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EXPLORING SUSTAINABLE HORIZONTAL COLLABORATION IN URBAN LAST-MILE LOGISTICS: AN INITIAL FRAMEWORK FOR ENHANCING COMPETITIVE ADVANTAGE IN THE UK

Khaled Ayad^{1*}, Prof. Panagiotis Georgakis, Dr. Suresh Renukappa

^{1*}University of Wolverhampton, United Kingdom, k.ayad@wlv.ac.uk

Abstract

This study explores the potential of horizontal collaboration (HC) in urban last-mile logistics (LML) to enhance sustainability and competitiveness amidst the rapid growth of e-commerce and urbanisation. Through a comprehensive literature review and a plan to undertake semi-structured interviews with logistics professionals, the research identifies key drivers, strategies, and challenges of HC. Theoretical lenses of Transaction Cost Economics and the Resource-Based View are used to understand the benefits of HC, including reduced transaction costs and enhanced competitiveness through resource synergy. The study aims to develop an initial sustainable theoretical framework for HC in LML, contributing to improved sustainability outcomes and increased competitiveness in urban last-mile delivery.

1. Introduction

The emergence of e-commerce resulting in the surge in urbanisation have exerted significant pressure on last-mile logistics (LML), presenting challenges in achieving sustainability goals and maintaining a competitive edge (Morganti et al., 2014). The last-mile, defined as the final leg of the supply chain where goods are delivered to the end consumer, is a critical component of the logistics process (Halldorsson & Wehner, 2020; Savelsbergh & Van Woensel, 2016). It is also the most costly part of the supply chain, accounting for up to 28% of the total cost to move goods (Morganti et al., 2014). This cost is accompanied by the complexity exacerbated by the rapid growth of e-commerce, leading to an increase in the volume of goods delivered and the frequency of deliveries, thus increasing the environmental impact and operational costs associated with LML.

In response to these challenges, there has been a growing interest in exploring innovative strategies to improve the efficiency and sustainability of LML. One such strategy is horizontal collaboration (HC), which involves companies at the same level of the supply chain working together to achieve common objectives (Crujissen et al., 2007; Shoeder et al., 2016). HC has been recognised as a potential solution to the challenges faced by LML, as it can lead to improved operational efficiency, reduced costs, and enhanced environmental sustainability (Gonzalez-Feliu et al., 2013; Ballantyne et al., 2013).

This paper aims to explore the potential of HC in urban LML within the context of the UK. It seeks to identify the key drivers, strategies, and challenges associated with HC and examine its overall impact on sustainability and competitiveness. The research is based on a literature search undertaken as part of PhD thesis and builds on existing literature and combines them with various relevant theoretical lenses to paint a clearer understanding of advantages relating to HC in LML. It was also focused on answering the following research questions: 1. What is the current outlook on HC in LML? 2. What are the main drivers for HC in LML? 3. What are the key strategies used, and which of them work best? 4. What are the challenges for HC in LML? 5. What are the existing research gaps, and what is the best approach to building a comprehensive framework?

In the future, a qualitative approach, involving semi-structured interviews with professionals in the logistics sector is planned to complete the PhD thesis. The findings are expected to contribute to the development of a comprehensive framework for sustainable HC in urban LML.

The paper is structured as follows. Section 2 provides a review of the literature on HC, LML, and sustainability. Section 3 outlines the research methodology, including the data collection and analysis methods. Section 4 presents the findings and discussion. Section 5 presents the initial proposed theoretical framework prior to the interviews for sustainable HC in urban LML and section 6 concludes the paper and provides directions for future research.

2. Literature Review

The literature on HC in LML and sustainability is extensive, reflecting the complexity of these concepts and their interrelationships.

Morganti et al. (2014) were among the first to highlight the challenges of meeting sustainability goals in the context of the rapid growth of e-commerce and urbanisation. They emphasised the pressure these factors exert on LML. Their work set the stage for the exploration of potential solutions such as HC. Cruijssen et al. (2007) and Schoeder et al. (2016) further delved into the potential of HC in urban LML. Their research identified key drivers, strategies, and challenges of such collaborative practices. They found that HC can lead to cost savings, improved service levels, and increased flexibility, thereby enhancing both sustainability and competitiveness. They also mentioned that the barriers to HC are experienced by both companies that participate in HC and companies that don't.

Gonzalez-Feliu et al. (2013) and Ballantyne et al. (2013) expanded on these insights, examining the overall impact of HC on sustainability and competitiveness. They stressed the potential benefits of HC, including reduced transaction costs and enhanced competitiveness through resource synergy. Their work highlighted the importance of HC in achieving sustainable logistics operations.

McKinnon (2013) and Soysal et al. (2012) contributed to the literature by conducting reviews of studies related to HC, LML, and sustainability. Their work synthesised the current state of knowledge in the field, providing a solid foundation for further research. They identified gaps in the literature and proposed directions for future research, emphasising the need for empirical studies to validate theoretical findings.

Macharis et al. (2014) and Papadopoulou et al. (1998) focused on the methodological aspects of research in this area. They advocated for the use of qualitative approaches, such as semi-structured interviews, to gain deeper insights into the experiences and perspectives of professionals in the logistics sector. They argued that such approaches can provide rich, context-specific data that can enhance our understanding of the complexities and nuances of HC in LML.

Gansterer and Hartl (2017) provided a survey based around the concept of HC, specifically collaborative vehicle routing, a key aspect of HC in LML. Their work highlighted the benefits of HC in improving routing efficiency and reducing environmental impact. They argued that collaborative vehicle routing can lead to significant cost savings, reduced carbon emissions, and improved service levels, thereby contributing to the sustainability and competitiveness of logistics operations.

Adetiloye and Awasthi (2023) emphasised the importance of stakeholder collaboration in achieving sustainable city logistics operations. They argued that effective planning and coordination among various stakeholders, including logistics service providers, customers, and government agencies, are crucial for the success of HC initiatives. They also highlighted the role of information sharing and trust in facilitating effective collaboration.

Schlicher and Lurkin (2022) explored the economic aspects of HC, focusing on collaborative price setting. Their research demonstrated the potential of HC in enhancing competitiveness and market performance. They found that collaborative price setting can lead to more competitive prices, benefiting both logistics service providers and their customers.

Kayikci (2018) explores the impact of digitisation on logistics and supply chain management. She highlights the benefits of digitisation, such as real-time transparency, small lot sizes, multiple product variants, connected processes, and decentralised, autonomous management. This work is relevant as it points to the potential of digital technologies in enhancing HC and improving the sustainability of LML.

Verlinde, Macharis, and Witlox (2012) discuss the concept of urban consolidation centres as a measure to reduce the number of motorised freight vehicles in cities. They highlight the challenges associated with these centres, such as their reliance on government subsidies, and suggest alternative consolidation strategies. This work is relevant as it explores innovative solutions to the challenges of urban LML, which can inform the development of sustainable HC practices.

Finally, Miao (2022) addressed the issue of data privacy in HC. His work on privacy-preserving logistic regression for horizontally distributed data highlighted the need to balance data utility and privacy in collaborative learning, a concern that is particularly relevant in the context of digitalised logistics operations. He proposed a privacy-preserving algorithm that allows logistics companies to collaborate in a secure and efficient manner.

The absence of a comprehensive framework is a significant limitation in the current literature. Such a framework would provide a structured approach to understanding and enhancing competitive advantage, allowing for a more systematic analysis and implementation of strategies. It would also help identify and manage drivers and challenges, thereby improving the effectiveness of competitive advantage initiatives.

3. Methodology

The methodology for this study was designed to ensure a comprehensive and rigorous approach to the literature review. The process was divided into seven steps, as outlined below:

1. Formulation of Research Questions

The first step involved the development of clear research questions based on identifying and understanding strategies, drivers, and challenges related to HC in LML. The research questions were carefully crafted and mentioned in the introduction section of the review, considering the existing gaps in the literature and the specific objectives of the review.

2. Literature Search

A comprehensive search of relevant literature was conducted using appropriate databases and search terms. The databases chosen for this search included ScienceDirect, Scopus, Web of Science (WoS), DOAJ (Directory of Open Access Journals), IEEE Xplore and TRID (Transport Research International Documentation). The search terms were selected to be as comprehensive as possible, focusing on the main topic of the review.

3. Screening of Studies

The identified studies were screened based on inclusion and exclusion criteria. Papers were included if they were peer-reviewed journals, government-level reports and book chapters to

focus on the highest quality articles and take a wide variety of literature. Papers that focus on horizontal or vertical collaboration were considered in order to benefit from some of the advantages that vertical collaboration may bring. Finally, papers that focused on HC in Urban LML were taken and not rural since rural LML poses a geographically significantly different challenge. As for exclusion, papers that did not discuss collaboration and those that were not English were not omitted. This involved removing duplicates, screening titles and abstracts for relevance, removing irrelevant journals, and reviewing the full papers.

4. Data Extraction

Relevant data from the included studies were extracted. This included the title, abstract, keywords, author's names, journal name, and year of publication. The data was extracted to an MS Excel spreadsheet for the purpose of screening.

5. Quality Assessment

The quality of the included studies was assessed. This involved evaluating the studies for risk of bias by looking at study design, conduct, and method of reporting.

6. Results Synthesis

The results of the included studies were synthesised. This involved importing the data into MS Excel for quantitative analysis and graphical representation of results. Papers were classified based on their contribution to the three categories of strategies, drivers, and challenges.

7. Interpretation of Findings and Conclusions

The findings were interpreted and conclusions were drawn based on the evidence gathered. This involved thematic analysis with an inductive approach, allowing for the identification and exploration of patterns and themes in the data without preconceived categories or concepts.

4. Findings and Discussion

In this section, the findings are grouped as follows, the challenges are linked to the relevant drivers and strategies that help overcome followed by a discussion on how they are connected.

Economic and Financial Challenges

Investment costs pose a significant challenge in collaborative logistics. However, the driver of local/regional development can help attract more investments into the sector. Coupled with the strategy of investing in infrastructure and technology, this can lead to more efficient operations, thus offsetting the initial investment costs (Nathanail *et al.*, 2021).

Depreciation, particularly of infrastructure and equipment, is another economic challenge. Operational efficiency can act as a driver to slow down the rate of depreciation (McDonald *et al.*, 2021). Regular maintenance and upgrade of equipment, as a strategy, can further extend the lifespan of assets and reduce the financial burden of depreciation (Gonzalez-Feliu, Pronello and Salanova Grau, 2018).

Profit sharing can be a contentious issue in collaborative logistics (Cleophas *et al.*, 2019).

Collaborating with local suppliers can drive a more equitable distribution of profits. Establishing clear

and fair profit-sharing agreements as a strategy can help resolve disputes and ensure all parties benefit from the collaboration.

Organisational and Operational Challenges

Data sharing is a crucial operational challenge (Merkert, Bushell and Beck, 2020). The driver of sharing information and resources can facilitate safe and efficient data exchange. Implementing secure data sharing platforms as a strategy can further enhance this process, ensuring all parties have access to necessary data while maintaining confidentiality (Montoya-Torres, Muñoz-Villamizar and Vega-Mejía, 2016).

Trust between partners is essential for successful collaboration. Customer satisfaction can act as a driver to build and maintain trust among partners (Amiri and Farvaresh, 2023). Building long-term relationships based on trust and mutual benefit can be an effective strategy to overcome trust-related challenges.

Operational decisions made individually can lead to inefficiencies. Better use of resources can drive alignment in operational decisions among partners (Gonzalez-Feliu and Morana, 2010). Coordinating decision-making processes as a strategy can ensure all parties are on the same page, leading to smoother operations.

Legal and Regulatory Challenges

Excessive bureaucracy can hinder the progress of collaborative logistics. Reducing environmental impacts can act as a driver to advocate for streamlined regulations (Nathanail *et al.*, 2021). This strategy can help reduce bureaucratic hurdles and promote environmentally friendly practices.

Legislation can pose challenges, especially when regulations differ between regions. Emissions reduction can act as a driver to ensure legal compliance. Complying with environmental regulations as a strategy can help address this challenge, ensuring all operations are within the bounds of the law (Peppel, Ringbeck and Spinler, 2022).

Confidentiality is a significant concern in collaborative logistics (Gonzalez-Feliu and Morana, 2010). Investment costs can drive the implementation of robust data security measures. This strategy can help protect confidential information, ensuring all parties feel secure in the collaboration.

Technological Challenges

Lack of data can hinder decision-making processes (Nathanail *et al.*, 2021). Revealing new business opportunities can act as a driver to invest in data collection and analysis tools. This strategy can provide valuable insights for decision-making, helping to overcome this challenge.

Innovation in communication technologies can improve operational efficiency and communication among partners (McDonald *et al.*, 2021). Increasing efficiency can act as a driver for adopting advanced communication technologies. This strategy can help improve communication and coordination among partners.

Managing information and communication flows can be challenging in complex networks (Gonzalez-Feliu and Morana, 2010). Increasing sales can drive the implementation of efficient information management systems. This strategy can help manage complex information and communication flows, leading to smoother operations.

Social and Cultural Challenges

A shift in customer and company views is required for successful collaboration (Barros *et al.*, 2021). Improving reputation can act as a driver to promote the benefits of collaboration. This strategy can help change perceptions and attitudes towards collaboration, leading to wider acceptance.

Social acceptance is crucial for the success of collaborative initiatives (Gonzalez-Feliu and Morana, 2010). Reducing environmental impacts can act as a driver to engage with the community and stakeholders (Rubini and Lucia, 2018). This strategy can help gain social acceptance for collaborative initiatives.

Loss of brand identity can be a concern for companies involved in collaboration (McLeod *et al.*, 2020). Customer satisfaction can act as a driver to maintain a strong brand presence while collaborating. This strategy can help preserve individual brand identity, ensuring companies do not lose their unique appeal.

Environmental Challenges

Demand points in highly congested areas can pose significant logistical challenges (Demir, Syntetos and van Woensel, 2022). Less road congestion and noise-pollution can act as a driver to optimise delivery routes. This strategy can help reduce congestion and improve service in congested areas, leading to more efficient operations and less environmental impact (Huschebeck and Leonardi, 2020).

Strategic Challenges

Determining the shares in outcomes, costs, and resources can be a contentious issue in collaborative logistics (Amiri and Farvaresh, 2023). Sharing cost and benefits can act as a driver to establish clear agreements on resource sharing. This strategy can help resolve disputes over resource allocation, ensuring all parties are satisfied with the distribution of resources (Gonzalez-Feliu *et al.*, 2013).

Poor strategic fit among partners can hinder the success of collaborative logistics (Pomponi *et al.*, 2013). Increasing competitiveness by raising economies of scale can act as a driver to align strategic objectives among partners. This strategy can help ensure a good strategic fit among partners, leading to more effective collaboration.

Lack of a shared vision can lead to misalignment and conflict among partners (Konietzko, Bocken and Hultink, 2020). Increasing customer coverage can act as a driver to develop a shared vision and goals. This strategy can help align the vision and goals of different partners, ensuring all parties are working towards a common objective.

5. Theoretical Framework

As a result of the findings, the following theoretical framework could be used to understand and address the challenges in HC for LML, this is based on research that was undertaken outside the scope of this paper.

1. **Transaction Cost Economics (TCE):** This theory can be used to understand the financial challenges in collaborative logistics, such as investment costs, depreciation, and profit sharing (Williamson, 1981). The strategies to mitigate these challenges could include investing in infrastructure and technology, regular maintenance and upgrade of equipment, and establishing clear and fair profit-sharing agreements.

2. **Resource-Based View (RBV):** This theory can be applied to address organisational and operational challenges such as lack of data, data sharing, and managing information and communication (Barney, 1991). Strategies under this theory could include implementing secure data sharing platforms, coordinating decision-making processes, investing in data collection and analysis tools, and implementing efficient information management systems.
3. **Agency Theory:** This theory can help understand challenges related to trust between partners, confidentiality, poor strategic fit, and lack of shared vision (Jensen, 1976). Strategies to address these challenges could include building long-term relationships based on trust and mutual benefit, implementing robust data security measures, aligning strategic objectives among partners, and developing a shared vision and goals.
4. **Institutional Theory:** This theory can be used to understand legal and regulatory challenges such as excessive bureaucracy, legislation, social acceptance, and loss of brand identity (Scott, 1975). Strategies to mitigate these challenges could include advocating for streamlined regulations, complying with environmental regulations, engaging with the community and stakeholders, and maintaining a strong brand presence while collaborating.
5. **Stakeholder Theory:** This theory (Freeman, 1984) can be applied to address technological challenges such as innovation in communication technologies, large-scale demand, time-differentiated delivery services, and demand points in highly congested areas. Strategies under this theory could include adopting advanced communication technologies, investing in infrastructure and technology, promoting the benefits of collaboration, and optimising delivery routes.
6. **Sustainability Theory:** This theory can be used to understand environmental challenges such as reducing environmental impacts, emissions reduction, greenhouse gas emission reduction, and less road congestion and noise pollution (Dyllick, 2002). Strategies to address these challenges could include advocating for streamlined regulations, complying with environmental regulations, engaging with the community and stakeholders, and optimising delivery routes.

This theoretical framework provides an understanding of the challenges in collaborative logistics and the drivers and strategies that can be employed to address these challenges. It allows for a holistic view of the situation, taking into account various aspects such as economic, organisational, legal, technological, social, and environmental factors. Ultimately, this framework could lead to improved environmental outcomes and increased competitiveness for organisations involved in urban LML (Van Duin et al., 2013; Allen et al., 2012).

6. Conclusion

In conclusion, this study has examined the potential of HC in urban LML, with the aim of enhancing sustainability and competitiveness. Through a comprehensive literature review, key drivers, strategies, and challenges of HC in LML have been identified.

HC has been recognised as a valuable solution to the challenges faced by LML, particularly with the rapid growth of e-commerce and urbanisation. Collaborating with companies at the same supply chain level can lead to operational efficiency, cost reduction, and environmental sustainability.

Addressing economic, organisational, legal, technological, social, and environmental challenges is crucial for successful implementation of HC in LML. Specific strategies and approaches are required to overcome these challenges and ensure effective collaboration.

However, it is important to acknowledge the current literature's limitations, particularly the lack of a comprehensive framework. Future research should include qualitative methods such as semi-structured interviews with logistics professionals to gain deeper insights and develop a comprehensive framework for sustainable HC in urban LML.

Overall, this study provides a basis for further research and practical applications in the field of HC in LML. By promoting collaboration and leveraging the identified drivers and strategies, organisations can overcome challenges, achieve sustainability goals, and maintain a competitive advantage in the dynamic urban last-mile logistics landscape.

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