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Exploring the theoretical foundations of horizontal cooperative logistics enterprise relationships

Badanie teoretycznych podstaw horyzontalnych relacji kooperacyjnych przedsiębiorstw logistycznych

Abstract. Understanding collaborative tactics is critical in today's changing corporate market. The research is based on a thorough investigation of four main theoretical frameworks: Transaction Cost Theory, Network Theory, Resource-based Theory, and Game Theory, each of which provides unique insights into the nature of horizontal cooperation. Understanding the complexities underlying these collaborations is critical as collaborative efforts have become increasingly important in modern business. This study examines the main principles of each theoretical framework and their consequences for cooperative enterprise partnerships through a thorough literature survey, providing a full knowledge of how organizations interact inside networks. The findings emphasize the multifaceted character of cooperative interactions. Transaction cost theory explores the choice between internal and external cooperation by analyzing transactional costs and hierarchies. Network theory stresses the importance of linkages and structures in corporate networks for competitive advantage. The significance of shared resources in collaborative success and value creation is highlighted by resource-based theory. Strategic decision-making and conflict resolution are illuminated by game theory. The research gives a comprehensive view of the complex nature of cooperative partnerships and their strategic value in modern business by combining these varied theoretical perspectives. This study's findings contribute to the underpinnings of business cooperation, stressing the relevance of these theories in describing the structure, dynamics, and strategic consequences of collaborative efforts across logistics enterprises.

Key words: logistics collaboration, transaction cost theory, network theory, resource-based theory, game theory, inter-firm cooperation.

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Synopsis. Zrozumienie taktyki współpracy ma kluczowe znaczenie na dzisiejszym zmieniającym się rynku korporacyjnym. Badanie opiera się na dokładnym zbadaniu czterech głównych ram teoretycznych: teorii kosztów transakcyjnych, teorii sieci, teorii opartej na zasobach i teorii gier, z których każdy zapewnia unikalny wgląd w naturę współpracy horyzontalnej. Zrozumienie złożoności leżącej u podstaw tej współpracy ma kluczowe znaczenie, ponieważ wspólne wysiłki stają się coraz ważniejsze we współczesnym biznesie. W niniejszym badaniu zbadano główne zasady poszczególnych ram teoretycznych i ich konsekwencje dla partnerstw przedsiębiorstw spółdzielczych poprzez dokładny przegląd literatury, dostarczając pełnej wiedzy na temat interakcji organizacji w sieciach. Wyniki badań podkreślają wieloaspektowy charakter interakcji kooperacyjnych. Teoria kosztów transakcyjnych bada wybór między współpracą wewnętrzną i zewnętrzną poprzez analizę kosztów i hierarchii transakcyjnych. Teoria sieci podkreśla znaczenie powiązań i struktur w sieciach korporacyjnych dla przewagi konkurencyjnej. Znaczenie wspólnych zasobów we wspólnym sukcesie i tworzeniu wartości podkreśla teoria oparta na zasobach. Strategiczne podejmowanie decyzji i rozwiązywanie konfliktów są oświetlone przez teorię gier. Badanie daje kompleksowy obraz złożonej natury partnerstw spółdzielczych i ich strategicznej wartości we współczesnym biznesie, łącząc te różnorodne perspektywy teoretyczne. Wyniki tego badania wnoszą wkład w podstawy współpracy biznesowej, podkreślając znaczenie tych teorii w opisywaniu struktury, dynamiki i strategicznych konsekwencji wspólnych wysiłków w przedsiębiorstwach logistycznych.

Słowa kluczowe: współpraca logistyczna, teoria kosztów transakcyjnych, teoria sieci, teoria oparta na zasobach, teoria gier, współpraca międzyfirmowa

JEL codes: L22, D23, L14, M21, C70

Introduction

Explaining the theoretical underpinnings of key aspects of horizontal logistics collaboration requires examining the definition of horizontal cooperation. Collaborative logistics refers to a practice wherein companies engage in cooperative efforts to enhance the efficiency of their supply chains, as opposed to operating independently and accepting the inefficiencies that often ensue [Ferrell, 2020]. Many logistics networks offer opportunities for both vertical and horizontal collaboration. Vertical collaboration occurs when multiple organizations within the supply chain – such as manufacturers, distributors, carriers, and retailers – jointly share responsibilities, resources, and performance information [Simatupang and Sridharan 2002]. On the other hand, horizontal collaboration involves relationships between companies that engage in similar activities or provide similar products and can derive mutual benefits from economies of scale through joint endeavors. Notably, these companies often find themselves in direct competition. Xu [2013] characterizes horizontal collaboration as an evolving process wherein firms operating at the same supply chain level collaborate by sharing information, resources, and occasionally, opportunities and risks.

Exploration of the theoretical underpinnings of horizontal cooperative linkages between logistics enterprises is critical for understanding the complexities and mechanisms that promote collaboration and coordination among various logistics organizations. In the realm of supply chain management, there are various organizational theories that provide essential insights into the dynamics of inter-company relationships.

In a comprehensive literature review within the field of supply chain management, Pomponi et al. [2015] aptly underscore the imperative need for robust theoretical foundations to underpin the examination of horizontal collaborations in logistics. They assert that these foundations should be constructed upon the bedrock of theoretical pluralism, advocating for the incorporation of various organizational theories that expound upon the dynamics characterizing relationships between companies within the supply chain. This strategic approach to theoretical pluralism is indispensable for the development of a framework aimed at orchestrating horizontal collaboration in the logistics domain [Verstrepen et al. 2009].

It is pivotal to recognize that crafting a framework for the design of horizontal collaboration (see Fig. 1) in logistics necessitates the establishment of formidable theoretical underpinnings [Pomponi et al. 2013]. Embracing the theoretical pluralism paradigm, which is warmly embraced within the realm of supply chain management, affords a holistic comprehension of the intricate dynamics and interactions weaving through organizations within the logistics sector. Such comprehension, in turn, is instrumental in analyzing and elevating the levels of collaboration and coordination within the logistics industry.

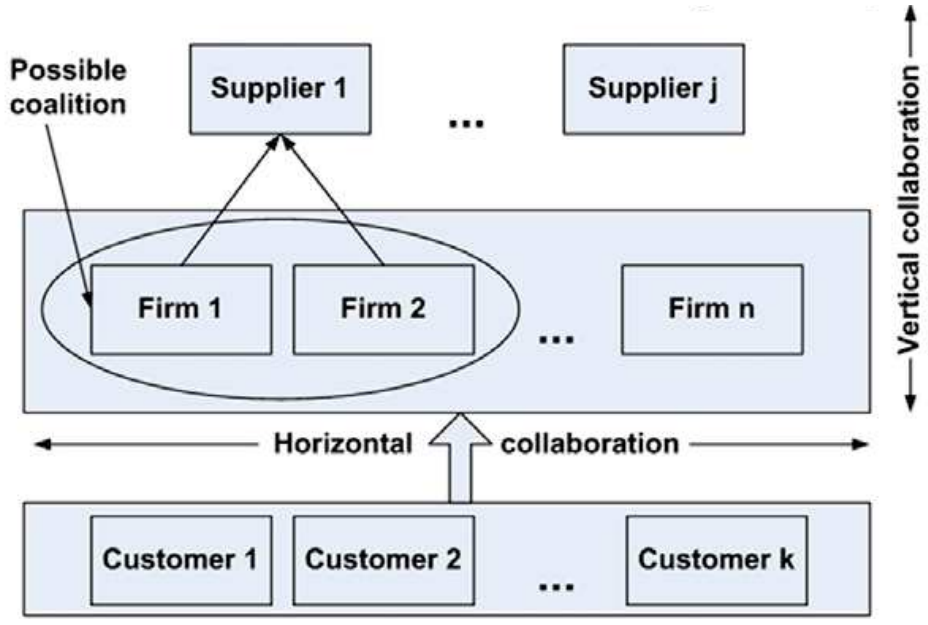

Figure 1: The business context considering collaboration and coalition formation
Rysunek 1: Kontekst biznesowy uwzględniający współpracę i tworzenie koalicji

Source: own elaboration based on: [Jouida et al. 2015].

Źródło: opracowanie własne na podstawie: [Jouida et al. 2015].

Furthermore, it is noteworthy that current research in the field of horizontal logistics cooperation predominantly revolves around evaluating the costs and benefits of collaborative efforts and ensuring the equitable distribution of these advantages among participating partners [Schulz and Blecken, 2010]. To the best of our knowledge, this study represents a pioneering effort in the examination of the theoretical foundations underlying horizontal logistics cooperation.

The paper is organized as follows: the next section presents the research objective and methods. The subsequent section presents the empirical findings and discussion, while the final section offers our conclusions.

Research objective and methods

The objective of this study is to analyze the theoretical underpinnings guiding the dynamics and processes of horizontal cooperative connections among logistics firms in depth. Prompted by the complex nature of logistics networks and the need for efficient coordination, this research raises critical questions: What factors drive horizontal cooperation in logistics, and how do different theoretical perspectives explain these dynamics? Employing a pluralistic theoretical approach, the study aims to enhance the practice and understanding of horizontal collaboration in the logistics sector.

The methodological framework employed in this study revolves around a comprehensive review of the existing literature. This approach entails a meticulous examination and analysis of pertinent research findings and theoretical frameworks within the realm of supply chain management. The literature review is primarily oriented toward various organizational theories that elucidate the intricacies of inter-company dynamics within the supply chain. The overarching objective of this extensive literature review is to establish a robust theoretical groundwork for horizontal collaborations in the field of logistics. By broadening the scope of our review to encompass a diverse range of sources, we aim to adopt a stance of theoretical pluralism in our methodology. This methodological choice is designed to furnish us with a comprehensive grasp of the intricacies and interplays that underlie horizontal cooperative relationships within the logistics industry, thereby enriching our overall understanding of this multifaceted phenomenon.

Result and discussion

Table 1 presents an overview of the key theories that underpin the concept of logistics cooperation. These theories provide a theoretical foundation for understanding the dynamics and mechanisms involved in horizontal cooperative logistics enterprise relationships. The table outlines the characteristics of each theory, and provides relevant literature references for further exploration and in-depth analysis.

Table 1. Theory of logistics cooperation
Tabela 1. Teoria współpracy logistycznej

Aims and concepts	Outcomes of horizontal cooperation	Literature
	Transaction cost economics	
Transaction Cost Economics (TCE] is a conceptual framework focused on analyzing the costs involved in negotiating, coordinating, and overseeing transactions within the context of supply chain management. TCE explores the complexity of these transaction costs, particularly their hierarchical nature within firm management. A key aspect addressed by TCE is the decision-making process regarding the choice between external and internal collaboration. This choice is informed by an assessment of relative transaction costs and associated layer costs. Transaction cost economics provides a systematic approach to comprehending these costs, offering organizations a structured framework to make informed decisions about collaboration strategies.	TCE is useful in aiding businesses in making educated decisions on collaboration tactics. It assists enterprises in assessing the efficiency and cost-effectiveness of collaborating with other firms by giving a systematic way to analyze transaction costs. Based on an analysis of the costs associated with each alternative, this framework assists in assessing whether it is more effective to cooperate internally inside the firm or seek external collaborations.	Łupicka [2005]; Gancarczyk [2011]; Hobbs [1996]; Piboonrungroj and Disney [2015]; Visser [2007].
	Network theory	
Network theory views a firm as a node within a broader network, engaging in various relationships like strategic partnerships and alliances. This theory emphasizes the importance of these relationships and structures in improving business efficiency and gaining competitive advantages. It focuses on understanding factors that influence partner selection, network design, and resource distribution, along with the flow of information and knowledge among participants in the network.	Network theory assists businesses in understanding how their network connections may help them achieve strategic goals such as resource sharing, knowledge transfer, and collaborative innovation. To optimize the benefits of cooperation, the theory assists enterprises in organizing cooperative initiatives, optimizing network architecture, and selecting appropriate partners. It also gives insight into how to manage information flow and collaborative processes in order to attain collective efficiency and a competitive advantage.	Hearnshaw and Prataviera et al. [2023]; Provan et al. [2008]; Skjřtt-Larsen [2000]; Wilson [2013]; Moro Visconti [2019]; Xu et al. [2016].
	Resource-based theory	
Resource-based theory focuses on unique resources such as knowledge, technology, brands, and financial capital that form the foundation for collaboration and value creation. It emphasizes identifying and utilizing complementary resources that generate synergies and enhance the capabilities of partners. This theory is key to understanding how resources contribute to a firm's strategic advantage.	In the context of horizontal cooperation, resource-based theory guides firms in sharing resources to achieve mutual benefits like efficiency, innovation, and competitiveness. It provides a framework for firms to strategically collaborate, leveraging each other's strengths to create value and achieve a competitive edge through cooperation. This theory is instrumental in exploring corporate collaboration and understanding the value-creation processes in cooperative ventures.	Käkelä [2019]; Lai et al. [2008]; Oerlemans and Meeus [2001]; Olavarrieta and Ellinger [1997]; Salge [2013].

cont. Table 1
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Aims and concepts	Outcomes of horizontal cooperation	Literature
	Game theory	
Game theory investigates strategic interactions between partners, notably in settings of cooperation, rivalry, negotiation, and risk management. It takes into account knowledge asymmetry, differing desires, and the strategic actions of the parties concerned. This theory is useful in modeling interactions in order to understand cooperation dynamics and develop optimal methods.	In the context of horizontal cooperation, game theory is an important tool for forecasting outcomes and developing tactics that take into account the actions and reactions of other enterprises. It facilitates decision-making processes in which the interaction of multiple businesses' tactics influences collective outcomes. Companies may efficiently traverse the intricacies of cooperative agreements, coordinate tactics for mutual advantage, and manage the risks and benefits of such cooperation by employing game theory.	Artanari et al. [2015]; Balza-Franco et al. [2017]; Lozano [2013]; Reyes [2005]; Toyasaki et al. [2017]; Xu et al. [2012].

Source: own elaboration.

Źródło: opracowanie własne.

Transaction Cost Economics

Transaction cost economics, initially introduced by Ronald Coase [1937] and subsequently expanded upon by scholars such as Williamson [2010], provides a theoretical framework for understanding the costs associated with transactions and collaborations within organizations. TCE posits that organizations face transaction costs, including negotiation, coordination, and monitoring costs when engaging in market exchanges or forming collaborative relationships. These transaction costs can influence the choice between internal and external modes of organizing economic activities. Transaction cost theory is useful in the setting of horizontal cooperation, when firms work while being prospective rivals. This idea helps to explain why collaborative techniques are preferred over market transactions or hierarchy. TCE provides a solid framework for understanding the dynamics of these connections by studying transaction costs and their impact on the efficiency and effectiveness of horizontal collaboration.

In the realm of Supply Chain Management [SCM], TCE has found practical applications in elucidating decision-making dynamics concerning the insourcing or outsourcing of operational functions. This application entails a comprehensive evaluation of transaction costs, which play a pivotal role in shaping the choice between these two operational approaches. Research in this domain has demonstrated that a lower magnitude of transaction costs typically leans in favor of the outsourcing option, while conversely, a scenario characterized by higher transaction costs tends to encourage the adoption of in-house operations [Wiliamson 2008]. This observation underscores the significance of transaction cost considerations as a principal factor influencing the strategic choices made by organizations in the field of SCM. Such insights provide valuable guidance to companies seeking to optimize their operational strategies, enhance cost efficiency, and improve their overall supply chain performance [Piboonrungroj and Disney 2015]. TCE is used to decide whether a company should maintain in-house logistics services or outsource them

to third parties [Skjřtt-Larsen 2000, Visser 2007, Huo et al. 2018]. This decision is based on evaluating the transaction costs involved. A study by Williamson [2010] showed that companies with complex logistics needs and high transaction costs tend to keep these services in-house. On the other hand, companies with simpler logistics requirements and lower transaction costs often find outsourcing more cost-effective. These insights guide logistics companies in optimizing operational strategies and enhancing supply chain efficiency, demonstrating the real-world utility of TCE in this sector.

III Network Theory

The supply chain network represents an amalgamation of collaborating partners functioning as an interconnected network. Enterprises have transitioned from engaging in competition as isolated entities to participating in a collective supply chain network. The ultimate victors in this paradigm will be those enterprises that excel in the efficient organization and coordination of their collaborative partnerships. This proficiency enables them to deliver superior, expedited, and more proximate services to end-users through the supply chain network [Xu et al. 2016].

In accordance with network theory, a firm's relationships with other companies often represent its most valuable resource. Gaining access to complementary investments and competencies in partner firms constitutes a significant asset [Skjřtt-Larsen 2000]. The intangible assets, particularly tacit knowledge, play a pivotal role in ensuring a firm's enduring competitive edge because they are challenging to replicate [Nelson and Winter 1982]. These assets frequently originate from external relationships and are inseparable from them [Ford 1990]. The network's long-term stability is largely due to the fact that if the network were to collapse, these intangible assets would disappear. The network model basically implies that a firm's ongoing communication with other players is critical in acquiring new resources and abilities. This assumption implies a shift in attention from understanding how a firm's resources are allocated and structured internally to understand how these resources are aligned with the actions and resources of other players in the broader environment. An indispensable competence in designing effective supply chain networks is the ability to construct chains of capabilities, encompassing both the company's internal capabilities and those of the organizations with which the company forms alliances [Fine 1998]. This competency is pivotal in facilitating successful network development and operations.

Network theory not only elucidates the dynamics of connections and resource sharing in the context of horizontal logistics cooperation, but it also has a substantial influence on other operational elements (see Fig.2). Leitner [2011] and Karanja [2015] emphasize the need for effective coordination in logistics networks, emphasizing its impact on operational performance. Wang et al. [2021] investigate resource allocation techniques, stressing their relevance in logistics operations optimization. Furthermore, Lee [2016] and Xu et al. [2016] address the importance of information sharing in improving the efficacy of logistics partnerships. The use of network theory in logistics includes improving resource utilization [Wu et al. 2010], stimulating innovation [Zhang 2023], risk reduction [Chen et al. 2019], and gaining a competitive edge. These aspects are critical in developing strategic collaborations in the logistics business. By incorporating these insights, logistics

organizations may become more versatile and robust, efficiently navigating the logistics industry's dynamic terrain. The primary implications of network theory as they apply to horizontal logistics cooperation are depicted in Figure 2.

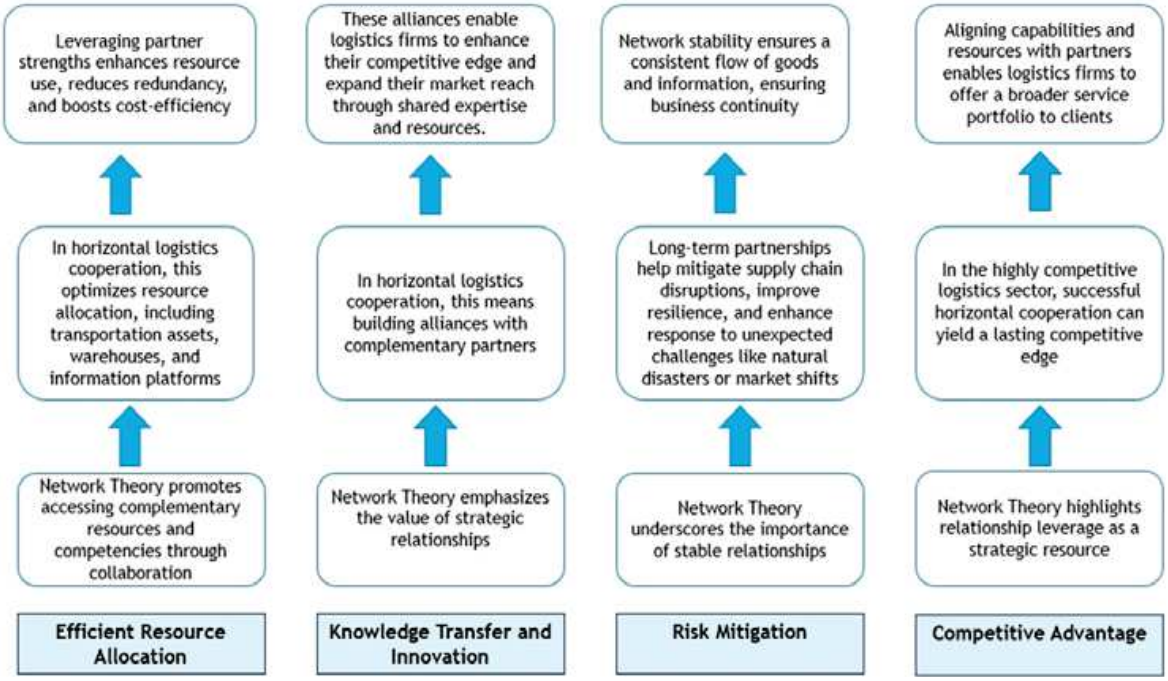

Figure 2. Network theory implication for horizontal logistics cooperation
Rysunek 2. Implikacje teorii sieci dla horyzontalnej współpracy

Source: own elaboration.

Źródło: opracowanie własne.

Resourced-based Theory

Resource-based theory (RBT) is rooted in the premise that an organization's distinctive resources and capabilities form the foundational basis for establishing and sustaining a competitive advantage. This theory critically examines the pivotal role played by these resources and capabilities in facilitating the attainment of competitive advantages [Armstrong and Shimizu 2007, Newbert 2007, Peng et al. 2008, Wong and Karia 2010, Bentamar 2021]. In the context of research pertaining to horizontal cooperative logistics enterprise relationships, this theoretical framework has been thoughtfully applied to explore the implications of logistics capabilities on firm performance [Morash and Lynch 2002, Lai 2004, Stank et al. 2005, Halldorsson et al. 2007, Yang et al. 2009, Nath et al. 2010, Koh et al. 2018].

This perspective underscores the profound significance of these unique assets in enabling a firm to not only outperform its competitors but also thrive in dynamic, collaborative environments. Within the domain of research concerning horizontal cooperative logistics enterprise relationships, scholars have adeptly harnessed this theoretical framework to scrutinize the direct influence of logistics capabilities on an organization's overall performance [Wu et al. 2006, Nath et al. 2010]. Furthermore, researchers have delved into

the intricate relationship between logistics capabilities and firm performance, particularly within the context of horizontal cooperative logistics enterprise relationships [Pomponi et al. 2015, Cui and Hertz 2011]. This exploration has encompassed an examination of how specific logistical competencies, such as effective supply chain management and streamlined distribution processes, contribute substantively to a firm's competitive advantage and enduring success within collaborative networks. The implications of resource-based theory for horizontal logistics cooperation are illustrated in Figure 3.

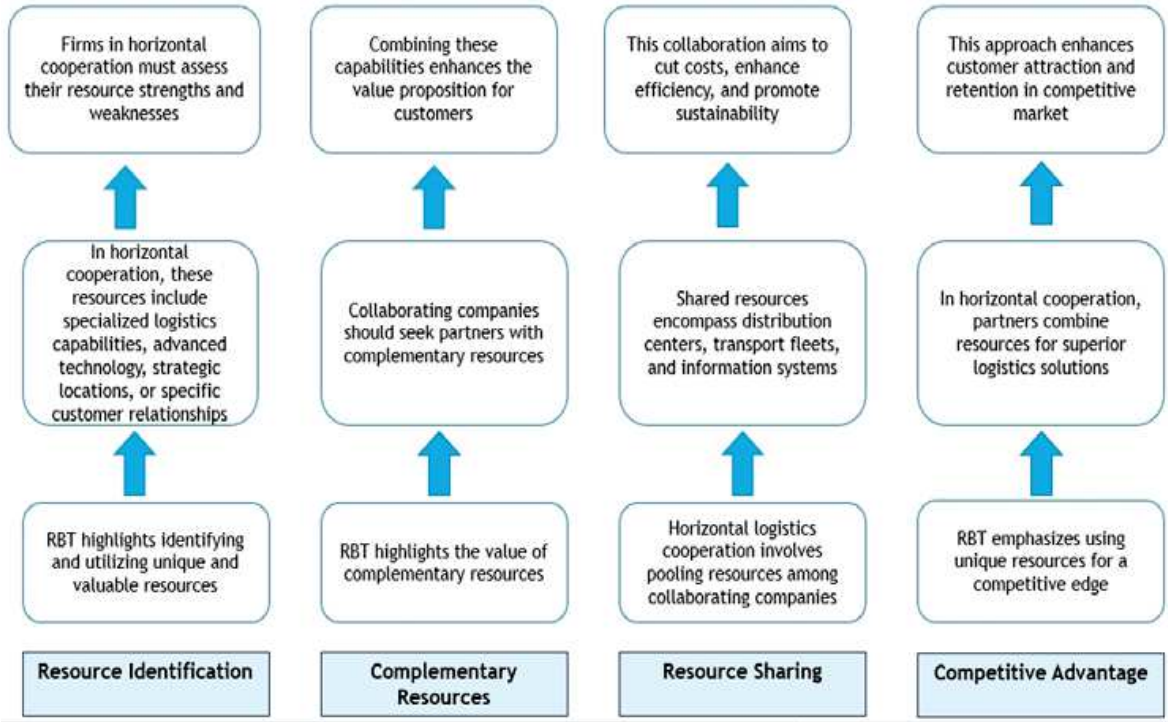

Figure 3. Resource-based theory implication for horizontal logistics cooperation
Rysunek 3. Implikacje teorii opartej na zasobach dla horyzontalnej współpracy logistycznej
Source: own elaboration.
Źródło: opracowanie własne.

Game Theory

Effective collaboration across varied logistics agents is critical for improving operational efficiency and cost-effectiveness, particularly in the context of horizontal cooperation [Hacardiaux and Tancrez 2020]. Numerous instances demonstrate how logistics organizations that collaborate horizontally might pool their resources to generate mutual benefits. For example, two horizontally collaborating businesses may decide to use a common inventory site, sharing fixed expenses across both organizations. Alternatively, when many horizontally collaborating enterprises transport products to the same geographical region, they may opt to collaborate on distribution by engaging a third-party logistics provider. Another popular example is two transportation businesses horizontally coordinating by exchanging information on transportation orders, facilitating return trips, or backhauling [Guajardo and Rönnqvist 2016]. The potential for horizontal logistics cooperation is tremendous, extending to numerous operational areas [Mason et al.,2007].

Successful horizontal logistics collaboration, on the other hand, presents critical considerations about cost and profit-sharing methods, as well as coalition development and administration. In a horizontal framework, one key question is how to evenly divide costs and profits among cooperating partners [Guajardo and Rönnqvist 2016]. A traditional strategy is proportionate allocation, which is often based on parameters such as the overall volume or weight of the carried items. This technique is simple, but it may not always fully reflect each participant's genuine contributions and interests [Verdonck et al. 2016]. More sophisticated techniques, on the other hand, make use of ideas founded in game theory, notably in the setting of horizontal collaboration. Game theory, which serves as a mathematical framework for evaluating strategic actions, is committed to constructing rational decision-making criteria, particularly in instances where partners in horizontal collaboration have competing interests. Game theory provides a sophisticated technique for addressing allocation difficulties and enabling resource sharing in the context of horizontal logistics collaboration. Furthermore, the Shapley value stands out in the context of horizontal logistics cooperation and game theory-based allocation approaches [Krajewska et al. 2008, Lozano et al. 2013, Vanovermeire et al. 2014, Defryn 2017, Luo et al. 2022]. A major component of cooperative game theory, the Shapley value, provides a systematic approach to allocate the

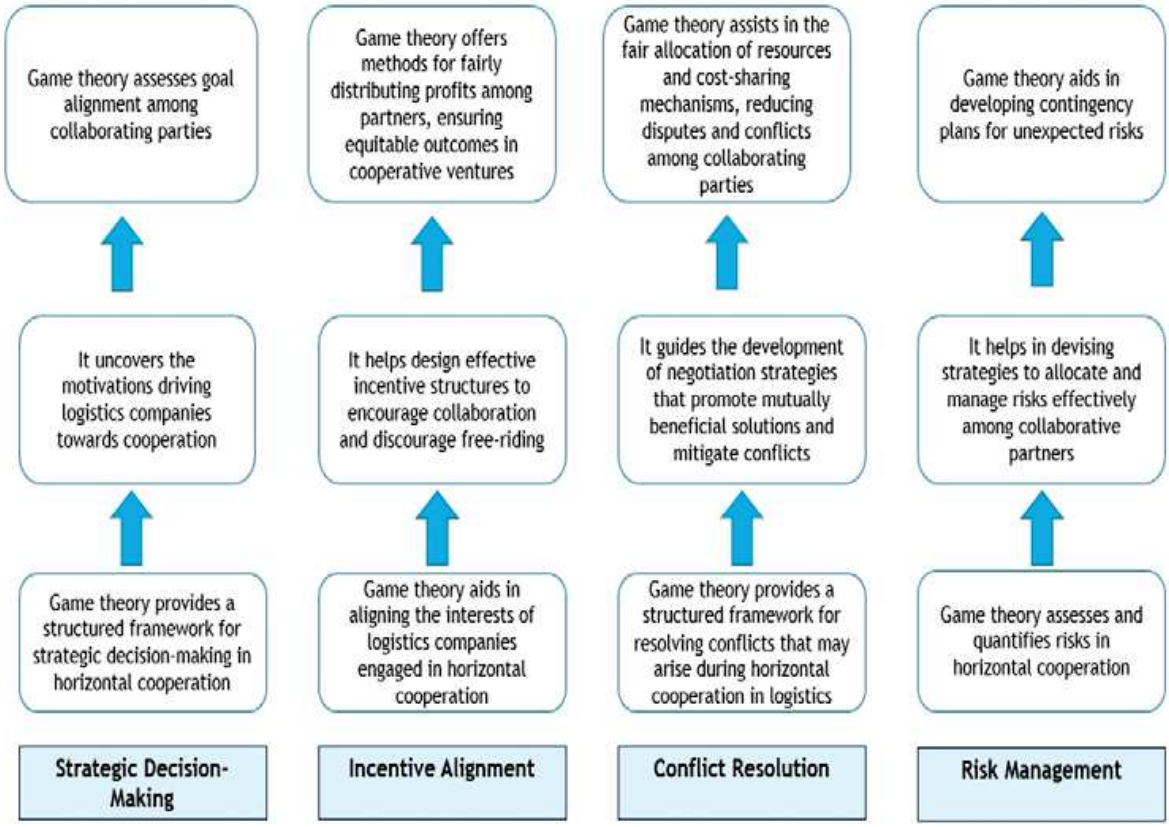

Figure 4. Game theory implication for horizontal logistics cooperation
Rysunek 4. Implikacje teorii gier dla horyzontalnej współpracy logistycznej

Source: own elaboration.

Źródło: opracowanie własne.

value created by a coalition of players among its members, particularly in the setting of horizontal cooperation across logistical companies. Krajewska et al. [2008] utilize the Shapley value to share the cost savings that occur from freight carriers working together to balance their request portfolios, minimizing the number of empty truck trips and obtaining significant cost savings. This value allocation approach takes into consideration each player's marginal contributions while evaluating all conceivable coalition forms in horizontal collaboration. Researchers and practitioners in horizontal logistics cooperation can design allocation techniques that take into account not just quantitative elements but also strategic behaviors and individual ambitions by employing game-theoretical models. These models aid in the optimization of decision-making processes, the encouragement of cooperative tactics, and the equitable and efficient allocation of resources in horizontal logistics collaboration. As a result, game theory plays an important role in creating the future of horizontal logistics cooperation, helping to ensure its development, sustainability, and success in horizontal cooperation settings [Cruijssen et al. 2007]. Figure 4 explores the application of game theory in the context of horizontal logistics cooperation. This representation likely delves into how strategic decision-making, influenced by game theory, can be utilized to manage cooperative relationships and competitive interactions within the logistics sector.

Summary and conclusions

Supply chain cooperation has emerged as an important area of relevance for all supply chains in recent years [Singh et al. 2018]. The research body on horizontal logistics collaboration is small, and most of the existing work is at the operational level [Martin et al. 2018]. This paper has integrated key theoretical perspectives from the strategy literature within the overlapping context of horizontal logistics cooperation for operations management [Zhang and Dhaliwal 2009], reflecting the complexity and multi-faceted nature of modern operations and supplier chain management. In this regard, the study article provides ideas that may be used to understand horizontal cooperative logistics firm relationships. These theories give insight into the intricate dynamics and mechanisms that enable logistical collaboration. The study investigates the elements that drive horizontal collaboration in logistics, using theoretical frameworks to provide insights into these dynamics. Transaction cost economics examines the factors that impact the decision between internal and external collaboration, including transactional costs and hierarchical structures. Network theory emphasizes the relevance of interactions and structures within business networks in attaining a competitive advantage. By emphasizing the production of synergies and value, resource-based theory highlights the relevance of shared resources and talents in attaining collaborative success. Game theory gives insights into strategic decision-making, conflict resolution, and forecast findings on the subject of horizontal logistics cooperation. These approaches together give a comprehensive knowledge of the intricacies and dynamics of horizontal logistics collaboration, highlighting the multifaceted nature of such collaborations. By synthesizing these theoretical perspectives, this paper enriches the analytical framework for dissecting and managing cooperative enterprise relationships.

Based on the research results in this paper, various directions for future research can be identified. Firstly, for transaction cost economics, further studies could investigate how evolving market conditions and digital transformations influence transaction costs in logistics collaboration. In the context of network theory, examining the impact of emerging network structures and digital platforms on logistics partnerships would be valuable [Falcone et al. 2019, Moro Visconti 2020]. Research expanding resource-based theory could focus on how shared technological resources foster innovation in logistics collaborations [Zhang and Dhaliwal 2009]. It is appealing in the context of game theory to examine adaptive cost distribution techniques via dynamic games, contractual frameworks, and systems capable of real-time modifications [Guajardo and Rönnqvist 2018]. This viewpoint acknowledges and addresses the inherent fluidity and unpredictability of strategic decision-making settings. Such an approach would allow for a more dynamic and responsive cost allocation model, in line with the changing nature of strategic contacts and the difficulties of real-time decision-making in uncertain contexts. Dahl and Derigs [2011] and Furuhata et al. [2015] have made efforts in this direction.

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