiving tracking information to stay updated with the delivery package.

Concerning the processing of returns or reverse logistics, when a customer returns a product, the manufacturer should be ready to process it. The customer might ship it directly to the manufacturer or through a third-party reverse logistics provider. Then, depending on the manufacturer's return policy, the returned product's quality, and the reasons for returning the product, the returned product will be either restocked or disposed of in case of malfunctioning. In B2C e-commerce, the new concept of reverse e-logistics was introduced. Reverse e-logistics refers to the return processes of reverse logistics in e-commerce. It starts when a customer wants to return a product order online. Different reasons can be given, including defective products, wrong items, or recycling. The most important thing for the manufacturer is to wisely reuse, repair, or remanufacture the product.

In conclusion, improving REL performance can lead to several benefits, as indicated by scholars in the REL field (Regattieri, Gamberi, Bortolini & Piana, 2018). However, the improvement process can't be achieved without understanding the diverse aspects of REL activities and where the gaps in REL performance persist. Up to now, there has been a lack of knowledge regarding REL performance. Numerous gaps have been unidentified or unresolved. In both cases, these gaps should be highlighted and analysed further if a firm wishes to improve its REL performance.

1.3.2. Insights on Reverse E-logistics Performance in the Middle East

Online shopping is growing at an exponential rate. For instance, in 2019, more than 1.92 billion people bought products or services online. Moreover, global retail e-commerce sales worldwide increased by 327% between 2014 and 2022. This increase in e-commerce translates into an increase in reverse logistics. The international reverse logistics market registered an amount of about \$ 415.2 billion in 2017, \$ 527.68 billion (an increase of 27% from 2017) by the end of 2021, and this number is expected to have an exponential growth reaching \$ 603.9 billion (an increase of 46% from 2017) by 2025 (Mazareanu, 2021). Therefore, costs coming from REL are extremely high and are expected to continue expanding. Thus, it is important to understand REL performance in detail and how to improve it. Asia-Pacific, North America and Europe were considered as three top global markets in 2018. With a size of € 2.4 trillion in size, the logistics market in Asia-Pacific took the first place globally, whereas North America came second with

€ 1.4 trillion, and Europe was third with € 0.9 trillion. In 2020, global retail e-commerce was about \$ 3.9 trillion. The region of Asia-Pacific alone yielded an amount of \$ 2.45 trillion in online retail sales (Sabanoglu, 2020), and it was the leading region in terms of increased e-commerce sales.

E-commerce in the Asia Pacific increased from 8.2% of global e-commerce sales to 20.4% by the end of 2019 (Ann & Rassi, 2020). The Middle East, which is a part of the Asia-Pacific region, was able to increase its e-commerce by 29% from 2011 to 2017 (Sanyala, 2019). This indicated opportunities to seize in the Middle East. The Asia-Pacific region is relatively large and comprises several countries considered developed and other countries regarded as developing. Furthermore, the Middle East region is still considered developing, and thus, very few studies and research were performed there. In particular, Lebanon and Syria are among the lowest-performing countries in terms of e-commerce, despite the fact that they are experiencing a higher number of e-users (Ren, Wang, Li, Yu & Zhang, 2020). Several reasons, such as bad infrastructure, high prices and a low Internet connection quality, the lack of electricity, the absence of governmental regulations, and low R&D, are behind such a performance lag. Therefore, the Middle East region, Lebanon and Syria in particular, were chosen because of opportunities faced with challenges and obstacles in light of the lack of scientific studies. As a result, the two countries, Lebanon and Syria, were selected for deeper analysis because of their specificities.

1.3.2.1. Middle East Region's Performance in E-commerce

The Middle East has a gross population of 350 million people, with 50% aged under 25. The Internet, social media platforms and digital tools are increasingly popular among the young population. E-commerce in the Middle East increased by 29% from 2011 to 2017, registering \$ 7 billion in 2011 and \$ 15 billion in 2015. This increase can be explained by an enormous jump in the Middle East's e-commerce users, in addition to the increase in the number of local retailers working online and offering customers products and services that were not available before (Sanyala, 2019).

SMEs are the main providers of employment in the Middle East region, representing around 80% to 90% of the private business sector (Mouselli & Khalifa, 2017). This indicates a huge opportunity for e-logistics improvement (Mouchawar, 2017). However, challenges still exist in the Middle East. The logistical system in the Middle East is still under development. For instance, several Middle Eastern countries suffer from poor infrastructure and a lack of postal codes, IT, and software development systems (Mouchawar, 2017). Nevertheless, most countries in the Middle East still lack specific instruments to institute Internet-focused e-commerce networks. E-commerce companies operating in this area acquired

little knowledge of the business' logistics (Mouselli & Khalifa, 2017). In addition to these challenges, there is a shortage of skilled and qualified managers, a lack of financing due to a relatively low presence of investor funding firms operating in the e-commerce industry, and logistical problems in the last-mile delivery, warehousing, loss mitigation, and payments (Sanyala, 2019).

Lebanon is situated in the middle of the Eastern Mediterranean area, giving it a strategic commercial connection between the Middle East and Europe. It is considered a developing country with a middle-income population and a recently increased poverty rate. Nonetheless, Lebanon has a high degree of urbanisation. Beirut alone has more than 400 000 Lebanese residents out of 6 million in total (Bahn & Ki, 2020). Lebanon is considered a crucial member and commercial partner of the European Union after signing the Euro-Mediterranean partnership agreement. Therefore, Lebanon offers a stimulating point to better understand e-commerce in the Middle East region (Abebe et al., 2020). Lebanon has several bilateral and regional trade agreements with the European Union, including the Euro-Mediterranean partnership. Lebanon can be a good example for other developing countries in the Middle East since it is considered a leader in ICT development. Moreover, Lebanon's location makes it a potential commercial liaison between the Mediterranean region, East Asia, and India. The Lebanese economic system is considered a free competitive market and a "laissez-faire", which is highly preferred by several e-commerce businesses. Lebanon registered first in terms of using social media in the Middle East, allowing it to profit from e-commerce (Ann & Rassi, 2020). Despite such opportunities, Lebanon still faces e-commerce challenges, such as low-quality Internet and communication services, high Internet and phone call prices, the absence of governmental e-services, the lack of governmental interference in legal matters, inefficient delivery, and insecure payment systems. Due to such problems, many firms do not consider this region for e-business (Ann & Rassi, 2020). Lebanon is behind in using advanced technology and innovation due to relatively low investments in R&D (Skafi et al., 2020). Nevertheless, Lebanon faces challenges with bad infrastructure, collapsing economy, and political corruption.

Syria is geographically located in the Levant area of the Mediterranean region, bordering Lebanon in the south, a location that granted it strong connections with several neighbouring and other countries, such as Russia, China, and Central Asia, thereby connecting these areas to broader streams of international trade (Anderson, 2018). Syria, a developing country, has a low-middle class income with a population of approx. 19 million. Syria's economic liberalisation started in 1990 by reorganising business networks that were previously completely dependent on the regime's market monopolisation (Ibeh & Kasem, 2011). Syria was open to the international economy and cultural inspirations till 2011 when the civil war star-

ted. Until this time, many businesses were interested in the country's opportunities. Many Syrian managers were educated in international universities, which explains the reason behind resemblances in the behaviour of Western and Syrian executives (Alamir et al., 2019).

Despite such opportunities, Syria faces several challenges starting with the shortage of financial resources, which appears in the high costs of doing e-business and the struggle to gather relevant information (Mouselli & Khalifa, 2017). Moreover, the Syrian ICT sector is still in its beginning, even compared to other countries in the Middle East. Syria has one of the worst ICT sectors (Ibeh & Kasem, 2011), which suffers due to the currently weak infrastructure, poor Internet connection, and complete absence of e-security. Moreover, employee challenges also exist due to the presence of a state of illiteracy in ICT. The problem is that improving ICT is getting increasingly difficult due to brain drain as skilled employees leave the country either due to higher salaries and better quality of life elsewhere or the current civil war (Alsaeed & Adams, 2015). This civil war not only led to financial and economic instabilities but also impacted diverse economic, social, and entrepreneurial facets. Moreover, in 2016 Syria's GDP decreased by 63% due to the war, resulting in more than 9 million unemployed and a high number of leaving firms (Alamir et al., 2019). The Syrian regime imposed obstacles even before the occurrence of the civil war by creating political challenges manifested by political barriers, such as the absence of freedom of the press and restricted access to the Internet, accessible only through government-controlled channels. The Syrian government failed to remove trade barriers associated with the European Common Agricultural Policy (Anderson, 2018). Socioeconomic challenges occurred in Syria as a result of corruption and poverty (Alsaeed & Adams, 2015). Nonetheless, Syria's government has high levels of bureaucracy and taxes that must be decreased in addition to enhancing the country's infrastructure. Considering the specificity of both countries, it was assumed that these factors are similar to those of other developing countries, so these two countries were chosen for research into REL performance.

In the West Asia region, Lebanon occupies 10 452 sq. km. According to 2021 estimates, the country was home to approx. 6.8 million people, and its GDP was \$ 14.8 billion. In Western Asia, Syria is bordered by Lebanon, Turkey, Iraq, and Jordan. As of 2010, Syria's population was 21.4 million, a substantial increase compared to 2000. As a result of continuous war, the number has decreased since then, and the exact Syrian population cannot be determined. A total of \$ 60.04 billion were spent by Syria on its gross domestic product in 2010. Online shopping is in its infancy in Lebanon and Syria. Compared to other countries, their success in online shopping was very primitive due to poor Internet infrastructure, limited online payment options, and poor delivery.

Moderate growth is being observed in the Lebanese e-commerce market. Even though Lebanon is ranked 5th on the UNCTAD B2C E-commerce Index 2017 for e-commerce readiness in the Middle East (and 56th globally), it still lags behind many of its neighbours. Based on the latest available data, e-commerce generated \$ 341 million in sales in 2016, representing an increase of 9.8% from 2015 (\$ 310 million). Nevertheless, it only represented 0.07% of GDP in 2016.

Online shopping has not been well accepted by local consumers since they are not yet ready to accept this new form of business because it seems risky and insecure (Mostafa & Hannouf, 2022). Economies, infrastructure, and politics pose major challenges to countries like Lebanon and Syria. However, on the other hand, 99% of all Lebanese firms are SMEs, which have become the dominant form of business. To a certain extent, all these firms require e-commerce as part of their businesses. Moreover, a total of 70% of jobs are accounted for by SMEs, and thus, they contribute significantly to the local economy by around 33% of the total GDP (Skafi et al., 2020). Despite all of these challenges, such as PayPal and other international payment systems are not allowed by the Central Bank of Lebanon due to the lack of infrastructure and significant economic problems. A 9.8% increase in e-commerce sales was recorded in 2016 to \$ 341 million (2.3 million people shopped online) from \$ 310 million in 2015. Further, Lebanese customers favoured cash on delivery over online payments due to a lack of trust in online security (Hamade, 2021). To improve their business brand awareness and image, many companies are utilising social media (Halawani et al., 2020).

According to the Statista website, Lebanon received \$ 2850.0 million from e-commerce in 2021. Returns generated around \$ 256.4 billion in the Asia-Pacific region in 2019. Merchandise returns worldwide exceeded one trillion dollars. The reverse logistics market is expected to grow as more consumers turn to online shopping. Among all regions, Asia-Pacific, including the Middle East, became a leader in e-commerce sales by 2020, accounting for half of all retail sales. In Asia-Pacific, e-commerce will account for 61 per cent of retail sales by 2025, which is the largest increase among other regions. In comparison, the share of retail e-commerce in North America is forecast to increase by 6% and in Europe by 3% within five years.

To assess a company's logistical performance, a method called Logistics Performance Index (LPI) is usually applied. LPI is calculated using six indicators: customs, infrastructure, ease of arranging international shipments, logistics quality and competence, Tracking and Tracing, and timeliness. By examining LPI scores, countries can identify different opportunities while improving gaps in their respective supply chain processes. As the LPI's value increases, so does the logistics system's development in the country (Janno et al., 2021). The World Bank studies LPI every two years. Upon the calculation of LPI, the World Bank uses an international survey of global freight forwarding firms and logistics carriers.

In addition to providing interactive benchmarking, LPI also allows countries to identify challenges and opportunities in their trade logistics performance and offers ways for improvement. LPI measures the movement of goods for its cross-border and intra-border efficiency. LPI provides qualitative assessments of countries in six areas, which are:

1. Customs: border management and customs clearance efficiency.
2. Infrastructure: infrastructure for trade and transportation.
3. Ease of arranging shipments: shipping at competitive prices is easy to arrange.
4. Quality of logistics services: trucking, forwarding, and customs brokerage services should be competent and high quality.
5. Tracking and Tracing: consignments can be tracked and traced.
6. Timeliness: the frequency with which shipments reach consignees within scheduled or expected delivery times.

For cross-country comparisons, LPI aggregates the data using standard statistical techniques. According to the World Bank, Lebanon and Syria were registered in the category of countries doing the worst in terms of logistics performance in 2018, as shown in Table 4 below.

Table 1.4 Logistics performance index with ranking (Source: World Bank, 2018)

Country	Score	Rank
Germany	4.20	1
Lithuania	3.02	54
Lebanon	2.72	79
Syrian Arab Republic	2.30	138

In the above table, compared to Germany (1st place worldwide) and Lithuania (54th place worldwide), Lebanon and Syria are lagging behind, where Lebanon is in 79th place, and Syria is in 138th place. This indicates the presence of gaps in logistical performance, which, in turn, affects the performance of e-logistics, and thus, consequently, the REL performance will be affected as well. In 2019, returns generated around \$ 381.8 billion in Europe, the Middle East, and Africa (EMEA). Other methods are also available for measuring RL performance, such as the Analytic Hierarchy Process (AHP), Decision Making Trial and Evaluation Laboratory (DEMATEL), Weighted Sum Method (WSM), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), the Analytic Network Process (ANP), all of which have advantages and disadvantages that are represented in Table 1.5 below (Shaik & Abdul-Kader, 2018).

Table 1.5 Advantages and disadvantages of RL's measuring methods (Source: elaborated by the author, 2022)

Method	Advantages	Disadvantages
AHP	- Improved focus on each criterion thanks to the hierarchical structure. - Different problems can be solved with ease using this method. - Easy calculations. - Quick results.	- Verification of results necessitates further analysis. - Complex weights assessment in the case of more participants. - Biased data is due to reliance strictly on experience. - Possibility of inaccuracies due to collinearity between objectives.
DEMATEL	- Handles the problem of criteria's interrelationship. - Efficiency quantification and calculations.	- Incapability to consider the ambiguities of respondent answers. - Unclear integration mechanism of respondent answers
TOPSIS	- Fundamental ranking. - Data is independent. - Easy calculations. - Quick results. - Use allocated information.	- Performs only on Euclidean distance; therefore, the calculation is impacted by neither positive nor negative values. - A slight variation of one indicator impacts end results.
WSM	- Easy to compute. - Effective for single-aspect problems.	- Ineffective for multiple preferences. - Assesses only one-aspect of problems.
ANP	- Analyses the interdependencies between variables, thereby reducing bias. - More precise forecasts thanks to continuous feedback support.	- Takes a lot of time and effort. - Doesn't support uncertainty.

A total of \$ 256 billion out of the \$ 381.8 billion was generated by returns from the Asia-Pacific region, including the Middle East. The reverse logistics market is expected to grow as more and more consumers turn to online shopping.

It is obvious from these figures that B2C e-commerce is growing in the Middle East due to the presence of e-logistics, yet neither can function well

without effective REL performance. Moreover, the Asia-Pacific region offers unique characteristics in B2C e-commerce. The reason for this is that it is the fastest-growing region for B2C e-commerce, necessitating improved performance by REL. As a result, the Middle East region was considered an opportunity for B2C e-commerce companies to invest in. Furthermore, Lebanon and Syria have lagged behind other countries in the region, so they were chosen for the study.

In conclusion, the Middle East's peculiarities allow firms to invest there. This is the fastest-growing region in terms of B2C e-commerce, and this necessitates improved REL performance. Therefore, the Middle East region was chosen for the study. Another reason for choosing Lebanon and Syria was their lagging behind other countries in the same region. More studies should be done there as the current scientific analyses are scarce.

1.3.3. Factors Impacting Reverse E-Logistics Performance

Globalisation has generated challenges and also competitiveness that must be considered by B2C e-commerce companies. Therefore, reinforcing the implementation of REL performance within an enterprise is a must. Nevertheless, although reverse flows are important for business performance, managing REL is a restricted aspect in the majority of firms, which leads to the unavailability of computerised management (Da Silveira Guimarães & Salomon, 2015). The strategies and policies for diverse stakeholders should be established to enhance stakeholder satisfaction. To obtain effective new technology systems, REL performance should be improved during different stages of product returns, and the data of the different products should be promptly managed (Shaik & Abdul-Kader, 2018). The effective implementation of REL is affected by the scarcity of resources, the lack of coordination between employees, managers, and suppliers, the data-breach possibility, outdated technologies, incompetent managers, and ineffective inventory management (Panghal et al., 2022). One of the biggest concerns in REL performance is managing returned goods via effective REL performance that ensures the lowest possible costs (Eskandarpour, Masehian, Soltani & Khosrojerdi, 2014). To face global and sustainable challenges, REL is a main area of interest which contributes to the implementation of a successful supply chain within an enterprise (Da Silveira Guimarães & Salomon, 2015). However, there are some barriers to acquiring an effective implementation of REL, such as management, organisational structures, the quality of goods, technology, infrastructure, financing, and legal barriers, which should be considered for improved REL performance (Sirisawat & Kiatcharoenpol, 2016). Nevertheless, there is an unpredictability in demand for returning products, which requires special knowledge. Moreover, integrating forward e-logistics with REL is challenging since the data with the

information level can be codified according to different criteria. Planning, controlling, flexibility, and agility are the forward logistics capacities that a firm may find difficult to transfer into REL performance (Vlachos, 2016). The implementation of REL operations presents many obstacles, known to be the level of uncertainty regarding the time and the number of items returned. A specialised system is required to manage the return flow, handling costs, and managing time, all of which are critical for the success of efficient REL performance. This is why several qualitative and quantitative models have been developed by different researchers to solve the issues that are associated with REL, such as inventory management, customer satisfaction, and client demands (Sri Yogi, 2015). Warehousing through proper inventory management, quality management, and effective infrastructure are indispensable factors to be considered when evaluating REL performance (Melo et al., 2022). The unsustainable utilisation of resources, ineffective economic performance, the nonexistence of professional managers, and inefficient IT systems are barriers to effective REL implementation (Münch et al., 2021). Altogether, there are six dimensions that present barriers to effective REL performance: economic, social, and environmental performance, in addition to governmental legislation, skilful managerial practices, and fierce competitors (Gu et al., 2021). REL is faced with several obstacles, yet the main ones are the return policies, quality management, and proper infrastructure (Azizi & Hu, 2021). The integration of REL performance with the entire supply chain is crucial, yet it cannot be achieved without efficient technological systems and recycling processes that aim to reduce the use of resources (Guarnieri et al., 2020). Upon evaluation of REL performance, management should evaluate the supply chain's recycling efficiency, production and environmental costs in addition to up-to-date IT systems (Jiang et al., 2020). It is worth mentioning that the objectives of REL teams should also include creating values and readiness to tackle such issues as incongruence and unintegrated problems inside REL performance and among REL members themselves (Li, Ying, Chin, Yang & Xu, 2018). The identification of main gaps in REL performance makes it easier to understand the required focus. This necessitates the identification of factors that are likely to affect REL activities and systems.

Several factors have been studied and identified to see their impact on REL performance. Annex B, divided into four parts, summarises the main citations done by all REL scholars discussing the probability of such factors impacting REL performance.

An important thing to understand is that only identifying the factors that affect REL performance is not enough; rather, a firm should understand this as a great opportunity since it will result in customer loyalty and satisfaction (Prakash & Barua, 2015). For instance, government policies and organisational structure are factors having a big impact and minimum dependence on REL activities.

Therefore, by identifying and improving such factors, REL performance will, in turn, improve (Yadav & Barve, 2015).

A sustainable supply chain is a way used to manage diverse flows of materials, information, and money. This will yield three different sustainable developments: environmental, economic, and social. The closed-loop supply chain (CLSC) is one of several kinds of sustainable supply chains strictly utilised to handle the recycling and recovery processes of end-of-life products. In CLSC, the manufacturer takes care of returned products themselves or via indirect channels. CLSC showed better results than a forward supply chain. Moreover, decreasing remanufacturing lead time and granting information clarity are crucial for the improvement of REL performance (Cannella, Bruccoleri & Framinan, 2016). The existence of an efficient, effective, and ideal electronic REL system, which contains consumers, retrieval and discarding centres, reproduction factories, and retailers, is crucial for the success of REL systems (Tosarkani, Amin & Zolfaghari-nia, 2020). Recently, the electronics manufacturers have been struggling with some factors that affected REL performance, namely, the lack of application of the global standards, research and development (R&D), experienced employees, and government support. In addition to these factors, changes occur in manufacturing costs, technology, exchange rate, competition, and environmental legislation. The presence of managerial, organisational, technological, infrastructural, and financial barriers is negatively correlated with REL performance (Sirisawat & Kiat-charoenpol, 2016). REL is positively correlated with economic, environmental, and social performance because competent managers, effective IT systems, and efficient resource handling are necessary to accomplish such objectives (Ivanova et al., 2022).

To improve REL performance, the focus should be on such logistics issues as transportation modes and routing, pick-up scheduling, and the use of third-party logistics. After that, the focus should be made on such management activities as picking, sorting, and reusing returned products (Sangwan, 2017). The information systems' capability results in such REL strategic benefits as improved REL performance and higher profits since they help in handling the logistical processes more efficiently, in addition to decreasing losses due to product returns (Shaik & Abdul-Kader, 2018).

Moreover, resource commitment manifested by allocating the financial, personnel and technological resources resulted in decreasing inefficiencies in product returns (Mahindroo, Samalia & Verma, 2018). In the electronics industry, the most types of returned goods are laptops, personal computers, cell phones, and televisions. Several different factors have a direct impact on REL performance, which are collectors, sorters, remanufacturers, recyclers, suppliers, and distributors. The two most difficult factors are disassembly and repair. There are other reasons besides those already mentioned: bad return policy, defective products,

the absence of a warranty, and wrong product delivery (Pandian & Abdul-Kader, 2017). Numerous businesses started integrating their REL activities into their supply chains and business strategies. The primary reason for REL occurrence is returned products that can be explained by warranties, end-of-use, and end-of-life returns. Therefore, the effective management of the return flow requires a well-developed infrastructure, less cycle time, ideal inventory management, good network and transport capacity, efficient recovery rate, and volume flexibility (Sri Yogi, 2015). Uncertainties in a product's life cycle and a firm's production capacity are very costly to firms if not handled properly, and most of the time, such costs are inevitable. The problem is that these and other factors are directly linked to developing an efficient and socially responsible REL system that will ensure the balance between the rights of the firm and customers in having a sustainable supply chain (Sudarto, Takahashi & Morikawa, 2017). REL, which is an indispensable part of logistics and supply chain management, is by itself a complex process made of several activities. It is directly impacted by operational performance and structure-conduct performance. This means that the external structure of a firm has a substantial impact on its strategic decisions (the conduct) for achieving better REL performance while at the same time forming entry barriers to new competitors.

From a theoretical point of view, REL is impacted by convenient and efficient resource utilisation (financial, managerial, technological, and physical), as the resource-based view theory clearly indicates. For a firm to maintain its competitive advantage, it should use internal resources efficiently since they are more effective than external ones for achieving better performance. Indeed, the effect of information technology, infrastructure, transportation vehicles, and organisational structure on REL performance are all positively correlated. The better such factors are ensured in an organisation, the better its REL performance (Morgan, Tokman, Richey & Defee, 2018).

Three strategies exist for the improvement of REL performance. These strategies are appropriate in different industries, especially the electronic and mobile phone industries. The strategies are joint, manufacturer, and third-party reverse logistics strategies. To be applicable, these strategies should be carefully studied with respect to logistics information, management, closed-loop capability, supply chain integration, supply chain coordination, conformity capability, institutional incentives, third-party reverse logistics, and customer satisfaction (Vlachos, 2016). Greater performance of companies arises when REL ties together its positively correlated salient task environment, such as customers, suppliers, competitors, and government agencies. A salient task environment is an extent to which directors give priority to the claims of diverse stakeholders, which is directly linked to the managers' insights regarding three characteristics: power, legitimacy, and urgency (Huang, Rahman, Wu & Huang, 2015). Moreover, other internal

factors — including management, finance, commitment to the efficient use of resources, information systems, cross-functional integration and cooperation, intellectual property's proper use and guard, warranties, repair, and recycling — all determine the success of REL performance and thus, the entire company's performance as well (Sirisawat & Kiatcharoenpol, 2016). The REL performance used to be assessed just from the cost viewpoint, but now other notions are also considered due to their major importance and impact on REL performance, namely, reliability, quality and lead times, environmental and social aspects, employees, managers, commitment to resources, returns' procedures, processing of information, updated information systems, guarantees, customer service, prompt response, availability of collection centres, compensations, and customer satisfaction (Euchi, Bouzidi & Bouzid, 2019).

Due to the increased attention of firms towards society, REL is affected by corporate social responsibility from the side of firms (corporate social responsibility) and consumers (consumer social responsibility). This has led to a new REL concept, which is the "Reverse Logistics Social Responsibility (RELSR)" that includes diverse supply chain stakeholders. REL is also affected by the product lifecycle, sustainability of resources, competitive advantage, capacity planning, pricing, environment, product recycling and breakdown rate, volume and timing of returns, and customer satisfaction (Sudarto, Takahashi, Morikawa & Nagasawa, 2016). REL performance is measured in terms of environmental, social, and economic (highest impact) sustainability, referred to as the triple bottom approach. Moreover, the contribution to the welfare of society and future generations, in addition to corporate social responsibility, significantly affects REL performance (Agrawal, Singh & Murtaza, 2016).

The most cited elements that are susceptible to affect REL performance are all summarised with respective relative authors in Table 1.6.

After a comparison of different methods suggested by scholars in the REL field, ten important factors were detected for further evaluation and analysis: third-party reverse logistics provider (3PRELP), organisational structure, infrastructure, guarantee, inventory management, customer service and satisfaction, management, employees, IT and technology, and quality management.

Different authors explained that certain unresolved issues in maintaining a good REL performance still persist. However, the suggestions made were only theoretical, and this necessitates further analysis to see the significance of the correlation between suggested factors and REL performance. Therefore, a discussion of the most important factors is necessary, as pointed out by the authors. The following analysis explains the difference in the point of view concerning the impact of such factors on REL performance.

Table 1.6. Most cited factors affecting reverse e-logistics performance (Source: elaborated by the author, 2021)

Factors Authors, Years	Management	Org. culture & structure	Quality management	Return policies & Guarantees	IT	Infrastructure	Third-party REL	Employees	Customer satisfaction	Inventory management
Eskandarpour, Masehian, Soltani & Khosrojerdi, 2014									X	
Prakash & Barua, 2015	X	X	X	X	X	X			X	
Huang, Rahman, Wu & Huang, 2015	X	X	X	X	X			X	X	
Yadav & Barve, 2015		X								
Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015					X	X			X	
Da Silveira Guimarães & Salomon, 2015				X	X					
Sri Yogi, 2015			X			X			X	X
Cannella, Bruccoleri & Framinan, 2016	X	X		X						X
Vlachos, 2016	X	X	X	X	X		X		X	X
Agrawal, Singh & Murtaza, 2016							X			X
Sirisawat & Kiatcharoenpol, 2016	X				X		X	X		
Sudarto, Takahashi, Morikawa & Nagasawa, 2016									X	
Cooper, Huscroft, Overstreet & Hazen, 2016									X	
Pandian & Abdul-Kader, 2017	X		X	X						X
Chinda, 2017	X					X				
Batarfi, Jaber & Aljazzar, 2017				X	X				X	
Sangwan, 2017							X		X	X
Sirisawat & Kiatcharoenpol, 2018	X	X	X	X	X	X				
Waqas, Dong, Ahmad, Zhu & Nadeem, 2018	X	X	X	X	X	X	X	X		
Morgan, Tokman, Richey & Defee, 2018	X	X	X	X	X	X		X		
Govindan & Bouzon, 2018	X				X	X				

End of Table1.6

Factors Authors, Years	Management	Org. culture & structure	Quality management	Return policies & Guarantees	IT	Infrastructure	Third-party REL	Employees	Customer satisfaction	Inventory management
Han & Trimi, 2018					X		X		X	
Mahindroo, Samalia & Verma, 2018			X		X				X	
Bal & Satoglu, 2018								X		
Panigrahi, Kar, Fen, Hoe & Wong, 2018			X						X	X
Li, Ying, Chin, Yang & Xu, 2018							X			
Tosarkani & Amin, 2018			X				X			
Chileshe et al., 2018										
Sremac, Stević, Pamučar, Arsić & Matić, 2018							X			
Ardila Gamboa & Ballesteros Riveros, 2019	X	X	X	X	X			X		
Euchi, Bouzidi & Bouzid, 2019	X		X	X	X			X	X	
Tan & Guo, 2019										
Bai & Sarkis, 2019							X			
Wang et al., 2019							X			
Daugherty, Bolumole & Grawe, 2019									X	
Ochocka, 2019									X	
Asian, Pool, Nazarpour & Tabaeian, 2019									X	
Jiang et al., 2020	X				X	X				
Guarnieri et al., 2020					X					
Azizi & Hu, 2021			X	X		X				
Gu et al., 2021	X									
Münch et al., 2021	X				X					
Panghal et al., 2022	X				X			X		X
Melo et al., 2022			X			X				X
Ivanova et al., 2022	X				X	X				X

Management. In addition to management, the successful REL capabilities depend on five main factors: logistics information, closed-loop supply chain, integration and synchronisation of a supply chain, conformity, and institutional incentives (Vlachos, 2016). Management accounts the most for having effective REL performance inside the organisation. Major barriers faced by management comprise the lack of commitment, poor strategic planning, the lack of experience, limited information, and resistance to change, especially everything new, even if such a modification could be beneficial in acquiring improved REL performance (Sirisawat & Kiatcharoenpol, 2016). REL operations can be affected by managers according to three essential characteristics: governance, influence and emergency (Huang, Rahman, Wu & Huang, 2015). The lack of interest, information, consciousness, and engagement by managers from several departments are viewed to be strong barriers to an effective REL settlement (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018; Govindan & Bouzon, 2018).

Employees present on production sites should have the necessary competencies but be accompanied by skilled managers to enhance REL performance effectively at the right time (Chinda, 2017). It is the job of directors to understand the importance of time alterations and to handle any obstacle when it is needed to switch from conventional to the most advanced systems, therefore adding value to REL operations. Moreover, this will consequently lead to a better competitive position in the marketplace (Sirisawat & Kiatcharoenpol, 2018). In the improvement of REL performance, the leading role is played by managers, and any lack of managerial skills, organisation or assistance or awareness of REL characteristics will contribute to a reduction in REL performance (Prakash & Barua, 2015). Legislating clear instructions, by which each employee is required to know his or her specific contribution to the well-being of REL settlement, should be asserted and followed up by skilled managers who benefit from advanced experience in the company (Cannella, Bruccoleri & Framinan, 2016). For REL operations to succeed, a task director should not be limited to only one side of the job but rather aim for enhanced management quality (Ardila Gamboa & Ballesteros Riveros, 2018).

A company's REL performance cannot attain the highest degree of effectiveness when experienced managers are absent, more specifically at the functional level of the supply chain (Pandian & Abdul-Kader, 2017). The importance of continuous REL manager attempts should be understood for sustaining REL performance (Morgan, Tokman, Richey & Defee, 2018). REL operations have a greater success probability with suitable managerial strategies, competencies and information (Euchi, Bouzidi & Bouzid, 2019).

Therefore, management is an important aspect for further studies as a probable factor possibly having a positive effect on REL performance. Hence, Hypothesis 1 is as follows:

H1: Management is positively correlated with REL performance.

Employees. Some companies producing electronic goods continue to suffer from negative REL performance due to unskilled employees (Sirisawat & Kiatcharoenpol, 2016). The personnel serving the client and responsible for the management of REL operations, such as returned goods, are essential for achieving customer satisfaction and advantageous REL performance (Euchi, Bouzidi & Bouzid, 2019). Empowering workers through their involvement in decision-making, providing them with suitable training, boosting communication and coordination, and enhancing their competencies are considered to be valuable characteristics for having skilled employees able to handle REL operations in the company's supply chain (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). One of the most powerful key indicators for a beneficial REL implementation, if not the strongest, is professionalism in managing a company's human resources (Ardila Gamboa & Ballesteros Riveros, 2018). A sustainable supply chain and, therefore, the sustainability of REL performance is associated with a positive performance of human resources (Morgan, Tokman, Richey & Defee, 2018). Good human resource management cannot be established without a positive relationship with all workers in the firm (Huang, Rahman, Wu & Huang, 2015). Keeping the highest number of workers for the company's activities and its supply chain, including REL performance, should be continuously supervised since any reduction in the number of workers would generate a bad effect on REL performance (Bal & Satoglu, 2018). Obtaining bad employee performance could be a sign of either incompetency or a lack of training. Regardless of the real reason behind substandard employee performance, a firm must act promptly and effectively to solve the problem (Euchi, Bouzidi & Bouzid, 2019).

Therefore, unprofessional, unskilled, and inexperienced employees will render the entire supply chain ineffective, which in turn will negatively impact the firm's REL performance. Hence, Hypothesis 2 is as follows:

H2: Incompetent employees are negatively correlated with REL performance.

Technology and Information Technology (IT). Technical advancements can enhance REL performance considerably since they reduce the duration to react and increase information to manage the REL procedures effectively (Sirisawat & Kiatcharoenpol, 2016). Social and corporate systems represent an added value to REL performance (Han & Trimi, 2018). Estimated global social media and e-commerce users were 2.5 billion in 2018 (Denктаş-Şakar & Sürücü, 2020). The opportunities of B2C businesses are seized because of the enormous technological improvement, and it is positively influencing REL operations (Batarfi, Jaber & Aljazzar, 2017). The best solution for implementing REL properly is the capitalisation and improvement of REL technology because the latter was found to have

a positive and significant impact on REL performance and the entire supply chain (Prakash & Barua, 2015). The main important factors influencing REL settlement effectively are the absence of IT processes, outdated technology and bad infrastructure. Therefore, as a solution, research and development should be more capitalised by companies. In addition, firms must always use updated and new technological systems (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). The fact that specific technology is ready represents an element of success in implementing REL effectively (Govindan & Bouzon, 2018).

Researcher-proposed benefits of sophisticated information technology are not exclusive to REL performance but also to innovations and the firm's responsiveness (Morgan, Tokman, Richey & Defee, 2018). Vital technologies, more specifically those that are secured by intellectual property, improve REL performance and reduce the costs of various functions (Vlachos, 2016). The use of sophisticated IT systems enhances coordination between employees and supervisors because they process information easier and quicker; thus, IT will improve REL performance whenever needed (Euchi, Bouzidi & Bouzid, 2019). Technological creativity can be employed as a major cause to enhance REL performance. Moreover, it can be used for environmental protection through the encouragement of recycling at decreased costs and reducing the use of production factors (Da Silveira Guimarães & Salomon, 2015).

A suitable way to manage the disposal of IT systems is a positive indicator of REL being implemented successfully (Ardila Gamboa & Ballesteros Riveros, 2018). A company that looks for an advantage from rivalry should have the most advanced technological systems and a powerful information system (Huang, Rahman, Wu & Huang, 2015). An information technology system is considered to be one of the strongest key elements that affect REL performance (Bouzon, Spriggo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). In other terms, when enhancements in the information of a logistical system are implemented, REL performance will enhance in return (Vlachos, 2016). The presence of IT systems is indispensable for supply chain managers being able to supervise REL operations efficiently (Mahindroo, Samalia & Verma, 2018). Terms were introduced for e-logistics and reverse e-logistics thanks to the existence of IT. Using electronic commerce is impossible without IT, and thus, REL cannot function without effective IT systems. Therefore, IT can have a significant positive impact on REL performance. Hence, Hypothesis 3 is as follows:

H3: IT is positively correlated with REL performance.

Third-party reverse e-logistics provider (3PRELP). Choosing the optimal 3PRELP, in terms of both costs and effectiveness, is central to the REL processes. The sustainability of the supply chain's resources and REL performance is highly dependent on the selection of 3PRELP, which gave it an even more important role

than before (Bai & Sarkis, 2019). Outsourcing REL activities to 3PRELP is favoured, especially when firms realise the difficulty of REL processes. What makes REL performance even more complicated is the scarcity of resources (Li, Ying, Chin, Yang & Xu, 2018).

Numerous partners are needed to cooperate competently to attain better REL performance (Tosarkani & Amin, 2018). Thus, the decision to outsource REL to a third party is increasingly more popular due to its significance (Sremac, Stević, Pamučar, Arsić & Matić, 2018). To enhance REL performance, attention should be drawn to the proper implementation of third-party logistics (Sangwan, 2017). Companies should be conscious of the type of REL function responsible for outsourcing to a third party. They should be the types of activities that a firm does not have a lot of information about it. Sometimes, firms wish to outsource processes with insufficient in-house resources or capabilities (Li, Ying, Chin, Yang & Xu, 2018). Therefore, firms have to wisely choose the best provider as it can create a significant added value to REL activities for the outsourcing firm (Sirisawat & Kiatcharoenpol, 2016; Bai & Sarkis, 2019). The REL processes are considered to be complex; therefore, companies lacking information on such operations choose the outsource a third-party reverse e-logistics' supplier to run the operation either partially or completely (Wang et al., 2019). An enterprise needs to have more than one offer to attain the highest REL performance (Tosarkani & Amin, 2018). In this context, assessing 3PRELP is obligatory (Vlachos, 2016). Sometimes, allying with a third-party REL offeror is necessary for implementing REL operations effectively because of its advantages ranging from reducing costs to having improved client service and, thus, better customer satisfaction (Sangwan, 2017; Sremac, Stević, Pamučar, Arsić & Matić, 2018). Outsourcing is an extraordinary choice; yet implemented properly through the choice of optimal third-party associates, it will improve REL performance and contribute to increased profits (Li, Ying, Chin, Yang & Xu, 2018). To improve REL operations, emphasis should be placed on the party that collects returned goods for various reasons, the utilisation method for the returned goods, and, finally, the place used to convey the recovered products (Sangwan, 2017).

The main two reasons for an effective REL implementation are protecting the environment and increasing profits. Nevertheless, due to the complications in its operations, REL cannot always be carried out by the company itself; therefore, there is a need for 3PRELP (Tosarkani & Amin, 2018). Then, laws and regulations come next, and the solution should be from the government's side, whereby it should issue laws and abide by them (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). A firm that does not possess transportation and distribution systems should consider a third party to manage such operations to decrease its costs (Agrawal, Singh & Murtaza, 2016). On the other hand, outsourcing logistics is complex as it is site-bound and presents several requirements that could be contradictory (Ilie-

Zudor, Kemény, Pfeiffer & Monostori, 2016). Thus, the presence of a good and reliable 3PRELP is a must, and the chosen provider should be the best available in the market (Han & Trimi, 2018).

Outsourcing to a third-party reverse e-logistics provider could cut a lot of costs since the firm can focus more on what it does best. Utilising the competitive advantage, the firm will further fortify its core competency in the field of its operation. Although 3PRELP also entails some risks, such as complete dependency on the third party, which may result in negative consequences in the case of its failure to deliver goods on time or manufacture quality products; nevertheless, the absence of 3PRELP in a form could result in an unfavourable market position due to the need to allocate time to the efficient management of such operations.

Therefore, Hypothesis 4 is as follows:

H4: The absence of effective third-party reverse e-logistics providers is negatively correlated with REL performance.

Inventory management. Companies unwilling to outsource have to deal strategically with inventory management, since this, in turn, will impact REL performance (Vlachos, 2016). An organised, efficient, and well-controlled REL can yield huge savings and better inventory management (Agrawal, Singh & Murtaza, 2016). Forecasting methods aid in determining and preparing the approximate amounts of inventory level. Moreover, when done correctly, forecasting methods can yield an acceptable inventory turnover rate, yet uncertainty always seems to exist. In the presence of good REL performance, good inventory management will improve its efficiency (Sri Yogi, 2015). It has been proven that managerial awareness of the importance of having good inventory control is indispensable to enhancing REL capabilities (Panigrahi, Kar, Fen, Hoe & Wong, 2018). Several studies showed that the higher the return of products, the higher the bullwhip effect, which is the orders that become more variable upstream in the supply chain. However, other studies have demonstrated that the stability of inventory management is enhanced when the amount of recollected goods increases as well (Cannella, Bruccoleri & Framinan, 2016).

Firms must understand the importance of how inventories are managed and all their diverse features, from collecting products to forecasting and managing returned products (Sangwan, 2017). If an enterprise opts to operate and handle all REL operations by itself, its inventory degrees have to be carefully understood and managed because of their direct effect on REL performance (Vlachos, 2016). If the company manages its inventory in a properly structured and monitored manner, it will result in decreased costs, increased profits, and increased customer satisfaction (Agrawal, Singh & Murtaza, 2016). One of the most complex components in inventory management is the capacity to forecast the number of goods that are estimated to be returned and ordered. Nevertheless, if the forecasting task

is performed correctly, then the performance of REL will be significantly enhanced (Sri Yogi, 2015). For this purpose, the company should be experienced enough to control and manage the degrees of inventory (Panigrahi, Kar, Fen, Hoe & Wong, 2018). Although it happens that returned goods for recycling reduce the costs of raw materials, this is considered an added value for companies that want to reduce their use of raw materials (Cannella, Bruccoleri & Framinan, 2016). Increasing REL performance is mandatory and should occur by concentrating on product realisation, decreasing lead time, minimising warehousing costs and spaces, increasing turnover stocks rate, and managing volume submissiveness (Sri Yogi, 2015). The major essential element of suitable inventory management is the disposal of good forecasting methods that facilitate the prediction of the estimated number of products and ensure their timely delivery (Pandian & Abdul-Kader, 2017).

Managing inventory levels inside an organisation could help it in managing unnecessary costs related to either surplus or shortage of stocks. Moreover, having incompetent inventory management in a firm can directly impact the presence of an effective supply chain. Hence, a firm must manage its inventory levels wisely and avoid substandard inventory management at all costs. Therefore, Hypothesis-5 is as follows:

H5: Bad inventory management is negatively correlated with REL performance.

Return Policy and Procedures/Guarantee. Several reasons exist for customers to return goods; among them is a warranty, which plays a significant impact on REL performance (Pandian & Abdul-Kader, 2017). Warranties can result in bigger volumes of repairs and returned goods, thus affecting REL processes (Huang, Rahman, Wu & Huang, 2015). However, not granting a good guarantee to customers will cause problems since they will not be convinced to buy the product in the first place (Euchi, Bouzidi & Bouzid, 2019). Numerous businesses started integrating REL strategies with their company strategies and supply chains because big volumes of returns are due to warranties (Sri Yogi, 2015). Firms manage REL differently, especially when it comes to their product warranties since it continuously impacts their sales (Panigrahi, Kar, Fen, Hoe & Wong, 2018). The major goal is to determine the value of a return policy on REL performance, and the findings proved that the more encouraging the return policy, the more profits will be generated by the firm (Batarfi, Jaber & Aljazzar, 2017).

Products may be returned by customers because of various reasons, e.g., recycling, dismantling, disposal, deficiency, and guaranteed product life cycle (Tosarkani & Amin, 2018). At some point, returns are destined to be considered in terms of recycling goals, and this imposes difficulties to be faced by inventory management and replenishments. Therefore, some answers are the reduction of remanufacturing and order lead-time as well as returning a certain percentage of

recycled products and forcing an obvious reverse order policy (Cannella, Bruccoleri & Framinan, 2016). Having undefined return strategies is similar to not having any policies (Euchi, Bouzidi & Bouzid, 2019). The time of return policy for firms in the electronic industry led to the biggest number of such returned products as laptops, mobile phones, personal computers and TVs (Pandian & Abdul-Kader 2017). Vagueness in determining the number of returns caused by recycling and dismantling can be managed easier by having a well-developed and delivered return policy that is clearer for clients and workers (Sudarto, Takahashi, Morikawa & Nagasawa, 2016). A positive return procedure for vendors emphasises the REL consideration for producers and further stakeholders (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). In different countries, waste management operations cannot be developed fully or to a certain extent because of the lack of a solid return policy (Govindan & Bouzon, 2018). Products may be returned for the purpose of a return policy, deficiencies, errors in delivery, or recycling. Among these causes, the most effective reason in terms of REL performance is the return policy (Pandian & Abdul-Kader, 2017). A company's return policy should focus on reducing the number of returns; however, sometimes, the presence of such a policy leads to increased volumes of returned goods (Sirisawat & Kiatcharoenpol, 2018). Enterprises are forced to acquire and convey a powerful return policy that is capable of handling and sorting all returned products depending on their most suitable paths, should it be recycling or remanufacturing in terms of increasing their value (Prakash & Barua, 2015).

Policy on returned products is required to avoid exclusivity to defective items but rather be inclusive to different goals like recycling and dismantling of goods (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). A rise in the number of sales depends on positive REL performance, which is negatively impacted directly by a precise well-developed and organised return policy that is conveyed to both employees and clients (Ardila Gamboa & Ballesteros Riveros, 2018). A firm's policy cannot sustain in the absence of a good return policy (Morgan, Tokman, Richey & Defee, 2018). Therefore, a solid return management procedure should be available for such an objective (Huang, Rahman, Wu & Huang, 2015). Enhancing the terms and conditions of a return policy, guaranteeing the value of recovery of returned products, and providing better policies compared to those of the market rivals is becoming a necessity (Da Silveira Guimarães & Salomon, 2015). Yet again, attention should be paid to the superior and adjusted needs of customers, and since it is required to have a return policy, the volume of returned products is likely to change as a consequence of such a policy (Vlachos, 2016). This can be explained by warranties that contribute to reassurance for the purchasers to buy the product (Euchi, Bouzidi & Bouzid, 2019). Nevertheless, similarly, warranties may contribute to larger volumes of returned goods and affect REL performance directly (Huang, Rahman, Wu & Huang, 2015). Because of its necessity and its

impact on REL performance and sales, the warranty process is considered an essential part not only of REL operations but the entire supply chain (Sri Yogi, 2015; Panigrahi, Kar, Fen, Hoe & Wong, 2018).

The importance of granting a warranty to e-customers is out of discussion since it is perceived as a “reassuring factor” for repeated purchases. However, such guarantees should be placed wisely to avoid unnecessary returns and, thus, unnecessary costs. Despite the challenge imposed by a return policy and warranties usually, the absence of such a policy would render a firm out of competition since no one is willing to take the risk of the probable acquisition of a wrong or defective product.

Therefore, Hypothesis 6 is as follows:

H6: The absence of a return policy and warranties is negatively correlated with REL performance.

Infrastructure. Infrastructure can be explained in diverse terms. Among the most important ones are the terms of such facilities as storage areas, equipment, and transportation (Sirisawat & Kiatcharoenpol, 2016). Infrastructure also extends to electricity, roads, maintenance, industry, forecasting planning, and systems to control returned products (Prakash & Barua, 2015). The lack of a solid and modern system poses enormous obstacles for B2C e-commerce firms (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). The defection removal amenities, infrastructure, and traditional employed resource markets are known for the prevention of the effective settlement of REL operations (Chinda, 2017). In other words, firms that have problems in their infrastructure have problems in managing returned or recalled goods and, thus, a problem in REL performance (Sirisawat & Kiatcharoenpol, 2016). Therefore, if a firm has a good infrastructure, it should be able to manage returned products efficiently. However, the absence of infrastructure will impact the company’s capability to manage these returns, which will cause high costs and losses (Prakash & Barua, 2015).

A company’s infrastructure is fundamentally connected to its supply chain. The infrastructure is a part of diverse logistical activities, including REL, which cannot be completed without convenient infrastructure (Morgan, Tokman, Richey & Defee, 2018). RL systems provide infrastructure with a logistical value that can identify, move, and choose waste management through all the steps of the reverse channels that add value as well as restock the forward supply chains (Melo et al., 2022). Bad technology and infrastructure are considered barriers not only to REL development but to the entire firm as well (Govindan & Bouzon, 2018). REL is driven by infrastructure and technology, which cause an enormous challenge manifested by a deficient logistical system. A common example would be in developing countries where transport infrastructure is extremely substandard, including bad roads, and this results in huge truck maintenance expenses and freight damage (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). Besides,

the relatively low quantity of crucial information and data results in inefficient urban operations and substandard solutions to urban freight complications (Campagna, Stathacopoulos, Persia & Xenou, 2017). Thus, a convenient infrastructure that considers resource efficiency must be selected if a firm wishes to have an efficient REL system (Sri Yogi, 2015). In other words, efficient REL performance cannot be reached without a firm's proper infrastructure (Chinda, 2017). REL affecting infrastructure can be internal, i.e., the technology for warehouses and spaces, cars for transportation, forecasting and supervising returns, utilising the most advanced equipment (Sirisawat & Kiatcharoenpol, 2016), or external, i.e., the design of roads and its aspects, Internet speed, and security measures taken for B2C e-commerce utilisers (Prakash & Barua, 2015).

An institution with a deficient structure has a negative REL performance, negative returns management, and low profits (Sirisawat & Kiatcharoenpol, 2016; Prakash & Barua, 2015; Sri Yogi, 2015; Govindan & Bouzon, 2018; Morgan, Tokman, Richey & Defee, 2018). This consequently means that a company aiming to improve its REL performance should begin improving its infrastructure since the latter does not only impact the REL performance but the entire company's supply chain as well (Morgan, Tokman, Richey & Defee, 2018; Govindan & Bouzon, 2018). However, the issue of a deficient infrastructure cannot be sometimes associated with the enterprise, which means it is not related to the company in itself but instead to the country where it is located and operates, and this poses very important concerns and challenges. For example, most developing countries, including the Middle East, suffer from diverse insufficient infrastructure, such as Internet, roads, water, and electricity. All of these inconsistencies caused firms operating in such countries to either pay high costs or eventually close their business in these regions (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). This is why many firms neglect such countries in their business feasibility studies. Therefore, governments should seek well-developed infrastructure to promote B2C e-commerce (Sri Yogi, 2015).

Infrastructure presence is indispensable for the success of reverse e-logistics. Without well-developed infrastructure, firms will be unable to manage REL processes efficiently; thus, REL performance will be in jeopardy. Hence, a firm operating in the e-commerce industry should focus on the availability of good internal infrastructure and well-developed external infrastructure in the operating country. In addition, it is important to be always updated and in a continuous improvement process since improved infrastructure means improved REL performance. Therefore, Hypothesis 7 is as follows:

H7: Infrastructure is positively correlated with REL performance.

Organisational Structure and Culture. The impact of organisational structure is highly significant for REL performance (Morgan, Tokman, Richey & Defee, 2018). Sound organisational structure positively affects REL performance.

However, the substandard organisational structure is considered a barrier to efficient REL performance. For instance, if the structure is not built to provide its working staff with continuous training and education, the firm will have poor REL performance (Sirisawat & Kiatcharoenpol, 2016). An organisational structure's impact levels on REL performance depend on its rules, guidelines, protocols, and cooperative atmosphere between its managers and employees (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). Sometimes, REL performance is affected by the bullwhip effect of the stock level consistency. This means that the existing organisational structure fails to accurately forecast order and inventory rates (Cannella, Bruccoleri & Framinan, 2016). Firms operating with REL networks should be aware of the stock levels concerning the returned products (Lopes, Correia, Costa e Silva, Monteiro & Borges Lopes, 2020). The organisational structure has one of the most potent impacts on REL. In turn, REL has a high dependency on the organisational structure to achieve better results. Studies related to REL performance proved that the first and the most elements impacting its performance are translated in terms of effectiveness and flexibility regarding institutional structure (Yadav & Barve, 2015). REL performance is directly connected to a robust institutional structure that acknowledges the elementary needs of its workers, activities and capabilities (Morgan, Tokman, Richey & Defee, 2018; Cannella, Bruccoleri & Framinan, 2016). Therefore, if an enterprise has an adequate institutional structure, REL performance would be enhanced (Sirisawat & Kiatcharoenpol, 2016). Nevertheless, the level of effect made by the institution's system on REL performance depends on the company's philosophy, rules, concepts, cooperation, and degree of formality or informality within the enterprise (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018).

The most considerable factors that influence the supply chain's performance and REL in the case of catastrophes are the institutional structure and relevant governmental policies (Yadav & Barve, 2015). A well-tackled, clear, and effective institutional structure will provide companies with a competitive advantage and perform significant alterations to measures increasing profits (Prakash & Barua, 2015). The infrastructure of companies can alter ineffective REL operations towards better effectiveness when an optimal structure is discovered (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). A negative institutional culture in a company could be extremely dependent on negative management, which, in turn, would generate negative REL performance (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). In finding a solution to any issue related to REL practices, the company's policies and instructions play a major role in prioritising the essential factors of REL operations (Sirisawat & Kiatcharoenpol 2018). The institutional culture that guides the policy development for a forward supply chain flow yet fails to consider REL will not lead to expected outcomes (Cannella, Bruccoleri &

Framinan, 2016). The managers and top executives have a responsibility of creating a helpful culture aimed at effective REL systems able to overcome any unexpected difficulty. A company without helpful culture is asking for negative REL performance (Prakash & Barua, 2015).

The culture capable of making REL successful is amongst the most important, if not the most robust, elements affecting REL performance (Ardila Gamboa & Ballesteros Riveros, 2018). Boosting a sustainable culture with regard to resources, supervision, and responsibilities allows for reaching the objectives of REL methods (Morgan, Tokman, Richey & Defee, 2018). Solid organisational performance is proven to exist in positive REL performance, which is strongly related to a cultural structure and procedures within the firm (Huang, Rahman, Wu & Huang, 2015). A culture that supports cooperation and communication between employees and the company, and its suppliers, also enables profit growth (Vlachos, 2016).

Firms should be aware that no one best organisational structure exists. In other words, there is no optimal structure. Each firm's structure depends on its objectives, products, and the effectiveness of its supply chain. However, good organisational culture facilitates the process of formulation and implementation of an effective organisational structure. Thus, firms should continue improving their cultures and structures since they impact the organisational functions, including REL performance. Therefore, Hypothesis 8 is as follows:

H8: Organisational cultures and structures are positively correlated with REL performance.

Customer Service and Satisfaction. Customer satisfaction denotes a crucial factor that impacts REL management regarding the handling of the reverse product flows (Huang, Rahman, Wu & Huang, 2015). The most significant factors affecting customer satisfaction in REL are the readiness to devote staff and resources to REL performance and maintaining a good customer relationship (Euchi, Bouzidi & Bouzid, 2019). The simplicity in finding "returns procedures" on the firm's website and the user rating of the same products referred to in the returns procedures are the most significant factors that affect customer satisfaction and their repurchasing decisions. Thus, firms must master REL processes to correctly endorse the values of customer relationship management (Smith, 2005). A main struggle in logistics and transportation is the vehicle routing problem (VRP) which indicates the number of vehicles situated in a depot and are estimated to meet the needs of several customers with several demands at the same time (Eydi & Alavi, 2018). Communication between consumers and merchants is crucial to e-commerce, e-logistics, and reverse e-logistics. A complaint is an indicator of vital information concerning customer dissatisfaction. If firms overlook these complaints, the customers simply switch to competitors. Therefore, firms have to recognise consumer complaints and counteract them by placing and implementing

recovery strategies to sustain customer satisfaction and improve financial results (Pulansari, Sukma Donoriyanto & Masruroh, 2016).

Firms wishing to win and sustain their competitive advantages should consider customer satisfaction in REL as an important factor to focus on. This is done by ensuring a good forward logistics function and the presence of reliable third-party logistics service providers. Product returns are a very significant concern for most firms. A product may be returned due to customer dissatisfaction with functionality, bad packaging, defects or delivery error due to wrong information or human mistakes (Jaaron & Backhouse, 2016). To obtain good customer service, firms must know the expenses of their inventory to avoid falling into the shortage or surplus trap (Sri Yogi, 2015). The focus on a better REL system initiates attention to good customer service since the latter will yield more sales and enhance the whole supply chain (Linton et al., 2007). Facilitating customer contact and continuous communication with the return service staff are major constituents for reaching optimal customer satisfaction levels (Euchi, Bouzidi & Bouzid, 2019).

Customer service refers to all the functions associated with offering products efficiently and effectively to ensure customer satisfaction (Cooper, Huscroft, Overstreet & Hazen, 2016). Customer service is the delivery of goods to customers in a way that differentiates the firm's values using good logistics management, which results in customer satisfaction and logistics management (Euchi, Bouzidi & Bouzid, 2019). Good client service means good satisfaction and leads to enhanced REL performance. Effective customer service has several benefits, such as better sales and more profits (Vlachos, 2016; Euchi, Bouzidi & Bouzid, 2019; Sudarto, Takahashi, Morikawa & Nagasawa, 2016; Daugherty, Bolumole & Grawe, 2019). Nevertheless, positive client service cannot be taken away from inventory management since any product that is out of stock will generate a negative service (Sri Yogi, 2015). Now, possibly more than ever, customer service impacts REL activities and the entire organisation. This is due to its significant relevancy to customer satisfaction (Cooper, Huscroft, Overstreet & Hazen, 2016). Customer service is the minimum service that a customer expects to obtain during any purchase. Thus, in the case of returning a product through REL, the customer expects good service as well (Asian, Pool, Nazarpour & Tabaeian, 2019).

Despite the fact that several firms utilise diverse social media platforms for B2C e-commerce, they overlook the importance of good customer service, which may lead to returned products and increased REL costs (Daugherty, Bolumole & Grawe, 2019). The biggest challenge that client service faces are the difference in needs and demands between customers, and B2C e-commerce companies should be conscious of satisfying the needs of clients (Ochocka, 2019). This explains the importance of the entire supply chain, including REL, to cooperate, aiming to ensure that customer needs are met (Ochocka, 2019). In the case of returning a product, the customer expects a fast, immediate, and effective service (Asian, Pool,

Nazarpour & Tabaeian, 2019). The two essential variables that impact customer satisfaction in terms of REL performance are the commitment of staff and maintaining a positive relationship with the client (Euchi, Bouzidi & Bouzid, 2019). The best network system deals with handling and returning products in seven stages: starting from primary customers, collecting hubs, redistributing hubs, removal, recycling, discarding hubs, and secondary clients (Eskandarpour, Masehian, Soltani & Khosrojerdi, 2014). The most important keys that affect REL performance in regard to customer satisfaction are encouragement, costs, added value, consumer attitude, supply chain management, return procedures (impact consumer preservation), retailing, network capacities, and information (Panigrahi, Kar, Fen, Hoe & Wong, 2018).

The objective to contribute to the benefit of shareholders and customers will increase customer satisfaction and will retain more clients (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). Good, differentiated, experienced and ensured customer service is also manifested through the after-sales service, including the one that considers B2C e-commerce, which positively influences REL functions (Da Silveira Guimarães & Salomon, 2015). A relationship benefits twice from enhanced REL performance, i.e., through enhanced decision-making processes and more satisfied clients (Sri Yogi, 2015). The effectiveness of REL functions manifests through the decrease in expenses, profit growth and customer satisfaction, thus ensuring a solid rivalry advantage in the e-logistics market (Huang, Rahman, Wu & Huang, 2015). It is important for companies to understand the essence of satisfied clients as this state retains them in the firm and represents a likely increase in profits (Prakash & Barua, 2015). Successful implementation of REL systems is vital for the enhancement of customer satisfaction and the firm's performance. Nevertheless, the measurement criteria and standards are still restrained (Han & Trimi, 2018). Various REL operations, such as handling returned goods, keeping clients informed, and receiving their feedback, are necessary to maintain good customer satisfaction (Mahindroo, Samalia & Verma, 2018).

The management of the returned goods represents a challenge for firms; therefore, they should understand how to include some characteristics in their supply chains to maintain client satisfaction and reassure them. The client satisfaction level will be measured similarly to the company's REL. Without customer satisfaction, no repeated purchases will occur. Thus, REL and the entire supply chain should be dedicated to improving the customer's buying experience. Therefore, Hypothesis 9 is as follows:

H9: Customer satisfaction and service are positively correlated with REL performance.

Quality Management. The aspect of returned products is the most ignored in good REL performance (Sirisawat & Kiatcharoenpol, 2016). The exchange of

quality should not be translated into quantity since this can be accomplished by effective quality supervision and quality control systems (Prakash & Barua, 2015). The indefinite amount of returned goods can influence the quantity of these products in the case where quality management is weak or unavailable in a company and, therefore, impacts REL performance (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). Assessing REL performance in itself without considering the measurement of quality management is completely useless (Ardila Gamboa & Ballesteros Riveros, 2018). The measurement of a product as solid or weak depends on three quality criteria: adequacy, reasonability, and corrupted standards (Pandian & Abdul-Kader 2017). Operative durable REL competency is associated with the most updated functional performance when it comes to better manufacturing quality, lead time, and volume production (Morgan, Tokman, Richey & De-fee, 2018).

Good quality supervision must not give more importance than it should to the necessity of having superior client service quality (Huang, Rahman, Wu & Huang, 2015). Decreasing the number of defective goods to have improved elements of REL characteristics would render the supply chain ineffective (Euchi, Bouzidi & Bouzid, 2019). Enhancing the quality of products via effective quality control and evaluation systems augments customer loyalty and, therefore, enhances customer satisfaction (Vlachos, 2016). Adding value to consumers means keeping the quality of products, which requires good quality management systems capable of tracking consumer feedback and demands (Mahindroo, Samalia & Verma, 2018).

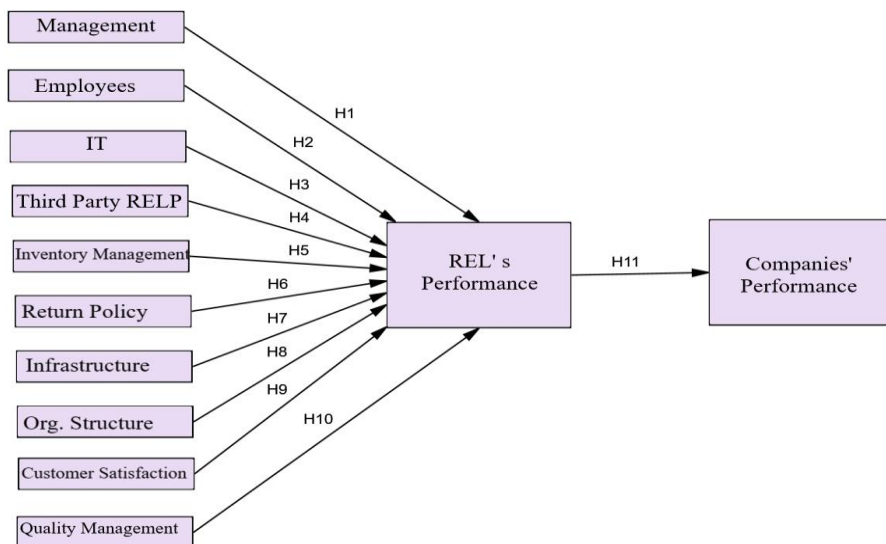


Fig. 1.5. Proposed theoretical framework

Quality management, assurance, and control are important aspects of having good supply chain production. By doing so, a firm can decrease the number of products returned due to substandard quality, thereby decreasing costs and helping to maintain better REL performance. Therefore, Hypothesis 10 is as follows:

H10: Quality management is positively correlated with REL performance.

In conclusion, the selected factors led to the creation of a proposed theoretical framework, as explained in Fig. 1.5.

Therefore, to analyse the correlation with REL performance factors, first, we need to identify REL measurement and companies' performance, which is described in the following sections.

1.3.4. Measuring Reverse E-logistics Performance

Performance measurement (PM) is defined as steps to quantify diverse past activities in an organisation to become more efficient and effective (Pandian & Abdul-Kader, 2017). The PM system is a process of allocating responsibilities, decision-making, setting performance targets, and giving the result by analysing the achievement of the targets (Shaik & Abdul-Kader, 2018; Da Silveira Guimarães & Salomon, 2015). PM is defined as the way to compute the effectiveness and efficiency of the firm's actions. Although some firms are aware of REL's significance, most of them either face complications or knowledge of how to maintain an effective performance measurement system (Chaves, Giuratto & Ferreira, 2020). Convenient performance measurement systems are needed to manage, quantify, and enhance REL activities (Lamba, Yadav, Barve & Panda, 2020). For a firm to acquire sustainable competitive performance, it has to reorganise its supply chains in a well-designed financial structure and contribute to society and the environment (Euchi, Bouzidi & Bouzid, 2019). Performance assessment context affords a balanced interpretation of external and internal activities and the firm's outcomes and its factors (Agrawal, Singh & Murtaza, 2016). Performance can also be evaluated through the development of omni-channels, which is the process of integrating the entire supply chain through four steps: examination and assortment, categorisation and testing, and processing and storing (Ang & Tan, 2018). Benchmarking practice is considered one of the best in which the performance measurement model is appropriate. Successful management of operation results is the success of an enterprise in the long run and consists of accurately including important areas in the performance model of a firm (Agrawal, Singh & Murtaza, 2016). The performance measurement model system consists of implementing three steps: first, presenting the areas of success, such as the measures of performance; second, calculating the relative weights of the dependent and independent criteria of success by employing the hybrid model; and finally, evaluating each REL performance measure

and calculating the global performance score of the firm (Shaik & Abdul-Kader, 2018). An adequate multi-criteria decision-making method, which comprises both quantitative and qualitative methods, aims to specify a clear PM of REL in firms. However, taking all things together and ignoring the sustainability approach will not get the firm a good performance result. Sustainability is either through the sustained and continuous effective REL application or the understanding and implementation of the importance of efficiency in using fewer resources (Bal & Satoglu, 2018).

These discussed methods provide good results only when a wide number of choices are considered. The flexibility of criteria is required, which helps decision-makers to choose among different options, and the methods should be easily employed and understood by decision-makers and stakeholders participating in the decision-making process (Shaik & Abdul-Kader, 2018). Every firm must have an efficient performance measurement system since it has been proven to be an indispensable business tool for a firm's success. Not only does PM play a crucial role in the firms' objectives but in the evaluation and future decision-making as well. The PM's absence is a major problem for the supply chain's efficiency, performance, and costs (Sri Yogi, 2015). Every firm should apply the method for enhancing REL performance in accordance with its needs, systems, networks' capabilities, and generated revenues (Panigrahi, Kar, Fen, Hoe & Wong, 2018). PM is crucial for a firm aiming to reach its goals and establish better competitive strategies (Sri Yogi, 2015).

Only several authors discussed how REL performance measurement could be done due to its complexity (Shaik & Abdul-Kader, 2018; Sri Yogi, 2015; Agrawal, Singh & Murtaza, 2016; Pandian & Abdul-Kader, 2017). Perhaps, the best way to measure REL performance is by measuring four important points: REL cycle time, network capacity, transportation capacity, and the recovery efficiency rate (Sri Yogi, 2015). From another perspective, considering the economic and profit programmes, technology, and corporate social responsibility programmes, can be used as well to measure REL performance (Da Silveira Guimarães & Salomon, 2015). In every firm, the need for certain competencies is required to measure REL performance. The measurement process usually uses such effective indicators as financial, environmental, innovations, meeting diverse stakeholder needs, and social (Shaik & Abdul-Kader, 2018). The triple bottom approach is very popular in measuring REL performance. It relies on considering three aspects: economic, environmental, and social performance, in addition to their relative sub-criteria that help in further analysis (Agrawal, Singh & Murtaza, 2016). PM can also be done in terms of the lead time, input and output quantities, and stimulating agents. These represented agents are mainly the gatherer, provider, supplier, reproducer, and recycler (Pandian & Abdul-Kader 2017).

The complexity of REL performance measurement necessitates considering indicators that facilitate this process. Such indicators as a good green and environmental image, flexibility in recycling or fixing defective products, good quality products, responsiveness rates, costs, and revenues can be used to measure REL performance (Sirisawat & Kiatcharoenpol, 2016). Over the past few years, the following criteria were the most frequently utilised in measuring the REL performance process: information and communication, management, technology, and social commerce. Social commerce, in prospect, has four important sub-criteria: reviews, quality control, customer relationships management, and utilisation risk (Han & Trimi, 2018). However, two very important aspects are often neglected in REL measurement performance, i.e., the commitment to efficiency when using resources and the frequency of returned goods (Mahindroo, Samalia & Verma, 2018).

PM of REL is the way of estimating the efficiency of the total activities related to REL activities. Here, efficiency refers to meeting customer needs at the lowest costs possible but, at the same time, achieving customer satisfaction (Euchi, Bouzidi & Bouzid, 2019). Firms seeking opportunities for a better market position should strive to excel in measuring performance in terms of environmental, economic, and controlling aspects (Huang, Rahman, Wu & Huang, 2015). Evaluating and measuring the degree of a firm's enhancement on important REL outcomes, such as technology implementation, distribution periods, inventory quantities, and maximum capacity usage, will all lead to a sustainable REL and, thus, a sustainable supply chain (Morgan, Tokman, Richey & Defee, 2018). Therefore, REL performance enhancement cannot be reached without enhancing environmental, economic, and social aspects since they are positively related to REL performance (Bal & Satoglu, 2018; Sudarto, Takahashi & Morikawa, 2017). Measuring REL performance is undoubtedly a complex task. Thus, to facilitate this process, the measurement should be considered for three aspects: environmental, social, and economic performance. The choice of using these three aspects was particularly due to the fact that first, they are exhaustive for all the mentioned factors by REL experts. Second, they were highly suggested by most REL studies, and a consensus has been reached concerning this method. Therefore, further analysis of the environmental, social, and economic performance is made to facilitate REL performance.

Environmental Performance. In terms of REL performance, three major elements are important for the environmental activity, i.e., public or governmental agencies, suppliers and clients (Huang, Rahman, Wu & Huang, 2015). The current economic environment is characterised by gradually changing, unstable and unpredictable needs, a variety of products, reduced life cycles of goods, and increased rivalry in the market (Euchi, Bouzidi & Bouzid, 2019). Competing conventional REL systems count on isolating the economic and social characteristics

from REL activities, the most advanced systems that encompass the economic, societal and environmental features to ensure a sustainable REL performance (Sudarto, Takahashi, Morikawa & Nagasawa, 2016). The major issue for REL operations should not only be reducing costs but protecting the environment and transitioning towards the “go green” principle. The governmental rules and policies can improve recycling and, thus, REL quality (Tan & Guo, 2019).

To reduce electronic waste, REL performance can be improved through new rules and ensured adherence to the existing requirements by the local government (Bal & Satoglu, 2018). Other best solutions for the reduction of the environmental effect are improving the green performance, the reproduction industries, and the initiation of recovery centres associated with recycling (Tosarkani & Amin, 2018). Logistics centres must be well-furnished with amenities and infrastructure and have a decent layout strategy for the efficient and fruitful performance of such processes. Challenges of high transportation costs, facilities, energy, delivery closing dates, and control are somehow still inevitable, and all have a negative impact on the environment (Zarali, Yazgan & Delice, 2018). The absence of rules and subsidies from the government for sound return supervision systems will demotivate companies to consider the negative impact of their activities on the environment (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). REL implementation can be improved and influenced by strict governmental laws, rules and strategies and penalties imposed on companies that violate the rules; it is crucial to monitor the adherence to such rules and not simply impose them by legislation (Chileshe et al., 2018).

Looking from a different perspective, customers can have a significant impact on enterprises polluting the environment by way of boycotting their goods, for instance. However, this can be impossible due to the lack of environmental consciousness among the customers (Sirisawat & Kiatcharoenpol 2018). Many countries currently have laws imposing environmental rules to impede the illegal disposal of hazardous and non-hazardous materials. This motivated companies to improve their REL performance and reduce costs (Chinda, 2017). Penalties imposed for the failure to observe environmental laws have been considered useful to motivate companies to consider REL as a necessary tool (Da Silveira Guimarães & Salomon, 2015). Nevertheless, legislation and its implementation are impossible without political will, which is not always available, particularly in developed nations (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). Well-organised, thought-through and straightforward environmental rules should be present to protect the environment and improve REL performance. Laws should require companies to decrease pollution and recycle more. In cases of failure to abide by such legislation, fines should be non-negotiable (Prakash & Barua, 2015). Thus, the aim to abide by such rules obligates companies to improve their REL functions to reduce costs (Euchi, Bouzidi & Bouzid, 2019). Nevertheless, in some cases,

conflicting rules are considered disadvantageous to REL performance if companies fail to realise the importance of such existing laws (Govindan & Bouzon, 2018). Efficient REL is an indispensable part of the green supply chain management (GSCM) success, and it is the method used to have environmental sustainability (Kiatcharoenpol & Sirisawat, 2020). For GSCM to succeed, REL performance and processes must be efficient because of a significant relationship between REL performance and GSCM sustainability (Chan, Man, Fang & Campbell, 2020). Therefore, environmental performance should be highly considered if a firm wishes to improve its REL performance.

Social performance. Social networks and e-commerce add value to better corporate social responsibility (CSR) by finalising the utilisation of goods by recycling procedures (Han & Trimi, 2018). REL performance depends on social performance, which can be assessed by client safety and feedback (Agrawal, Singh & Murtaza, 2016). To enhance the social characteristic of REL performance, companies must elaborate procedures to ensure the tracking of the goods' life cycle by such means as system dynamics structures (Sudarto, Takahashi & Morikawa, 2017). It is important to match B2C's expectations for REL, also considering the environmental and societal features (Euchi, Bouzidi & Bouzid, 2019). Reverse logistics social responsibility (RLSR) is a type of REL that is carried out as a purposeful, clear social responsibility method. The main essential key about RLSR is that it is a type of REL that directly influences the social responsibility concept (Sudarto, Takahashi, Morikawa & Nagasawa, 2016). Few companies consider REL performance when it comes to social aspects in addition to the environmental and economic. Social sustainability has been shown to be advantageous in terms of improving the REL performance of B2C e-commerce enterprises (Agrawal, Singh & Murtaza, 2016). Social elements that influence REL performance can be associated with the improvement of the company's and society's image, and they are perceived as respect for human rights, worker rights, suppliers, and the environmental (Chileshe et al., 2018). The absence of corporate ethics and social responsibility affects REL performance negatively (Waqas, Dong, Ahmad, Zhu & Nadeem, 2018). Care for social aspects is necessary for various supply chain operations, especially in terms of directing to a solid reverse e-logistics implementation (Chinda, 2017).

Sometimes, firms neglect the importance of good social performance because they consider it unessential and costly; however, the reverse is true. Therefore, social performance must not be neglected and should be considered a crucial part of REL performance.

Economic Performance. REL performance depends strongly on a firm's economic capacity, which can be assessed by the return on investment (ROI), as well as through the creation of an added value to a firm's resources and clients (Agrawal, Singh & Murtaza, 2016). The financial and economic consequences

generate large expenses in REL operations (Waqas, Dong, Ahmad, Zhu & Na-deem, 2018). Many costs are included in REL, e.g., for distribution, transportation, recycling, packaging harmful goods, testing, restitution, and technologies. All of them should be managed efficiently to avoid a negative effect on REL performance (Sirisawat & Kiatcharoenpol, 2016). Enormous costs faced by many institutions because of returned goods can be reduced by tactically implementing REL that augments the firm's performance by several degrees (Mahindroo, Samalia & Verma, 2018). Costs for returned goods can vary from two to three times the standard costs for one shipment of goods (Huang, Rahman, Wu & Huang, 2015). Unfortunately, many companies consider REL an unavoidable fact yet do not believe in its ability to reduce useless costs considerably. Fortunately, such solutions as the introduction of design reproduction, recycling and disposal improve REL performance and, therefore, decrease costs (Govindan & Bouzon, 2018). Reduced expenses of the last disassembly in itself can result in many benefits for the effectiveness of REL functions like the protection of the environment and solidifying the position in the e-market among major rivals (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). Companies face a substantial burden of expenses if they neglect the financial REL constituent as a major factor in the company's supply chain. They consider it a luxury instead of a basic need (Chileshe et al., 2018). The advantageous REL implementation necessitates economic funding from the firm, actors, and also the government to ensure a sustainable synchronisation between all players with a major role in practising REL (Prakash & Barua, 2015). Costs can be decreased via the re-utilisation of recycled products, which also improves performance (Chinda, 2017). REL functions necessitate a solid funding source for improving the performance, but also, the enhancement of REL performance will generate more profits (Vlachos, 2016).

Finance is the centre for having successful REL activities and improved operational activities for the entire firm. REL is an indispensable part of the firm's supply chain, and its improvement is impossible without correct, accurate, and meaningful financial measures. Therefore, a financial analysis should be done to improve REL performance. Thus, Hypothesis 11 is as follows:

H11: REL performance is positively correlated with the efficiency of a company's performance.

In conclusion, the assessment of REL performance and its measurement involve the following three factors: environmental, economic, and social performance. Therefore, the economic performance will be measured in terms of revenues, operating costs, and cost savings. The environmental performance will be measured in terms of energy consumption, the firm's green image, and compliance with environmental regulations. Finally, social performance will be measured in terms of created social projects, community expectations, and legal practices. These performance standards were strongly recognised because of their

considerable necessity in REL performance measurement, as noted by REL researchers and analysts.

1.4. Measuring B2C E-commerce Companies' Performance

In the previous sections, the identification of suggested factors that might have a significant correlation with REL performance was undertaken. The eight factors were: management, employees, IT, return policy and warranties, infrastructure, organisational structure and culture, customer satisfaction, and quality management. Then, to identify such a correlation, the REL measurement has to be made using the following environmental, social, and economic performance. To see if a correlation exists between REL performance and B2C e-commerce performance, B2C e-commerce performance criteria should be identified. Therefore, this section explains the method for measuring the B2C companies' performance.

Intellectual capital (IC), manifested by human, physical, and structural types of capital, is crucial to enhance B2C e-commerce companies' performance, and it is also perceived as the key factor of the companies' market growth. The efficient management of IC leads to an increase in the companies' value. Thus, measuring IC's efficiency is a must to maintain a sustainable competitive advantage. The resource-based view of a company helps in determining how the key resources create value for the firm (Shaik & Abdul-Kader, 2018). IC is measured in four main different ways: the direct intellectual capital (DIC), which calculates the dollar values of intangible assets through different IC components, the market capitalisation method (MCM), which estimates the difference between a company's market value and its owners' equities, the return on assets (ROA), which associates a company's average revenues on assets with its market average, and the scorecard (SC) method, which registers different IC constituents into scorecards (Nourani, Chandran, Kweh & Lu, 2018). The efficient use of human capital leads to improved firms' performance in diverse logistics and reverse e-logistics processes. Human capital refers to how employees contribute with their abilities, skills, and knowledge to the rise in the firms' capabilities. It is measured by the knowledge-based economy through diverse staff characteristics, experimenting with novel firms' structures, and stressing customer relationships, fast innovations, and fierce universal competition (Euchi, Bouzidi & Bouzid, 2019).

Urbanisation, technological advancement and fierce competition result in a massive demand for goods and services, thereby making their distribution inside the cities a must for public authorities (Karakikes & Nathanail, 2017). Urban logistics is the flow of products affected by traffic jams and morphology (Muñuzuri, Larrañeta, Onieva & Cortés, 2005). It signifies a geographical zone of challenges

for carriage and logistics actions, equally in logistics sustainability and performance (Papoutsis, Dewulf, Vanelslander & Nathanail, 2018). Various solutions in urban zones have been tried, yet without a large-scale or long-term application (Quak, Balm & Posthumus, 2014). Thus, a vital element of sustainable competency is the capability to entice, grow, and keep human capital (Kucharčíková & Mičiak, 2018).

Logistics performance is positively correlated with the supply chain management strategy, and both are positively correlated with marketing performance, which, in turn, is also positively correlated with financial performance. However, the supply chain management strategy and logistics performance are not correlated with financial performance (Green, Whitten & Inman, 2008). The evaluation of B2C e-commerce companies' performance is heavily impacted by REL performance. Several authors explained how a firm could measure its performance. One famous method is the balanced scorecard (BSC), by which firms can indicate the overall performance and suggest where improvement can be made (Nourani, Chandran, Kweh & Lu, 2018). Commitment to resource efficiency is a key indicator of good performance (Sri Yogi, 2015). Although the efficient use of resources is applied in REL performance measurement, it is used for companies' performance as well (Mahindroo, Samalia & Verma, 2018). Resource efficiency, mixed with low cost, is sometimes sufficient for effective performance measurement (Euchi, Bouzidi & Bouzid, 2019). Efforts to enhance a firm's performance alone might negatively affect the entire supply chain and, thus, lead to catastrophic results. Performance can be measured by measuring the financial and marketing results. As a matter of fact, for efficient measurement of companies' performance, a company should consider the financial capital, physical capital, and operational capacity (Jianu, Jianu & Turlea, 2017). To properly assess a company's performance related to REL, a firm should definitely consider such performance characteristics as product lifecycle, market strategies, procedures, and the firm's production and monitoring capabilities (Wang et al., 2019).

An effective company's PM should not be done without a good supply chain management measurement, which can be made in terms of cost savings and operational efficiency (Yadav & Barve, 2015). The formation of omni-channels can be effective as well. These channels include the assessment of procedure assimilation, information stream, and inventory turnover rate (Ang & Tan, 2018). Performing capacity planning efficiently and flexibly is an effective indicator of companies' performance (Sudarto, Takahashi & Morikawa, 2017). Such indicators as a firm's financial performance, market competition, use of technology, and employee satisfaction, are used by logistics firms to measure their competencies in the market of their domain (Chinda, 2017). Considering financial situations and lowering costs are good indicators of efficient companies' performance; however,

neglecting stakeholder satisfaction might negatively impact a company's performance (Govindan & Bouzon, 2018). REL itself contributes to the firm's financial performance. Thus, taking care of REL means taking care of the firm's performance as well since they are directly linked (Larsen, Masi, Feibert & Jacobsen, 2018).

A beneficial way to measure performance uses key performance indicators for various costs incurred over a specific period. For instance, measuring the before-and-after effect of implementing efficient REL in terms of collection costs and energy savings is a good reference for measuring a firm's performance (Sangwan, 2017). From another perspective, performance evaluation should be like a triple-way framework: the strategic, tactical, and operational framework, thus changing the evaluation into a cost-benefit analysis (Pandian & Abdul-Kader 2017). The focus on the reduction in resource consumption, including energy, is an indispensable part of an efficient firm's performance (Wang et al., 2019). Nonetheless, operational performance costs should also be included in the evaluation processes (Morgan, Tokman, Richey & Defee, 2018). First, a firm needs to identify diverse scales of finance, stakeholders, procedures of in-house and out-house production, and the novelty to be used as a competitive edge (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). Standards in the quality of goods or services, in addition to cost measurement, are good indicators to measure a firm's performance (Li, Ying, Chin, Yang & Xu, 2018). Other firms rely heavily on using the net present value (NPV) as a sole indicator to measure the economic performance of a firm, and for them, this is the most important factor that should be studied and monitored; however, alone, it is not enough (Bogataj & Grubbström, 2013).

Measuring a company's performance is a good indicator of the firm's operating success. Such a measurement can help in action-taking since it will highlight the strengths and weaknesses in a company's system. The problem is that it is complicated, and the authors suggest several measurement methods. However, not all factors were proven significant. Therefore, to have a good performance measurement, the firm should consider three aspects: profits and costs, resource commitment, and operational capacity, since they are most suggested and cited by scholars specialising in performance measurement.

Profits and Costs. The major reason to improve B2C e-commerce company's functions is the probable augmentation in profits caused by increasing its efficiencies (Li, Ying, Chin, Yang & Xu, 2018). The retrieval and resale of used goods, the overhaul of virgin goods, and the resale of finished goods to other parties are the processes that mostly decrease costs and increase profits (Julianelli, Caiado, Scavarda & Cruz, 2020). The rise in asset values during a period is measured in the growth in profits (Jianu, Jianu & Turlea, 2017). The maximisation of

profits should be incorporated into the institutional culture and labour empowerment. The reason is that the costs of centralised decisions are lower than decentralised (Batarfi, Jaber & Aljazzar, 2017). An essential element in the cost decrease and profit increase is the range of the company's flexibility (Melo et al., 2022). A company should be capable of increasing or decreasing production depending on demand forecasting methods aiming to ensure profit sustainability (Sri Yogi, 2015). For optimal profit, a firm should provide a product benefit that consumers like and appreciate (Selviaridis & Norrman, 2015). Customer loyalty imposes an important effect on the company's profits (Ramaseshan, Rabbanee & Tan Hsin Hui, 2013). Consumers consider a product to be of high value when their perceived expectation is met, and the difference between cost and value is worthwhile (Calabuig-Moreno, Crespo-Hervas, Nunez-Pomar & Valantine, 2016).

Good communication between employees, managers and customers will result in better efficiency of inputs, thereby decreasing unnecessary costs, all of which will be translated into higher profits (Levina & Vilnai-Yavetz, 2015). E-maintenance of the company should never be overlooked. The continuous maintenance of all systems and services will yield more money in the long term, even if it will lead to an increase in costs in the short term (Turki & Rezg, 2017). The recovery of goods for reproduction, redressing, fixing, and recycling is a hallmark of profitable companies (Agrawal, Singh & Murtaza, 2016). Briefly speaking, to see profits, a company should run cost-effectively in all its diverse activities, especially REL processes (Han & Trimi, 2018).

Profit maximisation is the first objective in for-profit organisations. A firm unable to gain profit will not stay in the market; therefore, profit is a must. Insufficient profit is a sign of bad organisational performance. Thus, companies must seek methods to optimise profits for better company performance (Jiang et al., 2020).

Resources Commitment. In the case of effective REL performance, the efficient use of resources in the entire supply chain and also B2C e-commerce operations will reduce costs due to a lower number of returns (Mahindroo, Samalia & Verma, 2018). B2C e-commerce performance highly depends on the performance of the environment, characterised by low use of energy and the best use of inputs (Agrawal, Singh & Murtaza, 2016). Centres of distribution with better efficiencies measure their efficiency by calculating outputs over inputs. Such centres have improved REL performance and better decision-making, thus, higher profits (Ardila Gamboa & Ballesteros Riveros, 2018). To reduce electronics waste, B2C e-commerce performance should be improved through the enhancement of activity planning and resource disposal (Bal & Satoglu, 2018). The fast evolution of online access has contributed to the increase in the number of returned goods and, therefore, more losses. Thus, profit sustainability is related to the

extent of commitment to resources and positive REL performance (Mahindroo, Samalia & Verma, 2018).

B2C e-commerce activities are crucial and should be considered in strategies to have efficient use of production factors. However, some obstacles, such as those faced by management and environmental awareness, prevent the effective implementation of B2C activities (Sirisawat & Kiatcharoenpol 2018). Commitment to diverse resources, whether natural or human, is a key component for obtaining sustainable company performance. REL, operational, and supply chain performance, in addition to lower environmental pollution, all impact the organisational performance as a whole (Morgan, Tokman, Richey & Defee, 2018). Due to the scarcity of resources, firms found themselves in a situation trying to reduce costs but, at the same time, attempting to stay competitive in the field of interest. This dual challenge is impossible to overcome without a new and updated REL system that considers techniques to efficiently bootstrap resources (Huang, Rahman, Wu & Huang, 2015). Organisations that gather resources from distributors, retailers, wholesalers and even consumers will establish a REL system that is capable of controlling all its activities more economically and efficiently (Euchi, Bouzidi & Bouzid, 2019). No doubt, the firm is responsible for the efficient use of resources, yet, at the same time, the customers must consume the products responsibly, especially in terms of disposing of them (Sudarto, Takahashi, Morikawa & Nagasawa, 2016). The powerful motivators for the quick REL evolution are numerous, among which the top reasons are the scarcity of resources and raw materials used in production (Han & Trimi, 2018). The advantage gained from an effective REL system is a decrease in the utilisation of the firm's resources (Shaik & Abdul-Kader, 2018). REL focuses on growing the efficiency of production factors and improving and elevating the value of the firm's resources (Chileshe et al., 2018).

Being efficient in the use of resources means a commitment to their good usage (Ivanova et al., 2022). The impact of resources on organisational performance is high and sometimes could be the reason behind poor performance. Sometimes, firms are working with all diverse functional activities well, yet they end up with poor performance. Therefore, attention should be given to the significance of resources for organisational performance, and not only REL performance, despite the fact they are interrelated.

Operational Capacity. The operational capability of a B2C e-commerce company can be assessed by a firm's respective actual assets and other equipment or assets that can be utilised to increase resource efficiency through the use of technology (Jianu, Jianu & Turlea, 2017). In addition, the functional capacity in terms of efficiency should be considered in each phase of REL operations because it is a vital element for the success of a company's supply chain management (Yadav & Barve, 2015). At the operational level, a company must check all pro-

cesses and methods to guarantee the prevention and correction of hazardous products. This requires talented employees and skilled directors (Pandian & Abdul-Kader 2017). Operational performance should be assessed in terms of reducing resource wastage and in improvements done in terms of faster lead time, better-forecasted inventory amount, and the sustainability of the entire supply chain (Morgan, Tokman, Richey & Defee, 2018). Reconsideration of recycling activities and decreased transportation costs contribute to better operational performance. However, sometimes, firms neglect the importance of economies of scale and fail to improve their operations to have enough capacity for such activities (Vlachos, 2016). Managers responsible for decision-making in the organisation must understand the importance of optimising their firms' operations, especially in terms of transportation and shipment (Mejjaoui & Babiceanu, 2018). When the operational capacity of a firm increases, the chances to go multinational and sell products in more countries increase as well (Bouzon, Spricigo, Rodriguez, De Queiroz & Cauchick Miguel, 2015). Thus, operational capacity is an indispensable part of measuring a company's performance (Tseng & Hung, 2014).

In the absence of efficient operational capacity, operational performance will be impacted (Ivanova et al., 2022). This will, in turn, impact the entire firm's performance. Enhancing REL performance is positively correlated with improving operational performance due to enhanced supply chain systems (Münch et al., 2021). Therefore, firms must consider enhancing their operational capacities to enhance their performance (Melo et al., 2022). Table 1.7 summarises the main findings in terms of measuring B2C e-commerce companies' performance.

Table 1.7. Measuring B2C e-commerce companies' performance (Source: elaborated by the author)

Author, year	B2C e-commerce Companies' Performance		
	Profits	Resources	Operations
Ramaseshan, Rabbanee & Tan Hsin Hui, 2013	X		
Quak, Balm & Posthumus, 2014			
Tseng & Hung, 2014			X
Bouzon, Spricigo, Rodriguez, De Queiroz & Miguel, 2015			X
Huang, Rahman, Wu & Huang, 2015		X	
Levina & Vilnai-Yavetz, 2015	X		
Sri Yogi, 2015	X		
Selviaridis & Norrman, 2015	X		
Yadav & Barve, 2015		X	
Agrawal, Singh & Murtaza, 2016	X	X	

End of Table 1.7

Author, year	B2C e-commerce Companies' Performance		
	Profits	Resources	Operations
Calabuig-Moreno, Crespo-Hervas, Nunez-Pomar & Valantine, 2016	X		
Sudarto, Takahashi, Morikawa & Nagasawa, 2016		X	
Vlachos, 2016			X
Batarfi, Jaber & Aljazzar, 2017	X		
Pandian & Abdul-Kader 2017			X
Karakikes & Nathanail, 2017			
Jianu, Jianu & Turlea, 2017			X
Turki & Rezg, 2017	X		
Ardila Gamboa & Ballesteros Riveros, 2018		X	
Bal & Satoglu, 2018		X	
Chileshe et al., 2018		X	
Han & Trimi, 2018		X	
Shaik & Abdul-Kader, 2018		X	
Mahindroo, Samalia & Verma, 2018		X	
Mejjaoui & Babiceanu, 2018			X
Morgan, Tokman, Richey & Defee, 2018			X
Morgan, Tokman, Richey & Defee, 2018		X	
Li, Ying, Chin, Yang & Xu, 2018	X		
Sirisawat & Kiatcharoenpol 2018		X	
Euchi, Bouzidi & Bouzid, 2019		X	
Wang et al., 2019			
Julianelli, Caiado, Scavarda & Cruz, 2020	X		
Jiang et al., 2020	X		
Münch et al., 2021			X
Ivanova et al., 2022		X	X
Melo et al., 2022	X		X

In conclusion, the performed analysis concerning the measurement of the B2C e-commerce companies' performance stresses the necessity to consider three elements that follow in terms of the measurement of a firm's performance: profits and costs, the commitment of resources, and functional capability. These factors will be considered vital notions, as noted by numerous scholars in REL and performance measurement fields.

1.5. Conclusions of the First Chapter

Technological progress and the digital age stimulated the evolution of logistics to a new and improved form, i.e., “e-logistics”. It is widely used by B2C e-commerce businesses due to its significant benefits, such as increased profits, higher customer satisfaction, and better performance. The development of B2C e-commerce necessitated the development of e-logistics. However, the B2C e-commerce business lacks attention in published studies and articles about REL performance, especially in the Middle East, which faces insufficient scientific knowledge on REL performance peculiarities in this region. Moreover, the presence of models for evaluating and improving REL performance is still relatively low. The problem is that no B2C e-commerce firm can avoid having returned goods and, thus, cannot avoid REL. The diverse REL operations cost B2C e-commerce companies significant sums, which necessitates new solutions. To find such solutions, first, the most significant factors that impact REL performance were identified. The literature analysis showed that in the REL field, authors have mostly identified eight factors: management, quality management, organisational structure and culture, IT, customer satisfaction and service, return policy and warranties, employees, and infrastructure. To measure a B2C e-commerce company’s performance, the following criteria will be used: environmental performance, social performance, and economic performance. The following criteria were suggested for measuring the companies’ performances: profits and costs, resource commitment, and operational capacity. Finally, a theoretical framework with suggested hypotheses was created, which will be tested in the next chapter.

Forming Research Methodology for Measuring Reverse E-logistics' Performance in the Middle East

This chapter investigates the methodology applied to analyse the factors affecting the performance of a REL system in organisations. It describes in detail the following applied methodologies: structural equation modelling, multi-criteria assessment (DELPHI), and multi-scoring. Then, it explains the implemented research structure and the main respondent's criteria and their demographic characteristics. The summarized research results of this chapter are published in the author's two publications (Al Majzoub 2019, Al Majzoub & Davidavičienė, 2021).

2.1. Methodology and Research Procedures

The dissertation aimed to identify the most important factors that affect REL performance and see if REL, in turn, affects the B2C e-commerce companies' performance and set guidelines for improving REL performance of B2C e-commerce firms operating in the Middle East. This led to three research questions, RQ1: What are the most important factors that are directly correlated with REL performance?; RQ2: Is REL performance positively correlated with B2C

e-commerce companies' performance?; RQ3: What are the guidelines for improving the REL performance of a Middle Eastern B2C e-commerce firm?

To reach the study's objectives and find answers to formulated research questions, the previous chapter discussed theoretical background studies in addition to performing a comparative analysis. Such analysis permitted the development of hypotheses necessary for determining the significance of factors impacting REL performance. The process is summarised in Fig. 2.1 below.

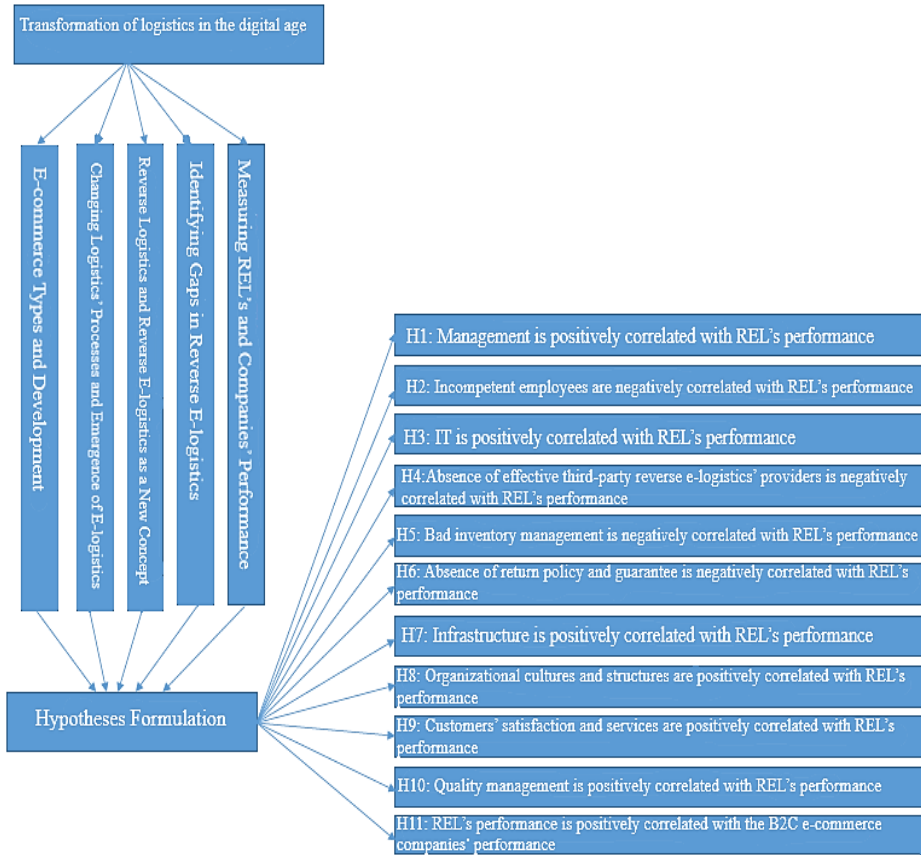


Fig. 2.1. Process of hypotheses formulation
(Source: elaborated by the author, 2020)

As Fig. 2.1 above shows, the process of hypotheses formulation started from the analysis of the literature review concerning the main findings in the field of e-commerce, e-logistics, and reverse e-logistics. First, e-commerce types and development were introduced, followed by the analysis of changing logistics processes and the emergence of e-logistics. Then, the presence of reverse logistics

and the transformation to a new form, REL, was identified. Then, seeking to answer the research questions, gaps in REL performance were identified and analysed. Finally, measuring B2C e-commerce companies' performance was explained. This led to the formulation of the following 11 hypotheses.

H1: Management is positively correlated with REL performance.

H2: Incompetent employees are negatively correlated with REL performance.

H3: IT is positively correlated with REL performance.

H4: The absence of effective third-party reverse e-logistics providers is negatively correlated with REL performance.

H5: Bad inventory management is negatively correlated with REL performance.

H6: The absence of a return policy and warranties is negatively correlated with REL performance.

H7: Infrastructure is positively correlated with REL performance.

H8: Organisational cultures and structures are positively correlated with REL performance.

H9: Customer satisfaction and services are positively correlated with REL performance.

H10: Quality management is positively correlated with REL performance.

H11: REL performance is positively correlated with the B2C e-commerce companies' performance.

Thus, the next step is to validate the above hypotheses by accepting or rejecting them, using questionnaires and SEM through Amos and SPSS software. Then, to have better confirmation of the results, the evaluation by seven experts was conducted. The proposed process methodology and its sample size are depicted in Figure 2.2.

As the figure shows, the sample size is divided into two parts: companies and experts. All in all, 412 companies were selected, and the structural equation modelling methodology was implemented. According to SEM experts, the convenient sample size should be one of either three possibilities: the sample size should range between 100 or 200, 5 to 10 questions for every parameter, or ten questions for each sub-variable (Wolf, Harrington, Clark, 2013). This research has 13 variables with 34 sub-variables multiplied by ten yields; thus, the required sample size is 340. The chosen sample size was 412, which is more than sufficient to have valid results.

First, for the structural equation modelling, a five-point Likert scale questionnaire (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) was used to perform the analysis. The questionnaire was sent to 652 e-commerce companies operating in the electronics field in Lebanon and Syria.

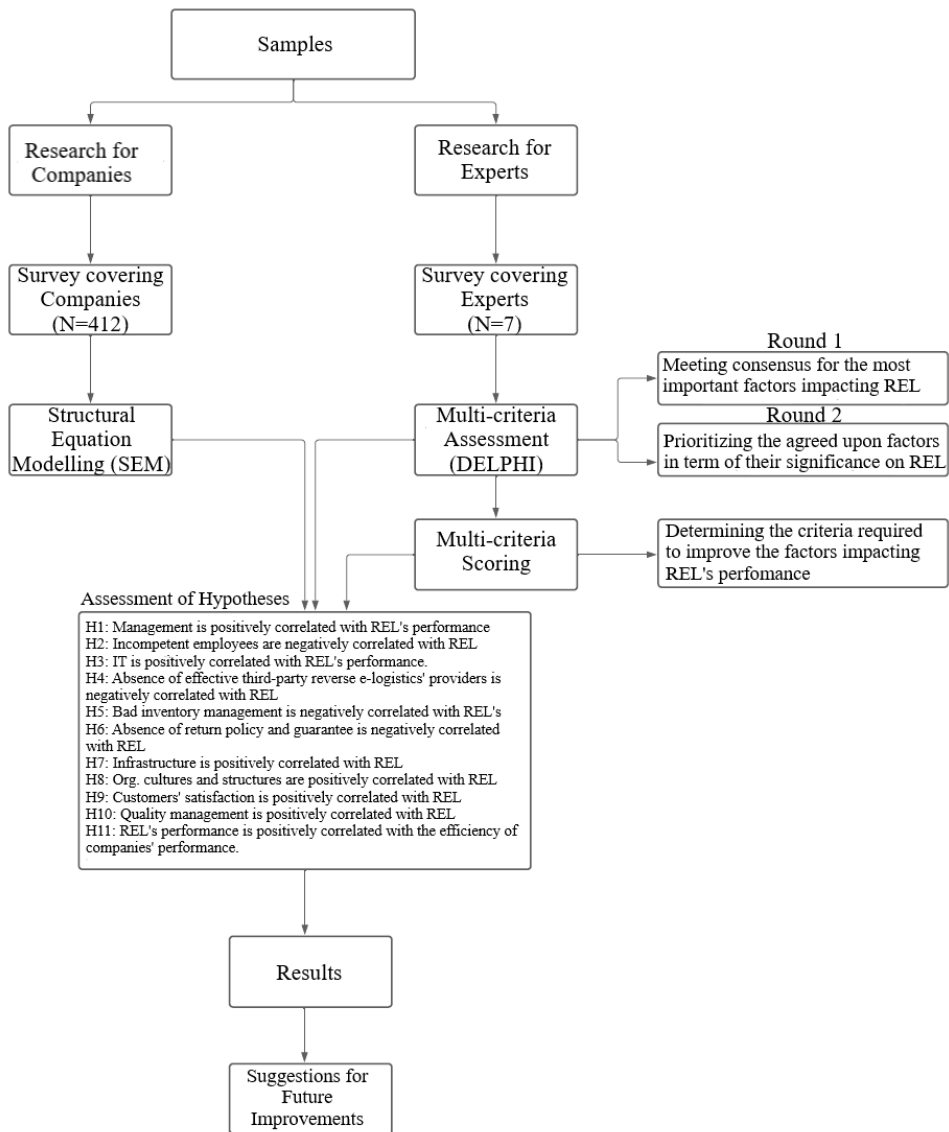


Fig. 2.2. Research Structure (Source: elaborated by the author, 2022)

The questionnaire had 67 questions, six of which were on demographics, seven questions were related to the company's profile, and 54 questions asked about reverse e-logistics factors and the company's performance. The questions were taken from articles by authors who are experts in the REL field. The questions and their sources are summarised in Annex C.

The criteria used for the selection of candidates were as follows:

- Working in supply chain management for at least two years.
- Experienced in e-logistics and REL.
- Having a minimum of a bachelor's degree in business administration.
- Being in the same company for at least two years.

Out of the 652 questionnaires, 412 were returned, representing a response rate of 63.19%, which is sufficient to perform the analysis. The questionnaire used a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). The respondents' demographics are summarised in Table 2.1 below.

Table 2.1. Demographic characteristics of respondents (Source: elaborated by the author)

Category	Frequency	Percentage (%)
Age		
< 25	23	5.58%
≥ 25 and 35 <	97	23.55%
≥ 35 and 45 <	183	44.42%
≥ 45	109	26.45%
Gender		
Male	282	68.45%
Female	130	31.55%
Education		
Bachelor	113	27.43%
Master	264	64.08%
PhD	35	8.49%
Job Position		
Junior level	53	12.87%
Middle level	176	42.71%
Senior level	122	29.61%
Upper management	61	14.81%
Years of Experience		
< 2	0	0%
≥ 2 and 5 <	101	24.51%
≥ 5 and 10 <	182	44.18%
≥ 10	129	31.31%
Years with the same company		
< 2	0	0%
≥ 2 and 5 <	181	43.93%
≥ 5 and 10 <	127	30.82%
≥ 10	104	25.25%

Table 2.1 above shows that the oldest age category was between 35 and 45 (44.42%), followed by the category more than 45 (26.45%), then between 25 and 35 (23.55%), and finally, the less than 25 (5.58%). Concerning gender, there were 68.45% males and 31.55% females. In terms of education, the highest category was master's degree (64.08%), then bachelor's (27.43%), and, finally, PhD (8.49%). For job positions, the highest category was middle level (42.71%), followed by senior level (29.61%), then upper management (14.81%), and, finally, junior level (12.87%). For years of experience, the highest percentage was for years of experience between 5 and 10 (44.18%), then greater than 10 (31.31%), followed by 2 and 5 (24.51%), and, finally, less than 2 (0%). Concerning the last category, years with the same company, the highest percentage was for 2 to 5 years (43.93%), then between 5 and 10 (30.82%), followed by longer than 10 (25.25%), and, finally, less than 2 years (0%).

Table 2.2 below summarises the operating characteristics of the firm.

Table 2.2. Operating characteristics of the firm (Source: elaborated by the author, 2020)

Category	Frequency	Percentage (%)
Year in operation		
1 ≤ years of operation ≤ 3	72	14.14%
4 ≤ years of operation ≤ 10	193	37.92%
11 ≤ years of operation ≤ 50	176	34.58%
years of operation ≥ 51	68	13.36%
Industry of operation		
Electronics	458	89.98%
Other	51	10.02%
Category	Frequency	Percentage (%)
Country of operation		
Lebanon	301	59.14%
Syria	208	40.86%
Both	0	0%
Headquarters country		
Lebanon	396	77.80%
Syria	113	22.20%
Perform REL activities		
Yes	412	80.95%
No	97	19.05%

Table 2.2 shows that the highest percentage is for companies operating between 4 and 10 years (37.92%), followed by 11 to 50 (34.58%), then between

1 and 3 (14.14%), and, finally, more than 51 (13.36%). For the operations industry, the majority was in electronics (89.98%), followed by other industries (10.02%), and none in both (0%). Concerning the country of operations, most firms were operating in Lebanon (59.14%), whereas Syria came second (4.086%). For headquarters country, the highest percentage was Lebanon (77.80%), followed by Syria (22.20%). Finally, most companies performed REL activities (80.95), and some did not (19.05%).

For the expert evaluation, seven professionals were selected, and two methodologies were implemented: the multi-criteria assessment (DELPHI) and the multi-criteria scoring. DELPHI is a multi-criteria assessment tool that enables the achievement of an agreement in a group of experts on a certain topic where none previously existed. Delphi is a method whereby experts are chosen to put their long expertise in answers to a questionnaire. The current study aimed to determine the impact of diverse factors that affect the performance of reverse e-logistics performance.

Decision DELPHI was utilised to improve the quality of decision-making when it came to evaluating business models. The advantages of such a method are incessantly repeating until a consensus is reached. DELPHI has several advantages over other methods; thus, it was chosen for this study. First, DELPHI is relatively easy to use and simple to calculate, despite having a higher significance in terms of validity than other related parametric variance tests. Second, Delphi allows achieving consensus in expert responses in a way that such consensus will arise with one representative view. Third, DELPHI permits the utilisation of data compiled in the study and can build on such data once found significant and valid. Finally, DELPHI is a multi-criteria tool that has a minimal cost for maximum output since its costs are relatively low (San-Jose & Retolaza, 2016).

Delphi was applied as follows:

First, seven experts were chosen according to the following criteria:

1. A minimum of a master's degree in supply chain/logistics management.
2. At least ten years of experience in logistics/supply chain.
3. A minimum of five years of experience in reverse e-logistics.
4. A top manager inside the organisation.

Delphi is performed in two main rounds. Round 1 gathers the answers from experts in the field of the supply chain. Then, based on the results of Round 1 and after determining the expert consensus, another questionnaire is sent in Round 2 to analyse the chosen factors in detail.

In Round 1, experts were asked about the 15 most important factors that have an impact or can improve reverse e-logistics performance. Then, in Round 2, the same experts were asked to answer a questionnaire divided into two main parts. Part A took their opinions on the importance of the mentioned factors regarding REL performance, and part B evaluated the importance of diverse REL activities

on companies' performance. Rounds 1 and 2 are depicted in annexes D and E, respectively.

In the DELPHI method, experts were asked to list the most important factors that impact REL performance first in Round 1 and then to fill out the questionnaire sent in Round 2. The demographic characteristics of the seven experts are as follows: 28.58% of experts were between 35 and 45, 42.84% were between 46 and 56, and 28.58% were between 57 and 64. Males experts comprised 71.42%, and 28.58% were females. Experts from Lebanon comprised 57.14%, and 42.68% were from Syria. Master's degree holders amounted to 71.42%, and PhD holders comprised 28.58%. Finally, 57.14% of the experts had experience between 10 and 15 years, 14.28% between 16 and 25 years, and 28.58% between 26 and 30 years. Finally, a multi-criteria scoring method was used where the same seven experts were asked to give points for the factors and their relative criteria. The multi-criteria scoring method was used to determine in detail how the identified factors that affect REL performance could be improved. A scale of 0 to 10 was used, where 0 — not all likely to have an effect, and 10 — extremely likely to have an effect. The total number of points assigned to eight factors must add to ten. The same applies to the assigning points for criteria where each part must have the sum of ten points. Data validation was performed so the total cannot exceed ten.

2.2. Conclusions of the Second Chapter

This chapter explains the theoretical framework conducted throughout this dissertation. Then, after such introduction, eleven hypotheses were generated and divided into two parts, part one represented the hypotheses concerning factors affecting REL performance (hypotheses 1 to 10), and the second part concerned the impact of REL activities on the B2C e-commerce companies' performances. The process of hypothesis formulation was discussed using a proposed theoretical framework. To acquire an enhanced REL performance, a firm must understand diverse factors impacting such systems. Therefore, this chapter explicitly illustrated the methodology that must be implemented to reach such objectives.

To better understand the methodology process and research procedures, the model was proposed to generate correlation tests. The methodology was divided into three parts: structural equation modelling (SEM), multi-criteria assessment (DELPHI), and the multi-criteria scoring method. The SEM part was performed using the AMOS software after sending a questionnaire to 412 B2C e-commerce companies operating in the REL field. The questions were chosen from already tested hypotheses from well-known authors in the REL field. Moreover, the criteria behind the selection of candidates were carefully chosen. Then, descriptive statistics was done to better explain the results obtained. Then, to have a better

validation of the answers, the opinions of seven experts were taken and considered using the multi-criteria assessment, DELPHI. In this methodology, two rounds were performed to ensure consistency, consensus, and validity. Finally, the multi-criteria scoring method was used to determine in detail how the identified factors that affect REL performance can be improved.

After deciding the methodology, criteria, and sample size, the results can be validated. This is done in the following chapter, which illustrates the discussion of the obtained results.

Modelling Reverse E-logistics

This chapter discusses the results obtained from SEM, DELPHI, and multi-criteria scoring methods and then demonstrates the finalised research model that can be used to improve REL performance for B2C e-commerce businesses suffering from inefficient REL performance. The summarized research results of this chapter are published in the author's two publications (Al Majzoub & Davidavičienė, 2020, Al Majzoub & Davidavičienė, 2021).

3.1. Discussion of Structural Evaluation Modelling Results

The previous chapter illustrated and explained the SEM methodology. The number of returned questionnaires was 412, representing a total response rate of 63.19%, sufficient for performance analysis. The questionnaire used a five-point Likert scale questionnaire (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).

To check the validity of the questionnaire, Cronbach's alpha value was applied. For a questionnaire to be valid, the value of Cronbach's should be between 0.7 and 1.0. All of the below values are greater than the alpha value of 0.70, which indicates reliability. Thus, this proves that results for the studied diverse latent

variables are reliable. The summary of alpha values is documented in Table 3.1 below.

Table 3.1. Values of recorded Cronbach's alpha (Source: elaborated by the author, 2020)

Factor	Cronbach's alpha
Management	0.979
Employees	0.706
IT	0.973
Third-party REL providers	0.719
Inventory management	0.793
Return policy/Guarantee	0.777
Infrastructure	0.869
Organisational structure & culture	0.983
Customer satisfaction/service	0.956
Quality management	0.767

Regarding sampling validity, two famous tests were applied to measure its adequacy. First, the Kaiser-Meyer-Olkin (KMO) test was used, which indicates significance when its value is higher than 0.5. In this study, KMO = 0.739 indicates reliability. Second, Bartlett's test value indicates significance when its value is less than 0.5. In this study, Bartlett's test = 0.000 also indicates reliability. Thus, this analysis proves that the compulsory adequacy level is satisfied. Moreover, the average variance extracted test (AVE) was applied to test the validity further. In the case the AVE value is more than or equals 0.5, then this indicates the presence of validity. AVE values are recorded in Table 3.2 below.

Table 3.2. Values of recorded average variance extracted (AVE) (Source: elaborated by the author, 2020)

Factor	Average Variance Extracted (AVE)
Management	0.865
Employees	0.580
IT	0.843
Third-party REL providers	0.525
Inventory management	0.651
Return policy/Guarantee	0.560
Infrastructure	0.795

End of Table 3.2

Factor	Average Variance Extracted (AVE)
Organisational structure & culture	0.870
Customer satisfaction/service	0.860
Quality management	0.553

For constructing the research model and testing the formulated hypotheses, the AMOS software was utilised. The constructed model is depicted in Fig. 3.1 below.

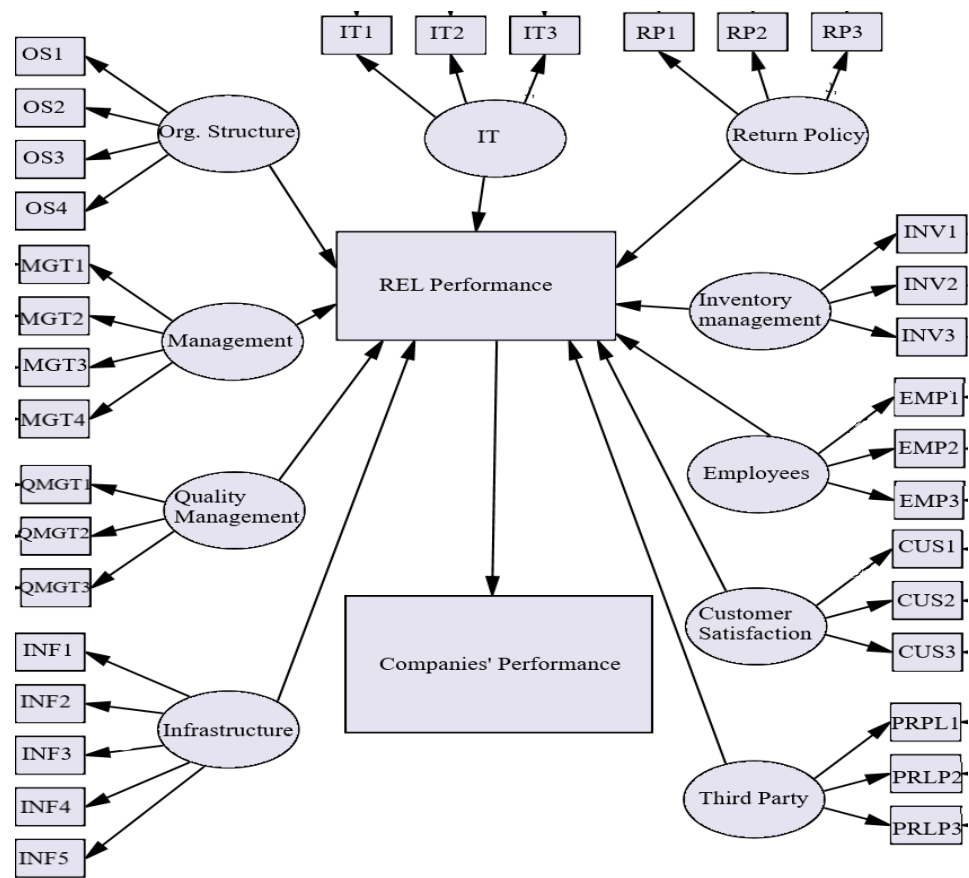


Fig. 3.1. Constructed research model
(Source: elaborated by the author, 2020)

The abbreviations used are as follows:

- OS = Organisational structure;
- Mgt = Management;
- Qmgt = Quality management;
- Inf = Infrastructure;
- IT = Information technology;
- Inv = Inventory management;
- Emp = Employees;
- Cus = Customer satisfaction;
- Prlp = third-party REL providers.

Using the AMOS software, the model fit presence was examined. Table 3.3 below lists the important indicators that explain the existence of a model fit in this study.

Table 3.3. Model fit data (Source: elaborated by the author, 2020)

Model	Default
CMIN	0.114
DF	526
CMIN/DF	2.158
P	0.000
CFI	0.956
GFI	0.875
RMSEA	0.053
SRMR	0.038
Pclose	0.114

CMIN is the model's chi-square, which must be divided by the degree of freedom (*DF*) to test the model fit. To test the model's chi-square, the *CMIN* formula should be implemented. It is explained in formula 3.1 below:

$$CMIN = \hat{C}, \quad (3.1)$$

here *CMIN* = discrepancy $\hat{C}$, where $1 \leq CMIN/DF \leq 3$.

Thus, by applying this formula, the *CMIN/DF* = 2.158. The *CMIN/DF* must be between 1 and 3, which proves the existence of a model fit.

CFI is the comparative fit index, which compares the model fit with respect to the independent variables. CFI explains the difference between the observed and expected covariance matrices. To indicate model fit, CFI must be equal to or more than 0.950.

CFI is the comparative fit index, where $0.95 \leq CFI$.

In this model $CFI = 0.956$, which proves the existence of a model fit. CFI is calculated by applying formula number 3.2 below:

$$CFI = 1 - \frac{\max(\hat{C} - d, 0)}{\max(\hat{c} - d_b, 0)} = 1 - \frac{NCP}{Ncp_b}. \quad (3.2)$$

GFI is the goodness-of-fit index. It measures the fit between the hypothesised model and the observed covariance matrix. GFI must be equal to or more than 0.90 to indicate the existence of model fit.

GFI = goodness-of-fit index, where $0.90 \leq GFI$.

In this study, $GFI = 0.875$, which indicates a good model fit since it is still in the acceptable range variance. GFI was calculated by applying formula 3.3 below:

$$GFI = 1 - \frac{\hat{F}}{\hat{F}_B}. \quad (3.3)$$

$RMSEA$ is the root mean square error of approximation. It is used as a tool for regulating the sample size where chi-square statistics are applied. It is employed as an addition to the tests of chi-square fit. $RMSEA$ should be equal to or less than 0.060.

$RMSEA$ = root mean square error of approximation, where $RMSEA \leq 0.06$.

In this study, $RMSEA = 0.054$ proves the existence of a model fit. $RMSEA$ is calculated by applying formula number 3.4 below:

$$RMSEA \equiv \sqrt{\frac{\hat{C} - d}{nd}} = \sqrt{\frac{1}{n} \left(\frac{\hat{C}}{d} - 1 \right)}. \quad (3.4)$$

$SRMR$ is the standardised root mean square residual. It has two roles. First, it tells if any value is missing from the data, and second, it tells the discrepancy's square root among the sample covariance and the model matrices. $SRMR$ should be equal to or less than 0.08.

$SRMR$ = standardised root mean square residual, where $SRMR \leq 0.08$.

In this study $SRMR = 0.038$, which indicates a model fitness. $SRMR$ is calculated by applying formula 3.5 below:

$$RMR = \sqrt{\sum_{g=1}^G \left(\sum_{i=1}^P \sum_{j=1}^{j \leq i} \left(\hat{s}i_j^{(g)} - \sigma_j^{(g)} \right) \right)} \bigg/ \sum_{g=1}^G i p \times (g). \quad (3.5)$$

P-close is the P value for investigating the null hypothesis, which states that the $RMSEA$ sample is not larger than 0.05. P-close gives an evaluation concerning the close fit test, whereas the P value gives an evaluation concerning the exact fit test. P-close must be more than 0.05 to prove a good measure fit index.

P-close is the P value for investigating the null hypothesis, where $P\text{-close} \geq 0.05$, which is the case in this study since $P\text{-close} = 0.114$. P-close is calculated by applying formula 3.6 below:

$$PCLOSE = 1 - \Phi\left(\hat{C} \middle| 0.05^2 nd, d\right). \quad (3.6)$$

A conclusion drawn from the above analysis is that the empirical data of this study fit the model. This means that the proposed model is fit and can be applied to test the formulated hypotheses. The existence of such model fitness proves that the recorded results are valid. Hence, the managerial implication for firms wishing to improve their REL performance will be considered effective due to the presence of this model fit.

Having proved the existence of the model fit, now the estimated values should be given and analysed. This will be divided into two parts. The first is related to factors impacting REL performance, whereas the second is directed towards REL activities impacting companies' performance. To begin with, the results of the questionnaire must be analysed.

Concerning the correlational study between the supply chain factors and REL performance, the correlation coefficient of factors impacting REL performance and the REL correlation coefficient for companies' performances are summarised in Table 3.4 below.

Table 3.4. The correlation coefficient of factors affecting reverse e-logistics (Source: elaborated by the author, 2020)

Factors under study	Correlation Coefficient	P-value
Management → REL performance	0.187	***
Incompetent employees → REL performance	-0.05	***
IT → REL performance	0.253	***
Absence of third-party reverse e-logistics providers → REL performance	-0.034	0.297
Bad inventory management → REL performance	-0.012	0.658
Absence of return policy and guarantee → REL performance	-0.028	***
Infrastructure → REL performance	0.444	***
Organisational structure and culture → REL performance	0.268	***
Customer satisfaction and service → REL performance	0.574	***
Quality management → REL performance	0.04	***
REL performance → B2C e-commerce companies' performance	0.144	0.047**

*** P-value < 0.01, **P-value < 0.05.

To proceed with the analysis, studying the correlation between the variables with REL performance is a must. A value of the correlation coefficient between 0 and 0.3 is considered a weak positive correlation, between 0.3 and 0.6 is a moderate positive correlation, whereas between 0.6 and 1.0 proves a strong positive correlation. Consequently, the value between 0 and -0.3 is considered a weak negative correlation, between -0.3 and -0.6 is a moderately weak correlation, whereas between -0.6 and -1.0 proves a strong negative correlation (Taylor, 1990; Asuero et al., 2006; Schober & Schwarte, 2018).

Therefore, management (0.187), organisational structure and culture (0.268), IT (0.253), and quality management (0.04) have a weak positive correlation with REL performance. Moreover, customer satisfaction and service (0.574) and infrastructure (0.444) have a moderate positive correlation with REL performance.

On the other hand, the absence of a return policy and warranties (-0.028), bad inventory management (-0.012), incompetent employees (-0.05), and the absence of third-party reverse e-logistics' providers (-0.034) all recorded a weak negative correlation with REL performance. This means that these factors will result in bad REL performance in case of their absences. As for the effect of REL performance (0.144), it has a weak positive correlation with companies' performance. This means that improvement in REL will result in improved company performance. A conclusion can be made from this analysis to see if the formulated hypotheses are rejected or not rejected.

The hypotheses test of significance is based on <0.05 level of significance. Although some hypotheses show a negative correlation, the analysis showed that any P-value >0.05 is, respectively, rejected. Therefore, the null hypothesis is always insignificant to correlation, therefore:

H0: correlation is = 0 (null).

Ha: correlation is $\neq$ 0 (alternative).

Thus, a value of < 0.05 level of significance shows that H0 is not rejected. This means that there is a 0 correlation in the population for this tested variable from which the sample was selected. Whereas a value > 0.05 means that Ha is the one that is not rejected. However, certain sentences were rephrased to eliminate the confusion.

Hypothesis 1(H1). Management is positively correlated with REL performance (correlation coefficient = 0.187, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm has good management, then REL performance will be improved. Thus, when management goes up by 1 standard deviation, REL performance goes up by 0.187 standard deviations.

Hypothesis 2(H2). Incompetent employees are negatively correlated with REL performance (correlation coefficient = -0.05, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that unskilled employees in REL

practices will have a negative impact on REL performance. Thus, when incompetent employees go up by 1 standard deviation, REL performance goes down by 0.05 standard deviation.

Hypothesis 3(H3). IT is positively correlated with REL performance (correlation coefficient = 0.253, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm has good information technology, then REL performance will be improved. Thus, when IT goes up by 1 standard deviation, REL performance goes up by 0.253 standard deviations.

Hypothesis 4(H4). The absence of effective third-party reverse e-logistics providers is negatively correlated with REL performance (correlation coefficient = -0.034 , $p = 0.297$) is rejected due to a P-value higher than 0.05.

Hypothesis 5(H5). Bad inventory management is negatively correlated with REL performance (correlation coefficient = -0.012 ; $p=0.658$) is rejected due to a P-value > 0.05 .

Hypothesis 6(H6). The absence of a return policy and warranties is negatively correlated with REL performance (correlation coefficient = -0.028 , $p < 0.05$), is not rejected since the P-value is less than 0.05. This indicates that if a firm does not have return policies and warranties, its customers will not be willing to buy from it. This will result in bad REL performance. Therefore, when the return policy and guarantee go up by 1 standard deviation, REL performance goes down by 0.028 standard deviations.

Hypothesis 7(H7). Infrastructure is positively correlated with REL performance (correlation coefficient = 0.444, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm has an effective infrastructure, the REL performance will be improved. Thus, when infrastructure goes up by 1 standard deviation, REL performance goes up by 0.444 standard deviations.

Hypothesis 8(H8). Organisational cultures and structures are positively correlated with REL performance (correlation coefficient = 0.268, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm has good organisational structures and cultures, REL performance will be improved. Thus, when organisational structure and cultures go up by 1 standard deviation, REL performance goes up by 0.268 standard deviations.

Hypothesis 9(H9). Customer satisfaction and services are positively correlated with REL performance (correlation coefficient = 0.574, $p < 0.05$) are not rejected since the P-value is less than 0.05. This indicates that if a firm can achieve customer satisfaction through good services, REL performance will be improved. Thus, when customer satisfaction goes up by 1 standard deviation, REL performance goes up by 0.574 standard deviations.

Hypothesis 10(H10). Quality management is positively correlated with REL performance (correlation coefficient = 0.04, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm has good quality management

of its products, this will result in better REL performance. Thus, when a firm's quality management goes up by 1 standard deviation, REL performance goes up by 0.04 standard deviation.

Hypothesis 11(H11). REL performance is positively correlated with the company's performance (correlation coefficient = 0.144, $p < 0.05$) is not rejected since the P-value is less than 0.05. This indicates that if a firm can achieve good REL performance, then the company's performance will be improved. Thus, when REL performance goes up by 1 standard deviation, then the company's performance goes up by 0.144 standard deviations. All the formulated hypotheses and their respective results are summarised in Table 3.5 below.

Table 3.5. Formulated hypothesis with their corresponding results (Source: elaborated by the author, 2020)

Hypothesis	Estimate	P-value	Rejected/Not Rejected
H1: Management is positively correlated with REL performance.	0.187	***	Not Rejected
H2: Incompetent employees are negatively correlated with REL performance.	0.268	***	Not Rejected
H3: IT is positively correlated with REL performance.	0.253	***	Not Rejected
H4: The absence of effective third-party reverse e-logistics providers is negatively correlated with REL performance.	-0.028	0.380	Rejected
H5: Bad inventory management is negatively correlated with REL performance.	-0.012	0.658	Rejected
H6: The absence of a return policy and warranties is negatively correlated with REL performance.	-0.05	***	Not Rejected
H7: Infrastructure is positively correlated with REL performance.	0.574	***	Not Rejected
H8: Organisational cultures and structures are positively correlated with REL performance.	0.268	***	Not Rejected
H9: Customer satisfaction and service are positively correlated with REL performance.	0.444	***	Not Rejected
H10: Quality management is positively correlated with REL performance.	0.04	***	Not Rejected
H11: REL performance is positively correlated with the B2C e-commerce companies' performance.	0.144	0.047**	Not Rejected

*** P-value < 0.01, **P-value < 0.05.

A head-to-head comparison between companies providing e-logistics in Lebanon and Syria shows many similarities and few differences. Although the final number of Lebanese companies was 250, compared to the Syrian 162, the two countries showed some similarities. These similarities are summarised in three main points. First, the eight factors identified as important in Lebanon: management, quality management, organisational structure and culture, IT, customer satisfaction and service, return policy and guarantee, employees, and infrastructure, all had approximately the same significance in Syria. Moreover, the other factors mentioned in the study did not significantly impact REL performance. Second, REL performance was directly related to improved efficiency in companies' performance in Lebanon and Syria. Third, both countries share some patterns in terms of consumer behaviour, such as comparing prices to quality. This may be due to the very similar culture in both countries, which might have led to the same answers to a high number of questions. Concerning the differences in reverse e-logistics in Lebanon and Syria, they can be summarised by two main points. First, concerning the most demanded products online in Lebanon were smart mobile phones and sports equipment. Whereas in Syria, the consumers preferred buying laptops and tablets the most. Second, Lebanese consumers preferred high customer service when it came to customer satisfaction. However, Syrian consumers cited good prices as the most important thing for customer satisfaction.

In conclusion, Lebanon and Syria have many commonalities that make it easier to consider e-businesses willing to take part in the Middle East. Thus, similar e-commerce strategies can be successful for both countries, with minor modifications required.

To sum things up, a firm willing to improve its REL performance should focus on all the factors accepted in the formulated hypotheses. These factors are management, quality management, organisational structure and culture, IT, customer satisfaction and service, return policy and guarantee, employees, and infrastructure. Moreover, once the firm can improve REL performance, it will be able to achieve better efficiency in its performance as well.

3.2. Expert Evaluation of Reverse E-logistics Factors

In the previous chapter, the DELPHI method was introduced and explained. DELPHI is a multi-criteria assessment tool that enables the achievement of agreement among a group of experts on a certain topic where none previously existed. In DELPHI Round 1, the experts gave 24 different factors.

Factors below 51% consensus were rejected, and others were gathered into the same category due to their relevance. For instance, guarantee and return policy was considered as one factor. After the analysis and categorisation, the factors

were summarised into ten main groups: management, IT, infrastructure, third-party reverse e-logistics, organisational structure and culture, quality management, inventory management, employees, return policies and guarantees, and customer satisfaction.

After identifying the factors, Round 2 was set. The sent questionnaire asked the experts to rank the factors impacting REL activities using a scale from 0 (strongly disagree) to 9 (strongly agree).

Expert agreement on each factor was assessed as follows:

Answers lower than 4 meant a low agreement, between 5 and 6 was a medium agreement, and between 7 and 9 was a high agreement.

By calculating the interquartile range (IQR), a consensus was determined. The IQR measures the middle 50 in a given data series. Therefore, the IQR is a measure of outliers or where the majority of the values lie. IQR is the first quartile subtracted from the third quartile, and thus IQR is calculated using the following formula 3.7:

$$\text{IQR} = Q3 - Q1. \quad (3.7)$$

When the value of IQR is less than or equals 1 ($\text{IQR} \leq 1$), consensus exists, and thus, expert answers are accepted for a certain factor to have an impact on REL performance.

Management, employees, infrastructure, organisational structure/culture, customer satisfaction, and quality management all have $\text{IQR} = 1$, and IT has an IQR of zero, which means that they are all accepted and considered for further analysis. Whereas third-party reverse e-logistics and a return policy/warranties had an $\text{IQR} = 5$, and inventory management had an $\text{IQR} = 6$, which means that they were rejected due to the lack of consensus.

After identifying the final factors, the mean is calculated.

Therefore, based on the consensus acceptance and mean calculations, factors affecting reverse e-logistics performance can be prioritised as follows:

The most important factor that should be considered is customer satisfaction (mean = 8.72), followed by infrastructure (mean = 8.5), organisational structure/culture (mean = 7.2), IT (mean = 7.0), and management (mean = 6.6), whereas employees and quality management are of equal importance (mean = 6.5).

The next step was to assess the expert agreement on each factor separately. The environmental, social, economic, and overall performance all had $\text{IQR} = 1$, which means they were all accepted and considered for further analysis. After identifying the final accepted REL activities, the mean was calculated.

Therefore, based on the consensus acceptance and mean calculations, the above factors could be prioritised as follows: overall companies' performance

affected the most by REL activities (mean = 7.72), followed by the economic performance (mean = 7.43), then the social performance (mean = 7.00), and, finally, the environmental performance (mean = 6.85).

In conclusion, according to the DELPHI method that considered the opinion of seven experts in the field of REL, a firm that is willing to improve its REL performance should focus on the following factors: management, quality management, organisational structure and culture, IT, customer satisfaction and service, employees, and infrastructure. Moreover, once the firm can improve REL performance, it will be able to achieve better efficiency in its performance as well.

Then, it was decided to perform the multi-criteria scoring questionnaire to identify and find the exact solutions in the context of the research. Experts were asked how the identified factors could improve REL performance. Therefore, the third questionnaire was sent to the experts to explain in detail the process of improving the seven identified factors. In addition to the seven identified factors, an eighth factor (Return Policy), considered a significant factor to impact REL performance, was added. The questionnaire of the multi-criteria scoring is depicted in Annex F, and all tables regarding expert calculations and the analysis of results are given in Annex G.

The experts were first asked to use a scale of 0 to 10 to indicate the significance of each of the eight identified factors on REL performance. Experts were scoring on the condition that the ten points should be distributed in total among the identified factors; that is, the maximum total points allocated to the factors should not exceed the sum of 10. The reason for using this forced distribution concept in the multi-scoring method is that it provides higher accuracy due to the limitation of equal distribution, and hence, it decreases the probability of having factors with the same ranking. Moreover, it eliminates the expert leniency in giving equal scores to the same factors in addition to removing the central tendency as well. Finally, it decreases biases because an expert can neither under-evaluate nor over-evaluate the factors due to the presence of the forced choice.

First, the experts were asked to rate the factors affecting REL performance. According to the experts, the factors impacting REL performance in the order of significance were: customer satisfaction (Mean = 2.28), infrastructure (Mean = 2.00), organisational structure and culture (Mean = 1.85), IT (Mean = 1.71), management (Mean = 0.85), employees (Mean = 0.71), quality management (Mean = 0.28), and return policy (Mean = 0.28).

Then, experts were asked to rate the criteria of factors to analyse methods of improving the factors. The first factor and its relative criteria to be analysed is the criteria of customer satisfaction. The answers of expert scores of factors affecting REL performance are summarised in annex H.

Experts agreed that customer satisfaction could be improved by focusing on the following criteria in terms of their relative significance and to be given priorities as follows: first, the most important criterion is “CRM follow up with all REL processes” (Mean = 3.28); then, “after-sales service for returning defective/wrong product” (Mean = 2.71) followed by “after-sales service for returning defective/wrong product (Mean = 2.28); then, “CRM has shared customer database” (Mean = 0.85) and finally, “process maps” and “value-stream mapping” (Mean = 0.42).

Then, the experts were asked to rate the criteria of the employee factor. Experts agreed that employee performance in REL can be improved by focusing on the following criteria in terms of their relative significance and to be given priorities as follows: first, the most important criterion is “providing training courses on REL activities, such as procurement, production, returns handling” (Mean = 3.14), followed by “letting employees feel that they make a social impact by taking their opinions into consideration while developing REL performance” (Mean = 2.85), then “cross-training on diverse REL activities” (Mean = 2.28), then with lower importance to “offering employee rewards based on best performers in REL activities” (Mean = 0.85), and “promotion based on meeting objectives for REL systems” (Mean = 0.85).

Then, the experts were asked to rate the criteria of the infrastructure factor. Experts agreed that infrastructure’s performance in REL can be improved by focusing on the following criteria in terms of their relative significance and to be given priorities as follows: first, the most important criterion is “installing solar panels” (Mean = 3.00), followed by “installing solar photovoltaics” (Mean = 2.42), “material handling systems” (Mean = 1.85), then “Electric cars” (Mean = 1.57), “Item order fulfilment systems” (Mean = 0.85), and finally “road train” (Mean = 0.28).

Then the experts were asked to rate the criteria of IT factor. Experts agreed that IT performance in REL can be improved by focusing on the following criteria in terms of their relative significance and to be given priorities as follows: first, the most important criterion is using software “Integration Hub” for EDI (Mean = 3.00), followed by using the RFID (Radio frequency tag) technology (Mean = 2.71), implementing the bar code identification (Mean = 1.85), software excel for SPC (Mean = 1.42), using ZigiOps software for EDI (Mean = 0.57), software QI Macros for statistical process control (SPC) (Mean = 0.42).

Then, the experts were asked to rate the criteria of the management factor. Experts agreed that the management performance in REL can be improved by focusing on the following criteria in terms of their relative significance and to be given priorities as follows: first, the most important criterion is “integrating REL activities with entire supply chain” (Mean = 2.28), followed by “MBO”

technique (Mean = 2.14), “viewing suppliers as a valuable resource” (Mean = 2.14), “comparing budget of previous year” (Mean = 1.71), “leading REL by example” (Mean = 1.42), and finally, “using REL budget discrepancy” (Mean = 0.28).

Then, experts were asked to rate the criteria of the organisational structure and culture factor. Experts agreed that organisational structure and culture performance in REL can be improved by focusing on the following criteria in terms of their relative significance and be given priorities as follows: first, the most important criterion is “low-formality and open-communication channels” (Mean = 5.4), followed by “interconnected REL units with a flat hierarchy” (Mean = 4.71).

Then, the experts were asked to rate the criteria of the quality management factor. Experts agreed that quality management could be improved by the implementation of the in-process inspection, where work is inspected at each stage of the process (Mean = 6.14), as well as by the implementation of the in-process inspection, where work is inspected at each stage of the process.

Experts were asked to rate the criteria of the return policy factor. According to the experts, improving the return policy can be achieved by focusing on the following criteria in terms of significance: the first criterion is the financial incentive, which is achieved by implementing product recovery based on a financial incentive concept (Mean = 6.71), and the second criteria is the exchange item, which is achieved by the implementation of return policy based on exchanging the item instead of a refund (Mean = 3.28).

After analysing all the factors and criteria required for improving the factors affecting REL performance, the factors considered insignificant by the experts were removed (red colour), and those considered to have a significant impact on the factors were approved to be a part of the model (green colour).

The model with all criteria is depicted in Fig. 3.2, whereas the finalised conceptual research model is summarised in Fig. 3.3.

The steps in the created model propose solutions for improving REL performance for electronic B2C e-commerce companies operating in the Middle East and developing countries. The next section provides guidelines on improving REL performance through proper implementation of the proposed model.



Fig. 3.2. Model of all studied criteria (Source: elaborated by the author, 2021)

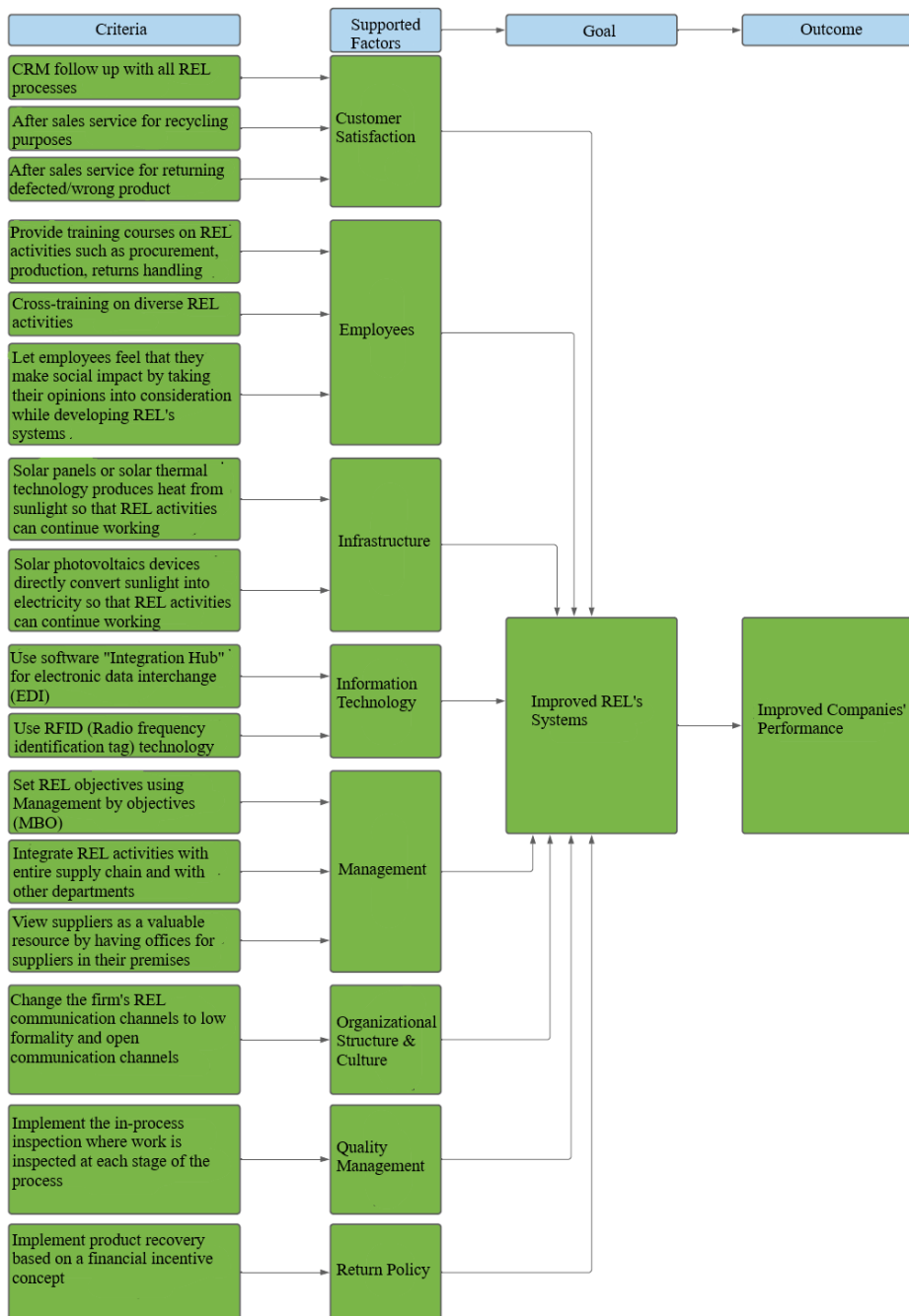


Fig. 3.3. Finalised conceptual research model (Source: elaborated by the author, 2021)

3.3. Guidelines for Improving REL Performance

From all the range of suggested factors from the literature review and the previous research rounds, it was identified that 16 out of 35 criteria were the most significant and should be considered by managers in taking the following steps. Managers must understand that to improve REL performance, they must first improve the customer satisfaction factor, which can be achieved by taking the following steps:

- Managers must focus on integrating CRM with REL performance by following up with all REL processes (returns, recalls, repairs, repackaging for restocking or resale, recycling and disposal, etc.).
- Then, managers must integrate the after-sales service with REL performance, particularly for recycling.
- Finally, managers must assign after-sales service for returning defective/wrong products coming from REL activities.

Second, managers must work on improving employee performance, which can be achieved by taking the following steps:

- Managers must provide training courses on REL activities, such as procurement, production, and handling returns for all employees in their supply chain and, particularly, those dealing with REL processes.
- Managers must focus on performing cross-training on diverse REL activities so that employees can get more acquainted with REL performance.
- Finally, managers have to let employees feel that they make a social impact by considering their opinions while developing REL performance.

Third, managers must work on improving their infrastructure, which can be achieved by taking the following steps:

- Managers must install solar panels or solar thermal technology that produces heat from sunlight so that REL activities can continue working without interruption.
- Managers must consider installing solar photovoltaic devices that directly convert sunlight into electricity so that REL activities can continue working without interruption.

Fourth, managers must work on improving their Information Technology (IT), which can be achieved by taking the following steps:

- Managers must use the software “Integration Hub” for electronic data interchange (EDI) to facilitate the process of staying connected with all their primary stakeholders, such as KPI suppliers.
- Managers must consider using the RFID (radio frequency identification tag) technology whereby digital data encoded in RFID tags or smart labels are captured by a reader through radio waves that automatically identify

objects, collect data about them, and enter those data directly into computer systems with little or no human intervention.

Fifth, managers must work on improving their management skills, which can be achieved by taking the following steps:

- Managers must set REL objectives using management by objectives (MBO)
- Managers must integrate REL activities in the entire supply chain and other departments by having effective leadership and interpersonal skills.
- Managers must view suppliers as valuable resources by having offices for suppliers on their premises.

Sixth, managers must work on improving the organisational structure and culture, which can be achieved by taking the following steps:

- Managers must consider changing the organisational structure into an organic one whereby a firm's REL communication channels are changed to low formality and open communication channels.

Seventh, managers must work on improving the quality management of their supply chains, which can be achieved by taking the following steps:

- Managers must implement in-process inspection where work is inspected at each stage of the process, and in the case of one defective product, the whole production should be stopped immediately, thereby decreasing defective product incidents.

Finally, managers must work on improving the return policy, which can be achieved by taking the following steps:

- Managers must implement product recovery based on the concept of financial incentives. This means that once a customer returns a product for recycling, the firm should grant them either a discount for the new purchase or a certain amount of money as a reward.

3.4. Theoretical Contribution of Reverse E-logistics to Management Theories

Several studies have been performed in the REL field, but very few focused on resolving the issues related to enhancing REL performance in the electronics field in such developing countries as the Middle East. Only a small number of studies have investigated REL in the context of sustainability and this interrelationship. There is a need to examine the relationship between REL and sustainable development. In addition, the social aspect of REL sustainability has been largely overlooked. Moreover, most previous studies have focused on evaluating REL performance in general without considering REL processes. While product disposition is a key REL component, little attention has been given to the disposition

decisions in REL and their potential impact on sustainability performance. Since there are different disposition options during the REL process, an evaluation of how each disposition option would impact sustainability performance would enable firms to make informed decisions on choosing the appropriate disposition options. Making an appropriate disposition decision leads to extending the product's life and can achieve various sustainable development goals.

Thus, the dissertation results contributed to resource management and sustainable development and the theory of resource-based view (RBV).

3.4.1. Contribution to the Science of Resource Management and Sustainable Development

Resource management and sustainability interfere in diverse aspects of our work and daily life. For instance, the use of non-renewable resources is causing major impacts on the environment and operating costs (Mwanza & Mbohwa, 2017). Resource commitment is manifested by allocating financial, human, and technological resources, which results in decreasing inefficiencies in product returns. Cost and environmental impact reduction initiatives are achieved through eco-design and reverse logistics. The trinity of eco-design, resource allocation, and reverse logistics can be seen as green and sustainable supply chain practices in the circular economy. As a result, ecological and resource initiatives need to build a cooperative relationship with reverse logistics. REL is the branch in logistics that deals with returning goods sold via e-commerce and reducing resource utilisation through effective management of recycling, waste discarding, restoring, and re-manufacturing. Thus, REL contributes to resource management and sustainable development. Sustainability or sustainable development means meeting present needs without compromising the needs of future generations. Based on this definition, to secure the future of the children, protecting the environment is the most important step to preserving resources.

Reverse logistics play a major role in decreasing waste and thereby achieving environmental, social and economic sustainability. Sustainable resource management is the repeated utilisation of resources to prevent their depletion. This allows future generations to benefit from the existence of such resources since some have already been used up. Resources are scarce, and a limited supply of non-renewable resources is available. Therefore, the focus is on renewable resource science to ensure continued reuse and greater sustainability. Resource commitment is one of the scientific fields that still lacks sufficient scientific knowledge and contributions. Reverse logistics contributes to society's well-being through the role of reverse logistics in the re-utilisation of resources and has a positive effect on the sustainability of the environment.

Reverse logistics activities are the basic processes that implement many resources and skills. REL is an alternative that reduces negative impacts on the environment associated with the recovery of materials. REL also includes an ecological benefit by increasing product recycling and recovery and, thus, less usage of resources. The efficient use of resources is also translated into improved economic performance (Ivanova et al., 2022). REL helps manage the inflow, storage, and disposal of secondary goods and related information using the traditional supply chain to restore value or to ensure appropriate disposal. Therefore, REL is devoted to the handling of returned goods to be either recovered through such processes as re-utilisation, fixation, renovation, recycling, and prefabrication or completely discarded (Euchi, Bouzidi & Bouzid, 2019). Cost and environmental impact reduction initiatives are achieved through eco-design and reverse logistics. The trinity of eco-design, resource allocation and reverse logistics can be seen as a green and sustainable supply chain practice in the circular economy. As a result, ecological and resource initiatives need to build a cooperative relationship with reverse logistics. Reverse logistics activities are the basic processes that implement many resources and skills. Based on such significance, allocating resources to reverse logistics systems rises the chances of improving the service of supply chain firms.

Efficient resource management and sustainable development can't be achieved without the presence of effective information technology (IT). Logistics resource configuration and management adequately wire IOT-enabled (Internet of Things) dynamic optimisation for sustainable reverse logistics at the physical layer, with the goal of optimising the conformation of reverse logistics resources. Moreover, managers have an indispensable role to play in sustainability. Managers are responsible for managing processes sustainably, which is the skill of structuring business activities in a way to achieve sustainable results. Nonetheless, managers have to make sure that they are working closely with their employees. Strong and sustainable reverse logistics capabilities can be the result of resources specifically dedicated to not only managers but also employees to have the commitment to reverse logistics and supply chain sustainability. Manufacturing, logistics, and reverse logistics, as part of a sustainable supply chain network, are integral to sustainable development. Therefore, the importance of having competent and committed employees is unimpeachable. Employees' main purpose should be to obtain sustainable development by paying attention to the environment, society, and economy. In logistics, the term "sustainable development" is utilised since logistics, as a human activity, first and foremost involves transport, packaging, and warehousing management activities, all of which necessitate the presence of skilful employees. Although these activities grant firms a competitive advantage, they can produce negative effects on the environment and economy in the case of an ineffective infrastructure. As a prerequisite to sustainable

supply chain development, effective manufacturing, logistics, and reverse logistics network design and infrastructure is needed. In reverse logistics, sustainable reverse logistics aims to solve environmental complications by lessening the global negative impact of logistics on the environment and, at the same time, considering the economic impact of recycling and waste disposal. Sustainable reverse logistics can be selected by evaluating several key categories, such as quality, time, waste, cost, and recycling efficiency, all of which necessitate the presence of effective infrastructural systems.

Both management and infrastructure activities, when efficiently implemented, will lead to efficient resource management. The latter will be translated into sustainable development in terms of economic, social, and environmental performance. As one of the issues associated with moral responsibility and social sustainability, reverse logistics can be used as a regulatory strategy for preventing environmental degradation. Therefore, the presence of a return policy and warranties can play a major role in this area. Return policies and warranties can be used to intensify recycling by ensuring that the returned products will not be returned haphazardly; hence more significant sustainability of resources will exist. Customer satisfaction is essential for maintaining effective resource management and sustainable development. Customer satisfaction is achieved using effective reverse logistics systems. Reverse logistics plays a major role, sustaining by increasing sales, offering new usable recycled products, saving costs, and achieving customer satisfaction and loyalty, considering social and ecological aspects. When a customer is satisfied, the likelihood of returning a product decreases, contributing to efficient resource management. Quality management also contributes to sustainable development. It helps in cost minimisation and prompt delivery while maintaining high-quality products, all of which are also considered important due to the presence of reverse logistics.

All of the previous factors contribute to resource management and sustainable development science under one condition, which is the presence of a collaborative and supportive organisational structure and culture. The presence of a globalised market necessitates the existence of measures to be applied to the organisational structure and culture to reduce the increase in waste from the production process and the negative impact of final disposal. Developing a reverse logistics system for businesses with a focus on responsible disposal and maximising value is a must and can be achieved through effective organisational structure and supportive culture.

Due to concerns regarding the ecological, circular economy and sustainable development, reverse logistics is drawing the attention of companies. Reverse logistics helps to obtain sustainable development of resources by reducing carbon emissions. Sustainability-oriented reverse logistics refers to a system that efficiently and cyclically recycles and retreats waste based on the framework of a

circular economy and green logistics, aiming for sustainable development. Resource and energy utilisation are key features of a successful reverse logistics system. A major part of sustainable development is reverse logistics. Through reverse logistics, waste can be recycled and reused, resulting in significant environmental benefits. Getting waste recycled and repurposed through reverse logistics results in substantial pollution reduction. Sustainable development aspires to achieve this ideal state. Reverse logistics is, therefore, an effective way to remedy resource shortages and pollution problems and promote sustainable development.

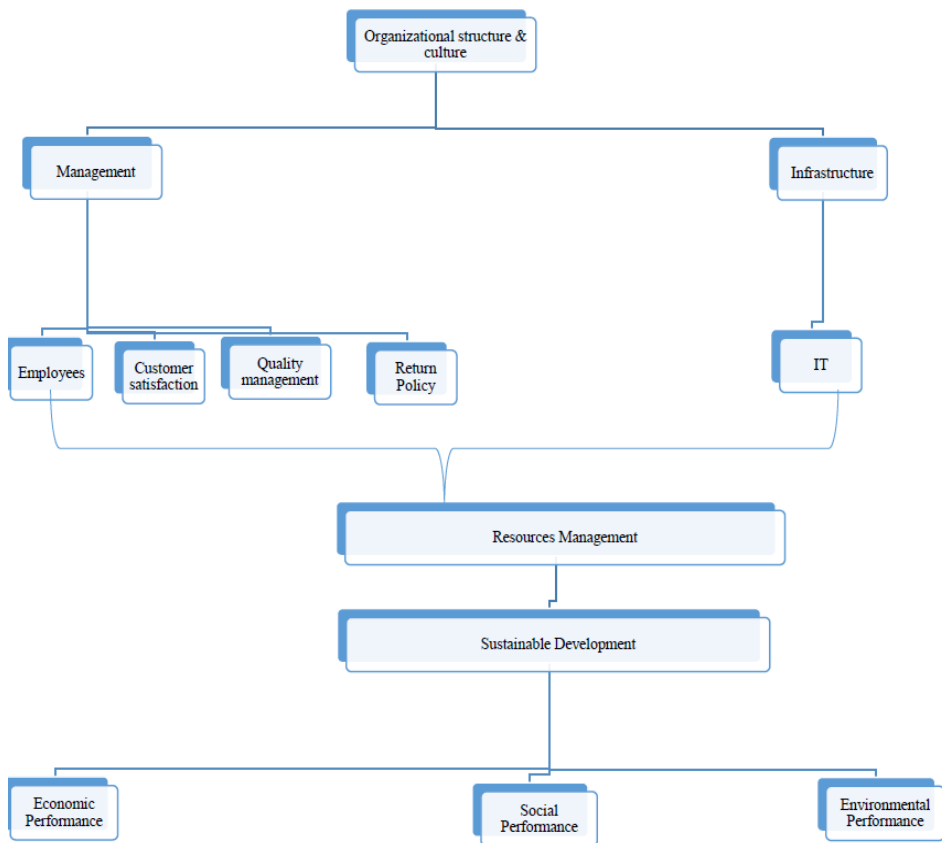


Fig. 3.4. Dissertation contribution to resources management and sustainability
(Source: elaborated by the author, 2021)

The dissertation significantly contributes to resource management and sustainable development science as it focuses on the efficient and sustainable use of resources in a supply chain, e-logistics, and reverse e-logistics (REL). Thus, the

dissertation findings discuss resource allocation through a created REL framework that emphasises the focus on the efficient use of resources, leading to sustainable development in terms of social, economic, and environmental aspects. The finalised research model focuses on adding value to resource management and sustainable development science by suggesting the processes described in Fig. 3.4.

The contribution to resource management and sustainable development science is explained as follows: first, the organisational structure and culture play a vital part in obtaining resource management and sustainable development since it is considered the starting point for most managerial and infrastructural decisions. Then, management should be improved not only in terms of resource management but all science that requires management. It is the role of management to make sure to choose wisely the effective implementation of human resource management activities, to ensure employee and customer satisfaction, to maintain good quality management practices, and warranty and return policy procedures. Needless to say, organisational structure and culture also assist the continuous development of its infrastructure, such as IT, electricity, and operations, by staying updated on the novel and latest technological trends. The findings of this dissertation differ from those in previous studies found in the REL literature by new scientific insights on sustainability and resource management, ensuring that REL practices are well-established.

The sustainable management concept has three main branches: economy, environment, and social needs of future generations. Such branches are used in the created model that sustains the economic practicability, in addition to meeting the needs of future generations through the efficient use of resources and, thus, preventing their depletion. Therefore, sustainable management serves to enhance the implementation of sustainable business activities by managing them so that resources can be of mutual benefit to the firm and society for its current and future generations as well. Due to the increased attention given by firms to society, REL is affected by corporate social responsibility from the point of view of firms (corporate social responsibility) and consumers (consumer social responsibility). This has led to a new REL concept: Reverse Logistics Social Responsibility (RELSR). REL activities play a crucial role in the supply chain, e-logistics, and B2C e-commerce. The existing literature is rare, and it lacks the knowledge, aspects, and peculiarities of the REL system. Thus, inefficiencies in REL systems are still prevalent within the supply chain management field and B2C e-commerce businesses as lack of knowledge of REL's power to impact the entire resource's management and sustainable development science. Therefore, the model proposed by the dissertation contributes to the scientific literature gaps in resources management and sustainable development by emphasising the significance of resources

impacting REL performance which can be managed properly and, thus, lead to sustainable development.

The economic and social development of countries highly depends on the efficient use of resources. Several industries emit high a level of pollution and exert high pressure on the existing natural resources that are initially scarce. This is considered to be a crucial factor in countries' development. Moreover, attaining the missions of countries can't be achieved without the efficient use of resources and effective resource management. Meeting customer needs is essential; however, it should not be made without sustainable actions to preserve the resources for future generations and, thus, preserve the environment. This will help in attaining resource management, obtaining sustainable development, and depicting REL drivers and enablers. The results help REL managers to proactively manage and sustain their resources. It emphasises the significance of resources in the supply chain that are crucial for designing and setting up effective REL systems. Such logistical resources are complimented by other resources in the firm, such as management, employees, infrastructure, and knowledge management. Resource management awareness is built through the bundling of the supply chain and REL process in addition to the resources conveyed from and to the firm.

An essential basis for sustainable development is that people's needs should be maintained in equilibrium with the ecosystem's ability to manufacture and recuperate while at the same time meeting society's development wants. This could be accomplished by the sustainable development process, which is divided into three main dimensions: the environmental, economic, and social dimensions, all of which are explicitly explained in this dissertation on how REL activities should be measured, maintained and sustained.

The dissertation presents a theoretical framework that conceptualises the process of sustainability. In this regard, the dissertation delivers three types of theoretical contributions. First, it develops a theory about the processes of having effective REL performance that fits the efficient companies' performance and integrative supply chain. Moreover, it suggests the theory about the resources that B2C e-commerce businesses need to develop and to quest between companies to undertake supply chain development programmes that enhance e-logistics performance. Third, the dissertation delivers an empirical validation for the application of the resource management framework to the development of social, economic, and environmental innovativeness capabilities.

The created model shows that resources dedicated to sustainable supply chain management are positively correlated with improved organisational performance by acquiring their sustainable reverse logistics systems. Reverse logistics resources can benefit businesses if they are used to develop sustainable reverse logistics capabilities, for instance, reducing pollution's impact on the environment. This means that effective strategic action is a crucial requirement for turning resource

investments into the success of sustainable reverse logistics systems. Resource commitment is regarded as a key factor in achieving supply chain goals.

REL's created model contributes to enhancing the performance of sustainability since it can directly affect cost saving in purchasing, inventory management, distribution and transportation, which can yield significant competitive advantage, in addition to increasing earned revenues. Population growth implies an increased demand for natural resources resulting in waste. Natural resources and wasteland capacity are finite, which is why reverse logistics is necessary. It is becoming increasingly popular to use reverse logistics to treat products more environmentally during their lifetime. The promotion of the model created in this dissertation will contribute to ecological methods of production, distribution, and logistics processes, green logistics and reverse logistics that contribute to protecting the environment. Logistics will continue to demonstrate sustainable development by implementing environmental and technological innovations and engineering them into enterprises and production and service sectors. The results of this dissertation can be useful to those departments responsible for planning resource management and sustainable development, which can also contribute to environmental policies within the regions where supply chain activities operate heavily.

The created model, with its diverse inputs, impacts the entire organisational performance. A strategic link exists between sustainable reverse logistics and organisational performance. Enterprises spend significant resources on sustainable strategies when determined to provide a potential competitive advantage. Therefore, companies can build resources to achieve a competitive advantage by using this type of higher-level resource for sustainable reverse logistics. Sustainable Reverse Logistics Capabilities are the company's capabilities that develop methods to meet changing partners, clients, and environmental necessities through sustainable reverse logistics systems.

Sustainability is the complete integration and balance of the triple-line approach manifested by environmental, economic and social objectives. Sustainable development is a crucial goal for firms since it affects long-term competitiveness, in addition to the fact that sustainability sometimes obliges firms to change their corporate strategic management. Sustainability in REL systems is achieved in one of two ways. The first is to sustain REL implementation and application, whereas the second one is to emphasise raising awareness in using resources more efficiently. Socially and environmentally responsibility, i.e., sustainability, increase customer satisfaction and loyalty. Resource management and sustainability can decrease the impact of firms on climate change and global warming when performing REL activities. This is due to the reduction of the final carbon footprint. Sustainable development emphasises the high quality of the environment, the protection of natural resources, the efficient use of natural resources, and the elimination of environmental burdens. The Sustainable Supply Chain Management

(SSCM) model influences eco-friendly manufacturing and consumption. The programme aims to support cooperation and the development of an integrated supply chain, fabrication, dissemination, and forward and reverse logistics, in addition to strategies in resource management. Companies need to utilise effective reverse logistics to achieve sustainability; the created model contributes to the sustainability of not only resources but the entire supply chain. It is important to realise that reverse logistics strategy and sustainability are interdependent. Businesses increasingly focus on improving efficiency in their processes, resulting in sustainable practices, such as recycling, reusing, reducing waste, and managing returns.

Sustainable logistics consists of sustainability in procurement, transportation, packaging, distribution, reverse logistics, and the control and design of sustainable supply chains. Researchers have determined that eco-design, life cycle evaluation, ecological manufacturing, reverse logistics, and waste management directly impact the performance of the logistics chain. Reverse logistics is derived from environmental issues. Supply chain sustainability has four pillars: sustainability of sourcing, producing, designing, and, most importantly, the sustainability of reverse logistics.

Sustainability refers to the integration of economic, social, and environmental performance in a traditional supply chain. Specifically, this dissertation links three REL dimensions, economic, social, and environmental, to innovation in resource sustainability initiatives in a supply chain. From the perspective of sustainability initiatives, reverse channels are an innovation that offers a social benefit. In light of the results, scientists can construct detailed studies using the created model about the causal relationships that exist between various variables operating between the innovations in sustainability initiatives that a manufacturer undertakes through a REL system to create value for their resources. Therefore, reverse logistics can create value that has the capability of generating earnings as an economic benefit and the ability to create resource sustainability for future generations as an equity social benefit. Recycling-oriented practices have been continuously promoted to reduce natural resource consumption and lessen environmental burdens while making sure sustainable growth is achieved. For development to be sustainable, resources must be conserved, environmental protection must be ensured, and social development needs to be realised concurrently.

In conclusion, this dissertation enriched the literature review by modelling REL solutions to increase B2C e-commerce companies' performance by closing the existing literature gap on Lebanese and Syrian B2C e-commerce companies. Moreover, it also contributes to the resources management & sustainable development topic by filling a critical gap in the scientific literature by developing a new concept of managing technology and innovation framework for Lebanese and

Syrian firms that manages sustainable B2C e-commerce organisational performance ranging from the supply chain, e-logistics, to reverse e-logistics. The dissertation paves the way for future research investigations on the factors and methods that should be implemented to enhance REL processes and organisational performance. Moreover, it helps attain sustainable performance in terms of efficiency and effectiveness outcomes in e-logistics that can be consistent with previous research results on resource management and sustainable development.

3.4.2. Contribution to the RBV Theory

The resource-based view (RBV) asserts that firms can achieve and sustain competitive advantage more successfully by focusing on internal resources rather than external factors. Based on RBV theory, the performance of an organisation will be defined primarily by internal resources. These resources can be categorised into three wide groups: people, processes, and systems. Employees, human-made machines, land, plants, and equipment can be tangible assets, while other assets are considered intangible, e.g., culture, knowledge, and intellectual property. Intangible resources are often more important for gaining and sustaining competitive advantage since they are more difficult to acquire and sell. In industries characterised by imperfect information, the resource-based view of the firm states that companies are best understood as combining heterogeneous and imperfectly mobile resources. To do so, firms have access to technologies, capabilities, competencies, and/or organisational forms. The resource-based view theory asserts that resources enable firms to respond to threats and exploit opportunities. When developing strategies that can lead to sustainable competitive advantage, the mix, type, amount, and nature of a firm's internal resources must be considered first and foremost. A firm's unique resources and capabilities need to be developed and exploited according to RBV while being constantly strengthened and maintained. Firms have an advantage in developing strategies that are not currently being implemented by their competitors.

According to RBV theorists, the focal firm has a sustainable advantage when other firms are unable to duplicate its strategy. The resource-based theory holds that an organisation can develop competitive advantages over its rivals through the acquisition of strategic resources. Strategic resources are assets that are rare, valuable, difficult to replicate, and irreplaceable. RBV is the best model to describe how focusing on resources can lead to competitive advantage, and it is a valuable theory to use in REL activities since the latter focus on resources' utilisation. In contrast to external opportunities and threats, the internal strengths and weaknesses of an organisation are relatively easy to control, so RBV in organisations focuses mainly on those internal elements. So, in the context of results, RBV

is the ideal framework for all conceptual thinking on the economic dimension of supply chain sustainability.

As far as resource relations in an organisation are concerned, it remains an issue. RBV did not discuss the diver interactions and the interdependency between resources on an internal level. Moreover, RBV did not mention how increasing competitive advantage is directly related to efficiency in resources. RBV overlooked the importance of integrating the supply chain with internal organisational resources, which would hinder the effectiveness of the organisational performance, leading to a state of resource malleability. Furthermore, RBV argues that a firm's resources are important for achieving business growth, yet resources alone are not sufficient. For instance, without effective logistics and supply chain management, resources will be depleted. When RBV was proposed, the level of technological advancement was low, whereas today's technology is progressing at an exponential rate, which might have a dramatic effect on the firm's resources. This technology led to the existence of e-commerce, e-logistics, and, consequently, REL to handle returns. The resource-based view of a company helps in determining how the key resources create value for firms, but a gap in maintaining internal resources in supply chain management is not discussed. RBV overlooked resources used inside the organisation to explain the reverse logistic context, within which resource efficiency decisions still lack knowledge. Two very important aspects are often neglected in REL measurement performance, i.e., the commitment to efficiency when using resources and the frequency of returned goods. To fill such gaps in RBV, a new concept was suggested in this dissertation regarding states improving REL performance to maintain efficiency in resource utilisation. The created model suggests the integration of RBV aspects with REL performance. The dissertation results and the created REL model propose that RBV logic can explain resource capability building and economic business aspects by focusing on sustainability-based operations in the supply chain. The contribution of REL to the RBV theory is depicted in Fig. 3.5.

From a functional perspective, a process model is created that contributes to the RBV theory since it aims to understand the performance resulting from creating a sustainable reverse logistics process by focusing on the internal firm's resources. The findings propose that resource obligations for reverse logistics are more related to sustainable reverse logistics, which is more effective than action. Sustainability occurs if a company allocates resources to attract people to sustainable supply chain activities and provides the financial, technical, administrative, and physical resources needed to effectively carry out reverse logistics activities. These results support the RBV theory and fill the gap in maintaining resource efficiency by building strategic structures which capitalise on interrelated resources linking desirable behaviour in appropriate strategic planning.

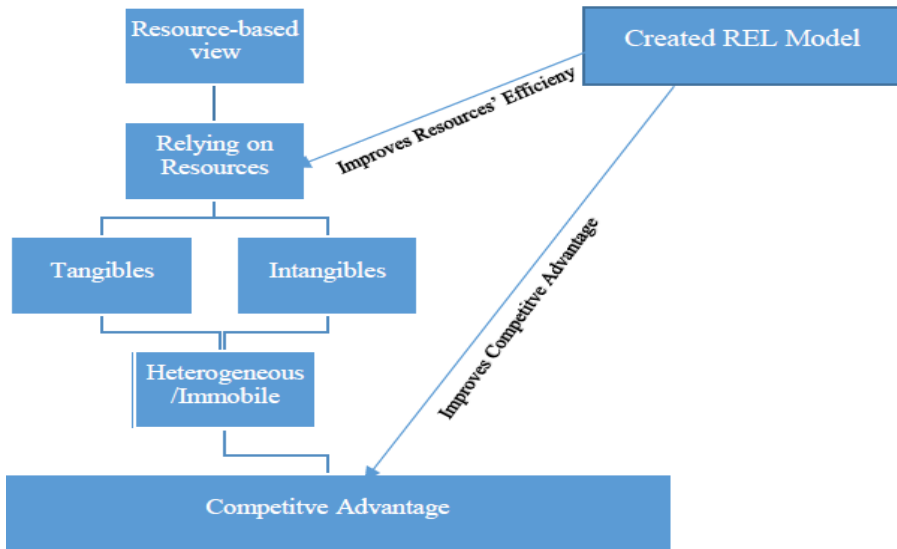


Fig. 3.5. REL created model contribution to the RBV theory
(Source: elaborated by the author, 2021)

The dissertation findings also show that efficient and sustainable reverse logistics capacity is correlated with higher production performance, as evidenced by more on-time delivery, higher product quality and higher capacity operations. The research assesses the strong commitment to sustainable supply chain management as a framework that provides support for human resources to also achieve sustainable development objectives. The academic community must always be reminded that efficient handling of resources has not yet been developed in reverse logistics, and SCM research is still ongoing.

Resources used in sustainable reverse logistics programmes are critical for the success of building a sustainable supply chain. The created model confirms that allocating resources according to RBV is important; however, it is not sufficient on its own. Therefore, the created model discusses the efficient use of resources which leads to a greater focus on internal resources, thus maintaining a sustainable competitive advantage. For a firm to maintain its competitive advantage, it should use internal resources efficiently since they are more effective than external ones for achieving better performance. Resources contribute to structures that support solid behaviour and provide improved performance through sustainable reverse logistics capabilities. Based on these results, this dissertation contributes to the RBV theory by including a REL framework that extends previous research on RBV implications in sustainable supply chains. Because of the chal-

lenges that REL imposes due to its complex operations and the scarcity of resources, some firms prefer outsourcing reverse e-logistics practices to third-party reverse e-logistics providers (3PRELP). Sustainability is achieved either through the sustained and continuous effective REL application or understanding and implementation of the importance of efficiency in using fewer resources. Due to the scarcity of resources, firms found themselves in a situation trying to reduce costs but at the same time attempting to stay competitive in their field. This dual challenge cannot be overcome without a new and updated REL system that considers techniques to bootstrap the resources efficiently. From a theoretical point of view, REL is impacted by convenient and efficient resource utilisation (financial, managerial, technological, and physical), as the resource-based view theory indicates. Thus, the created model contributes to the scientific literature of management theories by adding some insights to the RBV theory in closing gaps in internal resource management in the supply chain management field.

3.5. Conclusions of the Third Chapter

The implementation of the following methodologies was performed: SEM, DELPHI, and multi-criteria scoring method. Results were given in eleven formulated hypotheses, nine of which were accepted since they had a significant P value ($P < 0.05$), which suggested a significant correlation with REL performance. These factors were: management, quality management, organisational structure and culture, IT, customer satisfaction and service, a return policy and warranties, employees, and infrastructure. Concerning the two hypotheses that were rejected, they related to bad inventory management and the absence of third-party REL providers due to an insignificant P value ($P > 0.05$). Therefore, firms enhancing these factors will succeed in improving REL performance, e-logistics and, thus, B2C e-commerce businesses. Moreover, REL activities are positively correlated with increased efficiency of a company's performance. This means improved REL will result in better performance of firms as well. Moreover, the analysis showed that REL performance impacts B2C e-commerce companies' performance. Thus, improving REL performance will improve the performance of B2C e-commerce companies as well. All results obtained were valid and reliable.

This research model is an important guideline for firms that are still struggling and have problems in REL performance. It can offer solutions not only to B2C e-commerce businesses in the Middle East but also offer some advantages to any company in developing countries or the world since the identified factors are all common for the firm's supply chain and REL performance.

General Conclusions

1. After analyzing the scientific literature, the most important factors affecting REL were identified and a conceptual model was developed. In order to evaluate it, the identified factors were further analyzed in Lebanon and Syria. The results showed that the factors with the most significant impact on REL are: management, quality management, organizational structure and culture, IT, customer satisfaction and service, return policy and warranty, employees and infrastructure
2. In order to achieve better REL performance, companies must strengthen the identified factors: 1) customer satisfaction by integrating customer relationship management (CRM) into all REL, warranty service and recycling processes; 2) employee productivity by empowering REL employees and providing training on REL activities such as procurement, production and return handling; 3) infrastructure by installing solar panels and solar thermal technology that produces heat from sunlight so that REL activities can run continuously; 4) Information Technology (IT) by using Integration Hub software for electronic data exchange to maintain communication with all key stakeholders, such as Key Performance Indicators (KPI) providers, and using RFID (Radio Frequency Identification Tag) technology ; 5) leadership skills by implementing the Management

by Objectives (MBO) concept, with effective leadership and interpersonal skills, in addition to integrating REL activities with the entire supply chain and other departments; 6) organizational structure and culture by implementing an organic organizational structure; 7) quality management of supply chains by implementing inspection during the process; 8) finally, applying a return policy based on the concept of financial incentives.

3. Successful implementation of REL could benefit all levels of the organization. The practical significance of the developed model is that it reveals gaps in REL and thus provides opportunities to improve the effectiveness of REL, which in turn, as the results show, improves the performance of B2C e-commerce companies in developing countries. E-business companies should pay attention to these countries as growth opportunities but must consider and improve REL. The proposed REL model not only contributes to management theories related to resource management and sustainable development but also contributes to the resource-based theory (RBV) because reducing the extent of resource wastage exploits the concept of efficiency, thus addressing the problems of inefficiency and unsustainability of REL. As a result, the findings of this study can be used in management research.
4. Aspects such as the geopolitical situation, the changing macro environment, etc. could be named as limitations. In Lebanon, the study was conducted until October 2019, i. e. until the day of the revolution. It was followed by the explosion of the port of Beirut and severe economic conditions that persist. In Syria, it was difficult to communicate with companies because of 2011 war that took place and is still going on, which destroyed a lot of infrastructure. This may affect changes in the proposed solutions for B2C e-commerce companies in this country. Also, only Lebanon and Syria were selected, and other Middle Eastern countries have not yet been studied. Therefore, there is a need to conduct research and evaluate the acceptability of the model in other Middle Eastern countries such as the United Arab Emirates (UAE).

References

- Abebe, G. K., Bahn, R. A., Chalak, A., & Yehya, A. A. K. (2020). Drivers for the implementation of market-based food safety management systems: Evidence from Lebanon. *Food Science and Nutrition*, 8(2), 1082–1092. <https://doi.org/10.1002/fsn3.1394>.
- Accorsi, R., Manzini, R., & Maranesi, F. (2014). A decision-support system for the design and management of warehousing systems. *Computers in Industry*, 65(1), 175–186. <https://doi.org/10.1016/j.compind.2013.08.007>.
- Agarwal, V., Govindan, K., Darbari, J. D., & Jha, P. C. (2016). An optimization model for sustainable solutions towards implementation of reverse logistics under collaborative framework. *International Journal of Systems Assurance Engineering and Management*, 7(4), 480–487. <https://doi.org/10.1007/s13198-016-0486-3>
- Agatz, N. A. H., Fleischmann, M., & van Nunen, J. A. E. E. (2008). E-fulfilment and multi-channel distribution - A review. *European Journal of Operational Research*, 187(2), 339–356. <https://doi.org/10.1016/j.ejor.2007.04.024>
- Agrawal, S., Singh, R. K., & Murtaza, Q. (2016). Triple bottom line performance evaluation of reverse logistics. *Competitiveness Review*, 26(3), 289–310. <https://doi.org/10.1108/CR-04-2015-0029>.
- Alamir, I., Ayoubi, R. M., Massoud, H., & Hallak, L. Al. (2019). Transformational leadership, organizational justice and organizational outcomes: A study from the higher education sector in Syria. *Leadership and Organization Development Journal*, 40(7), 749–763. <https://doi.org/10.1108/LODJ-01-2019-0033>.

- Al Majzoub, M., & Davidavičienė, V. (2018). Multi-Layered Model of E-Logistic. In *10th International Scientific Conference "Business and Management 2018"* (pp. 121–131). <https://doi.org/10.3846/bm.2018.14>
- Aladwani, A. M. (2018). A quality-facilitated socialization model of social commerce decisions. *International Journal of Information Management*, 40, 1–7. <https://doi.org/10.1016/j.ijinfomgt.2018.01.006>.
- Alsaeed, A., & Adams, C. (2015). E-Service adoption in developing countries with instability status: The case of egovernment in Syria. In *Proceedings of the European Conference on E-Government, ECEG*, 376–385.
- Al-Somali, S. A., Gholami, R., & Clegg, B. (2015). A stage-oriented model (SOM) for e-commerce adoption: A study of Saudi Arabian organizations. *Journal of Manufacturing Technology Management*, 26(1), 2–35. <https://doi.org/10.1108/JMTM-03-2013-0019>.
- Anderson, P. (2018). Aleppo in Asia: Mercantile networks between Syria, China and post-Soviet Eurasia since 1970. *History and Anthropology*, 29(1), S67–S83. <https://doi.org/10.1080/02757206.2018.1513930>.
- Ang, A., & Tan, A. (2018). Designing reverse logistics network in an omnichannel environment in Asia. *Logforum*, 14(4), 519–533. <https://doi.org/10.17270/J.LOG.2018.307>.
- Ann, M., & Rassi, B. El. (2020). Why one e-business adoption model won't fit all firm sizes: The case of Lebanon's eservice industry. *The Electronic Journal of Information Systems in Developing Countries*, 86, 1–17. <https://doi.org/10.1002/isd2.12135>.
- Anthopoulos, L., Reddick, C. G., Giannakidou, I., & Mavridis, N. (2016). Why e-government projects fail? An analysis of the Healthcare.gov website. *Government Information Quarterly*, 33(1), 161–173. <https://doi.org/10.1016/j.giq.2015.07.003>
- Ardila Gamboa, C. D., & Ballesteros Riveros, F. A. (2018). Data Envelopment Analysis to measure relative performance based on key indicators from a supply network with Reverse Logistics. *Inge Cuc*, 14(2), 137–146. <https://doi.org/10.17981/ingecuc.14.2.2018.13>
- Arikan, E., Yilmaz, C., & Bodur, M. (2016). Expanding the boundary of brand extensions through brand relationship quality. *Journal of Business Economics and Management*, 17(6), 930–944. <https://doi.org/10.3846/16111699.2016.1220420>
- Asian, S., Pool, J. K., Nazarpour, A., & Tabaeian, R. A. (2019). On the importance of service performance and customer satisfaction in third-party logistics selection: An application of Kano model. *Benchmarking*, 26(5), 1550–1564. <https://doi.org/10.1108/BIJ-05-2018-0121>
- Asuero, A. G., Sayago, A., & González, A. G. (2006). The correlation coefficient: An overview. *Critical Reviews in Analytical Chemistry*, 36(1), 41–59. <https://doi.org/10.1080/10408340500526766>
- Azizi, V., & Hu, G. (2021). A multi-stage stochastic programming model for the multi-echelon multi-period reverse logistics problem. *Sustainability (Switzerland)*, 13(24), 1–15. <https://doi.org/10.3390/su132413596>
- Bahn, R. A., & Ki, G. (2020). Analysis of food retail patterns in urban, peri-urban and rural settings: A case study from Lebanon. *Applied Geography*, 87, 28–44. <https://doi.org/10.1016/j.apgeog.2017.07.010>.

- Bai, C., Sarkis, J. (2019). Integrating and extending data and decision tools for sustainable third-party reverse logistics provider selection. *Computers and Operations Research*, 110, 188–207. <https://doi.org/10.1016/j.cor.2018.06.005>
- Bal, A., & Satoglu, S. I. (2018). A goal programming model for sustainable reverse logistics operations planning and an application. *Journal of Cleaner Production*, 201, 1081–1091. <https://doi.org/10.1016/j.jclepro.2018.08.104>
- Balabanis, G., Reynolds, N., & Simintiras, A. (2006). Bases of e-store loyalty: Perceived switching barriers and satisfaction. *Journal of Business Research*, 59(2), 214–224. <https://doi.org/10.1016/j.jbusres.2005.06.001>
- Banytė, J., Tarutė, A., & Taujanskytė, I. (2014). Customer Engagement into Value Creation: Determining Factors and Relations with Loyalty. *Engineering Economics*, 25(5), 568–577. <https://doi.org/10.5755/j01.ee.25.5.8402>
- Batarfi, R., Jaber, M. Y., & Aljazzar, S. M. (2017). A profit maximization for a reverse logistics dual-channel supply chain with a return policy. *Computers and Industrial Engineering*, 106, 58–82. <https://doi.org/10.1016/j.cie.2017.01.024>
- Beysenbaev, R., & Dus, Y. (2020). Proposals for improving the Logistics Performance Index. *Asian Journal of Shipping and Logistics*, 36(1), 34–42. <https://doi.org/10.1016/j.ajsl.2019.10.001>
- Bogataj, M., & Grubbström, R. W. (2013). Transportation delays in reverse logistics. *International Journal of Production Economics*, 143, 395–402. <https://doi.org/10.1016/j.ijpe.2011.12.007>
- Bouzon, M., Spricigo, R., Rodriguez, C. M. T., De Queiroz, A. A., & Cauchick Miguel, P. A. (2015). Reverse logistics drivers: Empirical evidence from a case study in an emerging economy. *Production Planning and Control*, 26(16), 1368–1385. <https://doi.org/10.1080/09537287.2015.1049239>
- Brynjolfsson, E., Hu, J. Y., & Rahman, M. S. (2009). Battle of the Retail Channels: How Product Selection and Geography Drive Cross-channel Competition. *Inform*s, 55(11), 1–15. <https://doi.org/10.1287/mnsc.1090.1062>
- Calabuig-Moreno, F., Crespo-Hervas, J., Nunez-Pomar, J., Valantine, I. (2016). Role of perceived value and emotions in the satisfaction and future intentions of spectators in sporting events. *Engineering Economics*, 27(2), 221–229. <https://doi.org/10.5755/j01.ee.27.2.12288>
- Campagna, A., Stathacopoulos, A., Persia, L., & Xenou, E. (2017). Data collection framework for understanding UFT within city logistics solutions. *Transportation Research Procedia*, 24, 354–361. <https://doi.org/10.1016/j.trpro.2017.05.100>
- Cannella, S., Bruccoleri, M., & Framinan, J. M. (2016). Closed-loop supply chains: What reverse logistics factors influence performance? *International Journal of Production Economics*, 175, 35–49. <https://doi.org/10.1016/j.ijpe.2016.01.012>
- Cao, L., & Li, L. (2015). The Impact of Cross-Channel Integration on Retailers' Sales Growth. *Journal of Retailing*, 91(2), 198–216. <https://doi.org/10.1016/j.jretai.2014.12.005>

- Chan, C. K., Man, N., Fang, F., & Campbell, J. F. (2020). Supply chain coordination with reverse logistics: A vendor/recycler-buyer synchronized cycles model. *Omega (United Kingdom)*, 95, 1–27. <https://doi.org/10.1016/j.omega.2019.07.006>
- Chaves, G. de L. D., Giuriatto, N. T., & Ferreira, K. A. (2020). Reverse logistics performance measures: a survey of Brazilian companies. *Brazilian Journal of Operations & Production Management*, 17(2), 1–18. <https://doi.org/10.14488/bjopm.2020.018>
- Chen, L., Li, W., & Zhai, H. (2016). The analysis of reverse logistics model in the E-commerce models. *International Journal of Grid and Distributed Computing*, 9(9), 173–184. <https://doi.org/10.14257/ijgdc.2016.9.9.15>
- Chen, L., Li, W., & Zhai, H. (2016). The analysis of reverse logistics model in the E-commerce models. *International Journal of Grid and Distributed Computing*, 9(9), 173–184. <https://doi.org/10.14257/ijgdc.2016.9.9.15>
- Chen, Q., & Zhang, N. (2015). Does e-commerce provide a sustained competitive advantage? An investigation of survival and sustainability in growth-oriented enterprises. *Sustainability (Switzerland)*, 7(2), 1411–1428. <https://doi.org/10.3390/su7021411>
- Chileshe, N., Rameezdeen, R., Hosseini, M. R., Martek, I., Li, H. X., & Panjehbashi-Aghdam, P. (2018). Factors driving the implementation of reverse logistics: A quantified model for the construction industry. *Waste Management*, 79, 48–57. <https://doi.org/10.1016/j.wasman.2018.07.013>
- Chinda, T. (2017). Examination of Factors Influencing the Successful Implementation of Reverse Logistics in the Construction Industry: Pilot Study. *Procedia Engineering*, 182, 99–105. <https://doi.org/10.1016/j.proeng.2017.03.128>
- Choi, Y., & Mai, D. Q. (2018). The sustainable role of the e-trust in the B2C e-commerce of Vietnam. *Sustainability*, 10(1), 1–18. <https://doi.org/10.3390/su10010291>
- Cooper, A. L., Huscroft, J. R., Overstreet, R. E., & Hazen, B. T. (2016). Knowledge management for logistics service providers: The role of learning culture. *Industrial Management and Data Systems*, 116(3), 584–602. <https://doi.org/10.1108/IMDS-06-2015-0262>
- Da Silveira Guimarães, J. L., & Salomon, V. A. P. (2015). ANP applied to the evaluation of performance indicators of reverse logistics in footwear industry. *Procedia Computer Science*, 55, 139–148. <https://doi.org/10.1016/j.procs.2015.07.021>
- Dakhli, Z., & Lafhaj, Z. (2017). Efficient logistics enabled by smart solutions in tunneling. *Underground Space*, 2(4), 227–233. <https://doi.org/10.1016/j.undsp.2017.10.004>
- Daly, S. P., & Cui, L. X. (2003). E-logistics in China: Basic problems, manageable concerns and intractable solutions. *Industrial Marketing Management*, 32(3), 235–242. [https://doi.org/10.1016/S0019-8501\(02\)00267-5](https://doi.org/10.1016/S0019-8501(02)00267-5)
- Daugherty, P. J., Bolumole, Y., & Grawe, S. J. (2019). The new age of customer impatience: An agenda for reawakening logistics customer service research. *International Journal of Physical Distribution and Logistics Management*, 49(1), 4–32. <https://doi.org/10.1108/IJPDLM-03-2018-0143>
- Davidavičienė, V., Pabedinskaite, A., & Davidavicius, S. (2017). Social networks in B2B and B2C communication. *Transformations in business & economics*, 16(1), 69–84.

- Denktaş-Şakar, G., & Sürücü, E. (2020). Stakeholder engagement via social media: an analysis of third-party logistics companies. *Service Industries Journal*, 40(11), 866–889. <https://doi.org/10.1080/02642069.2018.1561874>
- Deutsch, Y., & Golany, B. (2018). A parcel locker network as a solution to the logistics last mile problem. *International Journal of Production Research*, 56(2), 251–261. <https://doi.org/10.1080/00207543.2017.1395490>.
- Erceg, A. (2018). Interconnection of E-Commerce and Logistics: Examples From Croatia and Turkey. *Business Logistics in Modern Management*, 18, 265–283.
- E.J. Wolf, K.M. Harrington, S.L. Clark, M. W. M. (2013). Sample Size Requirements for Structural Equation Models: An Evaluation of Power, Bias, and Solution Propriety. *National Institute of Health*, 76(6), 1–21. <https://doi.org/10.1177/0013164413495237>
- Eskandarpour, M., Masehian, E., Soltani, R., & Khosrojerdi, A. (2014). A reverse logistics network for recovery systems and a robust metaheuristic solution approach. *International Journal of Advanced Manufacturing Technology*, 74(9–12), 1393–1406. <https://doi.org/10.1007/s00170-014-6045-7>
- Esper, T. L., Jensen, T. D., Turnipseed, F. L., & Burton, S. (2003). The Last Mile: an Examination of Effects of Online Retail Delivery Strategies on Consumers. *Journal of Business Logistics*, 24(2), 177–203. <https://doi.org/10.1002/j.2158-1592.2003.tb00051.x>
- Euchi, J., Bouzidi, D., & Bouzid, Z. (2019). Structural analysis of acute success factors of performance of reverse logistics relative to customer satisfaction. *International Journal of Combinatorial Optimization Problems and Informatics*, 10(2), 39–56. <https://ijcopi.org/ojs/article/view/102>
- Evangelista, P., & Sweeney, E. (2006). Technology usage in the supply chain: The case of small 3PLs. *The International Journal of Logistics Management*, 17(1), 55–74. <https://doi.org/10.1108/09574090610663437>
- Eydi, A., & Alavi, H. (2018). Vehicle Routing Problem in Reverse Logistics with Split Demands of Customers and Fuel Consumption Optimization. *Arabian Journal for Science and Engineering*, 44(3), 2641–2651. <https://doi.org/10.1007/s13369-018-3311-2>
- Fontaine, P., Crainic, T. G., Jabali, O., & Rei, W. (2017). The Impact of Combining Inbound and Outbound Demand in City Logistics Systems. In *International Computer Software and Applications Conference* (Vol. 2, pp. 766–770). <https://doi.org/10.1109/COMPSAC.2017.234>
- Gavrilina, I., & Bondar, A. (2017). Logistics Solution for Choosing Location of Production of Road Construction Enterprise. In *IOP Conference Series: Materials Science and Engineering* (Vol. 262, pp. 1–7). <https://doi.org/10.1088/1757-899X/262/1/012072>
- Govindan, K., & Bouzon, M. (2018). From a literature review to a multi-perspective framework for reverse logistics barriers and drivers. *Journal of Cleaner Production*, 187, 318–337. <https://doi.org/10.1016/j.jclepro.2018.03.040>
- Green, K. W., Whitten, D., & Inman, R. A. (2008). The impact of logistics performance on organizational performance in a supply chain context. *Supply Chain Management*, 13(4), 317–327. <https://doi.org/10.1108/13598540810882206>

- Gu, W., Wang, C., Dai, S., Wei, L., & Chiang, I. R. (2021). Optimal strategies for reverse logistics network construction: A multi-criteria decision method for Chinese iron and steel industry. *Resources Policy*, 74, 1–13. <https://doi.org/10.1016/j.resourpol.2019.02.008>
- Guarnieri, P., Camara e Silva, L., & Vieira, B. (2020). How to Assess Reverse Logistics of e-Waste Considering a Multicriteria Perspective? *A Model Proposition. Logistics*, 4(25), 1–29. <https://doi.org/10.3390/logistics4040025>
- Guo, F., & Lu, Q. (2015). Model and Its Application in e-Commerce Customer Satisfaction Management. *Discrete Dynamics in Nature and Society*, 2015, 1–11. <http://dx.doi.org/10.1155/2015/691781>.
- Habibi, A., Sarafrazi, A., & Izadyar, S. (2015). Delphi Technique Theoretical Framework in Qualitative Research. *The International Journal of Engineering and Science (IJES)*, 3(4), 8–13. <https://www.researchgate.net/publication/272177606>
- Halawani, F. M., Soh, P. C. H., & Halawani, Y. M. (2020). Social media utilisation and business performance of hotels in Lebanon: Exploring the moderating effects of hotel classification. *Journal of Global Information Management*, 28(3), 58–76. <https://doi.org/10.4018/JGIM.2020070104>
- Hamade, L. (2021). The Impact of COVID-19 on E-commerce Use in Lebanon: A Quantitative Study. *The 4th International Conference on Economics and Social Sciences Resilience and Economic Intelligence through Digitalization and Big Data Analytics June*, 88–97. <https://doi.org/10.2478/9788366675704-010>
- Han, H., & Trimi, S. (2018). A fuzzy TOPSIS method for performance evaluation of reverse logistics in social commerce platforms. *Expert Systems with Applications*, 103, 133–145. <https://doi.org/10.1016/j.eswa.2018.03.003>
- Hansemark, O. C., & Albinsson, M. (2004). Customer satisfaction and retention: The experiences of individual employees. *Managing Service Quality*, 14(1), 40–57. <https://doi.org/10.1108/09604520410513668>
- Helo, P., & Szekely, B. (2005). Logistics information systems: An analysis of software solutions for supply chain co-ordination. *Industrial Management & Data Systems*, 105(1), 5–18. <https://doi.org/10.1108/02635570510575153>
- Hsu, C. L., & Lin, J. C. C. (2016). An empirical examination of consumer adoption of Internet of Things services: Network externalities and concern for information privacy perspectives. *Computers in Human Behavior*, 62, 516–527. <https://doi.org/10.1016/j.chb.2016.04.023>
- Huang, Y. C., Rahman, S., Wu, Y. C. J., & Huang, C. J. (2015). Salient task environment, reverse logistics and performance. *International Journal of Physical Distribution and Logistics Management*, 45(9), 979–1006. <https://doi.org/10.1108/IJPDLM-08-2014-0182>.
- Ibeh, K., & Kasem, L. (2011). The network perspective and the internationalization of small and medium sized software firms from Syria. *Industrial Marketing Management*, 40, 358–367. <https://doi.org/10.1016/j.indmarman.2010.08.004>.
- Ilie-Zudor, E., Kemény, Z., Pfeiffer, A., & Monostori, L. (2016). Decision support solutions for factory and network logistics operations. *International Journal of Computer Integrated Manufacturing*, 30(1), 1–11. <https://doi.org/10.1080/0951192X.2016.1145801>

- Islam, D. Z., & Zunder, T. H. (2013). Issues of eLogistics applications for varying stakeholders: findings from an online survey. *European Transport Research Review*, 5, 65–78. <https://doi.org/10.1007/s12544-013-0093-1>
- Ivanova, T., Rogaczewski, R., & Lutsenko, I. (2022). Influence of Reverse Logistics on Competitiveness, Economic Performance, Ecological Environment and Society. *Logforum*, 18(1), 49–58. <https://doi.org/10.17270/J.LOG.2022.640>
- Jaaron, A. A. M., & Backhouse, C. (2016). A systems approach for forward and reverse logistics design. *The International Journal of Logistics Management*, 27(3), 947–971. <https://doi.org/10.1108/ijlm-07-2015-0118>
- Jabeur, N., Al-Belushi, T., Mbarki, M., & Gharrad, H. (2017). Toward Leveraging Smart Logistics Collaboration with a Multi-Agent System Based Solution. *Procedia Computer Science*, 109, 672–679. <https://doi.org/10.1016/j.procs.2017.05.374>
- Janno, J., Mochalina, E. P., Vladimirovna, G., Labanova, O., Latonina, M., & Safulina, E. (2021). The Impact of Initial Data on the Logistics Performance Index Estimation: Estonian and Russian study. *LogForum*, 17(1), 147–156.
- Jia, L., Xue, G., Fu, Y., & Xu, L. (2018). Factors affecting consumers' acceptance of e-commerce consumer credit service. *International Journal of Information Management*, 40, 103–110. <https://doi.org/10.1016/j.ijinfomgt.2018.02.002>
- Jiang, H., Xiong, W., & Cao, Y. (2017). A Conceptual Model of Excellent Performance Mode of Port Enterprise Logistics Management. *Polish Maritime Research*, 24(3), 34–40. <https://doi.org/10.1515/pomr-2017-0102>
- Jiang, X., Li, J., Lu, Y., & Tian, G. (2020). Design of Reverse Logistics Network for Remanufacturing Waste Machine Tools Based on Multi-Objective Gray Wolf Optimization Algorithm. *IEEE Access*, 8, 1–11. <https://doi.org/10.1109/ACCESS.2020.3011509>
- Jianu, I., Jianu, I., & Turlea, C. (2017). Measuring the company's real performance by physical capital maintenance. *Economic Computation and Economic Cybernetics Studies and Research*, 51(1), 37–57. <https://ssrn.com/abstract=3136613>
- Julianelli, V., Caiado, R. G. G., Scavarda, L. F., & Cruz, S. P. de M. F. (2020). Interplay between reverse logistics and circular economy: Critical success factors-based taxonomy and framework. *Resources, Conservation and Recycling*, 158, 1–12. <https://doi.org/10.1016/j.resconrec.2020.104784>
- Kadłubek, M. (2015). The Selected Areas of E-logistics in Polish E-commerce. *Procedia Computer Science*, 65, 1059–1065. <https://doi.org/10.1016/j.procs.2015.09.052>
- Karakikes, I., & Nathanail, E. (2017). Simulation Techniques for Evaluating Smart Logistics Solutions for Sustainable Urban Distribution. *Procedia Engineering*, 178, 569–578. <https://doi.org/10.1016/j.proeng.2017.01.110>
- Kayikci, Y. (2018). E-Commerce in Logistics and Supply Chain Management. In *Encyclopedia of information science and technology* (Issue 1, pp. 1015–1026). <https://doi.org/10.4018/978-1-5225-7362-3.ch076>

- Kiatcharoenpol, T., & Sirisawat, P. (2020). A Selection of Barrier Factors Affecting Reverse Logistics Performance of Thai Electronic Industry. *International Journal of Intelligent Engineering and Systems*, 13(2), 117–126. <https://doi.org/10.22266/ijies2020.0430.12>
- Lai, N. Y. G., Kuah, A. T. H., Kim, C. H., & Wong, K. H. (2022). Toward sustainable express deliveries for online shopping: Reusing packaging materials through reverse logistics. *Thunderbird International Business Review*, 64, 351–362. <https://doi.org/10.1002/tie.22259>
- Lamba, D., Yadav, D. K., Barve, A., & Panda, G. (2020). Prioritizing barriers in reverse logistics of E-commerce supply chain using fuzzy-analytic hierarchy process. *Electronic Commerce Research*, 20, 381–403. <https://doi.org/10.1007/s10660-019-09333-y>
- Lang, G., & Bressolles, G. (2013). Economic performance and customer expectation in e-fulfilment systems: A multi-channel retailer perspective. *Supply Chain Forum*, 14(1), 16–26. <https://doi.org/10.7137/scfij/14.1.16>
- Larsen, S. B., Masi, D., Feibert, D.C., & Jacobsen, P. (2018). How the reverse supply chain impacts the firm's financial performance A manufacturer's perspective. *International Journal of Physical Distribution & Logistics Management*, 48(3), 284–307. <https://doi.org/DOI 10.1108/IJPDLM-05-2013-0155>
- Leung, K. H., Cheng, S. W. Y., Choy, K. L., Wong, D. W. C., Lam, H. Y., Hui, Y. Y. Y., Tang, V. (2016). A process-oriented warehouse postponement strategy for e-commerce order fulfilment in warehouses and distribution centers in Asia. In *Managerial Strategies and Solutions for Business Success in Asia* (pp. 21–34). <https://doi.org/10.4018/978-1-5225-1886-0.ch002>
- Leung, K. H., Choy, K. L., Siu, P. K. Y., Ho, G. T. S., Lam, H. Y., & Lee, C. K. M. (2018). A B2C e-commerce intelligent system for re-engineering the e-order fulfilment process. *Expert Systems with Applications*, 91, 386–401. <https://doi.org/10.1016/j.eswa.2017.09.026>
- Levina, O., & Vilnai-Yavetz, I. (2015). E-visibility maturity model: A tool for assessment and comparison of individual firms and sets of firms in e-business. *Electronic Commerce Research and Applications*, 14(6), 480–498. <https://doi.org/10.1016/j.elerap.2015.07.004>
- Li, Y. L., Ying, C. S., Chin, K. S., Yang, H. T., & Xu, J. (2018). Third-party reverse logistics provider selection approach based on hybrid-information MCDM and cumulative prospect theory. *Journal of Cleaner Production*, 195, 573–584. <https://doi.org/10.1016/j.jclepro.2018.05.213>
- Linton, J. D., Klassen, R. D., & Jayaraman, V. (2007). Sustainable supply chains: an introduction. *Journal of Operations Management*, 25, 1075–1082. <https://doi.org/10.1016/j.jom.2007.01.012>
- Liu, Y., & Luo, X. X. (2019). C2C interaction quality identification with SVM based on Kano model. *Concurrency Computation*, 31(12), 1–10. <https://doi.org/10.1002/cpe.4689>
- Lopes, C., Correia, A., Costa e Silva, E., Monteiro, M., & Borges Lopes, R. (2020). Inventory models with reverse logistics for assets acquisition in a liquefied petroleum gas

- company. *Journal of Mathematics in Industry*, 10(1), 1–15. <https://doi.org/10.1186/s13362-020-00078-0>
- Luo, X., & Bhattacharya, C. B. (2006). Corporate social responsibility, customer Satisfaction, and market value. *Journal of Marketing*, 70(4), 1–18. <https://doi.org/10.1509/jmkg.70.4.1>
- Mahindroo, A., Samalia, H. V., & Verma, P. (2018). Moderated influence of return frequency and resource commitment on information systems and reverse logistics strategic performance. *International Journal of Productivity and Performance Management*, 67(3), 550–570. <https://doi.org/10.1108/IJPPM-05-2016-0101>
- Marri, H. B., Irani, Z., & Gunasekaran, A. (2006). E-commerce and its impact in logistic management: A state of art. In *Proceedings of the European and Mediterranean Conference on Information Systems, EMCIS 2006 (Proceedings of the European and Mediterranean Conference on Information Systems, EMCIS 2006)* (pp. 1–10).
- Mazareanu, E. (2021, January 25). *Logistics industry worldwide - statistics & facts*. <https://www.statista.com/topics/5691/logistics-industry-worldwide>
- Mejjaoui, S., & Babiceanu, R. F. (2018). Cold supply chain logistics: System optimization for real-time rerouting transportation solutions. *Computers in Industry*, 95, 68–80. <https://doi.org/10.1016/j.compind.2017.12.006>
- Melo, A.C.S., Nunes, D.R.L., Braga Júnior, A.E. et al. (2022), “Analysis of activities that make up reverse logistics processes: proposition of a conceptual framework”. *Brazilian Journal of Operations & Production Management*, 19(2), e20221376. <https://doi.org/10.14488/BJOPM.2022.001>
- Merkevičius, J., Davidavičienė, V., Raudeliūnienė, J., & Buleca, J. (2015). Virtual organization: Specifics of creation of personnel management system. *E a M: Ekonomie a Management*, 18(4), 200–211. <https://doi.org/10.15240/tul/001/2015-4-014>
- Mir, I. A. (2018). Dimensionality and effects of information motivation on users’ online social network advertising acceptance. *RAE Revista de Administracao de Empresas*, 58(2), 174–187. <https://doi.org/10.1590/S0034-759020180206>
- Molinillo, S., Liébana-Cabanillas, F., & Anaya-Sánchez, R. (2018). A Social Commerce Intention Model for Traditional E-Commerce Sites. *Journal of Theoretical and Applied Electronic Commerce Research*, 13(2), 80–93. <https://doi.org/10.4067/S0718-18762018000200107>
- Morgan, T.R., Tokman, M., Richey, R. G., & Defee, C. D. (2018). Resource commitment and sustainability: a reverse logistics performance process model. *International Journal of Physical Distribution & Logistics Management*, 48(2), 164–182. <https://doi.org/10.1108/IJPDLM-05-2013-0155>
- Mostafa, R. B., & Hannouf, H. N. (2022). Determinants of Online Purchase Intention of Apparel Products in Lebanon. *International Journal of Online Marketing*, 12(1), 1–18. <https://doi.org/10.4018/ijom.288422>
- Mouchawar, R. (2017). Souq.Com’s CEO on building an e-commerce powerhouse in the Middle East. *Harvard Business Review*, 95(5), 1–9.

- Mouselli, S., & Khalifa, B. (2017). Entrepreneurship in Crisis: the Determinants of Syrian Students' Entrepreneurial Intentions. *Business, Management and Education*, 15(2), 159–173. <https://doi.org/10.3846/bme.2017.386>.
- Münch, C., von der Gracht, H. A., & Hartmann, E. (2021). The future role of reverse logistics as a tool for sustainability in food supply chains: a Delphi-based scenario study. *Supply Chain Management*, November, 1–22. <https://doi.org/10.1108/SCM-06-2021-0291>
- Muñuzuri, J., Larrañeta, J., Onieva, L., & Cortés, P. (2005). Solutions applicable by local administrations for urban logistics improvement. *Cities*, 22(1), 15–28. <https://doi.org/10.1016/j.cities.2004.10.003>
- Mwanza, B. G., & Mbohwa, C. (2017). Major Obstacles to Sustainability in the Plastic Industry. *Procedia Manufacturing*, 8, 121–128. <https://doi.org/10.1016/j.promfg.2017.02.021>
- Nisar, T. M., & Prabhakar, G. (2017). What factors determine e-satisfaction and consumer spending in e-commerce retailing? *Journal of Retailing and Consumer Services*, 39, 135–144. <https://doi.org/10.1016/j.jretconser.2017.07.010>
- Nourani, M., Chandran, V., Kweh, Q. L., & Lu, W. M. (2018). Measuring Human, Physical and Structural Capital Efficiency Performance of Insurance Companies. *Social Indicators Research*, 137, 281–315. <https://doi.org/10.1007/s11205-017-1584-6>
- Ochocka, J. (2019). Mobile technologies in logistic customer service as a tool for winning customers' satisfaction. *LogForum*, 15(3), 403–411. <https://doi.org/http://doi.org/10.17270/J.LOG.2019.338>
- Onoyama, T., Maekawa, T., Kubota, S., Tsuruta, S., & Komoda, N. (2009). Solution of the vehicle routing problem for a cooperative logistics network by using multistage GA. *Electrical Engineering in Japan*, 168(2), 28–37. <https://doi.org/10.1002/eej.20855>
- Pandian, G. R. S., & Abdul-Kader, W. (2017). Performance evaluation of reverse logistics enterprise—an agent-based simulation approach. *International Journal of Sustainable Engineering*, 10(6), 384–398. <https://doi.org/10.1080/19397038.2017.1370032>
- Panghal, A., Manoram, S., Mor, R. S., & Vern, P. (2022). Adoption challenges of blockchain technology for reverse logistics in the food processing industry. *Supply Chain Forum: An International Journal*, 1–10. <https://doi.org/10.1080/16258312.2022.2090852>
- Panigrahi, S. K., Kar, F. W., Fen, T. A., Hoe, L. K., & Wong, M. (2018). A Strategic Initiative for Successful Reverse Logistics Management in Retail Industry. *Global Business Review*, 19, 1–25. <https://doi.org/10.1177/0972150918758096>
- Papoutsis, K., Dewulf, W., Vanelslander, T., & Nathanail, E. (2018). Sustainability assessment of retail logistics solutions using external costs analysis: a case-study for the city of Antwerp. *European Transport Research Review*, 10(2), 1–17. <https://doi.org/10.1186/s12544-018-0297-5>
- Paredes, M. R., Barrutia, J. M., & Echebarria, C. (2014). Resources for value co-creation in e-commerce: A review. *Electronic Commerce Research*, 14(2), 111–136. <https://doi.org/10.1007/s10660-014-9135-6>

- Pham, T. S. H., & Ahammad, M. F. (2017). Antecedents and consequences of online customer satisfaction: A holistic process perspective. *Technological Forecasting and Social Change*, 124, 332–342. <https://doi.org/10.1016/j.techfore.2017.04.003>
- Pilinkiene, V., Kurschus, R.J., Auskalnyte, G. (2013). E-business as a source of competitive advantage. *Strategic Management Journal*, 18(1), 77–85. <https://doi.org/10.1002/smj.4250150912>
- Prakash, C., & Barua, M. K. (2015). Integration of AHP-TOPSIS method for prioritizing the solutions of reverse logistics adoption to overcome its barriers under fuzzy environment. *Journal of Manufacturing Systems*, 37, 599–615. <https://doi.org/10.1016/j.jmsy.2015.03.001>
- Pulansari, F., Sukma Donoriyanto, D., & Masrurroh, N. (2016). Customer's Perception and Expectation for Reverse Logistics Implementation. In *1st Global Conference on Business, Management and Entrepreneurship (GCBME-16)* (Vol. 15, pp. 208–211). <https://doi.org/10.2991/gcbme-16.2016.38>
- Qiu, L., Pang, J., & Lim, K. H. (2012). Effects of conflicting aggregated rating on eWOM review credibility and diagnosticity: The moderating role of review valence. *Decision Support Systems*, 54(1), 631–643. <https://doi.org/10.1016/j.dss.2012.08.020>
- Quak, H., Balm, S., & Posthumus, B. (2014). Evaluation of City Logistics Solutions with Business Model Analysis. *Procedia - Social and Behavioral Sciences*, 125, 111–124. <https://doi.org/10.1016/j.sbspro.2014.01.1460>
- Racherla, P., & Friske, W. (2012). Perceived “usefulness” of online consumer reviews: An exploratory investigation across three services categories. *Electronic Commerce Research and Applications*, 11(6), 548–559. <https://doi.org/10.1016/j.elerap.2012.06.003>
- Rajabalipour Cheshmehgaz, H., Islam, M. N., & Desa, M. I. (2014). A polar-based guided multi-objective evolutionary algorithm to search for optimal solutions interested by decision-makers in a logistics network design problem. *Journal of Intelligent Manufacturing*, 25, 699–726. <https://doi.org/10.1007/s10845-012-0714-x>
- Ramaseshan, B., Rabbanee, F. K., & Tan Hsin Hui, L. (2013). Effects of customer equity drivers on customer loyalty in B2B context. *Journal of Business & Industrial Marketing*, 28(4), 335–346. <https://doi.org/10.1108/08858621311313929>
- Raudeliūnienė, J., Meidutė-Kavaliauskienė, I., & Vileikis, K. (2016). Evaluation of Factors Determining the Efficiency of Knowledge Sharing Process in the Lithuanian National Defence System. *Journal of the Knowledge Economy*, 7(4), 842–857. <https://doi.org/10.1007/s13132-015-0257-4>
- Regattieri, A., Gamberi, M., Bortolini, M., & Piana, F. (2018). Innovative Solutions for Reusing Packaging Waste Materials in Humanitarian Logistics. *Sustainability*, 10, 1–10. <https://doi.org/10.3390/su10051587>
- Ren, Y., Wang, C., Li, B., Yu, C., & Zhang, S. (2020). A genetic algorithm for fuzzy random and low-carbon integrated forward/reverse logistics network design. *Neural Computing and Applications*, 32(7), 2005–2025. <https://doi.org/10.1007/s00521-019-04340-4>
- Richnak, P. (2016). New Development Directions of Logistics in an Industrial Company. In *Edamba 2016: International Scientific Conference for Doctoral Students and Post-*

Doctoral Scholars: Open Science & Open Innovation: Opportunities for Economics, Business, Management and Related Disciplines (pp. 315–323).

Rossi, S., Colicchia, C., Cozzolino, A., & Christopher, M. (2013). The logistics service providers in eco-efficiency innovation: An empirical study. *Supply Chain Management*, 18(6), 583–603. <https://doi.org/10.1108/SCM-02-2012-0053>

Sabanoglu, T. (2020, November 30). *Worldwide-retail-e-commerce-sales*. <https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales>.

San-Jose, L., & Retolaza, J. L. (2016). Is the delphi method valid for business ethics? A survey analysis. *European Journal of Futures Research*, 4(1), 1–15. <https://doi.org/10.1007/s40309-016-0109-x>

Sangwan, K. S. (2017). Key Activities, Decision Variables and Performance Indicators of Reverse Logistics. *Procedia CIRP*, 61, 257–262. <https://doi.org/10.1016/j.procir.2016.11.185>

Sanyala, S. (2019). Factors Affecting Customer Satisfaction with Ecommerce Websites - An Omani Perspective. *Proceeding of 2019 International Conference on Digitization: Landscaping Artificial Intelligence, ICD 2019*, 8(9), 25–30. <https://doi.org/10.1109/ICD47981.2019.9105780>.

Saridakis, G., Benson, V., Ezingear, J. N., & Tennakoon, H. (2016). Individual information security, user behaviour and cyber victimisation: An empirical study of social networking users. *Technological Forecasting and Social Change*, 102, 320–330. <https://doi.org/10.1016/j.techfore.2015.08.012>

Saskia, S., Mareš, N., & Blanquart, C. (2016). Innovations in e-grocery and Logistics Solutions for Cities. *Transportation Research Procedia*, 12, 825–835. <https://doi.org/10.1016/j.trpro.2016.02.035>

Schober, P., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia and Analgesia*, 126(5), 1763–1768. <https://doi.org/10.1213/ANE.0000000000002864>

Scholz-Reiter, B., & Höhns, H. (2003). Integrated software agents: Enabling technology for collaborative E-logistics and E-business. *International Journal of Computer Integrated Manufacturing*, 16(7–8), 517–525. <https://doi.org/10.1080/0951192031000115840>

Selviaridis, K., & Norrman, A. (2015). Performance-based contracting for advanced logistics services. *International Journal of Physical Distribution & Logistics Management*, 45(6), 592–617. <https://doi.org/10.1108/IJPDLM-11-2014-0267>

Shaik, M. N., & Abdul-Kader, W. (2018). A hybrid multiple criteria decision making approach for measuring comprehensive performance of reverse logistics enterprises. *Computers and Industrial Engineering*, 123, 9–25. <https://doi.org/10.1016/j.cie.2018.06.007>

Sirisawat, P., & Kiatcharoenpol, T. (2016). Correlation of barriers to reverse logistics performance using structural equation modelling. In *IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 144–148). IEEE. <https://doi.org/10.1109/IEEM.2016.7797853>

- Sirisawat, P., & Kiatcharoenpol, T. (2018). Fuzzy AHP-TOPSIS approaches to prioritizing solutions for reverse logistics barriers. *Computers and Industrial Engineering*, 117, 303–318. <https://doi.org/10.1016/j.cie.2018.01.015>
- Skačkauskienė, I., Vilkaite-Vaitone, N., Raudeliuniene, J., & Davidavičienė, V. (2016). A model for measuring passenger loyalty. *Transport*, 31(1), 100–107. <https://doi.org/10.3846/16484142.2015.1094748>
- Skafi, M., Yunis, M. M., & Zekri, A. (2020). Factors influencing SMEs' adoption of cloud computing services in Lebanon: An empirical analysis using TOE and contextual theory. *IEEE Access*, 8, 79169–79181. <https://doi.org/10.1109/ACCESS.2020.2987331>
- Skitsko, V. I. (2016). E-LOGISTICS AND M-LOGISTICS IN INFORMATION ECONOMY. *Logforum*, 12(1), 7–16. <https://doi.org/10.17270/J.LOG.2016.1.1>
- Smith, A. D. (2005). Reverse logistics programs: Gauging their effects on CRM and online behavior. *Vine*, 35(3), 166–181. <https://doi.org/10.1108/03055720510634216>
- Sremac, S., Stević, Ž., Pamučar, D., Arsić, M., & Matić, B. (2018). Evaluation of a third-party logistics (3PL) provider using a rough SWARA-WASPAS model based on a new rough dombi aggregator. *Symmetry*, 10(8), 1–25. <https://doi.org/10.3390/sym10080305>
- Sri Yogi, K. (2015). Performance evaluation of reverse logistics: A case of LPG agency. *Cogent Business and Management*, 2(1), 1–17. <https://doi.org/10.1080/23311975.2015.1063229>
- Sudarto, S., Takahashi, K., & Morikawa, K. (2017). Reprint “Efficient flexible long-term capacity planning for optimal sustainability dimensions performance of reverse logistics social responsibility: A system dynamics approach.” *International Journal of Production Economics*, 190, 45–59. <https://doi.org/10.1016/j.ijpe.2017.06.017>
- Sudarto, S., Takahashi, K., Morikawa, K., & Nagasawa, K. (2016). The impact of capacity planning on product lifecycle for performance on sustainability dimensions in Reverse Logistics Social Responsibility. *Journal of Cleaner Production*, 133, 28–42. <https://doi.org/10.1016/j.jclepro.2016.05.095>
- Sullivan, Y. W., & Kim, D. J. (2018). Assessing the effects of consumers' product evaluations and trust on repurchase intention in e-commerce environments. *International Journal of Information Management*, 39, 199–219. <https://doi.org/10.1016/j.ijinfomgt.2017.12.008>
- Sun, Q. (2017). Research on the influencing factors of reverse logistics carbon footprint under sustainable development. *Environmental Science and Pollution Research*, 24, 22790–22798. <https://doi.org/10.1007/s11356-016-8140-9>
- Tan, Y., & Guo, C. (2019). Research on Two-Way Logistics Operation with Uncertain Recycling Quality in Government Multi-Policy Environment. *Sustainability*, 11(3), 882. <https://doi.org/10.3390/su11030882>
- Tang, A. K. Y. (2019). A systematic literature review and analysis on mobile apps in m-commerce: Implications for future research. *Electronic Commerce Research and Applications*, 37, 1–14. <https://doi.org/10.1016/j.elerap.2019.100885>

- Tarn, J. M., Yen, D. C., & Beaumont, M. (2002). Exploring the rationales for ERP and SCM integration. *Industrial Management and Data Systems*, 102(1), 26–34. <https://doi.org/10.1108/02635570210414631>
- Taylor, R. (1990). Interpretation of the Correlation Coefficient: A Basic Review. *Journal of Diagnostic Medical Sonography (JDMS)*, 1, 35–39. <https://doi.org/10.1177/87564793900060010>
- Tosarkani, B. M., & Amin, S. H. (2018). A multi-objective model to configure an electronic reverse logistics network and third party selection. *Journal of Cleaner Production*, 198, 662–682. <https://doi.org/10.1016/j.jclepro.2018.07.056>
- Tosarkani, B. M., Amin, S. H., & Zolfagharinia, H. (2020). A scenario-based robust possibilistic model for a multi-objective electronic reverse logistics network. *International Journal of Production Economics*, 224, 1–22. <https://doi.org/10.1016/j.ijpe.2019.107557>
- Tseng, S. C., & Hung, S. W. (2014). A strategic decision-making model considering the social costs of carbon dioxide emissions for sustainable supply chain management. *Journal of Environmental Management*, 133, 315–322. <https://doi.org/10.1016/j.jenvman.2013.11.023>
- Turki, S., & Rezg, N. (2017). Study of the E-Maintenance Service in E-Logistic Supply Chain. In *Proceedings - 11th IEEE International Symposium on Service-Oriented System Engineering, SOSE 2017* (pp. 132–137). <https://doi.org/10.1109/SOSE.2017.21>
- Vakeel, K. A., Das, S., Udo, G. J., & Bagchi, K. (2017). Do security and privacy policies in B2B and B2C e-commerce differ? A comparative study using content analysis. *Behaviour & Information Technology*, 36(4), 390–403. <https://doi.org/10.1080/0144929X.2016.1236837>
- Vlachos, I. P. (2016). Reverse logistics capabilities and firm performance: the mediating role of business strategy. *International Journal of Logistics Research and Applications*, 19(5), 424–442. <https://doi.org/10.1080/13675567.2015.1115471>
- Wang, H., Jiang, Z., Zhang, H., Wang, Y., Yang, Y., & Li, Y. (2019). An integrated MCDM approach considering demands-matching for reverse logistics. *Journal of Cleaner Production*, 208, 199–210. <https://doi.org/10.1016/j.jclepro.2018.10.131>
- Waqas, M. C. barriers to implementation of reverse logistics in the manufacturing industry: A case study of a developing country, Dong, Q.-L., Ahmad, N., Zhu, Y., & Nadeem, M. (2018). Critical barriers to implementation of reverse logistics in the manufacturing industry: A case study of a developing country. *Sustainability*, 10, 1–25. <https://doi.org/10.3390/su10114202>
- Wardani, S. A., Handayani, N. U., & Wibowo, M. A. (2022). Barriers for Implementing Reverse Logistics in the Construction Sectors. *Journal of Industrial Engineering and Management*, 15(3), 385–415. <https://doi.org/10.3926/jiem.3539>
- Witkowski, K. (2017). Internet of Things, Big Data, Industry 4.0 - Innovative Solutions in Logistics and Supply Chains Management. *Procedia Engineering*, 182, 763–769. <https://doi.org/10.1016/j.proeng.2017.03.197>

- Wong, W. P., Soh, K. L., Chong, C. Le, & Karia, N. (2015). Logistics firms performance: Efficiency and effectiveness perspectives. *International Journal of Productivity and Performance Management*, 64(5), 686–701. <https://doi.org/10.1108/IJPPM-12-2013-0205>
- Wu, P.-J., & Lin, K.-C. (2018). Unstructured big data analytics for retrieving e-commerce logistics knowledge. *Telematics and Informatics*, 35(1), 237–244. <https://doi.org/10.1016/j.tele.2017.11.004>
- Wu, Y. C., Goh, M., Yuan, C. H., & Huang, S. H. (2017). Logistics management research collaboration in Asia. *International Journal of Logistics Management*, 28(1), 206–223. <https://doi.org/10.1108/IJLM-09-2013-0104>
- Xianglian, C., & Hua, L. (2013). Research on e-Commerce Logistics System Informationization in Chain. *Procedia - Social and Behavioral Sciences*, 96, 838–843. <https://doi.org/10.1016/j.sbspro.2013.08.095>
- Xu, S. X., Cheng, M., & Huang, G. Q. (2015). Efficient intermodal transportation auctions for B2B e-commerce logistics with transaction costs. *Transportation Research Part B: Methodological*, 80, 322–337. <https://doi.org/10.1016/j.trb.2015.07.022>
- Yadav, D. K., & Barve, A. (2015). Analysis of critical success factors of humanitarian supply chain: An application of Interpretive Structural Modelling. *International Journal of Disaster Risk Reduction*, 12, 213–225. <https://doi.org/10.1016/j.ijdr.2015.01.008>
- Yu, H., & Solvang, W. D. (2016). A stochastic programming approach with improved multi-criteria scenario-based solution method for sustainable reverse logistics design of waste electrical and electronic equipment (WEEE). *Sustainability*, 8(12), 1–28. <https://doi.org/10.3390/su8121331>
- Yu, H., & Solvang, W. D. (2017). A carbon-constrained stochastic optimization model with augmented multi-criteria scenario-based risk-averse solution for reverse logistics network design under uncertainty. *Journal of Cleaner Production*, 164, 1248–1267. <https://doi.org/10.1016/j.jclepro.2017.07.066>
- Zarali, F., Yazgan, H. R., & Delice, Y. (2018). A new solution method of ant colony-based logistic centre area layout problem. *Sadhana - Academy Proceedings in Engineering Sciences*, 43(83), 1–17. <https://doi.org/10.1007/s12046-018-0816-z>
- Zhang, P., Jia, L., Tian, G., & Li, X. (2007). A flexible solution framework for optimal decision in logistics systems. In *Proceedings of the IEEE International Conference on Automation and Logistics, ICAL 2007* (pp. 1806–1811). <https://doi.org/10.1109/ICAL.2007.4338867>
- Zhu, Y. Y. (2015). Research on the evaluation of customer satisfaction under B2C e-commerce. In *3rd International Conference on Mechatronics and Industrial Informatics "ICMII 2015"* (pp. 202–205). <https://doi.org/10.1109/ICNDS.2010.5479279>
- Zu Q., Sun B. (2015). Optimization of Order Picking Work Flow at the E-commerce Logistics Centres. In *International Conference of Human Centered Computing* (Vol. 8944, pp. 598–599). <https://doi.org/10.1007/978-3-319-15554-8>

List of Scientific Publications by the Author on the Topic of the Dissertation

Papers in the Reviewed Scientific Journals

Al Majzoub, M., & Davidavičienė, V. (2020). Measuring the impact of factors affecting reverse e-logistics' performance in the electronic industry in Lebanon and Syria. *Independent Journal of Management & Production (ijm&p)*, 11(1), 2194–2215. <https://doi.org/10.14807/ijmp.v11i7.1254>

Al Majzoub, M., & Davidaviciene, V. (2021). Measuring the impact of diverse factors on reverse e-logistics performance in Lebanon. *International Journal of Learning and Change*, 13, 419–436. <https://doi.org/10.1504/ijlc.2020.10032393>

Davidavičienė, V., & Al Majzoub, M. (2021). Performance of reverse logistics in electronic commerce: a case study from Lebanon and Syria. *Transport*, 3, 1–23. <https://doi.org/10.3846/transport.2021.14956>

Papers in Other Editions

Al Majzoub, M., & Davidavičienė, V. (2018). Multi-Layered Model of E-Logistic. In *10th International Scientific Conference "Business and Management 2018"* (pp. 121–131). <https://doi.org/10.3846/bm.2018.14>

Al Majzoub, M., & Davidavičienė, V. (2019). Comparative analysis of reverse e-logistics' solution in Asia and Europe. In Conference: *Contemporary issues in business, management and economics engineering 2019* (pp. 890–899). <https://doi.org/10.3846/cibmee.2019.091>

Al Majzoub, M. (2019). Meta-analysis of diverse factors affecting reverse e- logistics performance and its efficiency. In *Academics World International Conference 2019* (pp. 1–5). https://www.worldresearchlibrary.org/up_proc/pdf/3425-15790651231-5.pdf

Summary in Lithuanian

Įvadas

Problemos formulavimas

Specializuotos elektroninės logistikos grandinės suteikė B2C elektroninės prekybos įmonėms keletą pranašumų: sutaupius sąnaudų padidino pelną efektyviai naudojant išteklius ir padidino klientų pasitenkinimą (Mahindroo, Samalia & Verma, 2018). Vis dėlto elektroninė logistika susiduria su grąžinamų produktų iššūkiais, dėl kurių atsirado būtinybė sukurti naują elektroninės logistikos formą – reversinę elektroninę logistiką (angl. *Reverse e-logistics*, REL). Elektroninės logistikos sėkmė priklauso nuo veiksmingos REL veiklos, tačiau iki šiol vis dar esama REL efektyvumo spragų, ypač besivystančiose šalyse, pavyzdžiui, Artimuosiuose Rytuose. Tai ne tik praktinė problema. Pastebimas ir mokslinio požiūrio bei aiškių metodikų trūkumas. Išsivysčiusiose šalyse atlikta keletas tyrimų ir imtasi priemonių, tačiau besivystančiose šalyse, pavyzdžiui, Artimuosiuose Rytuose, ypač REL srityje, jų atlikta labai nedaug. Atrodo, kad REL procesai lengvai apibrėžiami, tačiau susiduriama su daugybe kliūčių. Daug mokslininkų sutinka, kad nuolatinis REL tobulinimas yra būtinas, siekiant užtikrinti didesnę sąveiką ir galiausiai įmonės gyvavimą (Wu & Lin, 2018).

Iki šiol įmonės yra įstrigusios neišspręstose REL efektyvumo problemose. Kadangi paskelbta labai mažai tyrimų ir straipsnių apie REL veiklą Artimuosiuose Rytuose, vis dar trūksta mokslinių žinių apie REL veiklos ypatumus, o REL veiklos vertinimo ir tobulinimo modelių vis dar yra palyginti nedaug. Vis dar trūksta mokslinių žinių apie REL veiklos ypatumus, o REL veiklos vertinimo ir gerinimo modelių vis dar palyginti nedaug.

Problema ta, kad nė viena įmonė negali visiškai užkirsti kelio REL atsiradimui, tačiau REL efektyvumą galima gerokai pagerinti (Euchi, Bouzidi & Bouzid, 2019). Siekiant tai padaryti, tyrimuose aptarti keli veiksniai, kurie gali turėti įtakos REL efektyvumui. Į šiuos veiksnius atsižvelgta atliekant tolesnę šio darbo analizę. Todėl, užpildžius šią tyrimo spragą, būtų pasiūlyti nauji būdai, kaip pagerinti B2C elektroninės prekybos įmonių REL efektyvumą.

Darbo aktualumas

B2C elektroninė prekyba sparčiai auga dėl kelių jos privalumų, pavyzdžiui, didėjančio pelno, klientų pasitenkinimo ir mažėjančių sąnaudų. 2016 m. pasaulyje buvo daugiau kaip 2,5 mlrd. B2C elektroninės prekybos vartotojų, o 2020 m. šis skaičius išaugo iki 3,4 mlrd. (36 proc. daugiau nei 2016 m.), iš kurių vien Azijos ir Ramiojo vandenyno regione (APAC) 2020 m. elektronine prekyba naudosis 2,15 mlrd. žmonių, todėl šis regionas užims pirmąją vietą tarp kitų regionų (Sabanoglu, 2020).

APAC regione, kuriam priklauso Artimieji Rytai, mažmeninės elektroninės komercijos apimtys labai išaugo. Iš tikrųjų šis regionas laikomas pirmaujančiu elektroninės komercijos pardavimų srityje. Pavyzdžiui, 2018 m. mažmeninės elektroninės prekybos pardavimo apimtis sudarė 0,4473 trilijono JAV dolerių, t. y. 15 proc. visų tų metų bendrųjų elektroninės prekybos pajamų (GREC). 2019 m. – 0,6367 trln. dolerių, t. y. 17 % GREC; 2020 m. – 0,8921 trilijono JAV dolerių, tai sudaro 21 % GRE; 2021 m. – 1,1986 trln. dolerių, t. y. 23 % GREC; 2022 m. – 1,429 trilijono JAV dolerių, t. y. 25 % GREC. Tiki-masi, kad 2024 m. ji pasieks 27 % GREC.

Norint gauti naudos iš elektroninės prekybos, reikia atsižvelgti į elektroninę logistiką, nes ji yra esminis elektroninės prekybos tobulinimo veiksnys. Elektroninė logistika plačiai atvėrė duris veiksmingam B2C elektroninės prekybos įgyvendinimui. Tačiau veiksmingas elektroninės logistikos įgyvendinimas neįmanomas be veiksmingos reversinės elektroninės logistikos (REL) efektyvumo. Tarptautinėje reversinės logistikos rinkoje 2017 m. užregistruota apie 415,2 mlrd. dolerių suma ir tikimasi, kad šis skaičius eksponentiškai augs – iki 2025 m. pasieks 603,9 mlrd. dolerių (Mazareanu, 2021). Šie skaičiai rodo, kaip svarbu išnaudoti galimybes APAC regione, nes šis regionas pirmauja elektroninės prekybos srityje. Atsižvelgiant į tai, kad elektroninės prekybos tobulinimas susijęs su elektronine logistika, o elektroninė logistika tiesiogiai susijusi su REL, todėl REL efektyvumą gerinti yra būtina.

Tyrimo objektas

Objektas – reversiniai elektroninės logistikos veiksniai, naudojami elektroniniam verslui Artimuosiuose Rytuose.

Darbo tikslas

Šio darbo tikslas – sudaryti reversinės elektroninės logistikos veiksnių modelį B2C elektroniniam verslui Artimuosiuose Rytuose.

Darbo uždaviniai

Darbo tikslui pasiekti buvo sprendžiami šie uždaviniai:

1. Išanalizuoti B2C elektroninės prekybos, tiekimo grandinės, elektroninės logistikos ir reversinės elektroninės logistikos srities tyrimus, siekiant ištirti REL veiklos problemas ir sukurti teorinę sistemą.
2. Nustatyti pagrindinius veiksnius, kuriuos reikia ištirti, ir sudaryti modelį, siūlantį sprendimus REL veiklai B2C elektroninėje prekyboje plėtoti Artimuosiuose Rytuose.
3. Įvertinti svarbiausius veiksnius, darančius įtaką REL efektyvumui, siekiant sukurti ir patvirtinti modelį, gerinantį B2C elektroninės prekybos įmonių REL efektyvumą Artimuosiuose Rytuose.

Tyrimų metodika

Pirmajame skyriuje taikoma mokslinės literatūros apžvalgos analizė (sisteminė ir lyginamoji), kuria remiantis suformuluotas teorinis pagrindas.

Siekiant surinkti duomenis iš 412 B2C elektroninės prekybos įmonių, susiduriančių su reversinės elektroninės logistikos problemomis, buvo išplatinta apklausa, paskui atliktas struktūrinių lygčių modeliavimas, daugiakriteris vertinimas ir 7 REL srities ekspertų daugiakriteris vertinimas balais.

Konstruktų validumo ir patikimumo testai atlikti naudojant Kronbacho alfa, Kaiseerio–Mejerio–Olkinio (KMO) testą, Bartleto testą, išgaunamos vidutinės dispersijos testą (AVE), koreliacijos matricą ir faktorines apkrovas. Rezultatų ir hipotezių analizė atlikta naudojant SPSS (socialinių mokslų statistikos paketas) 27 versijos programinę įrangą ir AMOS 26.

Darbo mokslinis naujumas

Disertacijoje pateikiamas toks teorinis indėlis į mokslo žinias:

1. Sukurtas modelis su nustatytais veiksniais, turinčiais svarbų ryšį su REL efektyvumu. Tuo prisidedama plečiant žinias apie esamus modelius ir praturtinant REL literatūrą, užpildant REL efektyvumo gerinimo mokslo spragas.
2. Indėlis į dvi pagrindines vadybos teorijas: pirmoji – ištekliais grindžiamas požiūris (Wernerfelt, 1984) ir darnus vystymasis (Wcd, 1987), praplečiant esamas žinias apie išteklių valdymą ir darnų vystymąsi, kuriant naują išteklių valdymo ir REL efektyvumo koncepciją pagal sukurtą modelį.
3. Modelis sukurtas remiantis elektroninės srities B2C elektroninės prekybos įmonių, veikiančių Libane ir Sirijoje, REL efektyvumu. Tai suteikia naują mokslinę vertę ir tikslių žinių apie REL specifiką besivystančiose šalyse.

Darbo rezultatų praktinė reikšmė

Siūlomą modelį ir gautus rezultatus gali naudoti B2C elektroninės prekybos įmonės, veikiančios besivystančiose šalyse, pavyzdžiui, kai kuriose Artimųjų Rytų šalyse, kurios vis dar kenčia nuo tam tikrų politinių konfliktų ir ekonominio nestabilumo.

Šiame darbe sudarytas siūlomas REL tyrimo modelis pabrėžia analizuojamų veiksnių svarbą, gerinant B2C elektroninės prekybos srityje veikiančių įmonių REL veiklą. Tokiu būdu sukuriamos galimybės veikti besivystančių šalių, kuriose trūksta išteklių, technologijų ir patirties, B2C elektroninės prekybos srityje.

Teoriniu požiūriu nedaug atlikta tyrimų REL tvarumo ir tarpusavio ryšio kontekste. Nors prekių perdavimas yra pagrindinė REL sudedamoji dalis, mažai dėmesio skiriama REL sričiai dėl prekių perdavimo ir galimo poveikio tvarumo rezultatams. Priimant tinkamus sprendimus, pratęsiama prekės gyvavimo trukmė ir galima pasiekti darnaus vystymosi tikslus.

Ginamieji teiginiai

Ginami šie teiginiai:

1. Elektroninės B2C prekybos įmonėms, veikiančioms Artimuosiuose Rytuose ir susiduriančioms su REL problemomis, taikomi aštuoni veiksniai ir sprendimai, kurie yra veiksmingiausi ir tinkamiausi REL efektyvumui pagerinti. Tai vadybė, darbuotojai, IT, grąžinimo politika ir garantija, infrastruktūra, organizacinė struktūra ir kultūra, klientų pasitenkinimas, kokybės vadyba.
2. Siūlomas REL modelis prisideda prie išteklių valdymo ir darnaus vystymosi vadybos teorijų ir prie išteklių pagrįsto požiūrio teorijos (RBV), todėl vadybos tyrimai gali būti atliekami naudojantis šio tyrimo rezultatais.
3. Besivystančiose šalyse išryškėjo spragos ir mokslinių žinių trūkumas REL srityje, tad sukurtas modelis, kaip parodė rezultatai, yra svarbus gerinant REL efektyvumą ir B2C elektroninės prekybos įmonių veiklą Libane bei Sirijoje.
4. B2C elektroninės prekybos įmonės, norėdamos pagerinti savo REL efektyvumą, turėtų naudoti sukurtą modelį, nes jis padės sumažinti išteklių švaistymo mastą didinant jų veiksmingumą, pasiekiant išteklių tvarumą, padidinant klientų pasitenkinimą ir pelną, tokiu būdu išsprendžiant REL neefektyvumo ir netvarumo problemas.

Darbo rezultatų aprobavimas

Disertacijos tema paskelbti trys moksliniai straipsniai: keturi – recenzuojamuose mokslo žurnaluose (Al Majzoub et al., 2020; Davidavičienė & Al Majzoub, 2021a; Al Majzoub & Davidavičienė, 2021b), trys – recenzuojamuose tarptautinių konferencijų straipsnių rinkiniuose (Al Majzoub & Davidavičienė, 2018, 2019a; Al Majzoub, 2019b). Disertacijoje atliktų tyrimų rezultatų tematika buvo perskaityti pranešimai septyniuose mokslinėse konferencijose:

- 10-ojoje tarptautinėje mokslinėje konferencijoje „Business and management 2018“, Vilnius, Lietuva.
- Tarptautinėje mokslinėje konferencijoje „Contemporary issues in business, management and economics engineering 2019“, Vilnius, Lietuva.
- Akademinei tarptautinėje mokslinėje konferencijoje „Management and information technology 2019“, Beirut, Lebanon.

Disertacijos struktūra

Disertaciją sudaro įvadas, trys skyriai, bendrosios išvados, literatūros šaltinių sąrašas bei 8 priedai (A-B-C-D-E-F-G-H). Darbo apimtis – 182 puslapiai, darbe pateikta 12 paveikslų ir 14 lentelių, panaudoti 187 literatūros šaltiniai.

1. Logistikos transformacija skaitmeniniame amžiuje

Technologinė pažanga auga eksponentiškai. Vienas svarbiausių tokios pažangos aspektų – informacinės ir ryšių technologijos (IRT), naudojamos įvairiose srityse. Dėl IRT atsirado elektroninės prekybos sritis. Elektroninė prekyba – tai sandorių, pavyzdžiui, prekių ir (arba) paslaugų pirkimas bei pardavimas kompiuterių tinklais, pavyzdžiui, internetu. Elektroninė prekyba būna labai įvairių rūšių, pavyzdžiui, verslas vartotojui (B2C), verslas vyriausybei (B2G), verslas verslui (B2B), vartotojas vartotojui (C2C), mobilioji komercija (m. komercija) ir t. t. Ji turi daug privalumų – taupo sąnaudas mažindama išteklių naudojimo mastą, didina pelną ir konkurencinį pranašumą, ypač COVID-19 pandemijos kontekste, taip sukurdamą galimybę B2C elektroninės prekybos įmonėms. Tinkamas elektroninės prekybos įgyvendinimas neįmanomas be veiksmingų logistikos sistemų. Logistika – tai užduotis, susijusi su išteklių judėjimu ir saugojimu juos gabenant tarp gamintojų ir klientų. Atsiradus internetui logistika taip pat buvo pakeista nauja forma, vadinama elektronine logistika. Tai logistika, kurios veikimas paremtas internetu, t. y. IRT naudojamos įvairiuose logistikos procesuose tiek vidinėse, tiek išorinėse tiekimo grandinėse. Elektroninė logistika yra labai svarbi ir neatsiejama elektroninės prekybos, ypač B2C, sėkmės dalis. Kad elektroninė prekyba būtų sėkminga, elektroninė logistika turi būti labai veiksminga. Nepaisant didžiulės sėkmės, kurią elektroninė logistika galėjo suteikti B2C prekybai, vis dėlto ji susiduria su keliais iššūkiais, trukdančiais jai būti tokiai sėkmingai, kokios įmonė norėtų. Pavyzdžiui, klientas gali grąžinti prekę dėl įvairių priežasčių – neteisingo užsakymo, prekės su defektu arba perdirbimo. Šis procesas vadinamas reversine logistika. Reversinė logistika – tai procesas, skirtas grąžintoms prekėms tvarkyti, laukiant, kol jos bus panaudotos tokiems tikslams, kaip pakartotinis naudojimas, sutvarkymas, atnaujinimas, perdirbimas ir pagaminimas, arba visiškai atmestos. Atsiradus IRT ir internetui, atsirado nauja RL sąvoka – reversinė elektroninė logistika (REL). REL yra reversinė logistika, galima dėl IRT. REL reiškia reversinės logistikos procesų vykdymą elektroniniu būdu arba internetu. REL – tai reversinis prekių srautas iš vartojimo vietos į gamybos vietą, kurį kartais palengvina elektroninės prekybos pardavėjas.

Nepriklausomai nuo priežasties, kodėl prekes galutinis naudotojas grąžina gamintojui, gali kilti nemažai problemų, jei jos nėra tinkamai valdomos. Vien dėl išlaidų, pati-

riamų grąžinant prekes, įmonės gali nutraukti savo veiklą. Problema ta, kad nė viena įmonė negali išvengti prekių grąžinimo, todėl svarbios REL sistemos yra būtinos, kad įmonės toliau gyvuotų. Tinkamai įdiegus REL sistemas, pagerės tiekimo grandinė, elektroninė prekyba ir įmonių veiklos rezultatai.

Tam tikri įgyvendinti sprendimai galėjo šiek tiek padidinti REL efektyvumą, tačiau juos vis tiek reikia labiau modifikuoti, o kiti sprendimai apskritai nepadarė reikšmingo poveikio. Gera žinia ta, kad galima pagerinti REL, tačiau problema yra žinių trūkumas, kuris labai būdingas B2C elektroninės prekybos įmonėms, ypač toms, kurios veikia besivystančiose šalyse, pavyzdžiui, Artimuosiuose Rytuose. Įvairūs REL srities autoriai aiškiai paaiškino, kad vis dar neišspręsti tam tikri klausimai, susiję su gerų REL efektyvumo palaikymu. Tačiau pateikti siūlymai praktiškai buvo tik teoriniai, todėl būtina tolesnė analizė, siekiant išsiaiškinti siūlomų veiksmų ir REL efektyvumo sąsajos reikšmingumą. Būtina aptarti, kokie veiksniai, REL mokslininkų nuomone, yra svarbiausi. Taigi šiame darbe daugiausia dėmesio skiriama įvairiems REL veiklos rezultatams, ypatumams ir modeliavimo sprendimams, kaip padidinti B2C elektroninės prekybos įmonių REL efektyvumą Artimuosiuose Rytuose. Iš Artimųjų Rytų šalių pasirinktos Libanas ir Sirija, nes jų ypatumai suteikia galimybę įmonėms investuoti. Taip yra dėl to, kad Artimieji Rytai yra sparčiausiai augantis regionas pagal B2C elektroninę prekybą, todėl būtina gerinti REL veiklą. Be to, abi šalys atsilieka nuo kitų šalių net tame pačiame regione. Pavyzdžiui, vis dar išlieka tokios problemos, kaip netinkama infrastruktūra, žlunganti ekonomika, politinė korupcija, nekokybiškos interneto ir ryšių paslaugos, didelės interneto ir telefono skambučių kainos, vyriausybės elektroninių paslaugų nebuvimas ir nepakankamas vyriausybės kišimasis į teisinius klausimus, neefektyvus pristatymas ir nesaugios mokėjimo sistemos. Šios problemos neleidžia B2C elektroninės prekybos įmonėms investuoti šioje šalyje. Tai reiškia, kad Libane ir Sirijoje reikėtų atlikti daugiau tyrimų, nes trūksta mokslinės analizės. Šio darbo tikslai yra šie: pirma, nustatyti svarbiausius veiksnius, darančius įtaką REL efektyvumui; antra, išsiaiškinti, ar REL savo ruožtu daro įtaką įmonių veiklos rezultatams; galiausiai nustatyti gaires, kaip pagerinti Artimuosiuose Rytuose veikiančių B2C elektroninės prekybos įmonių REL efektyvumą. Tai suformavo tris tyrimo klausimus: RQ1: kokie yra svarbiausi veiksniai, tiesiogiai koreliuojantys su REL efektyvumu; RQ2: ar geresnis REL efektyvumas teigiamai koreliuoja su įmonių veiklos rezultatais? RQ3: kokios yra gairės, gerinančios Artimųjų Rytų B2C elektroninės prekybos įmonių REL efektyvumą. Taigi, siekiant įgyvendinti tyrimo tikslus ir rasti atsakymus į suformuluotus tyrimo klausimus, atlikta literatūros apžvalga ir padarytos išvados dėl svarbiausių veiksmų, galinčių turėti įtakos REL efektyvumui. Analizė apibendrinta S1.1 lentelėje.

Išanalizavus REL srities literatūros apžvalgą, buvo pasiūlyta teorinė sistema ir suformuluota vienuolika hipotezių:

H1: Vadovybė turi teigiamą koreliaciją su REL efektyvumu.

H2: Nekompetentingi darbuotojai turi neigiamą koreliaciją su REL efektyvumu.

H3: IT turi teigiamą koreliaciją su REL veiklos rezultatais.

H4: Veiksmingų trečiųjų šalių reversinės elektroninės logistikos paslaugų teikėjų nebuvimas turi neigiamą koreliaciją su REL efektyvumu.

H5: Blogas atsargų valdymas turi neigiamą koreliaciją su REL efektyvumu.

H6: Grąžinimo politikos ir garantijos nebuvimas turi neigiamą koreliaciją su REL efektyvumu.

S1.1 lentelė. Dažniausiai minimi veiksniai, darantys įtaką reversinės elektroninės logistikos rezultatams (šaltinis: sudaryta autoriaus, 2021 m.)

Veiksniai Autoriai, metai	Vadovybė	Organizacinė kultūra ir struktūra	Kokybės valdyba	Gražinimo politika ir garantijos	IT	Infrastruktūra	Trečiųjų šalių REL	Darbuotojai	Klientų pasitenkinimas	Atsargų valdymas
Eskandarpour, Masehian, Soltani, & Khosrojerdi, 2014									X	
Prakash & Barua, 2015	X	X	X	X	X	X			X	
Huang, Rahman, Wu, & Huang, 2015	X	X	X	X	X			X	X	
Yadav & Barve, 2015		X								
Bouzon, Spricigo, Rodriguez, De Queiroz, & Cauchick Miguel, 2015					X	X			X	
Da Silva Guimarães & Salomon, 2015				X	X					
Sri Yogi, 2015			X			X			X	X
Cannella, Bruccoleri, & Framinan, 2016	X	X		X						X
Vlachos, 2016	X	X	X	X	X		X		X	X
Agrawal, Singh, & Mur-taza, 2016							X			X
Sirisawat & Kiatcha-roenpol, 2016	X				X		X	X		
Sudarto, Takahashi, Morikawa, & Nagasawa, 2016									X	
Cooper, Huscroft, Overstreet, & Hazen, 2016									X	
Pandian & Abdul-Kader, 2017	X		X	X						X
Chinda, 2017	X					X				
Batarfi, Jaber, & Aljazzar, 2017				X	X				X	
Sangwan, 2017							X		X	X
Sirisawat & Kiatcha-roenpol, 2018	X	X	X	X	X	X				
Waqas, Dong, Ahmad, Zhu, & Nadeem, 2018	X	X	X	X	X	X	X	X		
Morgan, Tokman, Richey, & Defee, 2018	X	X	X	X	X	X		X		

S1.1 lentelės pabaiga

Veiksniai	Vadovybė	Organizacinė kultūra ir struktūra	Kokybės valdyba	Grąžinimo politika ir garantijos	IT	Infrastruktūra	Trečiųjų šalių REL	Darbuotojai	Klientų pasitenkinimas	Atsargų valdymas
Autoriai, metai										
Govindan & Bouzon, 2018	X				X	X				
Han & Trimi, 2018					X		X		X	
Mahindroo, Samalia, & Verma, 2018			X		X				X	
Bal & Satoglu, 2018								X		
Panigrahi, Kar, Fen, Hoe, & Wong, 2018			X						X	X
Li, Ying, Chin, Yang, & Xu, 2018							X			
Tosarkani & Amin, 2018			X				X			
Chileshe et al., 2018										
Sremac, Stević, Pamučar, Arsić, & Matić, 2018							X			
Ardila Gamboa & Ballesteros Irveros, 2019	X	X	X	X	X			X		
Euchi, Bouzidi, & Bouzid, 2019	X		X	X	X			X	X	
Tan & Guo, 2019										
Bai & Sarkis, 2019							X			
Wang et al., 2019							X			
Daugherty, Bolu-mole, & Grawe, 2019									X	
Ochocka, 2019									X	
Asian, Pool, Nazarpour, & Tabaeian, 2019									X	

H7: Infrastruktūra turi teigiamą koreliaciją su REL efektyvumu.

H8: Organizacinė kultūra ir struktūra turi teigiamą koreliaciją su REL efektyvumu.

H9: Klientų pasitenkinimas ir paslaugos turi teigiamą koreliaciją su REL efektyvumu.

H10: Kokybės valdymas turi teigiamą koreliaciją su REL efektyvumu.

H11: REL efektyvumas turi teigiamą koreliaciją su įmonių veiklos rezultatais.

REL efektyvumo vertinimas grindžiamas šiais trimis veiksniais: aplinkosauginiu, ekonominiu ir socialiniu. Į šiuos veiklos standartus atsižvelgta dėl jų svarbos vertinant REL efektyvumą, kaip siūlė REL mokslininkai ir tyrėjai. Vertinant įmonių veiklos rezultatus, jie grindžiami pelnu ir sąnaudomis, išteklių įsipareigojimais ir veiklos pajėgumu. Šios nuorodos laikomos labai svarbiomis vertinant įmonių veiklos rezultatus, kaip nurodyta daugybėje REL ir efektyvumo vertinimo srities tyrimų.

2. Reversinės elektroninės logistikos efektyvumo Artimuosiuose Rytuose vertinimo tyrimo metodikos formavimas

Ankstesniame skyriuje suformuluotoms hipotezėms patvirtinti – atmesti arba neatmesti – buvo taikomos trys metodikos. Pirmoji metodika buvo struktūrinis lygčių modeliavimas (SEM), antroji – daugiakriterio vertinimo metodas (DELPHI) ir galiausiai trečioji metodika – daugiabalis vertinimo metodas.

Taikant SEM metodą, penkių balų Likerto skalės klausimynas (1 = visiškai nesutinku, 2 = nesutinku, 3 = neutralus, 4 = sutinku, 5 = visiškai sutinku) buvo išsiųstas 412 elektroninės prekybos įmonių, veikiančių elektroninės prekybos srityje Libane ir Sirijoje. Klausimyną sudaro 67 klausimai (žr. D priedą), iš kurių 6 klausimai yra demografiniai, 7 klausimai susiję su įmonės profiliu, o 54 klausimais klausiama apie reversinės elektroninės logistikos veiksnius ir įmonės veiklos rezultatus. Klausimai buvo paimti iš autorių, kurie yra REL srities ekspertai, straipsnių. Atrenkant kandidatus buvo taikomi šie kriterijai: dirbantys tiekimo grandinės valdymo srityje ne mažiau kaip dvejus metus; turintys patirties elektroninės logistikos ir REL srityje; turintys ne žemesnį kaip verslo administravimo bakalauro laipsnį; dirbti toje pačioje įmonėje ne trumpiau kaip dvejus metus.

Veiklos analizei pakanka 412 atsakymų. Pasak SEM ekspertų, patogus imties dydis turėtų būti vienas iš 3 variantų: imties dydis turėtų būti 100 arba 200, 5–10 klausimų kiekvienam parametrai arba 10 klausimų kiekvienam daliniam kintamajam (Wolf, Harrington & Clark, 2013). Šiame tyrime yra 13 kintamųjų su 34 daliniais kintamaisiais, kuriuos padauginus iš 10 gaunama, kad reikalingas imties dydis yra 340. Pasirinktas imties dydis buvo 412, o tai yra daugiau nei pakankamas dydis, kad rezultatai būtų pagrįsti.

Tada buvo taikomas DELPHI, kuris yra daugiakriterio vertinimo įrankis, leidžiantis pasiekti ekspertų grupės sutarimą REL tema, kai anksčiau tokio sutarimo nebuvo.

Septyni REL srities ekspertai buvo atrinkti pagal šiuos kriterijus:

- Ne žemesnis nei tiekimo grandinės ir (arba) logistikos vadybos magistro laipsnis.
- Ne mažesnė kaip 10 metų patirtis logistikos / tiekimo grandinės srityje.
- Ne mažesnė kaip 5 metų patirtis reversinės elektroninės logistikos srityje.
- Jis (ji) yra aukščiausio lygio vadovas organizacijoje.

Pirmajame etape ekspertų buvo klausiama apie 15 svarbiausių veiksmų, kurie turi įtakos arba gali pagerinti REL efektyvumą. Paskui antrame ture tų pačių ekspertų buvo paprašyta atsakyti į klausimyną, kuris suskirstytas į dvi pagrindines dalis. A dalimi siekiama sužinoti jų nuomonę apie minėtų veiksmų svarbą REL efektyvumui, o B dalimi – įvertinti įvairios REL veiklos svarbą įmonių veiklos rezultatams.

Galiausiai, taikant daugiakriterį vertinimo metodą, tie patys septyni ekspertai buvo paprašyti skirti balus už veiksnius, turinčius įtakos REL efektyvumui, ir jų santykinius kriterijus. Daugiakriterio vertinimo metodas buvo taikomas siekiant išsamiai nustatyti, kaip būtų galima pagerinti nustatytus veiksnius, turinčius įtakos REL efektyvumui. Buvo naudojama skalė nuo 0 iki 10, čia 0 reiškia, kad ne visi veiksniai gali turėti įtakos, 10 reiškia, kad labai tikėtina, jog turės įtakos. Bendra aštuoniems priskirtiems veiksniams skirtų balų suma turi būti lygi 10. Tas pats pasakytina ir apie kriterijams priskiriamus balus, kurių suma kiekvienai daliai turi būti 10 balų. Atliekamas duomenų patvirtinimas, todėl bendra suma negali viršyti 10.

Pasirinkus metodiką, kriterijus ir imties dydį, dabar reikia patvirtinti rezultatus. Tai atliekama kitame skyriuje, kuriame pateikiamas Gautų rezultatų aptarimas.

3. REL sprendimų modeliavimas naudojant suformuluotą modelį

Siekiant patikrinti naudoto klausimyno pagrįstumą, taikyta Cronbacho alfa reikšmė. Kad klausimynas būtų pagrįstas, Cronbacho alfa reikšmė turėtų būti nuo 0,7 iki 1,0. Visos toliau pateiktos reikšmės yra didesnės už alfa reikšmę 0,70, kuri rodo patikimumą. Tai įrodo, kad įvairių tiriamų latentinių kintamųjų rezultatai yra patikimi. Toliau tikrinant pagrįstumą taikytas išgaunamos vidutinės dispersijos testas (AVE). Jei AVE reikšmė yra didesnė arba lygi 0,5, kaip yra šiuo disertacijos atveju, tai rodo, kad tyrimas yra pagrįstas. Alfa ir AVE reikšmės pateiktos S3.1 lentelėje.

Koncepciniam modeliui sudaryti ir suformuluotoms hipotezėms patikrinti buvo naudojama AMOS programinė įranga. Koncepcinis modelis pavaizduotas S3.1 paveiksle.

Naudojant AMOS programinę įrangą buvo patikrintas modelio tinkamumas. S3.2 lentelėje paaiškinami svarbūs rodikliai, paaiškinantys modelio tinkamumą šiame tyrime.

Iš anksčiau pateiktos analizės daroma išvada, kad šio tyrimo empiriniai duomenys atitinka modelį. Tai reiškia, kad koncepcinis modelis tinka ir gali būti taikomas suformuluotoms hipotezėms patikrinti. Tokio modelio tinkamumo buvimas įrodo, kad užfiksuoti rezultatai yra pagrįsti. Taigi valdymo reikšmė įmonėms, norinčioms pagerinti savo REL efektyvumą, bus laikoma veiksminga, nes šis modelis tinka.

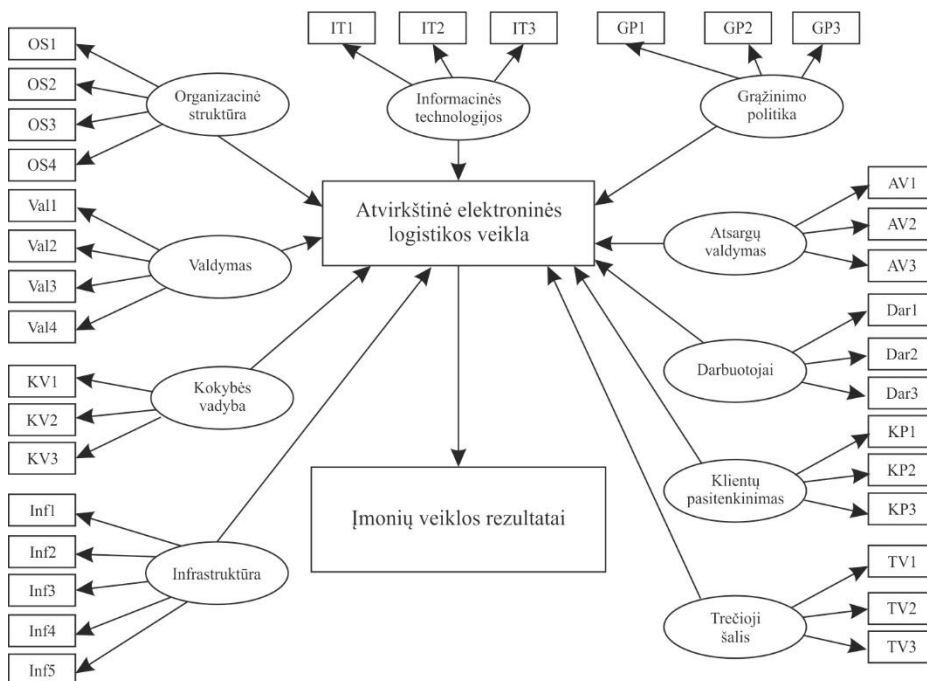
Atliekant tiekimo grandinės veiksnių ir REL efektyvumo koreliacijos tyrimą, toliau analizuojamas REL efektyvumui įtakos turinčių veiksnių koreliacijos koeficientas ir REL koreliacijos koeficientas su įmonių veiklos rezultatais: koreliacijos koeficiento reikšmė nuo 0 iki 0,3 laikoma silpna teigiama koreliacija, nuo 0,3 iki 0,6 – vidutine teigiama koreliacija, o nuo 0,6 iki 1,0 – stipria teigiama koreliacija. Atitinkamai reikšmė nuo 0 iki –0,3 laikoma silpna neigiama koreliacija, nuo –0,3 iki –0,6 – vidutiniškai silpna koreliacija, o nuo –0,6 iki –1,0 – stipria neigiama koreliacija. Be to, hipotezių reikšmingumo tyrimas grindžiamas $<0,05$ reikšmingumo lygmeniu. Nors kai kurios hipotezės rodo neigiamą koreliaciją, analizė parodė, kad bet kuri p reikšmė $> 0,05$ atitinkamai atmetama. Todėl nulinė hipotezė visada yra koreliacijos nereikšmingumas:

H0: koreliacija yra = 0 (nulinė).

Ha: koreliacija yra $\neq 0$ (alternatyvi).

S3.1 lentelė. Užfiksuotos Cronbacho alfa ir išgaunamos vidutinės dispersijos testo (AVE) reikšmės (šaltinis: sudaryta autoriaus, 2020 m.)

Veiksnyys	Cronbacho alfa	Išgaunamos vidutinės dispersijos reikšmės (AVE)
Vadovybė	0,979	0,865
Darbuotojai	0,706	0,580
IT	0,973	0,843
Trečiųjų šalių REL paslaugų teikėjai	0,719	0,525
Atsargų valdymas	0,793	0,651
Grąžinimo politika / garantija	0,777	0,560
Infrastruktūra	0,869	0,795
Organizacinė struktūra ir kultūra	0,983	0,870
Klientų pasitenkinimas ir (arba) aptarnavimas	0,956	0,860
Kokybės vadyba	0,767	0,553



S3.1 pav. Konceptinis modelis (šaltinis: sukurtas autoriaus, 2020 m.)

S3.2 lentelė. Modelio tinkamumo duomenys (šaltinis: sukurta autoriaus, 2020 m.)

Modelis	Standartinis modelis
CMIN	0,114
DF	526
CMIN/DF	2,158
P	0,000
CFI	0,956
GFI	0,875
RMSEA	0,053
SRMR	0,038
Pclose	0,114

Taigi $< 0,05$ reikšmingumo lygio reikšmė rodo, kad H_0 neatmetama. Tai reiškia, kad populiacijoje, iš kurios buvo atrinkta imtis, šio tiriamojo kintamojo koreliacija yra lygi 0. Reikšmė $> 0,05$ reiškia, kad H_a yra ta, kuri neatmetama. Tačiau tam tikri sakiniai buvo reformuluoti, kad būtų pašalinta painiava. Visos suformuluotos hipotezės ir atitinkami jų rezultatai apibendrinti S3.3 lentelėje.

Tai reiškia, kad įmonė, norinti pagerinti savo REL efektyvumą, turėtų sutelkti dėmesį į visus veiksnius, patvirtintus suformuluotose hipotezėse: vadovybė, kokybės vadyba, organizacinė struktūra ir kultūra, IT, klientų pasitenkinimas ir aptarnavimas, grąžinimo politika ir garantijos, darbuotojai ir infrastruktūra, tačiau trečiųjų šalių reversinės elektroninės logistikos paslaugų teikėjai ir atsargų valdymas buvo atmesti. Be to, rezultatai parodė, kad, įmonė, sugebėjusi pagerinti REL efektyvumą, taip pat galės pasiekti geresnį savo veiklos efektyvumą, nes tarp REL efektyvumo ir įmonės veiklos rezultatų yra teigiama koreliacija.

Palyginus įmonių, vykdančių elektroninės logistikos veiklą Libane ir Sirijoje, rezultatus, matyti, kad jie turi daug panašumų ir nedaug skirtumų. Nepaisant to, kad galutiname Libano įmonių tyrime iš viso dalyvavo 250 įmonių, o Sirijos – 162 įmonės, abiejose šalyse nustatyta tam tikrų panašumų. Šie panašumai trumpai apibūdinami trimis pagrindiniais punktais. Pirma, aštuoni veiksniai, kurie Libane pripažinti svarbiais: vadyba, kokybės vadyba, organizacinė struktūra ir kultūra, IT, klientų pasitenkinimas ir aptarnavimas, grąžinimo politika ir garantijos, darbuotojai ir infrastruktūra – Sirijoje buvo maždaug tokios pat svarbos. Be to, kiti tyrime minėti veiksniai neturėjo tokios didelės reikšmės REL efektyvumui. Antra, REL efektyvumas buvo tiesiogiai susijęs su geresniu įmonių veiklos efektyvumu Libane ir Sirijoje. Trečia, abiejose šalyse egzistuoja tam tikri bendri vartotojų elgsenos dėsningumai, pavyzdžiui, kainų lyginimas su kokybe. Tai gali būti susiję su labai panašia abiejų šalių kultūra, dėl kurios į daugelį klausimų galėjo būti atsakyta lygiai taip pat. Libano ir Sirijos REL skirtumus galima apibendrinti dviem pagrindiniais punktais. Pirma, paklausiausios prekės internete Libane buvo išmanieji mobilieji telefonai ir sporto įranga. Sirijoje vartotojai labiausiai pageidavo pirkti nešiojamuosius ir planšetinius kompiuterius. Antra, Libano vartotojai pirmenybę teikė aukštam klientų aptarnavimo lygiui, kalbant apie klientų pasitenkinimą. Tačiau Sirijos vartotojai nurodė, kad svarbiausias dalykas, lemiantis klientų pasitenkinimą, yra geros kainos. Abi šalys turi daug bendrų bruožų, dėl kurių į jas lengviau atsižvelgti elektroninėms įmonėms, norinčioms dalyvauti

Artimuosiuose Rytuose. Taigi labai panašios elektroninės prekybos strategijos gali būti sėkmingos abiejose šalyse, tik reikia nedidelių pakeitimų.

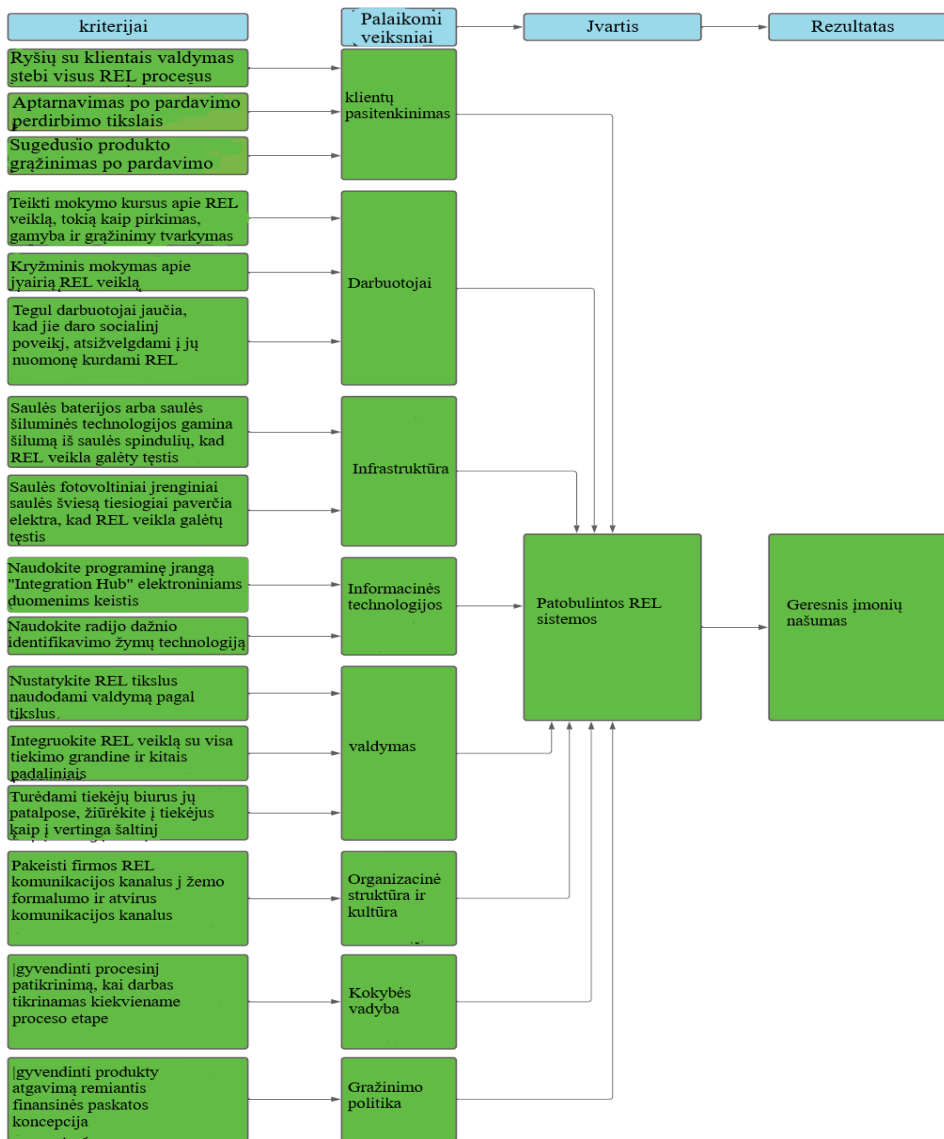
S3.3 lentelė. Suformuluota hipotezė ir atitinkami rezultatai (šaltinis: sukurta autoriaus, 2020 m.)

Hipotezė	Koreliacijos koeficientas	<i>p</i> reikšmė	Atmesta/neatmesta
H1: Vadovybė turi teigiamą koreliaciją su REL efektyvumu	0,187	***	Neatmesta
H2: Nekompetentingi darbuotojai turi neigiamą koreliaciją su REL efektyvumu	0,268	***	Neatmesta
H3: IT turi teigiamą koreliaciją su REL efektyvumu	0,253	***	Neatmesta
H4: Veiksmingų trečiųjų šalių reversinės elektroninės logistikos paslaugų teikėjų nebuvimas turi neigiamą koreliaciją su REL efektyvumu.	–0,028	0,380	Atmesta
H5: Blogas atsargų valdymas turi neigiamą koreliaciją su REL efektyvumu	–0,012	0,658	Atmesta
H6: Grąžinimo politikos ir garantijos nebuvimas turi neigiamą koreliaciją su REL efektyvumu	–0,05	***	Neatmesta
H7: Infrastruktūra turi teigiamą koreliaciją su REL efektyvumu	0,574	***	Neatmesta
H8: Organizacinė kultūra ir struktūra turi teigiamą koreliaciją su REL efektyvumu	0,268	***	Neatmesta
H9: Klientų pasitenkinimas ir aptarnavimas turi teigiamą koreliaciją su REL efektyvumu	0,444	***	Neatmesta
H10: Kokybės valdymas turi teigiamą koreliaciją su REL efektyvumu	0,04	***	Neatmesta
H11: REL efektyvumas turi teigiamą koreliaciją su įmonių veiklos rezultatais	0,144	0,047**	Neatmesta

*** *p* reikšmė < 0,01, ** *p* reikšmė < 0,05.

Taikydami DELPHI metodą, ekspertai sutiko, kad veiksniai, darantys įtaką reversinės elektroninės logistikos veiklos rezultatams, gali būti suskirstyti taip: svarbiausias veiksnys, į kurį reikėtų atsižvelgti, yra klientų pasitenkinimas (vidurkis = 8,72), po to eina infrastruktūra (vidurkis = 8,5), organizacinė struktūra / kultūra (vidurkis = 7,2), IT (vidur-

kis = 7,0), vadovybė (vidurkis = 6,6), o darbuotojai ir kokybės vadyba yra vienodai svarbūs (vidurkis = 6,5). Be to, ekspertai sutiko, kad kai įmonė sugebės pagerinti REL veiklą, ji galės pasiekti ir didesnę veiklos efektyvumą. Bendriems įmonių veiklos rezultatams didžiausią įtaką daro REL veikla (vidurkis = 7,72), paskui ekonominiai veiklos rezultatai (vidurkis = 7,43), tada socialiniai veiklos rezultatai (vidurkis = 7,00) ir galiausiai įtaką – aplinkosauginiai veiklos rezultatai (vidurkis = 6,85).



S3.2 pav. Parengtas koncepcinis tyrimo modelis (šaltinis: sukurtas autoriaus, 2021 m.)

Siekiant išsamiai išanalizuoti, kaip pagerinti nustatytus veiksnius, turinčius teigiamą koreliaciją su REL efektyvumu, taikytas daugiakriterio vertinimo metodas.

Parengtas koncepcinis tyrimo modelis apibendrintas S3.2 paveiksle.

Ekspertai sutiko, kad vadovai turi suprasti, jog, norėdami pagerinti REL efektyvumą, jie pirmiausia turi pagerinti klientų pasitenkinimą. Tai galima pasiekti integruojant santykių su klientais valdymą (CRM) su REL veikla, stebint visus REL procesus, integruojant aptarnavimą po pardavimo su REL veikla, teikiant aptarnavimo paslaugas po pardavimo, ypač perdirbimo tikslais, ir teikiant aptarnavimo paslaugas po pardavimo už sugadintos / netinkamos prekės grąžinimą. Siekdami pagerinti darbuotojų veiklą, vadovai turi rengti mokymus apie REL veiklą ir leisti darbuotojams pajusti, kad jie daro socialinį poveikį, atsižvelgdami į jų nuomonę ir plėtodami REL veiklą. Infrastruktūrai gerinti vadovai turi įrengti saulės baterijas ir saulės fotovoltinius įrenginius. Norėdami tobulinti IT, vadovai turi naudoti programinę įrangą „Integration Hub“, skirtą elektroniniams duomenų mainams (EDI), ir apsvarstyti galimybę naudoti RFID (radijo dažnio atpažinimo žymenų) technologiją.

Siekdami pagerinti vadovavimo įgūdžius, vadovai turi nustatyti REL tikslus, naudodami valdymo pagal tikslus sistemą (MBO), integruoti REL veiklą su visa tiekimo grandine, vertinti tiekėjus kaip vertingus išteklius ir savo patalpose įrengti tiekėjų biurus. Siekdami pagerinti organizacinę struktūrą ir kultūrą, vadovai turi pakeisti organizacinę struktūrą į organinę. Siekdami gerinti kokybės vadybą, vadovai turi įdiegti patikros procesą ir taip sumažinti nekokybiškų prekių atvejų skaičių. Galiausiai, kalbant apie grąžinimo politiką, vadovai turi įgyvendinti prekių grąžinimo sistemą, pagrįstą finansinio skatinimo koncepcija.

Bendrosios išvados

1. Atlikus mokslinės literatūros analizę, buvo nustatyti svarbiausi veiksniai, darantys įtaką REL, ir sukurta koncepcinis modelis. Siekiant jį įvertinti, nustatyti veiksniai buvo toliau analizuojami Libane ir Sirijoje. Rezultatai parodė, kad reikšmingiausią poveikį REL darantys veiksniai yra šie: vadovybė, kokybės vadyba, organizacinė struktūra ir kultūra, IT, klientų pasitenkinimas ir aptarnavimas, grąžinimo politika ir garantija, darbuotojai ir infrastruktūra.
2. Siekdamas geresnių REL veiklos rezultatų, įmonės turi stiprinti nustatytus veiksnius: 1) klientų pasitenkinimą, integruodamos santykių su klientais valdymą (CRM) į visus REL, garantinio aptarnavimo ir perdirbimo procesus; 2) darbuotojų našumą, suteikiant REL dirbantiems darbuotojams daugiau galių ir rengiant mokymus apie REL veiklą, pavyzdžiui, pirkimus, gamybą ir grąžinamų prekių tvarkymą; 3) infrastruktūrą: įrengti saulės baterijas ir saulės šilumos technologiją, kuri gamina šilumą iš saulės šviesos, kad REL veikla galėtų nenutrūkstamai veikti; 4) informacinės technologijos (IT), naudojant programinę įrangą „Integration Hub“, skirtą elektroniniams duomenų mainams, siekiant palaikyti ryšį su visomis pagrindinėmis suinteresuotosiomis šalimis, pavyzdžiui, pagrindinių veiklos rodiklių (KPI) tiekėjais, ir naudojant RFID (radijo dažnio atpažinimo žymos) technologiją; 5) vadovavimo įgūdžius, įgyvendinant valdymo pagal tikslus (MBO) koncepciją, turint veiksmingų vadovavimo ir tarpasmeninių įgūdžių, be to, integruojant REL veiklą su visa tiekimo grandine ir

- kitais skyriais; 6) organizacinę struktūrą ir kultūrą, įgyvendinant organinę organizacinę struktūrą; 7) tiekimo grandinių kokybės vadybą, įgyvendinant tikrinimą proceso metu; galiausiai, taikyti prekių grąžinimo politiką, kuri grindžiama finansinių paskatų koncepcija.
3. Sėkmingas REL įgyvendinimas galėtų būti naudingas visiems organizacijos lygmenims. Sukurto modelio praktinė reikšmė yra ta, kad jis atskleidžia REL spragas ir taip sudaro galimybes pagerinti REL efektyvumą, o tai savo ruožtu, kaip rodo rezultatai, pagerina B2C elektroninės prekybos įmonių veiklą besivystančiose šalyse. Elektroninio verslo įmonės turėtų atkreipti dėmesį į šias šalis kaip augimo galimybes, tačiau turi atsižvelgti ir gerinti REL. Siūlomas REL modelis ne tik prisideda prie vadybos teorijų, susijusių su išteklių valdymu ir tvariu vystymusi, bet ir prisideda prie išteklių grindžiamo požiūrio (angl. RBV) teorijos, nes, mažinant išteklių švaistymo mastą, išnaudojama efektyvumo koncepcija, taigi sprendžiamos REL neefektyvumo ir netvarumo problemos. Dėl to šio tyrimo išvados gali būti panaudotos atliekant valdymo tyrimus.
 4. Kaip ribotumaigalėtų būti įvardinti tokie aspektai kaip geopolitinė situacija, kintanti makro aplina ir pan. Libane tyrimas buvo atliktas iki 2019 m. spalio mėnesio, t. y. iki revoliucijos dienos. Po jos įvyko Beiruto uosto sproginimas ir susidarė sunkios ekonominės sąlygos, kurios vis dar išlieka. Sirijoje buvo sunku bendrauti su įmonėmis dėl 2011 m. įvykusio ir vis dar tebesitęsiančio karo, kuris sunaikino daug infrastruktūros. Tai gali turėti įtakos siūlomų sprendimų B2C elektroninės prekybos įmonių pokyčiams šioje šalyje. Be to, pasirinktos tik Libanas ir Sirija, o kitos Artimųjų Rytų šalys dar nebuvo tirtos. Todėl būtina atlikti tyrimus ir įvertinti modelio priimtinumą kitose Artimųjų Rytų šalyse, pavyzdžiui, Jungtiniuose Arabų Emyratuose (JAE).

Annexes

Annex A. Main Findings in REL Field

Annex B. Authors' Findings of Factors Affecting REL

Annex C. Questionnaire's Sources and Questions

Annex D. Round 1 Delphi's Questionnaire

Annex E. Round 2 Delphi's Questionnaire

Annex F. Multi-criteria Scoring Questionnaire

Annex G. DELPHI Analysis and Calculations

Annex H. Multi-criteria Scoring Results

Annex A. Main Findings in Reverse E-Logistics' Field

Author, Year	Main Findings of the Study
Euchi, Bouzidi, & Bouzid, 2019	According to this study, it was firstly noticed that the improved performance of REL will have consequently an enhanced economic performance and better clients' satisfaction. The most two main variables by which clients' satisfaction are affected from REL are stated as follows: the fact that the staff is dedicated to the service of clients, and the maintenance of a good relationship of clients regardless at what expense.
Govindan & Bouzon, 2018	Thirty-six barriers were totally analysed to verify their effect on the environmental sustainability and REL performance, and the direct stakeholders. The mainly considerable ones by which REL performance is affected are those barriers from inside the enterprise. They are represented by technology, infrastructure, profits, competencies and skills, rules and regulations competitors and the way of managing.
Han & Trimi, 2018	Social networks and corporate can be added as a value to the performance of REL and also improve corporate social responsibility by protecting the environment through taking care of used products to the fact that processes are recycled. Among the multiple platforms, one can note four that crucially necessary to improve the performance of REL which are: customers' relationships, comments and feedbacks of utilizers, quality control and the use of risks.
Y. Tan & Guo, 2019	The major issue of the operations of REL should not be only related to the reduction of costs but also are required to be designed to the environmental safeguard and also go green principle. It is stated that the integration of both forward and reverse logistics is necessary. Concentrating on factors that have negative impact on the performance of REL especially the ones that proved to have a positive correlation are the rules of governments which are likely to enhance the quality of recycle and this is due to the fact that the latter is highly uncertain and cannot be identified in an easy way.
Agrawal, Singh, & Murtaza, 2016	The performance of REL depends highly on three main factors ranked significantly by order which are first the economic factor measured through the creation of a supplementary value, ROI, second the environmental one measured by a low use of energy, and best use of inputs, and then social performance measured by clients' safety and complaints.
Ardila Gamboa & Ballesteros Riveros, 2019	Measuring the performance of distribution centers relies on key performance indicators (KPI) in REL's activities. Distribution centers are shown by outcomes to have an improved efficiency

Author, Year	Main Findings of the Study
	which is calculated by the calculation of outputs over inputs, and DC which have a better relative efficiency is calculated through a weighted average of outputs divided by the weighted average of inputs, have an enhanced performances of REL and therefore generate better profits and improved decision-making.
Bal & Satoglu, 2018	The major goal of REL's performance is for electric wastes to be recovered from several and distinguished electronic equipment, from the delivery to the return of these goods. Results are shown in the way that for reducing electronic wastes, the performance of REL has to be improved through the improvement of activities' planning, sustainability of resources and laws and regulations.
Batarfi, Jaber, & Aljazzar, 2017	Thanks to the enormous technological progress, and therefore e-commerce, B2C businesses capturing the opportunities in that field. Nevertheless, REL cannot be ignored, because it is always expected to have returns. The major objective is to determine the essence of return policy on the performance of REL and it was showed by the outcomes that profits increase when outcomes are reassuring.
Cannella, Bruccoleri, & Framinan, 2016	This inventory management is analysed by the study as well as orders and returned order flow in the firm. Returns are destined for the recycle objectives which requires to face some challenges concerning inventory management, and replenishments have to be continuously implemented. Solutions should consequently be on reducing refabricating and orders' lead-time, return's number of recycled products, and imposing a concrete reverse order policy. In addition, managerial implications are necessitated to decrease costs.
Chileshe et al., 2018;	The supply chain value should be strengthened with the REL operations. The most essential elements by which the performance of REL is affected are economic in terms of costs and quality, environmental when it comes to lower pollution, and social aspects such as go green concept.
Chinda 2017	Seventeen factors impact the performance of REL in the build of industry. The highest factors by which the highest considerable effects are scored are stated to abide to the rules and regulations, stimulating the recycle of products, managerial experience and infrastructure.

Annex B. Authors' Findings of Factors Affecting Reverse E-Logistics

Factors	Management																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
Authors, Years	Sirisawat & Kiatcharoenpol, 2018	X	X	X	X	X	X	X	X	X	X				X													X							
	Prakash & Barua, 2015	X	X	X	X	X	X	X	X	X	X						X																		
	Waqas, Dong, Ahmad, Zhu, & Nadeem, 2018	X	X	X	X	X	X	X	X	X		X	X			X		X																	
	Cannella, Bruccoleri, & Framinan, 2016	X	X																	X															
	Ardila Gamboa & Ballesteros Riveros, 2019	X	X	X	X	X			X						X			X									X		X						
	Pandian & Abdul-Kader, 2017	X	X	X	X	X																					X								
	Tyler R. Morgan, Mert Tokman, Robert Glenn Richey, 2018	X	X	X	X	X				X	X																			X					

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Huang, Rahman, Wu, & Huang, 2015	X	X	X	X		X		X		X				X	X	X					X	X				X	X		X		
Euchi, Bouzidi, & Bouzid, 2018	X	X	X	X			X	X				X	X	X	X	X					X				X					X	
Yadav & Barve, 2015;					X																										
Chinda 2017						X					X																				
Govindan & Bouzon, 2018;						X	X	X	X	X							X		X					X							
Bouzon, Spricigo, Rodriguez, De Queiroz, & Cauchick Miguel, 2015;							X	X	X	X							X						X								
Vlachos, 2016	X	X	X	X		X		X					X			X							X				X				
Agrawal, Singh, & Murtaza, 2016						X						X	X										X	X	X						
Y. Tan & Guo, 2019							X																								
Yadav & Barve, 2015;							X																								
Han & Trimi, 2018;							X	X					X	X	X	X	X	X	X					X	X						X
Sirsawat & Kiatcharoenpol, 2016								X		X					X									X							
Da Silveira Guimarães & Salomon, 2015				X				X										X	X		X	X					X				

[illegible]

Annex C. Questionnaire's Sources and Questions

Respondent's demographics: – age; – gender; – education; – job position; – years of experience in the supply chain; – years within the same company; – country of operation.	
Questions	Source
Factors affecting REL's performance	
Management	
MGT1: Managers continuously perform strategic planning for diverse REL activities.	Waqas et al. (2018)
MGT2: Managers are committed to achieving the firm's objectives, including REL ones.	Sirisawat, Kiatcharoenpol (2018)
MGT3: Managers lack cooperation with REL professionals, partners, and third-party REL providers.	Prakash, Barua (2015)
MGT4: Managers are well-experienced and aware of and understand diverse REL practices.	Waqas et al. (2018)
Organizational structure and culture	
OSC1: REL programs' evaluation, procedures, and guidelines, are well-explained, understood, and written.	Euichi et al. (2019)
OSC2: REL is not integrated with supply chain business processes.	Euichi et al. (2019)
OSC3: There is a lack of flexibility to change from traditional REL systems to new ones.	Euichi et al. (2019)
OSC4: No efficient and effective REL systems are used to monitor returns, and recalls are used.	Euichi et al. (2019)
Return policy and procedures/guarantee	
GRP1: Return procedures are consistent and relatively easy.	Euichi et al. (2019)

Questions	Source
GRP2: The return policy includes product returns by the customers in cases such as product end-of-life and defects.	Euchi et al. (2019)
GRP3: In case of defective/wrong product, the firm claims no liability whatsoever in this matter to refund or repair.	Euchi et al. (2019)
Employees	
EMP1: The Feel-good factors such as employee's morale, individual satisfaction are obtained in the company.	Govindan, Bouzon (2018)
EMP2: Number of employees is positively related to REL implementation	Mahindroo et al. (2018)
EMP3: Only skilled, experienced, and well-educated employees that are capable of handling returns and other REL activities are hired.	Mahindroo et al. (2018)
Inventory management	
IMGT1: The firm can forecast the approximate demand of goods/products	Sirisawat, Kiatcharoenpol (2018)
IMGT2: Risk of storage of hazardous materials is appropriately managed	Prakash, Barua (2015)
IMGT3: Reasons for returns are reasonable and are not the company's fault.	Sirisawat, Kiatcharoenpol (2018)
IT and technology	
IT1: The firm has the most updated technological systems and info for REL processes.	Han, Trimi (2018)
IT2: Direct computer-to-computer links with key vendors are installed.	Sirisawat, Kiatcharoenpol (2018)
IT3: Your Website/social media users is extremely easy in terms of using, ordering online, and returning a product	Euchi et al. (2019)
Infrastructure	
INF1: No technological infrastructure to adopt REL practices is available.	Waqas et al. (2018)
INF2: Your firm has a strong infrastructure facility (storage, transportation).	Sirisawat, Kiatcharoenpol (2018)
INF3: Your country suffers from bad infrastructure (electricity, bad road conditions, etc.)	Waqas et al. (2018)

Questions	Source
INF4: Your company has a robust disaster-resilient infrastructure and transport facilities	Waqas et al. (2018)
INF5: Your company has a strong system to monitor returns.	Sirisawat, Kiatcharoenpol (2018); Prakash, Barua (2015)
Third-party REL	
TPP1: Well-trained supply chain partners assist in REL implementation and management.	Govindan, Bouzon (2018)
TPP2: Cooperation with business partners in the supply chain is high in the REL implementation.	Sirisawat, Kiatcharoenpol (2018)

Annex D. Round 1 DELPHI's Questionnaire

Delphi Round 1

Location: _____
Age: _____
Years of experience in supply chain: _____
Educational level: _____
Gender: _____
Job position: _____

Dear expert,

Thank you for your valuable time taken to fill out the below questionnaire. We are doing a study concerning the impact of diverse factors that affect the performance of reverse e-logistics. This study will be done in three main rounds.

Round 1 will gather the answers from you and other experts in the field of supply chain. Then, based on the results of Round 1, another questionnaire will be sent in Round 2. Finally, Round 3 will be done only in case there's a necessity for consensus.

In your opinion, what are the most important 15 factors that have an impact or can improved reverse e-logistics' performance?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

Annex E. Round 2 DELPHI's Questionnaire

Delphi Round 2

Dear expert,

Thank you for your valuable participation in the following questionnaire.

This questionnaire is divided into two main parts. Part A, is to take your opinion regarding the importance of the below mentioned factors regarding reverse e-logistics (REL) performance.

Part B, is to evaluate the importance of diverse REL activities on companies' performance.

Please give your opinion using the following scale for both parts:

Strongly Disagree < 0 1 2 3 4 5 6 7 8 9 > Strongly Agree

Part A

Please rate the following statements using the above scale to study the impact of the below factor on REL's performance.

Scale	Statements
	Management is crucial for improving REL's performance.
	IT is relevant to good REL's performance
	Infrastructure rigid systems result in significant REL's performance
	Third-party reverse e-logistics provides impact REL's performance
	Organizational structure and culture are related to REL's performance
	Quality management is an indispensable part in REL's performance
	Inventory management is directly correlated to REL's performance
	Employees have significant impact on REL's performance
	Return policies and guarantees are indispensable for effective REL's performance
	Customer satisfaction is an inseparable factor in REL's performance

Part B

Please rate the following statements using the above scale to study the impact REL's activities on REL's performance.

Scale	Statements
	Importance of REL's activities in improving environmental performance
	Importance of REL's activities in improving economic performance
	Importance of REL's activities in improving social performance
	Importance of REL's activities in overall companies' performance

Annex F. Multi-criteria Scoring Questionnaire

Please give points/marks for the factors/subfactors below. Where 0 not all likely to have affect and 10 extremely likely to have affect.

The total number of points/marks assigned to the below seven factors (**Points for Factors**) must have sum of 10. For example, if you assigned 4 for the first factor the remaining points are 6, to be distributed among the remaining factors. The same applies for the assigning **points for subfactors** and criteria where each part must have sum of 10 points. Data Validation is performed so the total cannot exceed 10.

	Total Factor Score	Factors' Points	Factors	Points for Criteria	Total Criteria Evaluation Score	Criteria
Factors affecting REL Performance			Customer Satisfaction			CRM follow up with all REL processes (returns, recalls, repairs, repackaging for restock or resale, recycling and disposal, etc.).
						CRM has shared customer database of customers who are always returning their products.
						After sales service for recycling purposes.
						After sales service for returning defected/wrong product.
						Process maps tools to determines the parameters for process improvement by drawing REL process to implement cycle time reduction.
						Value stream mapping technique that performs flowcharting of REL processes to determine where customer value is created.
			Employees		0	Provide training courses on REL activities such as procurement, production, returns handling.
						Let employees feel that they make social impact by taking their opinions into consideration while developing REL's systems.
						Offer employee rewards based on best performers in REL activities.
						Cross-training on diverse REL activities
						Promotion based on meeting objectives for REL systems
			Infrastructure			Material Handling systems such as Automated storage and retrieval systems
						Item order fulfillment systems
						Solar panels or solar thermal technology produces heat from sunlight so that REL activities can continue working
						Solar photovoltaics devices directly convert sunlight into electricity so that REL activities can continue working.

	Total Factor Score	Factors' Points	Factors	Points for Criteria	Total Criteria Evaluation Score	Criteria
						Electric cars to be sustainable and responsible
						Road train such as Volvo's FH XXL Cab
		IT	IT			By using software "Integration Hub"
						By using software "ZigiOps"
						By using RFID (Radio frequency tag) technology
						By implementing the bar code identification.
						Software QI Macros
						SPC Software Excel
		Management	Management			Set REL objectives using Management by objectives (MBO)
						Lead by example when managing REL activities and employees.
						comparing the budget of REL from previous and current financial year
						minimizing the REL budgetary discrepancy.
						Integrate REL activities with entire supply chain and with other departments.
						View suppliers as a valuable resource by having offices for suppliers in their premises
		Org. Structure & Culture	Org. Structure & Culture			By implementing a number of interconnected REL units with a flat hierarchy, usually working collectively to obtain economies of scale and scope.
						By changing the firm's REL communication channels to low formality and open communication channels.
		Quality Management	Quality Management			Implement the visibility technique, that stops the production line whenever a defect occurs
						Implement the in-process inspection where work is inspected at each stage of the process,
			Return policy			Implement product recovery based on a financial incentive concept.
						Implement a return policy based on exG2:G37changing the item

Annex G. DELPHI Analysis and Calculations

Table G1. Suggested factors impacting REL's performance in the first round Delphi (source: created by author, 2020)

Factors	Frequency	Percentage
Infrastructure	7	100%
Management	6	85.71%
Government policies	3	42.85%
IT	7	100%
Competition	3	42.85%
CSR	3	42.85%
3PRELP	4	57.14%
Employees	4	57.14%
Corporate image	3	42.85%
Lead time	3	42.85%
Social network	5	71.42%
Guarantee	5	71.42%
Network's capacity	4	57.14%
Suppliers	5	71.42%
Costs	3	42.85%
Recycle	5	71.42%
Inventory management	5	71.42%
Return policy	5	71.42%
Distribution channels	2	28.57%
Transportation costs	3	42.85%
Internet Connection	5	71.42%
Customer satisfaction	7	100%
Quality management	4	57.14%
Organization structure/culture	4	57.14%

Table G2. Experts' answers in round 2 of DELPHI (source: created by author, 2020)

FACTORS	Management	Employees	IT	3PRELP	Inventory Management	Return Policy/Guarantee	Infrastructure	Org. structure/culture	Customer satisfaction	Quality management
REL's Performance	8	7	7	8	2	3	8	8	9	6
	5	8	6	7	9	7	8	6	9	7
	7	7	7	1	3	8	9	7	8	6
	6	6	7	3	1	2	9	8	9	7
	7	5	7	2	8	1	9	7	8	5
	6	6	8	5	6	4	8	7	9	6
	7	6	7	4	5	3	8	7	9	8
MEAN	6.58	6.43	7.0	4.29	4.86	4.0	8.43	7.14	8.72	6.43

Table G3. Experts' agreements in round 2 of DELPHI (source: created by author, 2020)

Factor	Agreement		
	Low	Medium	High
Management	0%	42.86%	57.14%
Employees	0%	57.14%	42.86%
IT	0%	14.29%	85.71%
3PRELP	57.14%	14.29%	28.57%
Inventory Management	42.86%	28.57%	28.57%
Return Policy/Guarantee	71.43%	0%	28.57%
Infrastructure	0%	0%	100%
Org. structure/culture	0%	14.28%	85.72%
Customer satisfaction	0%	0%	100%
Quality management	0%	57.14%	42.86%

Table G4. IQR measurement of factors impacting REL's performance (source: created by author, 2020)

Factor	Mean	IQR	Decision
Management	6.6	1	Not rejected
Employees	6.5	1	Not rejected
IT	7.0	0	Not rejected
3PRELP	4.5	5	Rejected
Inventory Management	4.6	6	Rejected
Return Policy/Guarantee	5.9	5	Rejected
Infrastructure	8.5	1	Not rejected
Org. structure/culture	7.2	1	Not rejected
Customer satisfaction	8.72	1	Not rejected
Quality management	6.5	1	Not rejected

Table G5. Accepted factors impacting REL's performance and their relative means (source: created by author, 2020)

Factor	Mean
Customer satisfaction	8.72
Infrastructure	8.5
Org. structure/culture	7.2
IT	7.0
Management	6.6
Employees	6.5
Quality management	6.5
Return Policy/Guarantee	5.9
Inventory Management	4.6
3PRELP	4.5

Table G6. Experts' answers about REL's impact on companies' performances (source: created by author, 2020)

Factors	Environmental performance	Economic performance	Social performance	Overall REL's activities
Companies' Performance	6	9	7	9
	7	8	6	8
	7	6	6	8
	6	7	9	8
	6	7	7	7
	7	8	7	6
	9	7	7	8
Mean	6.85	7.43	7.00	7.72

Table G7. Experts' agreement about REL's impact on companies' performances (source: created by author, 2020)

Companies' Performance	Agreement	
	Medium	High
Environmental Performance	42.86%	57.14%
Economic Performance	14.28%	85.72%
Social Performance	28.57%	71.43%
Overall REL's activities	28.57%	71.43%

Table G8. IQR measurement of REL's factors impacting companies' performances (source: created by author, 2020)

Companies' Performance	Mean	IQR	Decision
Environmental performance	6.85	1	Not rejected
Economic performance	7.43	1	Not rejected
Social performance	7.00	1	Not rejected
Overall companies' performance	7.72	1	Not rejected

Table G9. Accepted REL's factors impacting companies' performances and their relative means (source: created by author, 2020)

Companies' Performance	Mean
Overall companies' performance	7.72
Economic performance	7.43
Social performance	7.00
Environmental performance	6.85

Table G10. Experts' scores of factors affecting REL's performance (source: created by author, 2021)

Factor	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Mean Average
Customer Satisfaction	3	2	2	2	3	2	2	2.285714
Employees	0	1	1	1	0	2	0	0.714286
Infrastructure	2	2	2	2	3	2	1	2.00
IT	2	2	1	1	2	2	2	1.714286
Management	1	1	1	2	0	0	1	0.857143
Org. Structure & Culture	2	2	1	2	2	2	2	1.857143
Quality Management	0	0	1	0	0	0	1	0.285714
Return Policy	0	0	1	0	0	0	1	0.285714
Total Points	10	10	10	10	10	10	10	10

Annex H. Multi-criteria Scoring Results

Table H1. Experts' scores of customer satisfaction factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Cus- tomer Satis- faction	CRM follow up with all REL processes (returns, recalls, repairs, repackaging for restock or resale, recycling and disposal, etc.).	4	3	3	4	2	3	4	3.285714
	CRM has shared customer database of customers who are always returning their products.	0	0	0	2	2	2	0	0.857143
	After sales service for recycling purposes.	3	3	3	2	2	1	2	2.285714
	After sales service for returning defected/wrong product.	3	4	4	2	2	2	2	2.714286
	Process maps tools to determines the parameters for process improvement by drawing REL process to implement cycle time reduction.	0	0	0	0	1	1	1	0.428571
	Value stream mapping technique that performs flowcharting of REL processes to determine where customer value is created.	0	0	0	0	1	1	1	0.428571
Total		10	10	10	10	10	10	10	10

Table H2. Experts' scores of employees' factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Employees	Provide training courses on REL activities such as procurement, production, returns handling.	4	3	4	2	3	3	3	3.142857
	Cross-training on diverse REL activities	3	3	3	2	2	1	2	2.285714
	Offer employee rewards based on best performers in REL activities.	0	0	0	2	1	2	1	0.857143
	Promotion based on meeting objectives for REL systems	0	1	0	2	2	1	0	0.857143
	Let employees feel that they make social impact by taking their opinions into consideration while developing REL's performance.	3	3	3	2	2	3	4	2.857143
Total		10	10	10	10	10	10	10	10

Table H3. Experts' scores of infrastructure factor affecting REL's performance (source: created by author, 2021).

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Infra-structure	Material Handling systems such as Automated storage and retrieval systems	2	3	1	2	2	1	2	1.857143
	Item order fulfilment systems	0	1	1	1	1	1	1	0.857143
	Solar panels or solar thermal technology produces heat from sunlight so that REL activities can continue working	4	2	3	3	3	3	3	3.00
	Solar photovoltaics devices directly convert sunlight into electricity so that REL activities can continue working.	3	2	3	2	3	2	2	2.428571
	Electric cars to be sustainable and responsible	0	2	2	2	1	2	2	1.571429
	Road train such as Volvo's FH XXL Cab	1	0	0	0	0	1	0	0.285714
Total		10	10	10	10	10	10	10	10

Table H4. Experts' scores of IT factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
IT	Using software "Integration Hub" for electronic data interchange (EDI)	3	2	4	3	3	3	3	3.00
	Using software "Zigi-Ops" for electronic data interchange (EDI)	1	0	0	1	1	0	1	0.571429
	Using RFID (Radio frequency identification tag) technology	2	3	2	4	3	3	2	2.714286
	Implementing the bar code identification.	1	3	2	1	2	2	2	1.857143
	Software QI Macros for statistical process control (SPC)	1	0	0	1	0	1	0	0.428571
	SPC Software Excel for statistical process control (SPC)	2	2	2	0	1	1	2	1.428571
Total		10	10	10	10	10	10	10	10

Table H5. Experts' scores of management factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Management	Set REL objectives using Management by objectives (MBO)	2	3	1	2	3	2	2	2.142857
	Lead by example when managing REL activities and employees.	1	2	1	2	1	1	2	1.428571
	Comparing the budget of REL from previous and current financial year	2	1	2	2	2	1	2	1.714286
	Minimizing the REL budgetary discrepancy.	0	0	1	0	1	0	0	0.285714
	Integrating REL activities with entire supply chain and with other departments.	2	2	3	2	2	3	2	2.285714
	Viewing suppliers as a valuable resource by having offices for suppliers in their premises	3	2	2	2	1	3	2	2.142857
Total		10	10	10	10	10	10	10	10

Table H6. Experts' scores of organizational structure and culture factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Org. Structure & Culture	implementing a number of inter-connected REL units with a flat hierarchy, usually working collectively to obtain economies of scale and scope.	5	3	7	4	4	3	7	4.714286
	changing the firm's REL communication channels to low formality and open communication channels.	5	7	3	6	6	7	3	5.285714
Total		10	10	10	10	10	10	10	10

Table H7. Experts' scores of quality management factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Quality Management	Implement the visibility technique, that stops the production line whenever a defect occurs	3	4	4	5	5	3	3	3.857143
	Implement the in-process inspection where work is inspected at each stage of the process	7	6	6	5	5	7	7	6.142857
Total		10	10	10	10	10	10	10	10

Table H8. Experts' scores of quality management factor affecting REL's performance (source: created by author, 2021)

Factor	Criteria	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Average
Retrun Policy	Implement product recovery based on a financial incentive concept.	8	7	6	5	6	8	7	6.714286
	Implement a re-turn policy based on exchanging the item	2	3	4	5	4	2	3	3.285714
Total		10	10	10	10	10	10	10	10

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