Huo Ran[1], Zhang Min[2]

MASTERING ENTERPRISE COMPETITIVENESS MANAGEMENT THROUGH LOGISTIC ENGINEERING

Due to the rapidly changing global markets and the impact of digitalization, businesses must continually seek new opportunities to enhance their competitiveness, including the logistics principles application. While logistics alone may not grant substantial competitive advantages, its strategic alignment with key competencies, continuous improvement, and the application of logistics engineering principles can significantly enhance an enterprise's competitive standing. The article aims to provide a comprehensive understanding of logistic engineering and its potential to revolutionize enterprise competitiveness management. The primary hypothesis of this research postulates the conception of logistic governance as the creation of an institutional environment that imparts logistic principles and philosophy to all participants. In doing so, it ensures the selection and generation of superior logistic practices among those available in the market. Choosing these best practices and integrating them with dynamic capabilities promotes competitive growth within an enterprise. The selection of best practices is adjusted within the logistics governance framework, which is proposed to be considered a new theoretical concept. Providing additional hypotheses in connection with management's focus has aided in developing a high-level model for logistical engineering. This model highlights two critical processes: an operation process activated by an event timer and the subsequent logistical engineering process. The result of this sequence is the creation of institutional rules for the logistics system, thus establishing an overarching framework. This enhances the system's efficiency and adaptability amidst varied business situations.

Keywords: *logistics engineering, integrated supply chains, competitiveness management, logistics governance.*

Fig. 1. Tabl. 1. Lit. 14.

DOI: 10.32752/1993-6788-2023-1-259-81-89

Peer-reviewed, approved and placed: *12.01.2023.*

Хо Жань, Чжан Мінь

ВДОСКОНАЛЕННЯ УПРАВЛІННЯ КОНКУРЕНТОСПРОМОЖНІСТЮ ПІДПРИЄМСТВА ЗАСОБАМИ ЛОГІСТИЧНОГО ІНЖИНІРИНГУ

Через постійні та швидкі зміни глобальних ринків і вплив цифровізації підприємства повинні постійно шукати нові можливості для підвищення своєї конкурентоспроможності, у тому числі з застосуванням принципів логістики. Хоча логістика сама по собі може не надати істотних конкурентних переваг, її стратегічне узгодження з ключовими компетенціями та забезпечення постійного удосконалення засобами логістичного інжинірингу здатне значно підвищити конкурентоспроможність підприємства. Метою статі є всебічне розкриття змісту логістичної інженерії та потенціалу її застосування за для зростання рівня конкурентоспроможністю підприємства. Основна гіпотеза цього дослідження постулює концепцію логістичного управління як створення інституційного середовища, яке передає логістичні принципи та філософію всім його учасникам. За рахунок такої передачі відбувається залучення до бізнес-процесів найкращих логістичних практик серед доступних на ринку. Саме вибір цих передових практик та їх інтеграція з

[1] National Technical University «Kharkiv Polytechnic Institute». Ukraine.
[2] National Technical University «Kharkiv Polytechnic Institute». Ukraine

динамічними можливостями сприяє зростанню конкурентоспроможності підприємства. Відбір кращих практик корегується в рамках логістичного нагляду, який запропоновано розглядати як новий теоретичний концепт. Надання додаткових гіпотез, пов'язаних з зонами уваги менеджменту, допомогло розробити високорівневу модель логістичного інжинірингу. Ця модель висвітлює два критичні процеси: операційний процес, активований таймером події, і процес логістичного нагляду. Результатом взаємодії двох складових розробленої моделі є формування інституційних правил для логістичної системи, наявність яких підвищує ефективність логістики та забезпечує підсилення конкурентоспроможності.

Ключові слова: *логістичний інжиніринг, інтегровані ланцюги постачань, управління конкурентоспроможністю, логістичний нагляд.*

General statement of the problem and its connection with important scientific or practical tasks. Modern global markets are increasingly competitive (it goes from free goods, services, capital, and people flows across national borders), constantly dealing with the rapid emergence of new technologies, changing consumer preferences, perceiving the digitalization impact on the way of interaction with stakeholders, getting the great emphasis on social responsibility, etc. Due to these facts, all kinds of businesses must look persistently for new opportunities to improve their competitiveness. One of these opportunities and simultaneously one of the modern enterprise's critical success factors is the effective management of logistics processes, which allows for to optimize of costs, reduces the time of delivery of goods and services, improves the quality of customer service, and ensures the flexibility of production processes. It must be noticed that in the realm of competitive enterprise, logistics in isolation does not endow significant advantages. Indeed, the strategic importance of logistics is integrally bound to its capacity to bolster and amplify the existing key competencies within an organization. Furthermore, logistics plays a pivotal role in swiftly conveying the benefits of each of these competencies to the front lines of competitive positioning. In a dynamic, ever-evolving marketplace, these competencies are strategic assets that shape an enterprise's competitive posture and differentiation strategy. The deft application of logistics ensures that these strategic assets are efficiently and effectively deployed, thus optimizing their impact on competitive positioning.

Forming a robust logistics system is imperative to maintain high competitiveness. However, the establishment of such a system is a collaborative endeavor. The longevity of its benefits relies heavily on continuous improvement, a process which requires relentless innovation and an unyielding commitment to operational excellence. Pursuing this continuous enhancement of the logistics system is, in essence, a commitment to a culture of perpetual evolution. This culture underscores the significance of logistics engineering, which is a comprehensive approach to the creation and continuous development of logistics systems. Logistics engineering facilitates the effective and efficient design of logistics systems by amalgamating scientific principles and management strategies. It furnishes enterprises with the requisite tools to sustain their competitiveness over time. It becomes an indispensable resource for enterprises seeking to thrive in an increasingly competitive and demanding business environment.

The latest research and publications review. Numerous researchers have exhaustively explored the dimensions of logistics management. The focus of these investigations has primarily been the organization of logistics activities within crucial logistics

domains (these domains are particularly evident within the context of material and related to them flows). Logistics domain design has been discussed by a significant number of authors, such as D. Bowersox [3], M. Christopher [4], D. Closs [3], K. Grzybowska [5], M. Sullivan [13], and a lot of others. Consolidated usage of mentioned author's proposals allows the emergence of the broader logistics ecosystem with its own peculiarities of ensuring competitiveness.

As for the management of competitiveness, it too has been comprehensively articulated in academic literature. Eminent economists, such as M. Helmold [7], G. Hooley [8], C. Prahalad [11], N. Piercy [8], V. Ramaswamy [11], M. Porter [10], J. Rudd [8], have scrutinized factors that enable competitive advantages and have propounded various theories of competition. These investigations have yielded many insights that have significantly enriched our understanding of competitive dynamics and strategy formulation. However, competitiveness through logistics requires unique methodology and frameworks for implementation in practical enterprise work.

According to the authors of this article, the theoretical foundation for the synthesis of logistics and competitiveness assurance is encapsulated in the concept of dynamic capabilities. This framework, developed by D. Teece [14], underscores the role of the firm's ability to effectively combine, construct, and adapt both internal and external capabilities to tackle swiftly evolving circumstances. Dynamic capabilities are a lens that allows observing the strategic significance of a firm's ability to adapt, innovate, and renew its resources and competencies to maintain its competitiveness. Within this framework, logistics emerges as a form of dynamic capability, underpinning the firm's ability to continually reshape its operational and strategic horizons in response to evolving competitive landscapes. It, therefore, stands as an instrumental factor in the orchestration of resources and competencies that collectively enhance a firm's competitiveness. To elaborate, the logistics function is not merely a conduit for the flow of goods and services but an active participant in creating and sustaining the firm's competitive edge. By leveraging the dynamic capabilities framework, firms can transform their logistics function into a strategic asset, a sustainable competitive advantage that extends beyond operational efficiency and cost-effectiveness. However, proper tools need to be developed.

Identification of previously unresolved parts of the general problem to which the article is devoted. The intersection of logistics management and competitiveness reveals a fertile ground for applying the dynamic capabilities concept. It could become an exciting frontier in enterprise competitiveness management's academic and practical exploration, which needs more research. The author's proposal here is to focus such additional research on the logistics engineering concept and its usage for increasing the enterprise's competitiveness. Indeed, logistic engineering techniques could provide the foundation for integrating logistics with a company's dynamic capabilities. Logistic engineering is a multifaceted field, linking management and operational intricacies, representing a novel frontier in enterprise operations.

According to the B. Blanchard [2, c. 27], logistic engineering deals with the initial definition and ongoing evaluation of logistic system configuration and design. From this perspective, Logistic engineering could and should provide the resource and infrastructure support to the enterprise's competitiveness management system,

which B. Blanchard does not emphasize. B. Scholz-Reiter with coauthors [12, c. 1450] offer how to develop a self-controlled and efficient logistic system using a logistics engineering framework. This research combines logistic objects with scenarios of their usage. So, it is possible to expand such a proposal by considering the dynamic capabilities of logistic objects. Also, the [12] research should be expanded by the latest achievements in the information technology field and should take into account the integration interaction of market agents. E. Jones [9] has offered a structure of logistics engineering tools and represented relations of these tools with other areas of the enterprise's activity. Unfortunately, this study focuses mainly on developing unique engineering tools in specific areas of logistics rather than creating a coherent methodology for their application.

As we can see, given researches [2; 9; 12] explain the essence of logistic engineering. Nevertheless, logistic engineering potential still needs to be fully explored. As a subject, it has its right to exist. In the case of connections with competitiveness management, this concept necessitates further rigorous investigation. The orientation of logistic engineering towards competitiveness is a particularly under-researched area. Despite being a domain that holds promise in boosting a company's competitive edge, the dynamics and nuances of how logistic engineering enhances competitiveness have yet to be extensively delved into. These areas, focusing on optimizing logistic processes and strategies to bolster a firm's standing in the competitive market, offer valuable perspectives that require deeper academic insight.

The article's objectives. The article aims to provide a comprehensive understanding of logistic engineering and its potential to revolutionize enterprise competitiveness management. This purpose is related to the following research questions. What critical logistic engineering tools could be used under competitiveness management, and what are the potential benefits and challenges associated with these tools' usage? How does logistic engineering influence enterprises' performance, and how can enterprises effectively adopt these tools? After providing answers to the given questions, the article will first explore the fundamental concepts and principles underlying logistic engineering, and subsequently, it will examine its various applications and benefits. Furthermore, the paper will also discuss the challenges and barriers that organizations may encounter in implementing logistic engineering, as well as the strategies and best practices to overcome them.

The main part. The main article statement is that logistic engineering boosts logistic and supply management usage as a crucial enterprise's competitive advantage. Logistics engineering is a critical tool that facilitates ongoing improvements in business processes, thereby amplifying a company's competitive advantages. This field focuses on identifying, understanding, and perfecting various logistics procedures to optimize operations within the ever-changing corporate environment. Only such a focus allows consistent refine an enterprise's business process architectures to adapt to continuous shifts in market dynamics, technology, regulations, and societal trends.

Here we have to point out on some similarities and differences between logistic engineering with the Business Process Reengineering (BPR) concept provided by M. Hammer and J. Champy [6] in their classical work. While BPR's objective is a radical transformation leading to quantum leaps in cost, quality, service, and speed performance measures, it seems appropriate to involve logistics engineering in continu-

ous improvement loops. This constant evolution and continuous improvement underscores the need for business process management to stay flexible and responsive to maintain competitiveness. Logistics Engineering primarily emphasizes the design, planning, execution, control, and monitoring of logistic activities to create net value and synchronize supply and demand. It optimizes the complex orchestration of resources and processes involved in moving and storing goods, data, and services across an organization. To remain competitive, businesses must consistently refine their process architectures to adapt to continuous shifts in market dynamics, technology, regulations, and societal trends. However, this is possible after creating the complex orchestration of resources and processes involved in moving and storing goods, data, and services across an organization. It is also necessary to provide for the possibility of a significant discrepancy between the logistics system of the enterprise and the desired level of its competitiveness.

From the given perspective, the first author's proposal here is to ensure the alternation of BPR and logistics engineering cycles to obtain synergies from process reorganization, enhancing an organization's supply chain's efficiency, reliability, and cost-effectiveness. Since we are talking about building end-to-end processes, the authors propose implementing the «logistics governance» concept and its application to the enterprise's process flow management. The researchers mainly discuss logistic management or supply chain engineering as activities that plan, implement, and control business process flows. If we move away from a broad understanding of logistics, management is reduced to optimizing processes for transporting materials and goods. Revisiting the conventional understanding of logistics, better to talk non about supply chain engineering but about governance. Thus, the logistic governance concept has yet to be widely spread and still needs to be explored and studied. One of the few exceptions is J. Aitken's and A. Harrison's [1] article on developing the supply governance for logistic systems. From a narrow perspective, logistics governance could also be considered as managing goods and services flows. Understandably, logistics governance includes planning, coordinating, and monitoring such flows. However, this article offers an expanded understanding of logistic governance.

The central hypothesis of this study is to present logistic governance as the facilitation and formation of a logistic system by providing the institutional setting and disseminating logistic principles and their underlying philosophy to all involved stakeholders (in this case, it is proposed to further expand the logistics ecosystem proposed in the E. Jones' [9, c. 701-718] study). Through this innovative approach, the framework facilitates the identification and creation of outstanding logistic practices from an extensive range available in the market. Selection of the best logistics practices is not merely a logistic engineering standalone function in case of its connection with dynamic capabilities. Thus, this central research hypothesis postulates that by integrating the core logistic principles with dynamic capabilities through logistic governance, it paves the way for a robust competitive position in the market, ensuring long-term growth and sustainability. The central hypothesis is always elucidated through a collection of subsidiary hypotheses. These additional hypotheses are designed to investigate the overarching research question thoroughly. Table 1 catalogues each additional hypothesis and overviews its intricate interrelations. Table 1, at the intersection of rows and columns, represents the areas of enterprise management that may be impacted.

Table 1. **The research hypotheses and areas of logistic management attention**

Supporting research hypotheses	Components of logistics governance implementation				
	H_1	H_2	H_3	H_4	H_5
H_1: logistic engineering plays a crucial role in optimizing resource allocation and can enhance an enterprise's strategic decision-making process	–	The usage of logistic engineering within enterprise management can lead to increased customer satisfaction		Logistics governance make it possible to use joint knowledge management by economic agents	
H_2: the intelligent logistics systems incorporation within an enterprise's or integrated supply chain management reduce loses and enhances cost-effectiveness	Engineering provide cost optimization	–	Analyze the long-term economic benefits. Assess how sustainable practices within logistics engineering contribute to the competitiveness of enterprises.		
H_3: the involvement of the best logistics practices by engineering methods aligns them with the dynamic capabilities of the enterprise	Investigate the competitive advantage gained from adopting new logistic methods and technologies		–	Investigate how digital tools and platforms can streamline operations, reduce costs, and improve service	
H_4: the integration of digital technologies and data analytics in logistic engineering can foster predictive accuracy, enhancing enterprise competitiveness	Explore how artificial intelligence and machine learning algorithms can revolutionize logistics engineering, enhancing predictive accuracy and decision-making processes.			–	Awareness increases the reaction speed
H_5: usage of logistic engineering principles can augment the responsiveness and flexibility of an enterprise, thereby bolstering its competitive positioning	Examine the impact of digital transformation in the logistics sector on enhancing competitiveness		The usage of logistic engineering within enterprise management can lead to increased customer satisfaction		–

Thus, Table 1, combined with the set of additional hypotheses, unfolds a roadmap that traces the influence pathways from each hypothesis through the identified zones of intervention and onto the broader landscape of enterprise management. The hypotheses delineated in Table 1, and the enterprise management's attention zone have facilitated the elaboration of a high-level logistical engineering model (Fig. 1). Within this model, two essential processes have been accentuated. The operation process, which functions upon activation by the event timer, subsequently triggers the logistical engineering process. The output of this logistical engineering procedure culminates in establishing institutional rules governing the operation of the logistical system. The formulation of these rules further delineates the overarching framework within which the logistics system operates, enhancing its efficiency and adaptability in the face of diverse business scenarios.

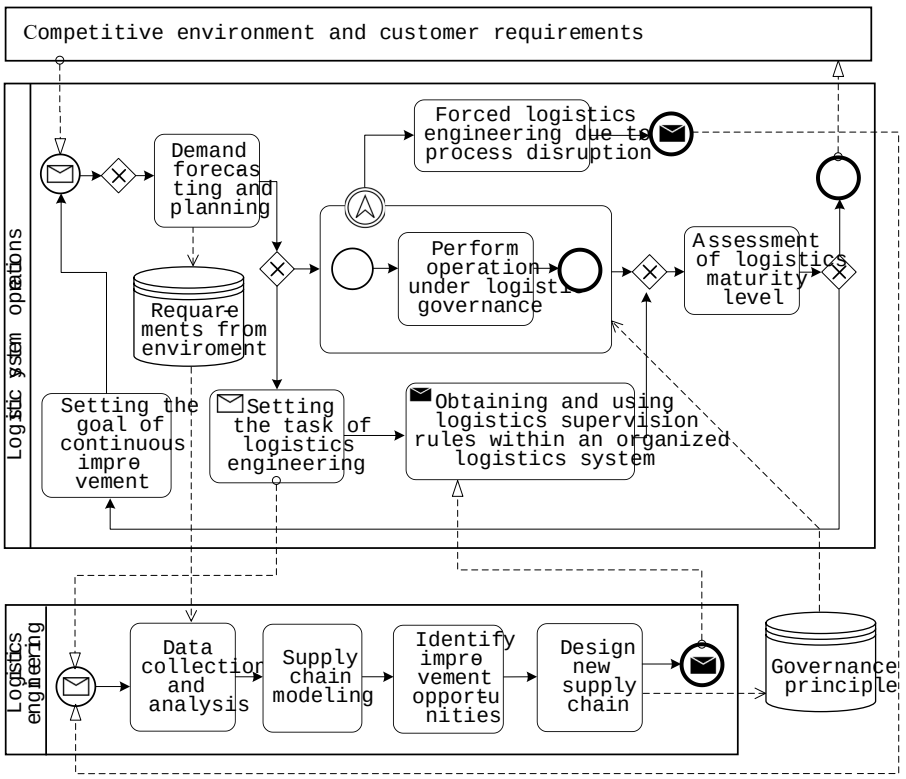

Fig. 1. **High-level and generalized BPMN model of logistic engineering**

Let us explain the particular blocks of the model from Fig. 1. The «Start event» includes the recognition of the need for a new or improved supply chain design. This activity initializes the continuous passing of the «Demand forecasting and planning» activity (it is initiated by a message or a timer event) that gathers the requirement for the logistics engineering (it also collects historical sales data, conducts market analysis, creates the demand forecast, etc.,). Upon the basis of this block, competitive environmental inquiries are compiled, which are subsequently conveyed to the block of logistical engineering. These requirements are consolidated to form a distinct informational entity. Subsequently, a gateway is introduced: either a pathway towards operations management is chosen, or a direct route to the engineering of the logistics system is embarked upon. The chosen path is contingent upon various factors, thus instilling a dynamic aspect within the decision-making process.

Due to high-level modelling, logistic engineering is presented as a sequence of some activities, which include: gathering relevant data about the existing supply chain (for example, transportation times, inventory levels, demand forecasts, and so on) within «Data collection and analysis» activity; using the collected data to develop a digital model of the supply chain (block «Supply chain modelling» can include constructing process maps and flowcharts); identifying bottlenecks, inefficiencies, and

opportunities for improvement (performing «Identify improvement opportunities» activity might involve using various analytical techniques and tools, such as simulations or optimization algorithms); design a new or improved supply chain («Design new supply chain» could involve choosing new suppliers, changing transportation routes, or reconfiguring warehouse layouts).

Conclusions and prospects for further research in this area. This research has examined the logistics principles for boosting the enterprise's competitiveness under rapid market changes. The successful alignment of logistics with core competencies (dynamic capabilities), perpetual improvement, and the strategic application of logistics engineering principles have been shown to significantly augment an enterprise's competitive stature. A robust understanding of logistical engineering and its latent capacity to metamorphose the enterprise's competitiveness management have been presented. The primary hypothesis, which advocates for the conception of logistic governance as the mechanism that institutionalizes logistic principles among all participants, has been critically examined. This approach ensures the selection and adoption of best logistics practices within the market, fostering the integration of these practices with dynamic capabilities to spur competitive growth. The logistics governance framework has been proposed and presented as a fresh theoretical concept. Additional hypotheses relating to management's focus have contributed to the development of a high-level model for logistical engineering. This model features two critical processes: an operational process ignited by an event timer and the ensuing logistics engineering process.

Several additional considerations could be incorporated into future research to ensure an exhaustive study of the subject at hand. Further research requires exploring how new digital technologies can optimize logistics governance and overall logistic system efficiency. Examining the impact and potential of emerging technologies such as artificial intelligence and blockchain for revolutionizing logistics operations is crucial. Secondly, in the face of growing environmental concerns, the role of sustainability in logistics and how it affects competitive advantage should be assessed. To conclude with further author's research, the resilience of the logistics system and the supply chain becomes critical. Therefore, exploring how resilience can be built into logistical engineering and how it impacts competitive advantage would be beneficial.

1. Aitken J., Harrison A. Supply governance tructures for reverse logistics systems. International Journal of Operations & Production Management. 2013. № 33(6). P. 745-764.

2. Blanchard B. Logistics Engineering & Management. USA: Pearson Education, 2014. 423 p.

3. Bowersox D.J., Closs D.J., Cooper M.B., Bowersox J.C. Supply Chain Logistics Management. New York: McGraw-Hill Education, 2019. 769 p.

4. Christopher M. Logistics & Supply Chain Management. London: Financial Time Prentice Hall, 2011. 288 p.

5. Grzybowska K., Awasthi A., Sawhney R. Sustainable Logistics and Production in Industry 4.0: New Opportunities and Challenges. Switzerland: Springer International Publishing, 2020. 298 p.

6. Hammer M., Champy J. Reengineering the corporation: a manifesto for business revolution. United Kingdom: HarperCollins Publishers Inc., 2001. 271 p.

7. Helmold M. Strategic Performance Management. Achieving Long-term Competitive Advantage through Performance Excellence. Gewerbestrasse: Springer, 2022. 210 p.

8. Hooley G.J., Piercy N.F., Rudd J. Marketing strategy and competitive positioning. United Kingdom: Pearson Education Limited, 2016. 584 p.

9. Jones E.C. Supply Chain Engineering and Logistics Handbook. New York: CRC Press, 2019. 757 p.
10. Porter M.E. Competitive Advantage. Creating and Sustaining Superior Performance. New York: The Free Press, 1998. 580 p.
11. Prahalad C.K., Ramaswamy V. The Future of Competition: Co-creating Unique Value with Customers. Brighton: Harvard Business Press, 2004. 257 p.
12. Scholz-Reiter B., Kolditz J., Hildebrandt T. Engineering autonomously controlled logistic systems. International Journal of Production Research. 2008. № 47(6). P. 1449-1468.
13. Sullivan M., Kern J. The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution. New Jersey: John Wiley & Sons, Inc., 2021. 480 p.
14. Teece D.J. Dynamic capabilities and strategic management. New York: Oxford University Press, 2009. 299 p.

---

1. Aitken, J., & Harrison, A. (2013). Supply governance structures for reverse logistics systems. International Journal of Operations & Production Management, 33(6), 745-764.
2. Blanchard, B. (2014). Logistics Engineering & Management. Pearson Education.
3. Bowersox, D.J., Closs, D.J., Cooper, M.B., & Bowersox, J.C. (2019). Supply Chain Logistics Management. McGraw-Hill Education.
4. Christopher, M. (2011). Logistics & Supply Chain Management. Financial Times Prentice Hall.
5. Grzybowska, K., Awasthi, A., & Sawhney, R. (2020). Sustainable Logistics and Production in Industry 4.0: New Opportunities and Challenges. Springer International Publishing.
6. Hammer, M., & Champy, J. (2001). Reengineering the corporation: a manifesto for business revolution. HarperCollins Publishers Inc.
7. Helmold, M. (2022). Strategic Performance Management. Achieving Long-term Competitive Advantage through Performance Excellence. Springer.
8. Hooley, G.J., Piercy, N.F., & Rudd, J. (2016). Marketing strategy and competitive positioning. Pearson Education Limited.
9. Jones, E.C. (2019). Supply Chain Engineering and Logistics Handbook. CRC Press.
10. Porter, M.E. (1998). Competitive Advantage. Creating and Sustaining Superior Performance. The Free Press.
11. Prahalad, C.K., & Ramaswamy, V. (2004). The Future of Competition: Co-creating Unique Value with Customers. Harvard Business Press.
12. Scholz-Reiter, B., Kolditz, J., & Hildebrandt, T. (2008). Engineering autonomously controlled logistic systems. International Journal of Production Research, 47(6), 1449-1468.
13. Sullivan, M., & Kern, J. (2021). The Digital Transformation of Logistics: Demystifying Impacts of the Fourth Industrial Revolution. John Wiley & Sons, Inc.
14. Teece, D.J. (2009). Dynamic capabilities and strategic management. Oxford University Press.