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exploring the city's influence on a transition

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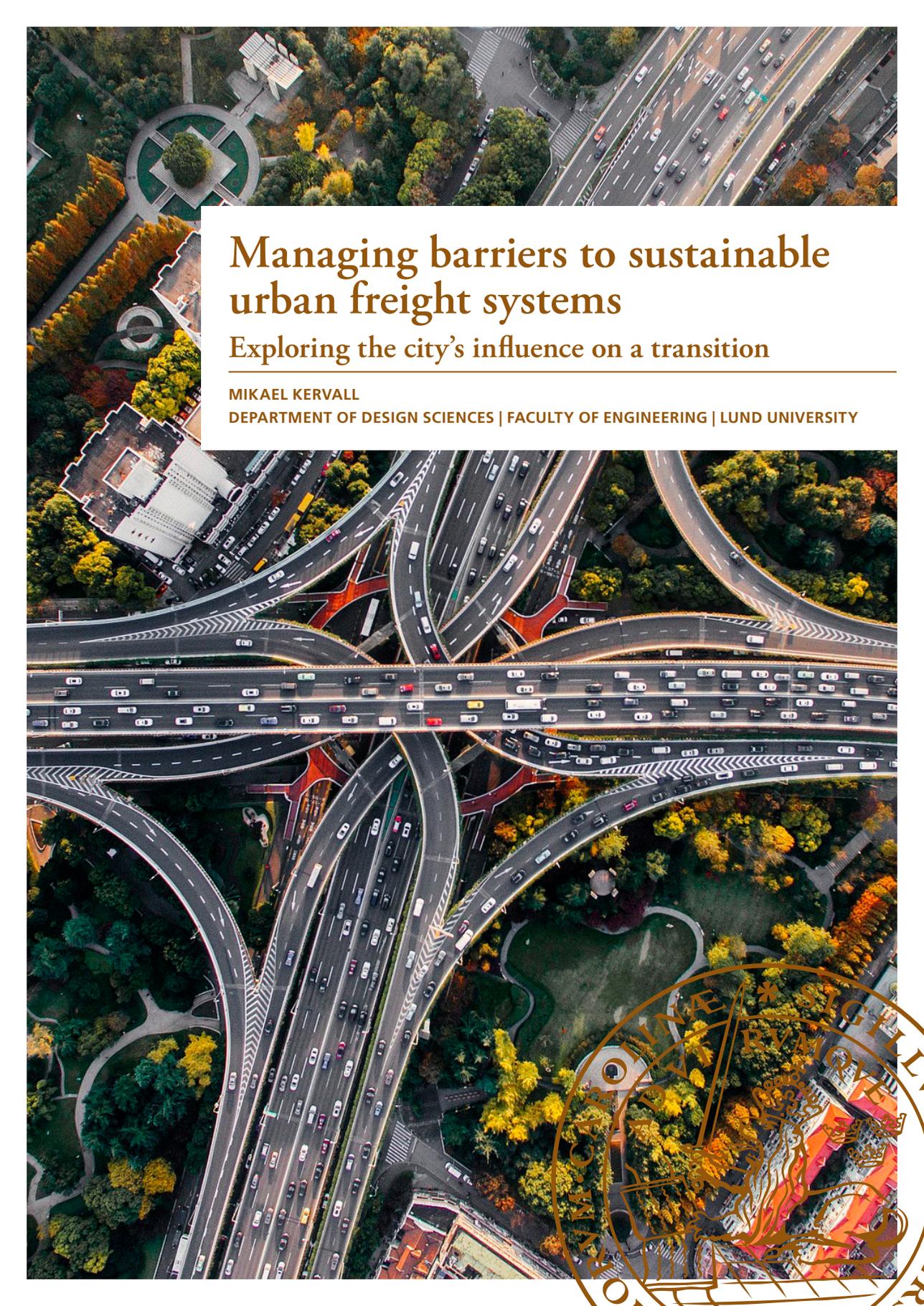
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An aerial photograph of a complex highway interchange in an urban setting. The image shows multiple levels of elevated roads with cars and trucks. Green trees and parks are interspersed between the roadways. A large building is visible on the left side. The overall scene depicts a dense urban environment with significant infrastructure.

Managing barriers to sustainable urban freight systems

Exploring the city's influence on a transition

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DEPARTMENT OF DESIGN SCIENCES | FACULTY OF ENGINEERING | LUND UNIVERSITY



Managing barriers to sustainable urban freight systems – Exploring the city's
influence on a transition

Managing barriers to sustainable urban freight systems

Exploring the city's influence on a transition

Mikael Kervall



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Managing barriers to sustainable urban freight systems

Exploring the city's influence on a transition

Mikael Kervall



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MADE IN SWEDEN 

*To the amazing planet earth and the curious children living in
this world*

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Abstract

Urban freight logistics is a growing phenomenon in cities and contributes to the wealth of citizens and businesses in urban areas. But it also has negative side effects such as emissions, congestion, and accidents, which eradicate some of their benefits for society. The current development of urban freight logistic activities is unsustainable. A more sustainable path of development is needed but is hindered by barriers in a wide variety of areas. The overall purpose of the research presented in this thesis is to explore how cities can support the transitions of their urban freight systems, past barriers, toward sustainability.

The research employs an inductive and qualitative approach. The basis of the research consists of three studies presented in the appended papers. Study 1 empirically explores barriers to fossil-free urban freight systems through the perceptions of multiple stakeholders in one urban freight system. It identifies nine categories of barriers that hinder this step of development toward sustainability. Study 2 is a systematic literature review of 93 peer-reviewed journal articles that explore the barriers to development, the interrelationship between barriers, and how barriers can be effectively addressed to enable development toward sustainable urban freight systems. Nine different categories of three different types of barriers are identified within the urban freight systems. To effectively address barriers to sustainable development, a combination of strategic barriers and contextual factors need to be considered to enable the development toward sustainable urban freight systems. Study 3 empirically explores and assesses the value of two frameworks focusing on transitions for analyzing a city's governance of the development of its urban freight system toward sustainability.

The research presents a holistic picture of the urban freight system as a complex socio-technical system, and of the barriers to development toward sustainability in this system. Such a holistic picture has not previously been available. It characterizes the barriers to development within the system and suggests how these can be effectively addressed. Furthermore, it identifies a method that cities can use in their governance of the development of an urban freight system toward sustainability. Finally, potential areas for future research are suggested.

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This thesis is the result of a mental journey which I started several years ago. In 2019 it was concretized, and I initiated my formal research journey. Several people have contributed to make this journey possible. I would like to express my gratitude to some of them here.

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List of publications

The research presented in this thesis is based on the following three papers. There is a summary of each paper in Section 4 and the complete papers are appended.

Paper 1

KERVALL, M. & PÅLSSON, H. 2020. Barriers to fossil-free urban goods transport systems – An explorative study of a Nordic city. NOFOMA. Iceland.

Paper 2

KERVALL, M. & PÅLSSON, H. 2022. Barriers to change in urban freight systems: a systematic literature review. *European Transport Research Review*, 14, 29.

Paper 3

KERVALL, M. & PÅLSSON, H. 2022. Sustainable development of urban freight – A transition governance approach. NOFOMA. Iceland.

Author's contribution to the papers

Paper 1

As the lead author Mikael Kervall collected, analyzed, and synthesized the data. He wrote most of the text. Henrik Pålsson contributed with experienced guidance throughout the process, on methodology and to the analysis. He also critically reviewed texts.

Paper 2

As the lead author Mikael Kervall collected, analyzed, and synthesized the data, and wrote most of the text. Henrik Pålsson contributed with experienced guidance in all stages of the study. He also critically reviewed texts when the paper was formed.

Paper 3

As the lead author Mikael Kervall collected, analyzed, and synthesized the data. He also explored and compiled theoretical frameworks and wrote the text. Henrik Pålsson contributed with guidance on methodology, gave constructive advice and critically reviewed the texts.

1 Introduction

This section presents the background, purpose, and objectives of the research.

1.1 Background

Urban freight logistics is a growing phenomenon in cities and contributes to the wealth and quality of life of citizens and to businesses in urban areas. But the growth of these activities is not unproblematic. The demand for urban freight logistics is evolving rapidly with societal trends like urbanization, digitalization, and a growing e-commerce (PostNord, 2019; Van Duin et al., 2018). The global urban freight transport demand, measured as ton-kilometers, has been forecasted to grow by nearly 150% from 2015-2050 (International Transport Forum, 2021). Urban freight logistic activities have side effects such as emissions, congestion, and risks for accidents, which eradicate some of their benefits for society.

Transport emits about one fourth of the EU's total greenhouse gas emissions (European Environment Agency, 2023). In order to achieve the overall emission targets for the European union, the greenhouse gas emissions from transport must decrease by at least 90% by 2050 (European Commission, 2020). A systemic change like this requires, for example, the availability of more sustainable alternatives for all kinds of transport as well as the implementation of effective incentives that support such a transition (European Commission, 2020). However, with the current trajectory, the global CO₂ emissions from urban freight transport are expected instead to increase by more than 50% from 2015 to 2050 (International Transport Forum, 2021).

Another side effect of urban freight is its contribution to congestion. The cost of congestion, much of which occurs in urban areas, is estimated to 100 billion euro/year in the European Union.

Both these examples indicate that the current development of urban freight logistic activities is unsustainable and that a more sustainable path of development is needed. A sustainable urban freight system should offer accessibility to freight transport, have externalities below harmful levels to humans and nature, should be resource, energy and cost efficient even if externalities are included, and contribute to urban environment (Behrends et al., 2008). But local authorities give little

attention to freight matters in urban areas. This affects their ability to guide the development of their urban freight systems toward sustainability (Lindholm, 2010).

1.2 Research problem

The necessary development toward sustainable urban freight systems is, however, hindered by more barriers than lack of attention from local authorities. Addressing these barriers is likely to have a greater impact than focusing on the drivers for development (Lindholm, 2010). Barriers to development can be found in a wide variety of areas. Barriers such as limitations in technology and infrastructure, investment thresholds, and uncertain political preferences have been identified in conjunction with the adoption of electric vehicles (Melander et al., 2022). Barriers related to traditions, stakeholders' knowledge, organization, goal alignment and cooperation have been identified in conjunction to freight policies (Nordtømme et al., 2015; Buldeo Rai et al., 2017; Van Duin et al., 2018). Two other studies identify the fragmentation of research and a lack of assessment models for alternative solutions as barriers (Bandeira et al., 2018; He, 2020). Yet another study identifies the lack of a common language and frameworks as barriers to adoption of potential solutions (Schliwa et al., 2015). However, different studies identify different barriers to development depending on their focus and context. This results in a fragmented picture of the barriers that hinder development from a holistic urban freight system perspective.

Another area of concern for development of urban freight systems toward sustainability is if and how such barriers are related to each other. Even if one barrier to development, in isolation, is manageable for a stakeholder in the system, a situation where multiple barriers must be overcome simultaneously, and several stakeholders' involvement is needed, can create such a complex environment that the complexity becomes a barrier in itself (Löfstrand et al., 2013; Pålsson and Johansson, 2016). The electrification of distribution trucks, for example, requires parallel development of technologies, infrastructure, policies, and business models. Development within these areas involves a multitude of stakeholders with different agendas (Löfstrand et al., 2013; de Carvalho et al., 2019). A structure for describing this complexity and the relationships between urban freight system development barriers and their context is currently missing.

Contributing to the complexity is the fact that urban freight systems have many different stakeholders (Taniguchi and Thompson, 2015). Stakeholders with direct impacts on the system are also actors in it (Ballantyne et al., 2013). A development toward sustainable urban freight systems will mean changes for the actors in these systems. The agendas of different actor and stakeholder groups are not aligned and sometimes conflicting (Aljohani and Thompson, 2018; de Carvalho et al., 2019;

Boudoin et al., 2014). Stakeholders' decisions depend on their own priorities (Taniguchi and Thompson, 2015; Butrina et al., 2017). Altogether, the combination of their activities forms the development of the urban freight system. Empirical studies including multiple stakeholder perspectives can contribute to insights that support development toward environmental sustainability in these systems (Cui et al., 2015; Ímre et al., 2021).

Local authorities and cities play a key role in stimulating development toward sustainable urban freight among stakeholders (Schliwa et al., 2015; European Commission, 2019). A city can use its combination of multiple roles in the urban freight system plus different tools to stimulate change (Lindholm and Browne, 2013; Schliwa et al., 2015; Taniguchi and Thompson, 2015). But all stakeholders' interests must be considered for a long-term survival of measures (Macharis and Milan, 2015). Strategic guidance, long-term focus and cooperation among authorities can support the creation of common goals among stakeholders (Smith, 2020). But freight matters receive limited attention from authorities (Allen et al., 2014) and authorities' competence and awareness about these matters is insufficient (Ballantyne et al., 2013). This risk to create instability in the governance of freight systems (Moloney and Horne, 2015) and confusion among stakeholders (Van Duin et al., 2018). Representatives for societal interests, like city officials, try to affect the development in urban freight systems with different measures. These measures intend to restrict or stimulate certain development directions, but tend to result in unintended effects (Kin et al., 2017; Macharis and Milan, 2015).

Previous research has concluded that urban freight must develop toward sustainability. It has also identified hindrances to this development when it comes to the adoption of certain solutions and related to certain stakeholders. Several studies indicate the existence of development barriers in freight systems, but different studies identify different barriers (Nordtømme et al., 2015; Schliwa et al., 2015; Buldeo Rai et al., 2017; Van Duin et al., 2018; Bandeira et al., 2018; He, 2020; Melander et al., 2022). Holistic perspectives and insights are missing about the barriers that hinder the transition of urban freight systems toward sustainability. Holistic perspectives can give new insights about how barriers affect each other and can be useful for the development of urban freight systems (Lagorio et al., 2016; Touboulic and Walker, 2015).

A city's unique spectrum of roles can be used to stimulate change in its urban freight system (Lindholm and Browne, 2013; Schliwa et al., 2015; Taniguchi and Thompson, 2015). But the measures currently used by cities to create change give questionable results (Kin et al., 2017; Macharis and Milan, 2015). Addressing complex issues in society – like urban freight system development toward sustainability – requires methods which combine the strengths of traditional top-down or market approaches into new governance models (Loorbach, 2010). This increases the chances for society to achieve both its short- and long-term goals.

This research aims to address the needs indicated in earlier research and to explore barriers to the development of sustainable urban freight systems from a holistic perspective and governance models that cities can use to govern the development of their urban freight systems.

1.3 Purpose, research questions, and objectives

The overall purpose of this research is to explore how cities can support the transitions of their urban freight systems, past barriers, toward sustainability. The research is built on three studies which contribute with different pieces of information aimed at answering the three guiding research questions:

1. What are the main categories of barriers to development toward sustainable urban freight systems from a holistic perspective?
2. How can these barriers be addressed in an effective manner from a holistic system perspective?
3. How can a city organization support a transition toward a sustainable urban freight system?

1.4 Research focus and demarcations

This research explores how cities can support transitions of their urban freight systems toward sustainability. A city is an elusive phenomenon that can be defined in different ways, such as by its skyline or by its process of development (Pile, 1999; Varzi, 2021). A city can be part of a larger urban area defined by its dense population. A city is also a stakeholder in its urban freight system with a wide spectrum of entities and roles, and a close connection to politics (Balm et al., 2016; Akgün et al., 2019). The research presented in this thesis focuses on how cities can support development in urban freight systems since earlier research has identified the city as a unique stakeholder that can use its position to affect the development of its urban freight system.

Sustainability is defined in different ways, but common definitions include a balance between ecological, societal and economic dimensions (Waseem and Kota, 2017). This research focuses on the environmental dimension of sustainability as a first step toward the goal of sustainable urban freight systems. This research is thereby aligned with Behrends et al. (2008) who state in their definition of sustainable urban freight transport that it “gives the objectives of what a totally sustainable system would look like” (Behrends et al., 2008, p. 704), but that the factors in different areas must be addressed on the way toward this goal. The thesis

research also aligns with Hassan and Lee (2015) who suggest that sustainability in the context of cities should be seen as transitions toward higher levels of sustainability.

1.5 Reading guidance

The research summarized in this licentiate thesis concerns the transition of urban freight systems toward sustainability. It is built on the results of three different research studies performed over a period of three years. Each of the individual studies has a different focus but altogether they contribute to exploring the transition of urban freight systems toward sustainability and how cities can support it. The licentiate thesis can be read as a separate summary of the research. For details about an individual study, the reader is encouraged to consult the appended papers.

2 Frame of reference

The research revolves around the development of urban freight systems toward sustainability. It aims to provide holistic perspectives on barriers to this development, and to identify how a city can support and lead such development toward sustainability. This section elaborates the theoretical grounds for the research in two parts: 2.1 describes the urban freight system and its central aspects related to the research, such as its stakeholders and barriers to development. 2.2 describes the theoretical frameworks applied.

2.1 Urban freight systems

Urban freight systems can be defined as the processes and operations that move goods in cities and urban areas (Amaya et al., 2021; Kiba-Janiak, 2017). Urban freight distribution is important to consider for sustainable development of cities (Macharis et al., 2014). Urban freight logistic activities serve to maintain the economy and lifestyle of the citizens, and to enhance business activities and industrial development in the urban environment (Anderson et al., 2005). The impacts on societies, environment and the economy of urban freight logistic activities in urban freight systems grow with urban areas and cities (Baker et al., 2023).

The two central aspects of urban freight systems in this research consist of its composition of **stakeholders and actors** whose actions altogether form the development of the system, and the **barriers to development** that hinder a transition toward sustainable urban freight systems. The following two subsections summarize the research status of these two central aspects.

2.1.1 Stakeholders and actors

Urban freight systems include a multitude of stakeholders with different impacts on the system (Taniguchi and Thompson, 2015). All who have an interest in the urban freight system can be characterized as stakeholders. Stakeholders are, for example, vehicle manufacturers, public transport operators, property owners, citizens, and NGOs such a trade and commercial organizations (Ballantyne et al., 2013; Katsela

and Pålsson, 2019). Stakeholders with direct impacts on the system are also actors in it (Ballantyne et al., 2013). According to this definition, shippers, customers, freight transport operators, and authorities that all contain different sub-groups are actors, while NGOs, property owners, and residents are not actors (Katsela and Pålsson, 2019; Ballantyne et al., 2013). Authorities can consist of the local, regional, and national ones, all of which in different ways affect the urban freight system (Ballantyne et al., 2013). On a general level, companies tend to strive for maximized profitability and customer satisfaction. Local authorities strive to maximize the attractiveness of a geographic area by balancing economic and environmental considerations (Taniguchi and Thompson, 2015; Katsela and Pålsson, 2019).

Cities and municipalities have special positions in urban freight systems. This is due to their wide spectrum of entities and roles in these systems, and to their close connections to politics (Akgün et al., 2019; Balm et al., 2016). A city can, for example, use its role as an important business partner (Moen, 2014), and policy tools, such as low emission zones (Goetz and Alexander, 2019) to stimulate development. Another possibility is to involve system stakeholders in the urban planning processes (Bjørgen et al., 2019). For the long-term, survival of measures, different stakeholders' needs and goals must be balanced (Macharis and Milan, 2015) and sufficient levels of cooperation be achieved between relevant stakeholders (Kijewska et al., 2021). Stakeholder management still requires further research (Lagorio et al., 2016). The challenges that society faces in governing the development of urban freight systems, with their different stakeholder groups, toward sustainability is one reason to this research.

2.1.2 Barriers to development

Barriers to the adoption of certain solutions by specific stakeholders are frequently mentioned in urban freight related research. A study on urban consolidation centers, for example, identified economic, social and cultural barriers, as well as practical barriers involving specific types of goods (Paddeu et al., 2018). Barriers to green supply chains were identified in the areas of economy, policy, and legitimacy (Walker et al., 2008). A study about freight partnerships identified barriers related to the organization of stakeholders and their cooperation (Lindholm and Browne, 2013). A study on companies' intentions to reduce emissions found barriers linked to logistics, organization, technology, and external factors (Pålsson and Johansson, 2016).

Other barriers to development are related to the local authorities' attention to freight matters. This attention and awareness needs to be raised in order to enable local authorities to play an active role in the development of urban freight systems (Lindholm, 2010). Freight gets limited attention compared to human transport (Allen et al., 2014), and freight matters are lacking in both human and economic resources (Akgün et al., 2019). This hampers local authorities' ability to accumulate

knowledge and handle complexity (Akgün et al., 2019). It risks resulting in a limited understanding of freight matters by local authorities and can contribute to further barriers to development (Ballantyne et al., 2013). There is a risk that freight matters will be missed in environmental action plans, for example (Goetz and Alexander, 2019). Policies and measures implemented by authorities risk being counterproductive if the consequences are not fully understood (Kin et al., 2017).

There is also a risk that initiatives will fail due to unforeseen side effects, such as economic consequences or missed stakeholders (Macharis and Milan, 2015; Macharis and Kin, 2017). Unclear policies and governance in the development process toward environmentally sound urban freight systems risk making such transitions unstable and inefficient (Moloney and Horne, 2015). They also confuse stakeholders (Van Duin et al., 2018). This multitude of barriers which risk hindering the development of urban freight systems toward sustainability is another reason to this research.

2.2 Theoretical frameworks

The development toward more sustainable activities in urban freight systems means that barriers to change must be overcome. It also means that stakeholders in urban freight systems will be affected and need to change their practices in various ways. If a stakeholder, like a city, wants to secure a certain outcome of the system development from a holistic system perspective, the development needs to be directed. This research uses three complementing theoretical frameworks, which support the analysis and contribute to answering the three research questions listed in Section 1.3.

Strategic management theories (Bryson, 1988; David and David, 2017; Dutton and Duncan, 1987; Kotter, 2012; Kotter, 2008) support the research presented with a framework for strategic change management. This was used to identify how barriers to development effectively should be addressed to enable the development of urban freight systems (i.e., Research question 2).

Research question 3, on how a city can support development in urban freight systems, was addressed with the help of two frameworks focusing on transitions. Transitions are large scale changes in societal systems (Hölscher et al., 2018). The multi-level perspective on socio-technical transitions (Geels, 2011) supports the analysis by linking the factors and forces, such as barriers and stakeholders, identified in an urban freight system with a socio-technical system perspective on transitions. The transition management framework (Frantzeskaki et al., 2012; Loorbach, 2010) addresses what a city can do to govern the development of its system in a certain direction.

These three frameworks are further elaborated in the following subsections: strategic management, a multi-level perspective on socio-technical transitions, transition management.

2.2.1 Strategic management

The development of urban freight systems toward environmental sustainability requires a multitude of stakeholders from multiple independent organizations to align their decisions and support the development of the system. Governance of this process requires long-term dedication, political backing as well as methods for change management that stimulate stakeholders to participate (Gammelgaard, 2015; Smith, 2020). Such a participation is stimulated by involvement and co-creation of value (Gammelgaard et al., 2017; Gammelgaard, 2015). Scholars in strategic management emphasize in different ways several of these components and provide insights relevant for the governance of urban freight system development, past barriers, toward sustainability (Bryson, 1988; David and David, 2017; Dutton and Duncan, 1987; Kotter, 2012; Kotter, 2008).

Strategic planning can help organizations to respond effectively to new situations (Bryson, 1988). Such planning is a structured process to produce decisions and other actions that set the direction of development for an organizational entity. A strategic planning process facilitates relevant decisions across functions and organizations to support the achievement of a goal. A strategic planning process combines a purpose with the internal and external factors in order to achieve a certain goal (Bryson, 1988; David and David, 2017). An organization for strategic planning needs to involve process sponsors who legitimize the process, process champions and a team. Those involved in strategic planning must be prepared to handle uncertainty and changes along the process. They should also prepare a platform and have the capability to communicate with various stakeholders about the process (Bryson, 1988). However, decision makers have a limited attention capacity where urgent, more pressing issues can distract their attention from important strategic changes (Dutton and Duncan, 1987; Kotter, 2012). Changes must be supported by a guiding coalition of stakeholders that see the importance of the change and have the mandate to drive it (Kotter, 2012).

In the research presented, the strategic management framework is used to explore how barriers identified in urban freight systems can be addressed effectively on a strategic management level. The insights from the analysis assisted in the development of the structure presented in Paper 2. The paper describes the interrelationships between the categories of barriers to development found in urban freight systems. The theory provided a ground for the suggested order of priority for addressing barriers to development of the urban freight system toward sustainability presented in Paper 2.

2.2.2 A multi-level perspective on socio-technical transitions

The multi-level perspective on socio-technical transitions (Geels, 2011) gives an overview of the factors and forces that must be considered in the transition of a complex socio-technical system, such as the urban freight system. This theoretical framework (Figure 1) can contribute to structuring the picture of the factors and forces that need to be considered in the development toward higher levels of sustainability in an urban freight system.

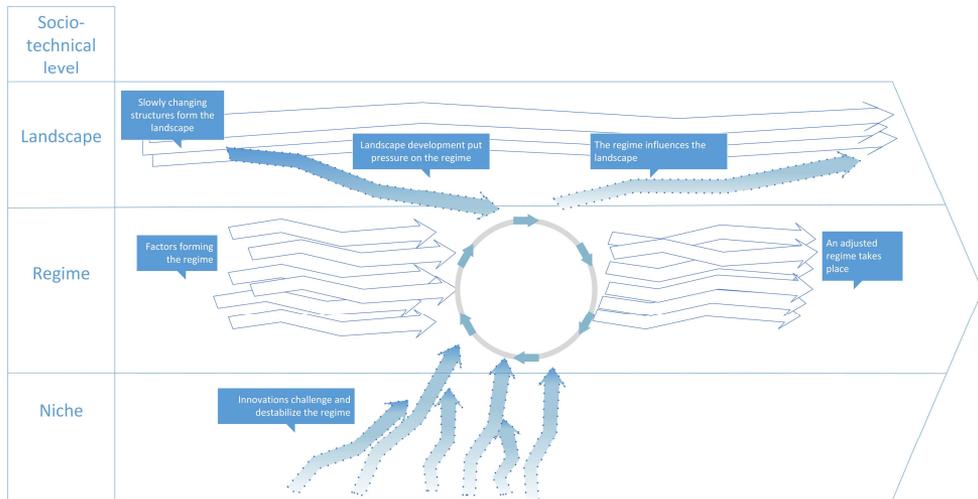


Figure 1. A multi-level perspective on socio-technical transitions. Adapted from Geels (2011).

According to the multi-level perspective, a socio-technical system can be described as a combination of three levels of factors that form the system: regime, landscape, and niche. The regime consists of factors that stabilize the system, while the landscape and niche factors destabilize the system in different ways.

Regime factors in transport systems can be technology, infrastructure, markets and economy, policy, knowledge and discourses (Geels, 2012). Over time, the regime contributes to incremental development of the system through established actors. These actors reproduce the regime through their beliefs and acts and they, as well as the processes in which they participate, are shaped by the regime. This creates stability in the socio-technical system but also change resistance, lock-ins and prevents radical development of the system.

There are several reasons why actors reproduce the regime. Economic dimensions are one reason, where actors defend investments, economies of scale and low costs (Kemp and Loorbach, 2003). The formulation of policies and perceptions of businesses' roles in society are other factors that can have a stabilizing effect. Additional reasons are the lack of knowledge about alternatives among established actors, uncertainties, and that different actors work towards different goals with

different time horizons (Geels, 2011). Yet another stabilizing source is the political demand for simple solutions and images of strong leadership (Klijn and Koppenjan, 2012). This gives a preference for short-term wins and low complexity instead of long-term but more relevant paths of development.

The stabilizing forces of the regime can be challenged by destabilizing forces from either the socio-technical landscape or niches (Geels, 2012). Landscape factors are long-term contextual factors in society that cannot be affected by the actors in a system. This context of, for example, an urban freight system in a city, is rather stable over time. In the long-term, urban freight systems are affected by societal trends like digitalization, e-commerce, urbanization and climate concerns (Taniguchi and Thompson, 2015). Niches, on the other hand, are delimited environments where radical innovations can be nurtured (Geels, 2011). If successfully developed and exposed to a broader environment, niches can destabilize an existing regime or parts of it. After a time of instability, a new combination of forces will balance each other, and a new or adjusted regime will emerge. Over time, this new regime can have an influence on the landscape. In the development of urban freight systems toward sustainability, one challenge will be to determine how the factors and forces constituting this socio-technical system can be combined to allow the emergence of a new more sustainable regime.

The multi-level perspective on socio-technical transitions is used in this research to analyze the factors and forces affecting the development of urban freight systems toward sustainability. It is applied in the analysis of an urban freight system presented in Paper 3.

2.2.3 Transition management

Transition management theory has an interorganizational focus and concerns changes in socio-technical systems. This makes the theory relevant for an urban freight system development toward sustainability, where a multitude of stakeholders will be affected. Transition management addresses the development of complex socio-technical systems by a combination of components originating in governance, network, and innovation theory (Klijn and Koppenjan, 2012; Frantzeskaki et al., 2012). By combining the strengths of different theoretical origins, transition governance increases the chances to achieve both long- and short-term goals in society (Loorbach, 2010). To be effective, public managers should combine networking, horizontal coordination of stakeholders, and innovation stimulation with hierarchical approaches when needed to achieve societal goals (Klijn and Koppenjan, 2012; Rhodes, 2007; Kjaer, 2011). In the transition management framework, components from areas such as complex systems, governance, sociology, political science and innovation studies are combined to form a framework for governance of goal-directed transitions of socio-technical systems toward sustainability (Loorbach, 2010; Frantzeskaki et al., 2012; Docherty et al.,

2018). From a governance perspective, the transition of a system is a multidimensional wicked problem (Kemp and Loorbach, 2003) and the governance approach must be adapted and developed over time (Tukker and Butter, 2007). This is because transitions are the result of many parallel processes and actions of actors who are beyond direct control of the governing party (Kemp and Loorbach, 2003). The transition management framework provides long-term guidance for the governance of transitions of complex systems that forms society (Loorbach, 2010). Guiding principles for the governance are to:

- Let long-term perspectives guide short-term actions
- Accept uncertainties
- Support networks and self-organization
- Make room for innovations

The transition management framework provides principles for how a governing party, like a city, can act to increase the chances of achieving societal goals, such as sustainable urban freight systems. In Paper 3, this theory is used to analyze empirical data about a city's activities to transform its urban freight system toward sustainability.

3 Research methodology

This section explains the methodological considerations in the research on an overall level. Such considerations for each study are detailed in the appended papers.

3.1 Research approach

The starting point of this research can be found in the basic ideas of systems thinking, in which a system is considered to be different than only the sum of its parts (Arnold and Wade, 2015). Inspiration comes from system theory which highlights the importance of understanding both the components and their interactions to be able to determine the system output (Björklund, 2018). This perspective and a concern about the system effects have been the guiding idea for all three studies that constitute the basis of this research. All three studies have included the perspectives of multiple stakeholders and considered multiple aspects of the urban freight system. The focus of the studies has successively moved deeper into systems thinking as defined by Squires et al. (2011). This means that the focus of the research has increasingly turned toward the relationships between areas within the urban freight system, its context, the complexity of the interrelationships, and how system change can be understood and purposefully governed and managed toward societal goals.

All studies in this research project employ an inductive, qualitative and exploratory approach (Bryman and Bell, 2017). Insights about the study objects are based on systematic interpretations of the data. The research is a systematic approach to explore and advance insights about the studied phenomenon: how cities can support the development toward sustainable urban freight systems. The results contribute to the theoretical understanding of the phenomenon but can themselves also be further advanced.

3.2 Research design

The research design is the structure upon which the selection of methods for data collection and analyses relies (Bryman and Bell, 2017). The overall purpose of the

research presented in this licentiate thesis is to explore how cities can contribute to sustainable transitions of urban freight systems.

Three studies were carried out and are summarized in this licentiate thesis (see Table 1). They are presented in chronological order and build on each other. What is common for all three studies is the desire to explore, understand and build insights on the transition of urban freight systems toward sustainability. This led to the selection of a qualitative research strategy and an inductive approach (Bryman and Bell, 2017).

The purpose of Study 1 (presented in appended Paper 1) was to explore and create a rich description of the barriers to development from a holistic perspective in one urban freight system that could serve as the foundation for the following studies. Study 1 was thus designed as a case study because such studies can provide rich pictures of a bounded system (Watson, 1994; Yin, 2014).

The intention of Study 2 (presented in appended Paper 2) was to address a research gap indicated by earlier research regarding holistic perspectives on urban freight systems and the barriers to change that arose in them. Study 2 was designed as a semi-systematic literature review (Snyder, 2019) in order to provide an overview of the research, find themes in the literature, and identify areas for future research. The foundation from Study 1 served as a point of departure for the qualitative analysis.

The purpose of Study 3 (presented in appended Paper 3) was to further contribute to the theoretical knowledge about the research phenomenon by addressing one of the main research gaps identified in the literature review presented in Study 2. Study 3 focuses on exploring and assessing the possibilities for a city to learn from transition theoretical insights about development processes in socio-technical systems and develop its governance of the transition toward sustainability in its system. For this purpose, rich data about one system was needed. This is why the case study design was chosen. The data from Study 1 was complemented and processed before it was used in Study 3.

Table 1. The three studies included in the thesis.

Study	1	2	3
Purpose	Explore barriers from a holistic system perspective	Explore barriers from a holistic system perspective	Explore frameworks for transition governance for analysis
Unit of analysis	Urban freight system	Urban freight system	Urban freight system
Context	One system	Multiple systems	One system
Study design	Case study	Systematic literature review	Case study
Main data collection method	Semi-structured interviews	Systematic search in databases	Semi-structured interviews
Data	Empirical	Journal articles	Empirical
Analysis of data	Qualitative	Qualitative	Qualitative

3.3 Research process

The research consists of three studies performed over a period from 2019 to 2022 and are summarized in this licentiate thesis in 2023. Each study is presented in one of the appended papers. Paper 1 and 3 were published as peer-reviewed conference papers. Paper 2 was published as a journal article.

Study 1, a case study, started in 2019 and was published in 2020. Study 1 served as an introduction to the research subject: the transition of urban freight systems toward sustainability. The design of Study 1 was inspired by a grounded theory approach (Corbin and Strauss, 2008). Study 1 was sparked by an interest in understanding why urban freight systems did not seem to develop toward fossil-free solutions. The inductive and explorative approach in the research, where one system was explored through the input from multiple stakeholders provided me with a platform of understanding about the barriers to development grounded in empirical data from one system.

Study 2, the systematic literature review, was initiated in 2020, finalized in 2021 and published in a journal in 2022. Study 2 broadened the basis for the research subject by examining earlier research results in urban freight. The results from the first case study (Study 1) provided the starting point for the demanding work of analyzing an extensive sample of earlier research articles, with different research focuses, in order to find and interpret the barriers to change which were experienced in their studied contexts. The holistic perspective on barriers in urban freight systems triggered the search for a structure that could help to explain how the barriers to the development of urban freight systems are related to each other. This

resulted in a model of understanding based on strategic management theory and a proposal of an order of priority in the work to overcome barriers.

Study 3, the second case study, started in 2022 and was published as a conference paper the same year. Study 3 took its starting point from the results of Study 1 and 2, changed the perspective, and started to explore theoretical support for a city's work to direct and govern the transition of its urban freight system toward sustainability. The two transition focused frameworks compiled in this study were tested on empirical data from the same city as in Study 1. These frameworks could explain the main factors and forces identified in the empirical data. They also helped us to identify potential areas of improvement for the city's current work. Finally, they added an order of priority for the city's coming strategic management activities intended to direct and govern the development of its urban freight system past the barriers and toward sustainability. Study 3 and the transition focused frameworks it applied gave me new holistic insights about the urban freight system. It also connected several separate thoughts about how stakeholders and their intentions in the urban freight system can be understood and combined into a holistic picture. The resulting picture explains the difficulties in developing urban freight systems toward sustainability and how these difficulties can be addressed on a strategic level.

3.4 Research quality

Potential threats to research quality exist in all phases of a research process. Considerations about the research quality here have been continual in this three-year process. Literature about research methods as well as discussions with colleagues have been invaluable in this work. The main source for methodological considerations in this research process has been Bryman and Bell (2017), complemented by other literature when it was considered relevant. Several criteria can be used to assess the quality of research (Bryman and Bell, 2017). In business and management research, three criteria have traditionally been particularly important: reliability, validity, and replicability. The traditional interpretations of this terminology are stronger related to quantitative than to qualitative research; alternative expressions with similar meanings are sometimes used in qualitative research. However, in this thesis, I stick to the traditional expressions since they, when adapted to a qualitative research context, are both relevant and expected to be familiar to potential readers.

On an overall level, the different aspects of quality are already addressed in the research design with the combination of case studies built on empirical data, and a systematic literature review built on the results of earlier research. This combination of numerous sources of data is positive both from a reliability and a validity point of view. One challenge in social research is the continuous development of the

research object. This means that the study object changes over time, and the results of similar studies made on different occasions can thereby differ. In those cases, the external reliability is lower than if the research object was static (Bryman and Bell, 2017). This challenge was addressed by securing and saving the raw data of the studies. The research process and its different steps were also documented to make it possible to replicate the analyses of the data at a later occasion, independent from the development of the research object.

Validity concerns if a study measures what it is intended to measure (Bryman and Bell, 2017). A challenge in qualitative research from this aspect is the researcher's impact on the results through the interpretations of data (Miles et al., 2020). In this research, the interpretations of data were frequently discussed between the researchers to create common interpretations and a more multifaceted understanding of the results as they emerged. Furthermore, the insights from the research over the course of three years were recurrently triangulated with both senior officials and respondents in the organization of the city in the case studies, as well as with peer researchers at conferences and in peer-review situations. This increases the internal validity of the research (Bryman and Bell, 2017).

External validity is another aspect to consider (Miles et al., 2020). It refers to the extent to which the study results can be generalized to other situations and environments. In this research, external validity was addressed by a combination of measures, including the research design by combining the case studies built on empirical data, and a literature review built on previous research results. Similarities in the results made it probable that the results of the analyses are transferable, to a certain extent, to other urban freight systems with similar contexts and thereby externally valid. Finally, the results in this research do not deviate significantly from what has been indicated in earlier research but instead partially confirms it. Altogether this indicates that the findings are externally valid and that results are transferable within certain limitations.

3.5 Limitations

Like all research, this research has its limitations. The findings are the results of human work intended to explore and understand how cities can support the transitions of urban freight systems toward sustainability. Even if the intention has been to present the best possible picture of this transition, the picture has its limitations and can be improved by future research. Securing the transferability and validity of the results can be a challenge in case studies. Including further cases could strengthen the external validity of these results. If further cases were added to this research, it could deepen and detail the information about barriers as well as

about approaches used by cities to govern the development of their urban freight systems.

Another aspect is the internal validity, which can be a challenge in qualitative research, where the results are in some sense constructed by the researchers. Even if extensive measures are taken to secure the validity of the results in a research process, it is a fact that the results are the outcome of a multitude of decisions and interpretations made by the researchers involved in the process. Their personal frameworks of references and decisions along the process affect the results. The process that led to the development of the model of understanding for managed change processes is, for example, built on a range of systematic interpretations of data from the literature review, combined with theoretical associations from the researchers' frameworks. Even if measures were taken to secure the internal validity in these processes, the researchers affect the results and thus the validity of these.

4 Results

This research investigates how cities can support transitions of their urban freight systems toward sustainability. Three studies were carried out and are presented in the three appended papers. This section presents a summary of the results of each paper. More extended versions are available in each of the appended papers.

4.1 Paper 1

Paper 1 addresses the need for holistic perspectives in urban freight system research and contributes to answering Research question 1. It empirically explores the barriers in one fossil-free urban freight system through the perceptions of multiple stakeholders. Nine categories of barriers are identified covering: technology, infrastructure, economy, policies and goals, organization, local politics, cooperation, knowledge in the city organization, and external factors. Paper 1 briefly discusses the emergence of seemingly tight relationships between certain categories of barriers, such as technology, infrastructure, and economy. The results show that from a system perspective, none of the barriers identified in the study are indicated to be unsurmountable by the participants. Instead, it is the combination of multiple barriers and the involvement of multiple independent stakeholders to overcome them which result in a challenging complexity and uncertainties for the stakeholders in the studied system. This is because the single stakeholders only control a fraction of the system, and the development of the system as well as overcoming the barriers to development are affected by the actions of other stakeholders. A city organization has several roles in the system that can be used to remove barriers to development and to stimulate the transition of its urban freight system toward fossil-free solutions.

4.2 Paper 2

Paper 2 also addresses the need for holistic perspectives in urban freight systems research. Apart from barriers to development, the study explores the interrelationship between them and how the barriers to change can be effectively

addressed to enable development toward sustainable urban freight systems. This systematic literature review of 93 peer-reviewed journal articles identifies 11 categories of barriers to change. An overview of the categories, their sub-categories, and the number of articles from the sample in which the barrier was identified are available in Table 2.

Table 2. Categories of barriers and their occurrence in the literature as presented in Paper 2.

Category	Sub-category	Qty
Technology	Unproven in application	8
	Lack of adaptation	2
Infrastructure	Lack of availability	10
	Risk of externalities	1
	Long lead time before benefits	1
Economy	Short-term focus	17
	Low profitability	15
	Small actors	4
	Costs	3
	Low market value	2
Policies	Lack of alignment	20
	Imbalanced measures	10
	Complexity	7
	Insufficient methods	5
	Resource limitations	1
Politics	Lack of commitment	13
	Unclear direction	3
Goals	Unaligned	22
	Unclear	4
Organization	Lack of resources	20
	Lack of intra- and interorganizational coordination	11
	Focus on easy wins	9
Knowledge	Lack of dissemination	30
	Scattered	23
	Unavailable	19
Cooperation	Complex alignment of interests	35
	Unclear gains	29

	Untraditional	21
	Weak management support	19
Societal factors	Uncertain future	13
	Require flexibility	5
First mover disadvantage	Difficult to overview consequences	6
	Lack of tradition	6
	Optional choice	6

Cooperation, and its different forms of struggle, is a frequent category of barriers identified in the study. The most common barrier sub-category identified is the one related to the complex alignment of stakeholders' interests and agendas. The second most common barrier sub-category is the lack of dissemination of knowledge between stakeholders in the system.

The study also investigates the relationships between categories of barriers in urban freight systems and develops a model of understanding for these. The model is based on a structured but interpretive mapping of 110 relationships between categories combined with an analytical framework built on strategic management literature.

Most of the identified barriers can be aggregated into three groups: strategic, instrument, and implementation barriers, and into a context consisting of the first mover disadvantage and societal factors barriers. The relationships between the barriers proposed in Paper 2 are illustrated in Figure 2. Strategic barriers concern the organization and collaboration between stakeholders. Instrument barriers are related to the formalization of strategies. Implementation barriers concern the realization of changes. Societal factors are contextual factors in the surrounding society that affect urban freight systems. The first mover disadvantage is also part of the context that affects change processes in urban freight systems. This disadvantage affects stakeholders, and risks discouraging them from change. Societal factors and the first mover disadvantage affect all stages of managed change processes. To overcome a combination of the first mover disadvantage and strategic barriers should be prioritized in managing change processes intended to support a transition toward sustainable urban freight systems.

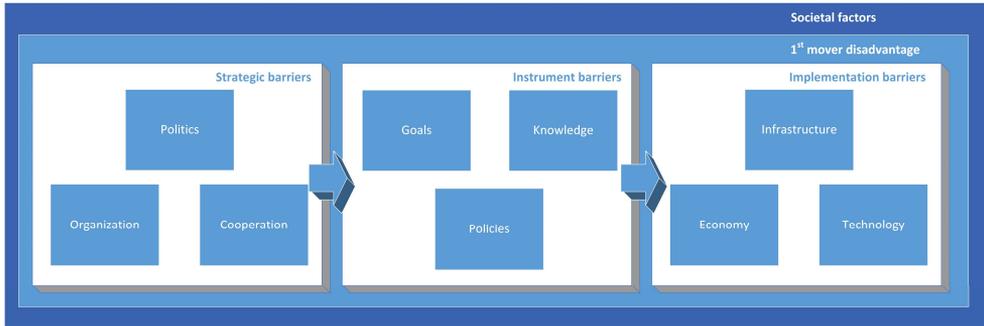


Figure 2. The relationship between barriers as proposed in Paper 2.

4.3 Paper 3

Paper 3 addresses how a city can govern the development of its urban freight system. The paper focuses on Research question 2 and 3. Two analytical frameworks focusing on transitions are used in the study to analyze empirical data about a Swedish city. These are the multi-level perspective on socio-technical transitions (Geels, 2011), and the transition management framework (Frantzeskaki et al., 2012; Loorbach, 2010). Both are helpful in understanding how a city can govern the development of its urban freight system toward sustainability. The multi-level perspective provided an overview and a structure for the factors and forces affecting the transition, which were identified in the empirical data from a city in Sweden. Most of the barriers to development presented in Paper 1 and 2 were proven to have similarities with the dimensions constituting a regime according to a multi-level perspective on socio-technical transitions. According to the multi-level perspective on transitions, larger changes in socio-technical systems are initiated either at the landscape level (by large societal trends such as digitalization or urbanization which also affect urban freight systems), or in niches by innovations – innovations that in urban freight could be exemplified by solutions for shared distribution, unattended deliveries, and new vehicle types. The transition management framework focuses on the management throughout a transition process by a governing party, like a city. As part of a transition governance framework, it could provide a basis for a structured transition management approach from the city toward its urban freight system, including all its stakeholders.

This type of structured approach (with the purpose to govern the development of the urban freight system toward sustainability) was missing in the empirical data from a Swedish city. Instead, the city organization was occupied by short-term matters and worked with incoherent priorities. Ambiguities around political will, visions, and goals in combination with the present organization of freight matters within the

city prevents a structured transition management approach to transforming the urban freight system toward sustainability.

5 Discussion

The importance of successfully reducing the emissions from freight transport and transforming freight transport systems toward higher levels of sustainability have been highlighted by several influential institutions (European Commission, 2019; European Environment Agency, 2019; United Nations, 2019).

The research presented in this thesis explores such a transition to sustainable urban freight systems along with a city's possibilities to support that development. The research applies a holistic perspective to barriers that hinder the development. It also explores a method that can support cities in their governance of these systems toward sustainability. It is based on three studies which complement each other and contribute to advancing the theoretical knowledge about different aspects of transitions of urban freight systems toward sustainability and how cities can support these.

This section presents the overall results of the thesis research. The results are related to previous knowledge about how cities can support the transitions of their urban freight systems, past barriers, toward sustainability and to each of the research questions which guided the research. The section is structured according to each of the three research questions.

5.1 A holistic perspective on barriers

The barriers to transitions toward sustainable urban freight systems presented in Paper 1 and 2 have many similarities, even though Paper 1 was based on one urban freight system and Paper 2 on the content of journal articles from global research about urban freight systems and the development initiatives related to them. In both studies barriers are identified in the areas of technology, infrastructure, economy, knowledge, policies, goals, organization, cooperation, and politics. Both studies identify the societal context in which the urban freight system exists as having influence on the system. The barrier "first mover disadvantage" was only identified in Paper 2, but most of its content is also identified in Paper 1 but not as a separate category.

Based on the results of both Study 1 and Study 2, it is apparent that difficulties in the cooperation between stakeholders is a significant barrier. It is the single most

identified category of barriers in the literature review. It was also reported previously that cooperation difficulties between stakeholders are a limiting factor for development initiatives in urban freight systems (Kiba-Janiak, 2017; Lofstrand et al., 2013; Zisis et al., 2018; Lindawati et al., 2014). But based on earlier knowledge, it has been hard to assess the impact of these difficulties on the possibilities to transform urban freight systems. However, the results from the systematic literature review in Study 2 show that more than every other article reports that there were issues in the cooperation between stakeholders. Reasons for the difficulties were most often unaligned interests and unclear gains for stakeholders in collaborating. The difficulties were accentuated by a lack of support from politicians to their local authorities for getting involved in freight matters, and because cooperation between some stakeholders was untraditional and rendered weak support from the managers in these organizations. These results are in alignment with the Study 1 results, where the barriers in one urban freight system are explored. The results of this case study conclude that both the companies and the city lack external pressure and a platform for improving their cooperation.

The second most frequently identified hinder for development in the literature review is the lack of relevant system knowledge among stakeholders in the urban freight system. This is due either to a lack of established procedures for disseminating knowledge between stakeholders, or that knowledge or data about the system is too scattered to be useful, or simply is missing. Thus, the knowledge development among stakeholders in the system is hampered. Scholars have previously indicated that freight transport receives less attention than passenger transport and that authorities lack competence about freight matters (Allen et al., 2014; Ballantyne et al., 2013). This lack of holistic knowledge about urban freight systems is confirmed in the Paper 1 case study. City officials lack both data about urban freight in general as well as about the urban freight activities generated by the city's own actions. City officials also express uncertainty about other freight related matters of importance. These include the political intentions and goals for development, legal possibilities to affect the development, and how activities to govern the development of the system can affect the business climate in the city.

Given the challenges forecasted for sustainable development of urban freight (European Commission, 2019; European Environment Agency, 2019; United Nations, 2019), both deep understanding about the components of urban freight systems and holistic system perspectives are needed. This research provides both an overview and rich descriptions of barriers to sustainable transitions of urban freight systems from a holistic system perspective. This information makes it possible to explore ways to address and overcome the barriers of importance for a transition of urban freight systems toward sustainability.

5.2 Addressing barriers

Holistic perspectives on urban freight systems can reveal insights about the interconnections between components of importance for development of these systems (Touboulic and Walker, 2015; Lagorio et al., 2016; Abbasi and Nilsson, 2012). Connections between different categories of barriers to development were indicated in earlier research. Muñuzuri et al. (2012) report a connection between difficulties in policy work in Spanish cities. Lack of cooperation between cities (Melander et al., 2022) indicates the connections between areas such as technology, infrastructure, economy, and politics for the adoption of electric vehicles. The holistic system perspective on barriers to development toward sustainable urban freight systems applied in this research made it possible to explore the relationships between the categories of barriers. In Study 2 a holistic picture of such barriers emerged. This picture enabled a structured mapping of the relationships between barriers and an analysis of the relationships with the help of strategic management theory. The proposed model of understanding contributes two new components to the scientific understanding of transitions of urban freight systems toward sustainability. First, it offers an overall picture of how the barriers to sustainable transitions are related in urban freight systems. Second, it offers an order of priority for effectively addressing the barriers to such transitions.

The outcome of governance efforts to transform urban freight systems toward sustainability is dependent on actions of the stakeholders in these systems. Their involvement and willingness, ability, and the capacity to cooperate around new ways to organize, new business models, and new technical solutions, for example, will determine the development of the system from a holistic perspective (Björklund, 2018; Arnold and Wade, 2015). The model of understanding and the results in Study 2 show the importance of involving different types of stakeholders to stimulate change throughout the system. Due to the connections between barriers, managed change efforts should start by addressing barriers at the strategic level. Overcoming the barriers at the strategic level impacts the possibilities to overcome the barriers at the instrument and implementation levels (Bryson, 1988; David and David, 2017). If the barriers at the strategic level are a top priority, it also means that the most frequently identified barrier category – cooperation – is addressed early in the process. Furthermore, it means that politicians – the local strategic leaders of the societal development – are involved with the stakeholders in both the city organization and businesses in defining the problems and goals for the sustainable development efforts. This type of leading coalitions is a prerequisite for change (Bryson, 1988; Dutton and Duncan, 1987; Kotter, 2012). This also enables the creation of a platform for exchange that can address the short-term, first mover disadvantages for those stakeholders that are willing to go in the forefront toward more sustainable practices.

5.3 Approaches for transition support

Transforming urban freight systems toward sustainability will require governance of the process to secure long-term societal interests. Study 1 and 2 focus on barriers and their interrelationships from a holistic system perspective. They say less about how barriers can be prevented and how drivers for change, like innovations, can be used to create a system transition toward sustainability. Neither do they explore how a stakeholder, like a city, can use its position to govern the development of its urban freight system. Previous research claims that changes require support by guiding a coalition of stakeholders that see the importance of the change and have the mandate to drive it (Kotter, 2012). Scholars previously also argued that a governing party must balance the interests of stakeholders and structures both within and outside the system (Weber, 2003; Macharis and Kin, 2017; Schliwa et al., 2015). Governance models that handle uncertainty, complexity and dependencies increase the chances to achieve both short- and long-term societal goals (Kemp and Loorbach, 2003; Loorbach, 2010; Abbasi and Nilsson, 2012).

We tried to meet the requirements stated in previous research by using two complementary frameworks, focused on transitions, that could support a city governing its urban freight system toward sustainability. These frameworks were assessed with the help of empirical data about an urban freight system.

The first framework, the multi-level perspective on socio-technical transitions, made it possible to arrange the empirical data into a structure that provided insights about the factors and forces that need to be considered in a transition of urban freight systems toward sustainability.

The second framework, focusing on transition management, can support a stakeholder such as a city in the governance of the development of the urban freight system toward sustainability. The transition management framework emphasizes the importance of participation and cooperation between stakeholder groups, thus addressing the main barrier to the development. The framework also emphasizes the importance of transparency and exchange between stakeholders and thus addresses the second most frequently identified barrier to change in urban freight systems from Study 2: dissemination of relevant knowledge about the system between stakeholders.

When the transition focused frameworks were applied on empirical data about an urban freight system, they provided a structure for the factors affecting the development of the system that did not exist before. The transition management framework helped us to structure the empirical data about the city in a new way and to identify complementing and missing activities in the city's governance work. The conclusion was that building and following a transition focused framework can be a useful approach for a city organization in its governance of a transition toward a sustainable urban freight system.

5.4 Contribution

This research contributes insights about the barriers to the development of urban freight systems toward sustainability. It focuses on the environmental dimension of the path toward sustainable urban freight systems, since urban freight systems have significant environmental side effects (Anderson et al., 2005; Behrends et al., 2008). It applies the previously missing holistic systems perspective (Touboulic and Walker, 2015; Lagorio et al., 2016) and identifies barriers to development toward sustainable urban freight systems. Based on the novel holistic picture, it suggests a model for how the barriers effectively can be addressed according to strategic management theories. This was not previously possible due to the lack of a holistic picture of barriers in urban freight systems. It also shows that the barriers as well as factors, like innovations and digitalization, that can affect the development of urban freight systems can be understood as parts of a transition of a complex socio-technical system (Geels, 2011). A city that intends to support and govern the development of its urban freight system in a direction toward sustainability can find methodical support in transition management theories (Loorbach, 2010; Frantzeskaki et al., 2012). These theories provide principles and methods that can help a city to involve stakeholders in cooperation and other activities that support development of the urban freight system toward sustainability.

In a larger perspective it is of course important to also go beyond the urban freight system and explore the factors behind the growth of these systems. Urban freight systems develop with urban areas and the economic activities in them (Baker et al., 2023; Behrends et al., 2008). If freight demanding economic activities grow in an unsustainable way in urban areas, it is hard to see that urban freight systems can become sustainable, even if cities govern the development of their urban freight systems toward sustainability. For a sustainable development of urban areas, it will also be important to understand and address the reasons behind the continuous growth of demand for these activities.

6 Conclusions

The research presented in this thesis addresses the possibilities of cities to govern transitions of urban freight systems toward sustainability. These possibilities are explored through the combination of three studies. Three questions guided the research. They concerned 1) the barriers to the development from a holistic system perspective; 2) effective addressing of the barriers; and 3) how a city can support development toward a sustainable urban freight system. The results are summarized in the following subsections.

6.1 Key findings

From a holistic system perspective, the development of urban freight systems toward sustainability is hindered by barriers in different areas. The barriers found in the empirical research of a Swedish urban freight system were similar to those found in the systematic literature review in the field. From a holistic system perspective, barriers to sustainable development were identified in the areas of technology, infrastructure, economy, knowledge, policies, goals, organization, cooperation, and politics. The societal context as well as the disadvantages for first movers can also serve as barriers. The barriers that were frequently identified concern difficulties in cooperation as well as insufficient dissemination of knowledge and information among the stakeholders.

The barriers are related to each other and to the context of the urban freight system. Barriers within the urban freight system can be categorized into three types: strategic, instrument, and implementation. Strategic barriers concern the stakeholders' organization and collaboration. Instrument barriers concern the formalization of strategies. Implementation barriers concern the realization of changes. The context in which the urban freight system exists must be considered. Effective initiatives to overcome barriers should start by addressing the strategic barriers first, while considering the contextual impact before addressing the other types of barriers. City officials can use a transition governance approach to govern the development of its urban freight system toward sustainability. The use of two transition focused frameworks: a multi-level perspective on socio-technical transitions (Geels, 2011), and the transition management framework (Loorbach, 2010; Frantzeskaki et al., 2012) can be a useful support. It provides a structure for

understanding the factors and the forces that affect the development in an urban freight system. It also provides guidance for governance activities at different stages and with different time-horizons in a transition toward a sustainable urban freight system.

Altogether, this research presents a holistic picture of the urban freight system as a complex socio-technical system including the barriers to the development of this system toward sustainability. This has not been previously available. The research characterizes the barriers to development within this system and suggests how these can be addressed effectively. In addition, it identifies a method that can be used by a city in its governance of the development of its urban freight system in the direction toward sustainability.

6.2 Implications

Altogether, this research contributes to the scientific knowledge about how cities can support transitions in their urban freight systems past the barriers toward sustainability. The research provides a holistic perspective on the barriers to sustainable transitions in urban freight systems. This perspective complements previous research where different barriers have been indicated in different situations. Based on the holistic system perspective, the research identifies relationships between barrier categories according to which the research suggests an order of priority for overcoming barriers for effective managed change efforts. This holistic picture of barriers and their relationships in urban freight systems seem to be novel. Finally, the insights from the previous studies in this research are used to identify and evaluate two frameworks for transition governance. These can be used to identify structures which prevent development of urban freight systems as well as forces which can be used to stimulate a transition of these systems toward sustainability. These transition-oriented frameworks were not assessed for urban freight system development toward sustainability before.

Practitioners can use the results to learn about the barriers to development toward sustainability in urban freight systems, and about how the development of these systems can be governed past barriers on the road toward sustainability. Stakeholders attempting to manage the development of urban freight systems can use the results to gain an understanding of the structures and forces affecting the development of the system from a holistic perspective and which must be addressed in a development directed toward sustainability. The transition management framework can (in combination with the holistic picture of barriers and their relationships) help transition managers to set priorities for their activities and to handle potential barriers to the development of urban freight systems.

On a societal level, this research contributes by identifying barriers in urban freight systems that hinder the achievement of societal goals on sustainable development. It provides proposals for how cities can work to effectively address and overcome these barriers. In so doing, the research contributes to sustainable development of urban environments and to the achievement of societal goals.

6.3 Future research

Further research is welcomed that continues to develop insights on how to support transitions toward sustainable urban freight systems. Such research, for example, could refine and develop the proposed model of understanding for managed change processes based on the results of Study 2. This novel model describes from a holistic systems perspective the relationships between barriers to change in urban freight systems. The validity of this model should be tested in future research before it is accepted as a valid picture of how barriers are related and can constitute a basis for strategies for overcoming barriers in urban freight system development initiatives. Future research could also extend the framework for transition governance and explore how this can be developed and complemented into a practically useful package of tools that can be used by cities and other stakeholders to direct the development of urban freight systems toward sustainability. The framework is now based on a relatively narrow set of theories. These could be complemented and combined with other theories to increase the explanatory value of the framework as well as its value as a toolbox for sustainable transition governance activities in urban freight systems. The framework could be developed regarding how known challenges – such as balancing stakeholder interests and disseminating information and knowledge about the urban freight system to relevant stakeholders – can be addressed more in detail. Future research could also continue to explore how a city can use innovations and changes in the long-term societal context, at the landscape level, of their urban freight systems to govern the development in a direction which is sustainable for society in the long-term. Future research could continue to empirically explore and assess the practices already used in cities to govern transitions of urban freight systems. Another aspect of transitions of urban freight systems toward sustainability is how progress can be measured. A framework for governance of sustainable transitions of urban freight systems must include procedures for evaluating the progress, learning from it and for adjusting the transition process.

In a larger perspective, this research is directed toward environmental sustainability, which is just one dimension of sustainability. By focusing on the social dimensions of urban freight system transitions toward sustainability, one can reveal further challenges and opportunities. Urban freight systems give different contributions to different stakeholder groups from a social perspective. One path of research could

be to explore how these contributions change in a transition toward sustainability. Including social sustainability would add another dimension to the holistic picture of urban freight systems. To find methods for balancing multiple stakeholder interests, and around several sustainability dimensions, will be a challenge for governing parties. The exploration and development of such methods can also constitute the basis for further research.

In an even larger perspective, the sustainability of the forecasted growth of urban freight demand can be questioned. Since this demand grows with growing freight demanding economies in urban areas, there is an apparent need for research about how this demand can be developed toward sustainability.

References

- ABBASI, M. & NILSSON, F. 2012. Themes and challenges in making supply chains environmentally sustainable. *Supply Chain Management: An International Journal*, 17, 517-530.
- AKGÜN, E. Z., MONIOS, J., RYE, T. & FONZONE, A. 2019. Influences on urban freight transport policy choice by local authorities. *Transport Policy*, 75, 88-98.
- ALJOHANI, K. & THOMPSON, R. G. 2018. A stakeholder-based evaluation of the most suitable and sustainable delivery fleet for freight consolidation policies in the inner-city area. *Sustainability (Switzerland)*, 11.
- ALLEN, J., AMBROSINI, C., BROWNE, M., PATIER, D., ROUTHIER, J.-L. & WOODBURN, A. 2014. Data Collection for Understanding Urban Goods Movement. In: GONZALEZ-FELIU, J., SEMET, F. & ROUTHIER, J.-L. (eds.) *Sustainable Urban Logistics: Concepts, Methods and Information Systems*. Berlin, Heidelberg: Springer Berlin Heidelberg.
- AMAYA, J., DELGADO-LINDEMAN, M., ARELLANA, J. & ALLEN, J. 2021. Urban freight logistics: What do citizens perceive? *Transportation Research Part E: Logistics and Transportation Review*, 152, 102390.
- ANDERSON, S., ALLEN, J. & BROWNE, M. 2005. Urban logistics—how can it meet policy makers' sustainability objectives? *Journal of Transport Geography*, 13, 71-81.
- ARNOLD, R. D. & WADE, J. P. 2015. A Definition of Systems Thinking: A Systems Approach. *Procedia Computer Science*, 44, 669-678.
- BAKER, D., BRIANT, S., HAJIRASOULI, A., YIGITCANLAR, T., PAZ, A., BHASKAR, A., CORRY, P., WHELAN, K., DONEHUE, P. & PARSONS, H. 2023. Urban freight logistics and land use planning education: Trends and gaps through the lens of literature. *Transportation Research Interdisciplinary Perspectives*, 17, 100731.
- BALLANTYNE, E. E. F., LINDHOLM, M. & WHITEING, A. 2013. A comparative study of urban freight transport planning: addressing stakeholder needs. *Journal of Transport Geography*, 32, 93-101.
- BALM, S., AMSTEL, W. P. V., HABERS, J., ADITJANDRA, P. & ZUNDER, T. H. 2016. The Purchasing Behavior of Public Organizations and its Impact on City Logistics. *Transportation Research Procedia*, 12, 252-262.
- BANDEIRA, R. A. M., D'AGOSTO, M. A., RIBEIRO, S. K., BANDEIRA, A. P. F. & GOES, G. V. 2018. A fuzzy multi-criteria model for evaluating sustainable urban freight transportation operations. *Journal of Cleaner Production*, 184, 727-739.

- BEHREND, S., LINDHOLM, M. & WOXENIUS, J. 2008. The Impact of Urban Freight Transport: A Definition of Sustainability from an Actor's Perspective. *Transportation Planning and Technology*, 31, 693-713.
- BJØRGEN, A., BJERKAN, K. Y. & HJELKREM, O. A. 2019. E-groceries: Sustainable last mile distribution in city planning. *Research in Transportation Economics*.
- BJÖRKLUND, M. 2018. *Hållbara logistiksystem., uppl 2.*
- BOUDOIN, D., MOREL, C. & GARDAT, M. 2014. Supply Chains and Urban Logistics Platforms. In: GONZALEZ-FELIU, J., SEMET, F. & ROUTHIER, J.-L. (eds.) *Sustainable Urban Logistics: Concepts, Methods and Information Systems*. Berlin, Heidelberg: Springer Berlin Heidelberg.
- BRYMAN, A. & BELL, E. 2017. *Företagsekonomiska forskningsmetoder*, Liber.
- BRYSON, J. M. 1988. A strategic planning process for public and non-profit organizations. *Long Range Planning*, 21, 73-81.
- BULDEO RAI, H., VAN LIER, T., MEERS, D. & MACHARIS, C. 2017. Improving urban freight transport sustainability: Policy assessment framework and case study. *Research in Transportation Economics*, 64, 26-35.
- BUTRINA, P., GIRON-VALDERRAMA, G. D. C., MACHADO-LEON, J. L., GOODCHILD, A. & AYYALASOMAYAJULA, P. C. 2017. From the Last Mile to the Last 800 ft Key Factors in Urban Pickup and Delivery of Goods. *Transportation Research Record*, 85-92.
- CORBIN, J. M. & STRAUSS, A. L. 2008. *Basics of Qualitative Research (3rd ed.): Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, California: SAGE Publications, Inc.
- CUI, J., DODSON, J. & HALL, P. V. 2015. Planning for Urban Freight Transport: An Overview. *Transport Reviews*, 35, 583-598.
- DAVID, F. R. & DAVID, F. R. 2017. *Strategic management : concepts and cases : a competitive advantage approach*, Harlow, Pearson.
- DE CARVALHO, P. P. S., DE ARAÚJO KALID, R., RODRÍGUEZ, J. L. M. & SANTIAGO, S. B. 2019. Interactions among stakeholders in the processes of city logistics: a systematic review of the literature. *Scientometrics*, 120, 567-607.
- DOCHERTY, I., MARSDEN, G. & ANABLE, J. 2018. The governance of smart mobility. *Transportation Research Part A: Policy and Practice*, 115, 114-125.
- DUTTON, J. E. & DUNCAN, R. B. 1987. The Influence of the Strategic Planning Process on Strategic Change. *Strategic Management Journal*, 8, 103-116.
- EUROPEAN COMMISSION 2019. A European Strategy for low-emission mobility.
- EUROPEAN COMMISSION 2020. Communication from the Commission to the European parliament, the council, the European economic and social committee and the committee of the regions. Sustainable and Smart Mobility Strategy – putting European transport on track for the future. In: MOVE (ed.). <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52020DC0789>: European Union.
- EUROPEAN ENVIRONMENT AGENCY 2019. Greenhouse gas emissions from transport in Europe. European Environment Agency.

- EUROPEAN ENVIRONMENT AGENCY 2023. Transport and Mobility. <https://www.eea.europa.eu/en/topics/in-depth/transport-and-mobility>: European Environment Agency.
- FRANTZESKAKI, N., LOORBACH, D. & MEADOWCROFT, J. 2012. Governing societal transitions to sustainability. *International Journal of Sustainable Development*, 15, 19-36.
- GAMMELGAARD, B. 2015. The emergence of city logistics: The case of Copenhagen's Citylogistik-kbh. *International Journal of Physical Distribution and Logistics Management*, 45, 333-351.
- GAMMELGAARD, B., ANDERSEN, C. B. G. & FIGUEROA, M. 2017. Improving urban freight governance and stakeholder management: A social systems approach combined with relationship platforms and value co-creation. *Research in Transportation Business & Management*, 24, 17-25.
- GEELS, F. W. 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1, 24-40.
- GEELS, F. W. 2012. A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. *Journal of transport geography*, 24, 471-482.
- GOETZ, A. R. & ALEXANDER, S. 2019. Urban Goods Movement and Local Climate Action Plans: Assessing Strategies to Reduce Greenhouse Gas Emissions from Urban Freight Transportation. *Mineta Transportation Institute Publications*.
- HASSAN, A. M. & LEE, H. 2015. The paradox of the sustainable city: definitions and examples. *Environment, Development and Sustainability*, 17, 1267-1285.
- HE, Z. 2020. The challenges in sustainability of urban freight network design and distribution innovations: a systematic literature review. *International Journal of Physical Distribution and Logistics Management*, 50, 601-640.
- HÖLSCHER, K., WITTMAYER, J. M. & LOORBACH, D. 2018. Transition versus transformation: What's the difference? *Environmental Innovation and Societal Transitions*, 27, 1-3.
- İMRE, Ş., ÇELEBI, D. & KOCA, F. 2021. Understanding barriers and enablers of electric vehicles in urban freight transport: Addressing stakeholder needs in Turkey. *Sustainable Cities and Society*, 68, 102794.
- INTERNATIONAL TRANSPORT FORUM 2021. ITF Transport Outlook 2021. https://stats.oecd.org/Index.aspx?DataSetCode=ITF_OUTLOOK_URB_GOODS: Organisation for economic co-operation and development(OECD).
- KATSELA, K. & PÅLSSON, H. 2019. A multi-criteria decision model for stakeholder management in city logistics. *Research in Transportation Business & Management*, 33, 100439.
- KEMP, R. & LOORBACH, D. 2003. Governance for Sustainability Through Transition Management. *EAEPE 2003 Conference* Maastricht, the Netherlands
- KIBA-JANIAC, M. 2017. Urban freight transport in city strategic planning. *Research in Transportation Business and Management*, 24, 4-16.

- KIJEWSKA, K., OLIVEIRA, L. K. D., SANTOS, O. R. D., BERTONCINI, B. V., IWAN, S. & EIDHAMMER, O. 2021. Proposing a tool for assessing the level of maturity for the engagement of urban freight transport stakeholders: A comparison between Brazil, Norway, and Poland. *Sustainable Cities and Society*, 72, 103047.
- KIN, B., VERLINDE, S., MOMMENS, K. & MACHARIS, C. 2017. A stakeholder-based methodology to enhance the success of urban freight transport measures in a multi-level governance context. *Research in Transportation Economics*, 65, 10-23.
- KJAER, A. M. 2011. Rhodes' contribution to governance theory: praise, criticism and the future governance debate. *Public Administration*, 89, 101-113.
- KLIJN, E.-H. & KOPPENJAN, J. 2012. Governance network theory: past, present and future. *Policy & Politics*, 40, 687-606.
- KOTTER, J. P. 2012. *Leading change*, Harvard Business Review Press.
- KOTTER, J. P. S., LEONARD A. 2008. Choosing Strategies for Change. *Harvard Business Review*. <https://hbr.org/2008/07/choosing-strategies-for-change>: Harvard Business School Publishing.
- LAGORIO, A., PINTO, R. & GOLINI, R. 2016. Research in urban logistics: a systematic literature review. *International Journal of Physical Distribution & Logistics Management*, 46, 908-931.
- LINDAWATI, VAN SCHAGEN, J., GOH, M. & DE SOUZA, R. 2014. Collaboration in urban logistics: Motivations and barriers. *International Journal of Urban Sciences*, 18, 278-290.
- LINDHOLM, M. 2010. A sustainable perspective on urban freight transport: Factors affecting local authorities in the planning procedures. *Procedia - Social and Behavioral Sciences*, 2, 6205-6216.
- LINDHOLM, M. & BROWNE, M. 2013. Local Authority Cooperation with Urban Freight Stakeholders: A Comparison of Partnership Approaches. *European Journal of Transport and Infrastructure Research*, 13.
- LOORBACH, D. 2010. Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. *Governance*, 23, 161-183.
- LÖFSTRAND, S., HELLGREN, J., THULIN, N., ENGD AHL, H., PETTERSSON, S., WILLIAMSSON, J. & SANDOFF, A. 2013. Feasibility of Electrifying Urban Goods Distribution Trucks. *SAE International Journal of Commercial Vehicles*, 6, 24-33.
- MACHARIS, C. & KIN, B. 2017. The 4 A's of sustainable city distribution: Innovative solutions and challenges ahead. *International Journal of Sustainable Transportation*, 11, 59-71.
- MACHARIS, C. & MILAN, L. 2015. Transition through dialogue: A stakeholder based decision process for cities: The case of city distribution. *Habitat International*, 45, 82-91.
- MACHARIS, C., MILAN, L. & VERLINDE, S. 2014. A stakeholder-based multicriteria evaluation framework for city distribution. *Research in Transportation Business and Management*, 11, 75-84.

- MELANDER, L., NYQUIST-MAGNUSSON, C. & WALLSTRÖM, H. 2022. Drivers for and barriers to electric freight vehicle adoption in Stockholm. *Transportation Research Part D: Transport and Environment*, 108, 103317.
- MILES, M. B., HUBERMAN, A. M. & SALDAÑA, J. 2020. *Qualitative data analysis : a methods sourcebook*, Los Angeles, SAGE.
- MOEN, O. 2014. Co-distribution of Municipal Goods in Sweden – Procurement from a New Standpoint. *Procedia - Social and Behavioral Sciences*, 125, 484-495.
- MOLONEY, S. & HORNE, R. 2015. Low Carbon Urban Transitioning: From Local Experimentation to Urban Transformation? *Sustainability*, 7, 2437-2453.
- MUÑUZURI, J., CORTÉS, P., GUADIX, J. & ONIEVA, L. 2012. City logistics in Spain: Why it might never work. *Cities*, 29, 133-141.
- NORDTØMME, M. E., BJERKAN, K. Y. & SUND, A. B. 2015. Barriers to urban freight policy implementation: The case of urban consolidation center in Oslo. *Transport Policy*, 44, 179-186.
- PADDEU, D., PARKHURST, G., FANCELLO, G., FADDA, P. & RICCI, M. 2018. Multi-stakeholder collaboration in urban freight consolidation schemes: Drivers and barriers to implementation. *Transport*, 33, 913-929.
- PILE, S. 1999. What is a city. *City worlds*, 3-52.
- POSTNORD. 2019. *E-handeln i Europa 2019* [Online]. <https://www.postnord.com/sv/media/rapporter/e-handel/e-handeln-i-europa-2019/>: POSTNORD AB (PUBL). Available: https://www.postnord.com/globalassets/global/sverige/dokument/media/rapporter/e-handel_europamaster.pdf [Accessed 01-27 2020].
- PÅLSSON, H. & JOHANSSON, O. 2016. Reducing transportation emissions: Company intentions, barriers and discriminating factors. *Benchmarking: An International Journal*, 23, 674-703.
- RHODES, R. A. W. 2007. Understanding Governance: Ten Years On. *Organization Studies*, 28, 1243-1264.
- SCHLIWA, G., ARMITAGE, R., AZIZ, S., EVANS, J. & RHOADES, J. 2015. Sustainable city logistics - Making cargo cycles viable for urban freight transport. *Research in Transportation Business and Management*, 15, 50-57.
- SMITH, M. 2020. Delivering the goods: executing sustainable transport policy through urban planning in Merseyside (2001–2010). *Planning Perspectives*.
- SNYDER, H. 2019. Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339.
- SQUIRES, A., WADE, J., DOMINICK, P. & GELOSH, D. 2011. Building a competency taxonomy to guide experience acceleration of lead program systems engineers. STEVENS INST OF TECH HOBOKEN NJ SCHOOL OF SYSTEMS AND ENTERPRISES.
- TANIGUCHI, E. & THOMPSON, R. G. 2015. *City logistics : mapping the future*, CRC Press.

- TOUBOULIC, A. & WALKER, H. 2015. Theories in sustainable supply chain management: a structured literature review. *International Journal of Physical Distribution & Logistics Management*, 45, 16-42.
- TUKKER, A. & BUTTER, M. 2007. Governance of sustainable transitions: about the 4(0) ways to change the world. *Journal of Cleaner Production*, 15, 94-103.
- UNITED NATIONS. 2019. *The Paris Agreement* [Online]. Available: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> [Accessed 12-04 2019].
- VAN DUIN, R., SLABBEKOORN, M., TAVASSZY, L. & QUAK, H. 2018. Identifying dominant stakeholder perspectives on urban freight policies: A q-analysis on urban consolidation centres in The Netherlands. *Transport*, 33, 867-880.
- VARZI, A. C. 2021. What is a City? *Topoi*, 40, 399-408.
- WALKER, H., DI SISTO, L. & MCBAIN, D. 2008. Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management*, 14, 69-85.
- WASEEM, N. & KOTA, S. Sustainability definitions—An analysis. *Research into Design for Communities, Volume 2: Proceedings of ICoRD 2017*, 2017. Springer, 361-371.
- WATSON, T. J. 1994. Managing, Crafting and Researching: Words, Skill and Imagination in Shaping Management Research. *British Journal of Management*, 5, 77.
- WEBER, K. M. 2003. Transforming large socio-technical systems towards sustainability: On the role of users and future visions for the uptake of city logistics and combined heat and power generation. *Innovation*, 16, 155-175.
- YIN, R. K. 2014. *Case study research : design and methods*, SAGE.
- ZISSIS, D., AKTAS, E. & BOURLAKIS, M. 2018. Collaboration in urban distribution of online grocery orders. *International Journal of Logistics Management*, 29, 1196-1214.



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