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The role of financial continuity, externalities and stakeholders

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Towards a Business Model for Viable City Logistics Initiatives

The role of financial continuity, externalities and stakeholders

KONSTANTINA KATSELA

DEPARTMENT OF DESIGN SCIENCES | FACULTY OF ENGINEERING | LUND UNIVERSITY



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City Logistics Initiatives

Towards a Business Model for Viable City Logistics Initiatives

The role of financial continuity, externalities and
stakeholders

Konstantina Katsela



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DOCTORAL DISSERTATION

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Abstract <p>Viable city logistics are built on a sound business model that considers the financial viability and performance, and the role of externalities and stakeholders. To this end, the purpose of this dissertation is to increase understanding of how a business model can contribute to achieving viable city logistics initiatives.</p> <p>The research presented is qualitative and consists of three studies and five papers. The first study, based on secondary data, provides insights into the content of business models for city logistics. The second study, a longitudinal case study, analysed various aspects of a business model in city logistics. It investigated how the stakeholders' goals can be combined and managed in a city logistics business model, and how financial continuity can be achieved through financial and environmental evaluations of the consolidation set-ups. The financial evaluation analysed the relative importance of various cost and revenue variables. The environmental evaluation of consolidation set ups included the development of different scenarios for freight consolidation. This improved the decision-making process by enabling the consideration of outcomes and their implications. The third study, a comparative longitudinal case study, analysed the importance of stakeholders' interaction in the different stages of the implementation process and evaluated the extent to which interaction can vary between two apparently similar initiatives.</p> <p>The starting point of this research was the need for viable business models in city logistics. To better understand what is required, the research identifies the potential content of such business models and shows how the content results in the creation of a conceptual business model. The research also provides new insights into the economy of scale for viable city logistics business models and concludes that a key to cost-effective city logistics is efficiency in terminal handling. The research shows that the costs of externalities is a critical factor for viable city logistics business models. Finally, the research identifies the patterns and criteria of stakeholders' interaction and develops a multi-criteria decision model for the management of stakeholders. Future research areas are proposed to extend and complement these findings.</p>			
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*Επιστήμη ποιητική ευδαιμονίας
Πλάτων, Έλληνας φιλόσοφος (427-347 πΧ)*

*Knowledge creates prosperity
Plato, Greek philosopher (427-347 BC)*

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Abstract

Viable city logistics are built on a sound business model that considers the financial viability and performance, and the role of externalities and stakeholders. To this end, the purpose of this dissertation is to increase understanding of how a business model can contribute to achieving viable city logistics initiatives.

The research presented is qualitative and consists of three studies and five papers. The first study, based on secondary data, provides insights into the content of business models for city logistics. The second study, a longitudinal case study, analysed various aspects of a business model in city logistics. It investigated how the stakeholders' goals can be combined and managed in a city logistics business model, and how financial continuity can be achieved through financial and environmental evaluations of the consolidation set-ups. The financial evaluation analysed the relative importance of various cost and revenue variables. The environmental evaluation of consolidation set ups included the development of different scenarios for freight consolidation. This improved the decision-making process by enabling the consideration of outcomes and their implications. The third study, a comparative longitudinal case study, analysed the importance of stakeholders' interaction in the different stages of the implementation process and evaluated the extent to which interaction can vary between two apparently similar initiatives.

The starting point of this research was the need for viable business models in city logistics. To better understand what is required, the research identifies the potential content of such business models and shows how the content results in the creation of a conceptual business model. The research also provides new insights into the economy of scale for viable city logistics business models and concludes that a key to cost-effective city logistics is efficiency in terminal handling. The research shows that the costs of externalities is a critical factor for viable city logistics business models. Finally, the research identifies the patterns and criteria of stakeholders' interaction and develops a multi-criteria decision model for the management of stakeholders. Future research areas are proposed to extend and complement these findings.

Popular Science Summary

Freight distribution is critical for cities to survive, grow and flourish, but it also has negative environmental, economic and social impacts. City logistics aims to reduce these negative impacts by efficiently managing the movements of goods in cities. However, to have a viable city logistics initiative, it is also necessary to have a viable business model.

A business model is a conceptual tool that helps city logistics initiatives to create and capture value and enhance their financial continuity. Current research in the area has identified the need for such models along with policies, strategies, and the critical factors that constitute such a model. There are limitations, though, in terms of the content, the financial considerations (including cost of externalities and economy of scale), and the stakeholders' interaction. This research further investigates these limitations.

The research aims to increase understanding of how a business model can contribute to viable city logistics initiatives. Twenty city logistics initiatives were reviewed. A longitudinal case study on a business model implementation in the city of Malmö was carried out, and a comparative study of two city logistics initiatives in Sweden was conducted. The studies analysed different aspects of business models for city logistics, such as cost structure, externality costs, and the inclusion and management of stakeholders.

The research supports the idea that the business model for city logistics assists in the fundamental reconception of viable city logistics initiatives. The research provides detailed insights into the content of the business model, its financial continuity, as well as the stakeholders' interactions. The research identifies the potential content of such business models and shows how the content leads to the creation of a conceptual business model. The research also provides insights into the relative importance of cost and revenue variables, and variables that determine the economy of scale. A key to cost-effective city logistics is to be efficient in terminal handling. The research shows that the cost of externalities needs to be included in the evaluation of city logistics because it is more likely to contribute to a financially viable business model. In this regard, the research identifies patterns in the environmental impact and the costs of externalities of consolidating urban freight in the different consolidation set-ups for the city of Malmö. The results indicate that no matter what the consolidation set-up is in other city logistics initiatives, the externalities should be included in the business model because they reduce the overall costs of the initiatives. Thus, the costs of externalities are a critical factor for viable business models for city logistics.

Finally, this research identified the patterns and criteria of stakeholders' interactions and developed a multi-criteria decision model for stakeholder management in the context of the business model. It can assist in co-ordinating stakeholders' goals and facilitating the interaction between them. Future research areas are proposed to extend and complement these findings.

From the findings, researchers can gain insights on how the business model for city logistics captures the key business entities – cost and revenue structures, economy of

scale, cost of externalities, stakeholders' interaction – and the relationships between them. These insights can assist them in initiating research that challenges and adds to existing scientific knowledge, such as including the pre-existing networks of stakeholders to find ways to solve problems that have not been addressed or solved before. Since the problems discussed are the problems of everyone who is affected by increased urban freight movements, it is hoped that policymakers and policy planners find evidence in the research to strengthen and stimulate the development of new and improved guidelines for the implementation of city logistics initiatives. To that end, practitioners working with city logistics initiatives and urban freight in general and their managers can benefit from reading the sections that address the need for profitability, business model implementation and stakeholders' engagement.

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Lund, 26 May 2020
Konstantina Katsela

Contribution to the Appended Papers

The research presented in this dissertation comprises the five papers that are listed below. A brief description of the authors' contribution to each paper is included. A summary of the results of the papers can be found in Chapter 4, while the full versions are appended to the printed version of the dissertation.

PAPER 1

Katsela, K. (submitted) Towards a conceptual business model for city logistics: A review identifying its content – Submitted to an international logistics journal.

An earlier version was published in the *Proceedings of the 22nd ISL Conference*, 2017, Ljubljana, Slovenia.

PAPER 2

Katsela, K., and Pålsson, H. (submitted) Viable Business Models for City Logistics: Exploring the Cost Structure and Economy of Scale in a Swedish Initiative. Submitted (2nd review round) to *Research in Transportation Economics*.

Konstantina Katsela collected the data and was responsible for the data analysis. Both authors were equally responsible for the research design and writing of the text. The propositions and final version of the paper were developed in agreement by both authors. An earlier version of this paper was presented and published in the *Proceedings of the 29th NOFOMA Conference*, 2017, Lund, Sweden.

PAPER 3

Katsela, K., Pålsson, H. and Ivernå, J. (submitted) Environmental Impact and Costs of Externalities of Using Urban Consolidation Centres: A 24-hour Observation Study with Modelling in Four Scenarios. Submitted (2nd review round) to the *International Journal of Logistics: Research and Applications*.

Konstantina Katsela wrote the main parts of the manuscript, which were critically revised by Henrik Pålsson who provided guidance and comments as well as assistance in the refinement of the final propositions. Konstantina Katsela and Johan Ivernå shared data collection and worked together on the presentation of the findings. The propositions and final version of the paper were developed in agreement by all authors. An earlier version was presented and published in the *Proceedings of the 30th NOFOMA Conference*, 2018, Kolding, Denmark.

PAPER 4

Katsela, K. and Browne M. (2019). Importance of the Stakeholders' Interaction: Comparative, Longitudinal Study of Two City Logistics Initiatives. Published in *Sustainability Journal: City Logistics – Special Issue*.

Konstantina Katsela, as the lead author, produced drafts of the text and introduced the idea to Michael Browne who provided experienced advice and suggestions. Both authors, who shared data collection and analysis, were responsible for the research design and writing of the text. The propositions and final version of the paper were developed in agreement by both authors. An earlier version was orally presented in the *11th International Conference on City Logistics*, 2019, Dubrovnik, Croatia.

Konstantina Katsela received commendations for her writing and presentation of the paper.

PAPER 5

Pålsson, H. and Katsela, K. (2020). A Multi-criteria Decision Model for Stakeholders Management in City Logistics. Published in *Research in Transportation Business and Management Journal*.

Henrik Pålsson introduced the idea to Konstantina Katsela. Both researchers, were responsible for the research design and for writing the text. The propositions and final version of the paper were developed in agreement by both authors. An earlier version was orally presented and published in the *Proceedings of the 28th NOFOMA Conference*, 2016, Turku, Finland

1 Introduction

The research presented in this dissertation was developed in the field of city logistics. This chapter starts by providing the background to city logistics and its definition. The research problematisation, purpose and questions are subsequently presented, followed by the research focus and demarcations. The dissertation readership is then presented. The chapter concludes with an outline of the dissertation.

1.1 Background

The twenty-first century is the century of rapid urbanisation with half of the world's population living in cities and urban areas (United Nations, 2014). Rapidly growing cities promote extra attractive opportunities for employment, education, cultural, consumption as well as a great deal of other activities (Taniguchi et al., 2005). With cities being places of consumption that rely on frequent or even express deliveries of freight goods, urban freight transportation has become more important for the development of cities, the supply of their residents and the maintenance of a better environment in urban areas (Taniguchi, 2014). This implies that as cities grow rapidly, they become more reliant on sustainable supply chains and thus on city logistics in order to timely, safely and effectively plan and co-ordinate the movement of freight goods (OECD, 2003).

The efficient and timely distribution of freight is critical for supporting the demands of modern cities. Without freight distribution, cities could not survive, grow and flourish over the decades. However, freight distribution has confronted several challenges in recent years including negative environmental, social and economic impacts. The concept of city logistics has the potential to provide solutions for several of these challenges (Rodrigue and Dablanc, 2017). City logistics is thus defined as, *“The means over which freight distribution can take place in urban areas as well as the strategies that can improve its overall efficiency while mitigating externalities such as congestion and emissions. It includes the provision of services contributing to efficiently managing the movements of goods in cities and providing innovative responses to customer demands”* (Rodrigue and Dablanc, 2017).

1.2 Research Problematisation

From the previous section, it is possible to visualise the city logistics challenges related to impacts on the environment (e.g. CO₂ emissions), on the economy (e.g. waste of resources and congestion resulting in decreasing deliveries and journey reliability), and on society (e.g. noise, poor quality of life, public health). These challenges affect not only the efficiency of freight distribution in the cities and the quality of life of citizens but also the eco-efficiency (reducing ecological damage while at the same time maximising cost efficiency) and viability of cities and countries (UNEP, 2012; CIVITAS Policy Note, 2015). The challenges are rather complex and multidimensional. To tackle them, various city logistics initiatives have been introduced and implemented, the results of which show a high risk of failure (Yamada and Taniguchi, 2006; van Rooijen and Quak, 2008; Browne et al., 2006). This risk is related to: the low profitability of the initiatives and their large dependency on governmental subsidies (Macharis and Melo, 2011, Gammelgaard, 2015; Cagliano et al., 2016), the absence of collaboration between the public and private sectors (Lindholt, 2010; Lagorio et al., 2016), business model limitations (Malhene et al., 2012; Quak et al., 2014; Björklund et al., 2017), and strict policy measures about urban consolidation centres (UCCs) (Schoemaker, 2002; Vahrekamp, 2013; Lagorio et al., 2016).

Research in the field of city logistics is multidisciplinary and diverse, drawing the attention of scholars from many research areas such as logistics management, business and economics, risk and environmental studies, sustainability and engineering. Through the lenses of their respective areas, these researchers have contributed to building evidence about the aforementioned challenges and risks for failure. Several have looked at how the continuity and recurrence of these functional challenges affect the initiatives (Taniguchi et al., 2016; Benjelloun et al., 2010), and how they can possibly be prevented, and if not, how they can constitute learning exemplars for other initiatives (Taniguchi et al., 2016; Rodrigue and Dablanc, 2017; Oliveira et al., 2018). However, there is still a need for more knowledge on how city logistics can consider these challenges. The dissertation research suggests that one way to do so is through the business model and uses the argumentation of Moen et al. (2019) and Zenezini et al. (2018) that viable city logistics initiatives are built on a sound business model.

Business models in city logistics have received abundant scholarly interest focused on the great need for such models in the field (Benjelloun et al., 2010; Quak et al., 2014; Cagliano et al., 2016), on policies and strategies (Benjelloun et al., 2010), and on the critical factors that constitute such a model (Björklund et al., 2017). A business model is a conceptual tool that describes how a firm creates and captures value. A well-referred and used business model is that of Osterwalder and Pigneur (2010) and consists of nine components: key partnerships, key activities, key resources, value proposition, channels, customer relationship, customer segments, cost structure, revenue streams.

A business model for city logistics revolves around the concept of governance of the infrastructure and the different roles played by the stakeholders involved in city logistics initiatives (Macário et al., 2008). The model needs to address crucial financial issues that are related to the initiative's infrastructure and operations facilities, policies,

management and core responsibilities (Benjelloun et al., 2010). Björklund et al. (2017) add to these insights and state that a business model for city logistics needs to describe how an initiative can gain financial benefits. Allen et al. (2014) state that such a financially viable business model should consider economies of scale. This is because the overhead costs of a city logistics initiative can be divided into several delivery units, such as parcels, that can generate revenue streams to cover costs (Allen et al., 2014; Triantafyllou et al., 2014; Brotcorne et al., 2019). That is why the cost structure and revenue streams must be understood.

Triggered by climate change and the environmental challenges, a growing body of research pays attention to externalities in correlation to business models (e.g. TURBLOG, 2011; Quak et al., 2014; Estrada et al., 2017). According to TURBLOG (2011) and Quak et al. (2014), no business model for city logistics should exist without externalities, yet the current consensus on business model creation is to create the model and then look at externalities via an environmental analysis. In line with this, current research has studied the impact of externalities from an environmental perspective with the use of frameworks, such as Browne et al. (2012), Rodrigue and Dablanc (2017), and van Duin et al. (2016). An important argument of the research presented in the dissertation is that externalities should also be studied in terms of their impact on the cost and revenue of city logistics. This impact in relation to the overall transportation costs and revenues in city logistics should be investigated (Russo and Comi, 2020).

A business model for city logistics should also consider the stakeholders' interaction and engagement, but such a stakeholder-centred model has been overlooked (Zenezini et al., 2018). The stakeholders' interactions can contribute to the sustainable growth of a city logistics initiative, to appropriate development of urban resources, and to the development of low-impact urban planning and transportation systems (Gatta et al., 2019; Browne et al., 2019; Lebeau et al., 2018). Hence, managing the way stakeholders interact is important for city logistics initiatives (Le Pira et al., 2017; Guerlain et al., 2019; Browne et al., 2019). This is mainly because the interactions between them vary in the different stages of an initiative (Lindholm and Browne 2013; Gonzalez-Feliu 2018), which is due to their diverse goals or the needs of the initiative (Gonzalez-Feliu 2018). Macário et al. (2008) and Zenezini (2018) argue that an appropriate business model is foundational for stakeholders in city logistics initiatives. To this extent, Taniguchi et al. (2018) argue that the business model for city logistics should promote interaction between stakeholders by designing collaborative schemes for them. In summary, the interaction between stakeholders needs to be managed and a combination of their goals needs to be fulfilled in the business model context of city logistics.

Based on the knowledge gained from previous research on business models for city logistics, this dissertation aims to understand the financial continuity, the role of externalities, and the role of stakeholders in business models for viable city logistics.

1.3 Research Purpose and Research Questions

The overall research purpose is:

To increase understanding of how business models can contribute to achieving viable city logistics initiatives.

To make the purpose more tangible, it has been divided into five research questions (RQs):

RQ1: How has the content of business models been considered in previous city logistics initiatives?

RQ2: What is the relative importance of different cost and revenue variables for a business model for city logistics?

RQ3: What is the role of externalities in a business model for city logistics?

RQ4: How important is the interaction between stakeholders in a city logistics initiative for a viable business model?

RQ5: How can the diversity of stakeholders' goals be managed in a business model for city logistics?

1.4 Research Focus and Demarcations

The research is in the field of city logistics and focuses on the study of one such system. It is thus important to define the factors and objectives of the system under study, one that is complex, consisting of several factors. These include diverse stakeholders with conflicting goals, operations and solutions that vary from small parcel deliveries by vans to pallets in full truckloads (Quak et al., 2018). The research thoroughly considers the diversity of stakeholders by investigating the interactions between them (**Papers 4 and 5**). The research also investigates the different consolidation set-ups of a UCC and a micro-terminal as solutions for the different effects on the environmental impact, cost structure and revenue streams of a city logistics initiative. A more detailed presentation is found in **Papers 2 and 3**.

It is also important to define who owns the business model, because that stakeholder is the one who makes the decisions and directs the business operations of a city logistics initiative. The owner also defines the mission and requirements of the initiative as well as the key partnerships. According to the literature, the owner of a city logistics business model should be either a stakeholder (Browne et al., 2019) or a firm that uses the model (Björklund et al., 2017). To that end, this research considers the owner of the business model under study to be the municipality/local governors as they are capable of taking actions, decisions and of forming specific policies (including rules and regulations).

This research uses the term *viable* because it aims to contribute to a greater understanding of how to attain city logistics initiatives that can thrive. It does acknowledge that *viable* is a more relevant term for initiatives that are developed and ongoing, but does not consider as failures initiatives that have been implemented within a limited time frame and that have served their purposes; nor does it consider as failures initiatives that took a pause in their operations during a restructuring process (e.g. the Copenhagen initiative). The term *viable* is used to avoid confusion and is in line with several researchers in the field, such as Balm et al. (2018); Björklund et al. (2017); Benjelloun et al. (2010). In this research, a viable business model is defined as one that results in the development of a city logistics initiative and aims to deliver economic, social and environmental benefits. A viable city logistic initiative is defined as one that is able to exist and is scalable and profitable with well-defined scope and mission.

In the scope of this research, it should be noted that the term *city logistics* (not *urban logistics*) is used in reference to freight distribution in cities and urban areas. The term was used to avoid confusion and is in line with several researchers in the field. Both terms are used interchangeably in the current literature. Similarly, the term *city logistics initiatives* is preferred over *city logistics projects* and is used to describe acts intended to resolve city logistics challenges and/or improve a situation. *Initiative* is a new plan or action to improve something or solve a problem in city logistics. *Project* is a planned activity intended to achieve a particular purpose within a given timeframe. In the appended papers, the following synonyms – *feasible*, *sustainable*, *viable* – are used more as a matter of style in the text rather than as specific concepts related to theory.

1.6 Readership

This dissertation is aimed at three different readerships. One is obviously composed of academics interested in the scientific field of city logistics. Researchers who want to investigate business models and/or stakeholders can benefit from the findings. So can those who apply methods such as reviews with multiple sources, longitudinal case studies that use analytical hierarchy processes, and who want to develop a case study protocol or financial and environmental evaluation, and/or comparative longitudinal case study.

The second readership is composed of practitioners for which some chapters are especially suitable. The introduction chapter provides a panorama of important challenges faced in relation to the implementation of city logistics initiatives. The discussion chapter provides an overview of the most important findings and how they interrelate with current knowledge from related initiatives. In particular, the dissertation author feels that those working with city logistics initiatives and urban freight in general can benefit from reading the parts that address the need for profitability in such initiatives. Profitability can be increased through economies of scale, and a better understanding of the potential impact of the cost of externalities in relation to the overall transportation costs and revenues. Managers of city logistics initiatives can gain insights about stakeholder interaction and engagement. These professionals may want to read

about the patterns and criteria for stakeholders' interaction (**Paper 4**), or about their goals and how to prioritise them (**Paper 5**) in order to understand how to resolve conflicts of interest and obtain the best possible solution.

A third readership is made up of policymakers and policy planners: those working on regulatory boards for urban freight. The perspectives from the stakeholders' engagement can provide them with insights on how to tackle the challenges of stakeholder policy acceptability in city logistics initiatives. The problems discussed here are the problems of everyone who is affected by increased urban freight movements. In a dissertation like this, it is hoped that policymakers and policy planners find evidence to strengthen and stimulate the development of new and improved guidelines that are helpful for the implementation of city logistics initiatives.

1.7 Dissertation Outline

The dissertation is composed of six chapters. Chapter 2 introduces the research methodology, which includes the scientific reasoning and positioning, the research design and applied methods and the research quality. Chapter 3 presents the frame of reference and the identified research gap. Chapter 4 summarises the purpose, findings and implications of the five appended papers. Chapter 5 discusses the research findings. Chapter 6 draws the conclusions of this dissertation and presents the major theoretical and practical research contributions. It concludes by highlighting directions for future research.

2 Research Methodology

This chapter comprises the research process from the beginning of the PhD studies up to the consolidation of this dissertation. It starts with the scientific reasoning and positioning of the research and defines the methodological approach. Then comes the research design and the iterative process that was followed to gain and transfer knowledge throughout the development of three studies and five scientific papers. The chapter ends with a discussion of the research quality in terms of reliability and validity.

2.1 Scientific Reasoning and Positioning

There are two potential perspectives that guide our understanding of reality and the search for (more) knowledge: objectivist and subjectivist. Both perspectives can apply to city logistics. From the objectivist perspective, one measures the nature and conditions according to which city logistics initiative is implemented. These measures often depend on events or objects that can be counted and that require evaluation from the individuals (Rodrigue, 2020). From the subjectivist perspective, one relies directly on the perceptions, assumptions and opinions of individuals about the conditions in which a city logistics initiative is implemented (Rodrigue, 2020).

The real-life problems studied in this research relate mainly to the *efficient and timely distribution* of freight in cities because this is critical for supporting city demands. Without freight distribution, cities could not survive, grow, and flourish. Still there are a number of challenges stemming from urban freight distribution, including negative environmental effects and financial and societal impacts. The efficiency of freight distribution and its impact on the environment and on society of the related activities are challenges that can be measured and addressed from an objectivist perspective. These challenges require an evaluation from the researchers and/or stakeholders in the initiatives. Next, the specific methodological components of the research approach are outlined.

2.1.1 Epistemological Positioning

The epistemological approach to this dissertation research is multidimensional, founded on social constructivism and with different interpretations. The dissertation author's view of knowledge is in line with Guba and Lincoln (1994): "*Multiple 'knowledges' can co-exist, when equally competent (or trusted) interpreters disagree, and/or*

depending on social, political, cultural, financial, ethnic, and gender factors which differentiate the interpreters". The scientific interpretation falls within a social scientific frame. The researcher's interpretations then "(...) *have to be further interpreted in terms of the concepts, theories, and literature of a discipline*" (Bryman, 2012). In this research, the challenges on how to achieve more viable city logistics initiatives are discussed in terms of the many stakeholders who possess multiple "knowledges" affecting this. These stakeholders have a diversity of goals and interests, usually financial, business and social. Thus, when their interpretations of the problem differ, it becomes a significant obstacle in conceiving and implementing the provisions of city logistics and makes for an interesting case study.

The stakeholders and their interactions are studied in the business model context. It is necessary to have a business model in order to make city logistics initiatives more viable so that activities will be implemented in a more cost and environmental efficient manner.

As discussed in the literature (Anand et al., 2014; Quak et al., 2018; Browne et al., 2019), there are multiple views among these multiple stakeholders involved in city logistics that can be studied, measured and described. The cities face similar challenges, but the stakeholders have different views on how to implement city logistics initiatives. These views differ among the stakeholders based on their goals and motives for participating. These views also differ among the city logistics initiatives due to their different characteristics, policies, rules and regulations. All this leads to conflicts and challenges for implementing city logistics. Ultimately, the stakeholders have to be understood as diverse beings that have key roles in city logistics initiatives, offering their perspectives and enriching the process of the initiatives (Browne et al., 2019). In practice, the dissertation author has had the opportunity to experience the different stakeholders' views during her participation in the SamCity Initiative (Appendix A). This led her to further investigate the stakeholders' interactions in city logistics initiatives (**Papers 4 and 5**).

The research needs to have an integrative view to respond to real world challenges in the city logistics context. As a researcher, the dissertation author has learnt (and is still learning) to reflect on her role as an investigator. She has learnt to engage with the world of reality by being someone who asks questions and looks for answers by combining knowledge from different disciplines and her educational background in economics. At the same time, she is aware that the knowledge generated about city logistics is influenced by the reasons and risks for failure of the initiatives, the need for research, as well as her perception of reality and what city logistics is.

2.1.2 Methodological Approach

The methodological approach of a researcher is never free of presumptions (Krogstie, 2012). It needs to be reflectively considered in relation to other possible methodological approaches. This means that there is no such thing as the "best" methodological approach (Arbnor and Bjerke, 1997). In turn, this may also indicate a denial to explore other paths to access knowledge.

Arbnor and Bjerke (1997) identify three methodological approaches a researcher can use: an *analytical approach*, a *systems approach*, and an *actor's approach*. The analytical approach is based on a positivistic paradigm. It focuses on facts that need to be described and explained with the support of theory by elaborating hypotheses and testing them against a theoretical framework. The systems approach provides a holistic view of the phenomenon under study, where the whole becomes more important than the individual parts (Arbnor and Bjerke, 1997). In a systems approach, the researcher explores the system in order to understand complex phenomena with the final goal of improving that system (Gammelgaard, 2004). Finally, the actor's approach aims to "*understand profoundly – and from the actor's point of view – the nature of the activities studied*" (Pihlanto, 1994), where the researcher is more action-oriented and uses knowledge to understand (Arbnor and Bjerke, 1997). The real world in the actor's approach is studied in terms of a few research objects, or in some case only one, since the aim is not to generalise (Arbnor and Bjerke, 1997).

The author chose the systems methodological approach for her research because it best aligns with her search for knowledge. The analytical approach was rejected because it breaks down reality into smaller units from which value-free, time-free, and context-independent causal-effect relations can be apprehended (Mentzer and Kahn, 1995). In contrast, the research presented is context-dependent because it takes into consideration the natural contexts in which city logistics initiatives function to collect the data and provide in-depth understanding of the phenomenon under study. This in essence also provides an understanding of the research purpose and questions. Specifically, city logistics is an open but complex system (Browne et al., 2019; Taniguchi et al., 2001) where the consolidation, distribution, handling, storage (Awasthi and Proth, 2006), tactical planning and scheduling of operations and management of resources (Crainic, 2008), as well as the interactions between different stakeholders take place (Anand et al., 2014; Browne et al., 2019). The complexity of the city logistics is also considerable due to its emergence (Anand et al., 2014) and due to the structures and the characteristics of the cities in which the initiatives are implemented (Browne et al., 2019). For instance, this emergent behaviour appears when a number of stakeholders operate and form a complex behaviour as a collective (Puckett et al., 2010) or when many structures in the cities (i.e. urban spatial structure or economic structure) are not used in the way they were originally intended (Browne et al., 2019). Moreover, and different from the analytical approach, the systems approach permits the researcher "to come very close to the research objects and the concrete settings" and enables the formulation of recommendations (Gammelgaard, 2004), both of which are in alignment with the purpose of this research.

In such a complex environment, any change can have ripple effects throughout the entire system. A systems approach can help to understand and express ongoing changes in a complex city logistics system; a change in the system occurs whenever there is a change in its constituent components or structures (i.e. consolidation, distribution, stakeholders, etc.) and the system needs to adapt to those changes (Browne et al., 2019). A conflict between a group of stakeholders, resulting in a possible barrier to communication between the private and public sectors, is a conflict that can easily affect the entire city logistics system (Taniguchi, 2014). The system can also be challenged

and enhanced by changes that occur in external interventions that interact with the components of the system, such as policies or rules and regulations, market, economy, technology and infrastructure. Regulatory and policy demands are very specific within this context and also affect the way the initiatives and/or several activities in the initiatives are designed and implemented (Browne et al., 2019). The understanding of the system and its emergent behavioural mechanisms can then be used to devise solutions for the challenges related to city logistics (Browne et al., 2019).

The actor's approach would be suitable if the focus was only on the stakeholders. Even though this research investigated the stakeholders by interviewing and observing them, the main objective was to have a holistic perspective on city logistics system. It is important to note that this research focuses on describing how to achieve more viable city logistics initiatives from a business model perspective in which the stakeholders are considered part of the business model (Section 1.2). Therefore, the multiple stakeholders together with their interactions need to be considered from a holistic view, which can be better investigated through a systems approach. A systems approach aims at co-ordinating independent motives to optimise the system's welfare (Anand et al., 2016). As a result, if city logistics initiatives want to change, it may not be because of the action of a particular stakeholder group, but because the entire system supports the change (Quak et al., 2018).

2.2 Research Design and Applied Methods

Research design is what sustains the logical part of this research, as it is the visible structure that frames the search for knowledge from the research questions to the development of particular studies and choice of methods (Yin, 2014). Overall, by defining the research design, a researcher is consciously deciding what will be observed and how, so that the research purpose is fulfilled and research questions are answered (Easterby-Smith et al., 2015).

The scientific area that is studied together with the type of research questions determine the research strategy and the appropriate methods. Considering the scientific systems approach, the research purpose and the research questions, it is natural to follow a descriptive path, where qualitative research methods are prioritised in empirical studies. Creswell (2013) emphasises that qualitative research is consistent with the systems approach: "*Qualitative research tries to develop a complex picture of the problem or issue under study. This involves reporting multiple perspectives, identifying the many factors involved in a situation, and generally sketching the large picture that emerges*". The data were collected in its natural setting (and not in a laboratory setting as in several experimental studies), and the dissertation author was active in interviewing and observing data collection as Creswell (2013) describes. Along the research process, rich data from multiple sources were gathered and analysed through inductive-deductive reasoning to establish or identify patterns and emergent themes, as described by Creswell (2013).

Inductive and deductive reasoning lead to different directions (DeCarlo, 2018). This, however, does not prevent the researcher from using both in the research process (DeCarlo, 2018). Bryman (2012) is critical of the sharp separation between inductive and deductive reasoning. Bryman (2012) clarifies that, “*To a large extent, deductive and inductive strategies are possibly better thought of as tendencies rather than as a hard-and-fast distinction*”. Similarly, Parkhe (1993) explains that inductive-deductive reasoning may not always compete, since they are continuous and inseparable processes in theory development. In such a way, inductive and deductive reasoning took part in different moments of this research process, which is in line with Hyde (2000).

The overall research design unfolds into three studies. The first study (review of initiatives study) was based on secondary data and a combination of sources (literature review, best practices reports review, initiatives’ reports and webpages) to achieve rigour and transparency in the review. The first study addresses RQ1 and provides more information about the content of the business model for city logistics (**Paper 1**). Since RQ1 called for the identification of how the content of business models has been considered by previous city logistics initiatives, a review study on city logistics initiatives with a combination of sources (something missing in current literature) was the most appropriate method to address this question.

The second and third studies (longitudinal case study, and comparative longitudinal case study) were empirically based on the SamCity case¹ (**Papers 2, 3 and 5**) and Stadsleveransen case² (**Paper 4**). The longitudinal case study examined the actual SamCity initiative by investigating the diverse stakeholder goals for participating (addressing **RQ5**) and the potential of obtaining a financially viable business model (addressing **RQ2** and **RQ3**). The data were gathered from multiple sources over one year. From the data, the dissertation author gained an in-depth view of an actual city logistics initiative, observed the stakeholders over the whole period and pilot implementation, and looked for possible changes that occurred over time. Because of this, the longitudinal case study was particularly useful for studying the development and the challenges of an actual initiative and seeing how certain things evolved in SamCity. In addition, this study included a financial evaluation (**Paper 2**) and an environmental evaluation of the consolidation setups (**Paper 3**). The financial evaluation provided knowledge on the value streams of business models for city logistics by analysing the relative importance of various cost, revenue and goods volume variables, and addresses **RQ2**. The environmental evaluation of consolidation set-ups contains a scenario development for the freight consolidation and allows for improved decision-making by enabling the consideration of outcomes and their implications and addresses **RQ3**.

The comparative longitudinal case study (**Paper 4**) investigated the importance of stakeholders’ interaction in the different stages of the implementation process of a city logistics initiative (SamCity) and evaluated the extent to which interactions may vary between two apparently similar initiatives (SamCity and Stadsleveransen). This study

¹ SamCity was carried out in the City of Malmö, Sweden and focused on creating a co-ordinated freight consolidation and distribution system with logistic services in the city centre (see Appendix A).

² Stadsleveransen started in 2012 in the City of Gothenburg, Sweden and has grown steadily since then in terms of the number of deliveries and the area within the inner city of Gothenburg are (see **Paper 4**).

was designed to answer **RQ4** and to provide rich data from multiple sources of stakeholder co-ordination and management, something that is lacking in the current literature. These multiple data sources helped to capture the complexity of interactions between stakeholders in the different stages of the implementation process, which is beneficial for viable city logistics initiatives. Hence, a comparative, longitudinal case study was most suitable to answer RQ4.

The studies are an integral part of the research and are described in the following sub-sections. Figure 1 presents the overall research design adopted in this dissertation.

Purpose: To increase understanding on how business models can contribute to achieving viable city logistics initiatives.		
Research Questions (RQs)	Studies	Outcomes (Papers)
RQ1: How have previous city logistics initiatives considered the content of business models?	Review on Initiatives Study	Paper 1
RQ2: How does the cost and revenue structure of a city logistics initiative affect economies of scale?	Longitudinal Case Study <div style="border: 1px dashed black; padding: 5px; margin-bottom: 5px;">Financial Evaluation (part of the longitudinal case study)</div> <div style="border: 1px dashed black; padding: 5px;">Environmental Evaluation of Consolidation Set-ups (part of the longitudinal case study)</div>	Paper 2
RQ3: What is the role of externalities in a business model for city logistics?		Paper 3
RQ5: How can the interaction between stakeholders in a city logistics initiative be managed?		Paper 5
RQ4: How important is the interaction between stakeholders in a city logistics initiative for a viable business model?	Comparative Longitudinal Case Study	Paper 4

Figure 1. Research design

2.2.1 Review of Initiatives Study (Paper 1)

The review of initiatives study responds to the first research question (**RQ1**). The nature of this research question called for an investigation of how city logistics initiatives have considered and implemented business models and their content. The review followed Candy's (2018) three-step guideline: 1. define research and required characteristics, 2. research strategy, and 3. synthesis, coding and categorisation. The guideline steps are increasingly being used in research when a combination of a literature review with other sources, such as webpages and videos, is used to extract information and achieve rigour and transparency in literature reviews (Candy, 2018).

The review employed two academic databases (Web of Knowledge and Scopus³) and did not limit itself to specific timeframes, journals or publishers in order to generate a comprehensive list of core contributions and to minimise the risk of excluding relevant literature. In line with other reviews in the field, specific keywords were defined as search criteria. These included various terms and combinations of terms to retrieve the sample such as: "city logistics and urban (freight) consolidation centres", "business model" and "business model for city/urban logistics". The sample of relevant journal publications that was retrieved consisted of 250 papers but together with the journal review, the best practices review helped the author to reduce the sample into 175 articles after removing duplicates.

In parallel, a review of the best practices was performed in which reports from BESTUFS, BESTFACTS, CITY MOVE, CITYLOG, the City Ports Project, CIVITAS (...) ⁴ were thoroughly reviewed. These reports are summaries of many European city logistics initiatives and in most cases, they provide a thorough description and important details of these initiatives that are lacking in journal publications. In other words, they describe and disseminate best practices of city logistics initiatives, the success criteria of the initiatives and address the reasons for failures or risks for failure of the initiatives. This best practices review was a means to extract more information about many of the initiatives and decide which ones to include in the review and which ones to exclude. In particular, it provided a greater understanding of the differences and similarities among several of the initiatives and how this could contribute to the scope of the **Paper 1** study. A variation of city logistics initiatives with different scopes and different business model types and applications was deemed to be more beneficial. Hence, a selection of 20 initiatives was finally made (see Table 3 in **Paper 1**). Together with the results of the journal review, those of the best practices review helped the author to reduce the sample to 150 articles, in which the twenty initiatives are analysed.

Once the initiatives were selected, their webpages were thoroughly examined to extract more information about their business models' content and implementation. Relevant videos, when provided and in English, were also watched and the author took notes regarding the business model and its content and components. Several reports of the performance and the implementation of the initiatives were examined. The

³ These two databases are commonly used in academic literature reviews, which is why they are used in this study too.

⁴ See **Paper 1** for a complete list of the best practices reports.

information gained was compared to information gathered from the journal articles and best practices reports.

The data were analysed in several rounds of coding and categorisation that were generated in several Microsoft Excel spreadsheets following the guidelines of Corbin and Strauss (1990). Coding categories were derived directly from the literature. The themes identified were assigned unique codes. This resulted in the identification of the way the stakeholders in the initiatives consider the content of the business model. The shortcomings of alternative categorisations from the review were addressed by carrying out a more in-depth categorisation of the business model components. A detailed presentation of the coding and categorisation is found in **Paper 1**. As part of this process, the author thoroughly discussed the rounds of coding and categorisation with another researcher who gave her input and expertise as a business models scholar⁵.

2.2.2 Longitudinal Case Study (Papers 2, 3 and 5)

According to Yin (2014), a single case study is suitable if the case is critical, unusual, typical or representative, revelatory, or longitudinal. A single-case study tends to prioritise the uniqueness and richness of the case. That is why a longitudinal case study was chosen to examine the SamCity initiative. SamCity is a significant city logistics initiatives on the Swedish national level in terms of its effort and scale, and thus would be able to provide rich data. In addition, SamCity could provide insights for similar initiatives that are attempting stakeholder engagement, cost and revenue structure and consolidation set-ups. Investigating such a significant case can lead to a better understanding of common practices and the dominant processes that guide city logistics initiatives.

The dissertation author was active in the SamCity initiative and present at the meetings during a one-year period and received invitations to all the events; hence, she gained an in-depth perspective of the initiative and the stakeholders involved. The author mainly listened and observed how the stakeholders behaved by watching for verbal cues and keeping notes. Thus, it was passive participation, as Spradley (1980) suggests. Some of the details observed were relevant to the purpose of the study and provide an answer to **RQ5**. These were observations related to how stakeholders interact with one another, the reasons why stakeholders were interested in such an initiative, their goals for participating in a city logistics initiative, or their expectations of how their own organisation would benefit. **Paper 5** presents a more thorough description of the methodological approach on how the stakeholders' goals and interactions can be managed, where an analytical hierarchy process method is used to rank the alternative goals and their importance in a stakeholder value matrix.

The dissertation author was also able to obtain rich data about how the UCC and the micro-terminal of SamCity operates, the initiative's financial structure and the measurements considered to alleviate the environmental impact. This answers **RQ2** and

⁵ This business model scholar was not involved in the study but as expert who holds a PhD in "travelling" business models she provided her expertise feedback in the coding and categorisation.

RQ3. The study involved a wide range of data collection methods, such as direct observations, semi-structured interviews, notes, archival data, meeting minutes and events, the combined results of which are presented in **Papers 2, 3 and 5**.

Although this type of study is normally characterised as qualitative research (Yin, 2014; Howell, 1972), the research presented in this dissertation also includes quantitative dimensions. Quantitative data, such as about the cost and revenue structure (financial evaluation), were selected and analysed by quantitative methods (i.e. cost-benefit analysis). According to Yin (2014) qualitative research often makes use of quantitative techniques for deeper analysis. For the quantitative dimension of the study, the dissertation author first examined a six-month pilot implementation of consolidated transportation and value-adding logistics services from the UCC to public establishments and private stores in the centre of Malmö, Sweden, between March and August 2015. The purpose was to investigate the impacts of cost, revenue and goods flow variables on the financial performance of the business model for city logistics (financial evaluation study, **Paper 2**). Then the transportation-related externalities on this six-month implementation (environmental evaluation of consolidation set-ups study) were examined. The purpose was to evaluate the actual environmental impact of transport consolidation in different city logistics scenarios (**Paper 3**).

The data collected for this longitudinal case study were documented in a protocol as suggested by Yin (2014). The protocol provided guidance and assistance in the data collection and the analysis as well as assistance into creating the interview guide. The protocol followed a chronological order covering the implementation process of the initiative and its performance outcomes. The protocol consists of 70 pages and six sections:

1. An overview of the initiative with all the published reports about the initiative.
2. Data collection sources: meeting minutes, notes, events, presentations, performance reports, e-mail summaries, participant observations and interviews.
3. Other forms of documentation, such as pictures and illustrations.
4. Detailed lists of the stakeholders: organisation, number of participants from each organisation involved in the initiative, participants name and contact information, participants' position in the company and role in the initiative, years of experience in the organisation and in logistics initiatives.
5. Links to interview transcriptions and survey results.
6. References to bibliographical information and relevant documents: journal publications on city logistics initiatives, best practices reports (e.g. BESTUFS and OECD).

Investigator triangulation was also applied in order to ensure that the interpretation and evaluation of the data were not influenced by the author's personal views, which is in line with Douglas and Johnsson (1977). The investigator triangulation was used as a form of crosschecking information between the researchers involved in the study in order to select what was relevant and important and to draw the conclusions in this study.

Financial Evaluation (Paper 2)

The empirical financial evaluation portion of the longitudinal case study provided an answer to **RQ2**. The evaluation data were collected by the transport providers, who used a set of tools related to the business management system, and by the municipality. A cost-benefit analysis in line with Gonzalez-Feliu (2012) was chosen and applied by the dissertation author to analyse the decisions and activities of the SamCity initiative. It was considered to be the most comprehensive and theoretically sound form for financially evaluating SamCity because it places monetary values on both the inputs (costs) and outcomes (benefits) of the city logistics activities of the initiative. All data were documented in a database in Microsoft Excel, which enabled the retrieval of particular pieces of data and notes. The following costs were summarised in the database: costs for overhead, UCC and distribution, parcel and pallet volumes, transport routes, and logistics services. **Paper 2** provides insights on the financial feasibility of business models in city logistics.

Environmental Evaluation of Consolidation Set-ups (paper 3)

The environmental evaluation addresses the third research question (**RQ3**) and includes four steps. The nature of this research question resulted in an empirical investigation of the transportation and environmental effects of using a UCC and/or a micro-terminal for the consolidation and distribution of goods. The first step was to map goods volumes and vehicle types, routes, load factors and delivery addresses. To do so, all the freight flows and freight vehicle movements in and out of the city centre were observed and captured in a 24-hour period at selected nodes in the city centre (see **Paper 3** for the nodes). The second step was to create scenarios for freight consolidation. The scenarios were used to estimate the transport and environmental performance of using a micro-terminal with or without a UCC. Based on the literature (Crainic et al., 2004; Verlinde et al., 2012), three scenarios were created and compared to the actual/current situation. The third step was to analyse the transport and environmental effects with the ArcGIS Network Analyst software for each scenario. The actual road network was used in the software to calculate the routing. The output consisted of: vehicle kilometres, number of vehicles needed, noise and air emissions (CO₂, NO_x, PM), freight vehicle movements, times of entry and exit of the vehicles in the city centre, and the routes. The fourth step was to calculate the effect on externality costs of the scenarios. The European Commission's handbook was used to estimate external costs in the transport sector (European Union, 2019). The externality costs were then compared between the scenarios.

2.2.3 Comparative, Longitudinal Case Study (Paper 4)

This study responds to **RQ4**. It investigates the importance of the stakeholders' interactions in the different stages of the implementation process of two apparently similar city logistics initiatives. It evaluates the extent to which the interactions may vary between them. The longitudinal comparison highlight the multiple stakeholders'

interactions and suggests that various degrees of such interaction exist and can be beneficial for viable city logistics initiatives. This study was designed following the guidelines of George et al. (2015) on how to perform comparative longitudinal research in mono-national (single country) case studies.

This case study was designed to provide rich data from multiple sources of stakeholder co-ordination and management, something that is lacking in the current literature. These multiple data sources helped to capture the complexity of the interactions between stakeholders in the different stages of the implementation process. The data sources included semi-structured interviews, secondary reports, observations and notes for both initiatives. The case study protocol of SamCity (described in Section 2.2.2) was also examined. The semi-structured interviews were conducted in December 2018 and January 2019 with the managers of the initiatives.

The data were analysed in three steps. The first was to empirically investigate how the SamCity initiative designed, implemented, and perceived stakeholder interactions by examining its case study protocol. Each part of the protocol that mentioned stakeholders' interactions was marked and then summarised. Thereafter the protocol of the Stadsleveransen initiative was examined, and much information about the initiative was covered during the interviews. In the second step, the results of the interviews were analysed. A coherent narrative was created with important quotes from the interviewees. This narrative was further analysed to determine what criteria the interviewees addressed for stakeholders' interaction; hence, a specific labelling was created. The outcomes of the interviews were then compared with the summarised outcomes of the protocol of the SamCity initiative in order to evaluate the extent to which the interactions varied between the two initiatives. In the third step, the patterns of the stakeholders' interactions in the two initiatives were evaluated. This was done for all the different stages of the implementation process of the two initiatives. The following aspects were examined: the communication and network strategies of the initiatives, and the degrees of stakeholder interaction as was summarised in the interview narratives and in the SamCity case study protocol.

The theoretical point of departure for the design of this study was that city logistics involve multiple stakeholders, the actions of whom determine the initiatives' outcomes (Guerlain, et al., 2019). More precisely, city logistics are influenced by the multiple stakeholders involved and their diverse and conflicting goals (Alves et al., 2019; Guerlain, et al., 2019). Hence, it is clear that by better co-ordinating the way stakeholders interact, one can improve the viability in the initiatives. This approach captured the criteria and patterns of the stakeholders' interactions. The longitudinal part of the study was beneficial in understanding the stakeholders' interactions in the different stages of the implementation process and how these interactions impact the implementation and development of initiatives over time.

This study also involved investigator triangulation to ensure that the interpretation and evaluation of the data were not influenced by the authors' personal views, which is in line with Douglas and Johnsson (1977). The investigator triangulation was also a form of crosschecking information between the two researchers involved in order to select what is relevant and important and draw conclusions. In addition, while conducting the interviews, feedback from the respondents was requested to ensure that

the authors were accurately depicting their points of views. **Paper 4** provides a more thorough description of the methodological approach.

The two cases, SamCity and Stadsleveransen⁶, were selected because they explore the phenomenon in a similar way and pursue a similar research goal. They were also considered to be significant city logistics initiatives on a national level in terms of effort and scale. In other words, the cases could provide insights for other initiatives that want to get their stakeholders to better co-operate in order to improve the urban environment. Both cases included similar stakeholder groups (municipalities/local governors, transport providers, property owners, haulier organisations, consumer/merchant trades associations, consumers/retailers) with the same key activities (problem solving, quality control and network, and research through collaboration and interaction with one another) and regular meetings with different foci among the different stakeholders. However, in Stadsleveransen the service is formally provided by “Innerstaden”, a non-profit company owned by the Property Owners’ Association and the Merchant Trade Association in Gothenburg, Sweden, while in SamCity the transport providers took the initiative for SamCity’s effective coordination of transport.

Before starting the study, the dissertation author was informed about the overall context of the Stadsleveransen initiative, as is further described in **Paper 4**. This knowledge was gathered by reading secondary data reports, which helped to select the initiative to study.

2.3 Research Quality

An important step in research is to evaluate its quality. There are several terminologies available for judging research quality, among them, reliability and validity (Creswell and Clark, 2011). Reliability is concerned with how consistent the results are in cases of repetition of the research (Yin, 2014). Validity is concerned with both construct validity, which shows whether a study measures what it states is to be measured (Mentzer and Kahn, 1995), and external validity, which shows the generalisability of the results (Bryman and Bell, 2011).

Yin (2014) presents four criteria to evaluate qualitative research: *reliability*, *construct validity*, *external validity*, and *internal validity*. The four criteria ensure quality in research and also follow the objectivist view (the view undertaken in this research). These criteria help to strengthen and defend the rigour with which the research has been conducted. They are described in the following paragraphs and summarised in Table 1.

Moreover, the researcher needs to critically consider that there are numerous influences, such as belonging to a specific research community or general discourses in society that can permeate the researcher’s production of knowledge. In addition,

⁶ The SamCity initiative evolved in two stages (2013-2014, 2014-2016). The Stadsleveransen initiative is still operating and has evolved in three stages (2012-2013, 2014-2016, 2017-onwards). A thorough description of the two cases is provided in **Paper 4**.

Bryman and Bell (2011) emphasise that any research findings are also subject to the choice of methods and bias as well as mistakes in the execution of the studies. The dissertation author has declared her epistemological (Section 2.1.1) and ontological (Section 2.1) views in which she made clear her personal stance as a city logistics researcher. When conducting interviews, the dissertation author followed the advice of Brinkmann and Kvale (2015) and let the respondents speak, as well as letting the interview be a place where the author could gain more knowledge. The dissertation author also focused on having interviews that provide rich texts for further interpretation, as suggested by Brinkmann and Kvale (2015). All the interviews were recorded and transcribed verbatim. In the data analysis, the dissertation author imported the interview files and coded them in Microsoft Excel, which also allowed her to keep track of how this coding was done.

Table 1 – Summary of research quality

Quality criteria	Overall approach	Data collection	Data analysis
Reliability	Definition of steps for data collection and analysis	Case study protocol/Interview guide Literature review	Categorisation and coding
Construct Validity	Operational measures for the concepts being studied during the data collection phase	Multiple sources interviews, observations, meeting minutes, notes, events, archival data, literature, database	Interview files imported and coded Coding scheme
External Validity	Detailing description of research methods and context of the study	Description of the sampling of respondents	Coding scheme related back to theoretical concepts from literature
Internal Validity	Credible findings and interpretations	Triangulation of multiple sources of evidence, e.g. interviews, observations, meeting minutes, notes, events, archival data, review, reports, webpages	Pattern matching of responses Member checks (reports with interview summary) Dialog with co-authors

Reliability is achieved during data collection and demonstrates that the research procedures are consistent and can be repeated with the same results (Ellram, 1996; Yin, 2014). The processes and designs of the studies of this research are well documented. To support reliability, the data from the review of initiatives study (**Paper 1**) were documented in Microsoft Excel spreadsheets that covered the selection, categorisation and coding phases of the study and were updated often, once new outcomes from the review were reached (e.g. once per day/every other day). The coding and categorisation for the selected data follows the guidelines by Corbin and Strauss (1990). The data from the longitudinal case study (**Papers 2, 3, 5**) were documented in a case study protocol as suggested by Yin (2014). In order to increase reliability, all interviews followed Brinkmann and Kvale’s (2015) guidelines. The respondents were also able to comment on the transcriptions of their interviews and the interpretations of the author. From a

data perspective, all interviews were both recorded and transcribed. The interview guides used for the interviews are presented in Appendices B and C. Similar steps were followed when coding the interviews for the analyses. Even though subjectivity remains in the analyses, another researcher could use the study to understand how the data were analysed and to benchmark another similar study.

Construct validity identifies the correct operational measures for the concepts being studied during the data collection phase (Ellram, 1996; Yin, 2014). Construct validity was strengthened in the longitudinal case study and the comparative longitudinal case study by collaborating with the co-authors of **Papers 2-5** in several phases of the data collection and data analysis in order to avoid misleading conclusions. Multiple sources were used such as interviews, observations, meeting minutes, notes, events, archival data, cost and revenue data, and all this evidence was converged. The data were registered in a protocol as suggested by Yin (2014) so the stakeholders' goals and interactions could be measured. The cost and revenues data were documented in a database using Microsoft Excel. This enabled the retrieval of particular pieces of data together with notes. Subsequently, the data were supplemented by what was found in the literature, which was also reviewed so that emergent concepts could be grounded in the existing data as far as possible (Cutcliffe, 2000). The construct validity was also strengthened by presenting the findings at the meetings and letting the participants review and comment upon them.

In the review of initiatives study (**Paper1**), the construct validity was strengthened by the author's choice to use both examples from practice to study the city logistics initiatives, and the implementation of the general business model supported by the academic literature.

External validity is equivalent to transferability or the generalisability of other researchers' findings in other contexts (Creswell, 2013). According to Mentzer and Flint (1997), external validity cannot be assured by a single case study, but the findings of a case study can inspire other researchers. However, the dissertation author agrees with the pro argument about the force of an example, as stated by Flyvbjerg (2006): "*good examples, extracted from a representative case, can provide enough knowledge to understand a broader reality*". This is in line with what Gerring (2004) stated about case studies: "*Indeed, the narrowest terrains sometimes claim the broadest extensions. Studies of a war are studies of war, studies of a farming community are studies of farming communities everywhere, studies of individuals are studies of humanity, and so forth*". According to Gerring (2004): "*One wishes to know both what is particular to that unit and what is general about it*". A case study is, in this sense, a piece of work in its microcosm but it still relates to a greater reality than what the case is connected to. Therefore, the study of SamCity in this dissertation is very suitable for city logistics as it provides examples and inspiration for other researchers.

According to Lincoln and Guba (1985), external validity is addressed by providing sufficient information about the context and the range of information collected. In all the empirical papers and in this dissertation, there is sufficient information provided on how the data were collected and the contexts. For instance, there is sufficient information about the selected initiatives and their contexts, the context of the case study protocol as well as about the interview respondents without disclosing their anonymity

but providing information about their roles in the initiatives and about the organisations they represent.

Internal validity refers to credible findings and interpretations (Lincoln and Guba, 1985; Creswell, 2013). To ensure internal validity, a researcher will mitigate personal bias and preconceptions when interpreting findings. To avoid finding only facts that confirm preconceptions and personal bias, the dissertation author used and triangulated multiple sources of evidence: interviews, observations, meeting minutes, notes, events, archival data, literature reviews, best practices reviews, webpages, reports. Some preconceptions were partly confirmed, but not totally, since the empirical evidence demonstrated that the respondents were aware of the need for viable city logistics initiatives and that the conflicting goals of stakeholders can be a barrier. According to Harrison et al. (2017), the goal of a research design that uses multiple sources for evidence is to develop a comprehensive understanding of the phenomenon studied.

Both case studies had a longitudinal design, which provided prolonged observations and engagement with the interviewees. The dissertation author tried to maintain iterative prolific discussions with the interviewees throughout with member checks (participants or respondents) and she also identified patterns in the interviews. As a result, she followed up by asking for feedback on her interpretations of the interviews. She also interacted with her colleagues and co-authors when she wrote the final results in the papers. Finally, she participated in industry meetings where she had the chance to present the findings of her empirical studies rather than only at academic conferences. By doing so, she was given feedback on her findings.

3 Frame of Reference

This chapter presents the literature that is of direct relevance to the research topic. A short background on business models is followed by a review of Osterwalder and Pigneur's business model. Then the importance of business models for city logistics research is discussed. The chapter concludes with the role of stakeholders in business model.

3.1 City Logistics

City logistics includes both urban freight distribution and the strategies that can improve its overall performance and efficiency while reducing congestion and environmental externalities (Rodrigue and Dabanc, 2017). Efficient city logistics creates more productive and attractive urban areas (Taniguchi, 2014) as it aims to optimally plan, manage and control the freight movements within a logistical network in an urban area by considering the interaction and collaboration among the stakeholders that are involved (Amaral et al., 2015).

City logistics is a diverse, complex system (Taniguchi et al., 2001; Quak et al., 2018; Browne et al., 2019) because it involves numerous components and interactions (Taniguchi et al., 2001). There is a high number of interconnected problems, challenges and potentials risks connected to this complexity, which has caught the attention of researchers (Anand et al., 2016).

As a result, the scope and focus of the research in the city logistics domain varies. What follows is a list of examples:

- Research on policy development (including rules and regulations) and its effects on city logistics systems (i.e. Stathopoulos et al., 2012; Comi et al., 2015).
- Research on policy development in correlation with the development of an efficient freight distribution system (Giuliano et al., 2013).
- Research on technical and technological solutions, where researchers have provided evidence that these can enhance city logistics performance (i.e. Quak, 2011; Browne et al., 2005; Taniguchi et al., 2018).
- Research on models and frameworks to evaluate city logistics initiatives as a whole (i.e. Rodrigue et al., 2017) and their financial performance (i.e. van Duin et al., 2016; Danielis et al., 2010; Gonzalez-Feliu, 2012).

- Research on the behaviour of stakeholders, key freight partnerships, global interest, transferability, company engagement and e-commerce (i.e. Lindholm, 2010; Lagorio et al.; 2016, Dabland, 2019).
- Research on living labs (i.e. Quak et al., 2016; Nesterova and Quak, 2016; Browne et al., 2019).
- Research on UCCs and freight movements considering environmental aspects (i.e. Yamada and Taniguchi, 2006; van Rooijen and Quak, 2008; van Rooijen et al., 2014; Verlinde et al., 2012; Björklund and Johansson, 2018; Browne et al., 2006; Paddeu et al., 2014).
- Research on business models (i.e. Malhene et al., 2012; Quak et al., 2014; Björklund et al., 2017).

However as Moen (2019) argues, the business model is one way to deal with this complexity. It is a strategic management tool that logs the components of the city logistics systems and can predict changes and interdependencies between them. The business model also includes:

- the scope and mission of the initiative (Cagliano et al., 2016).
- policies and strategies (Benjelloun et al., 2010).
- stakeholders' interactions (Zenezini, 2018).

Moen (2019) and Zenezini et al. (2018) state that viable city logistics initiatives are built on a sound business model.

3.2 What Is a Business Model?

A business model provides a thorough explanation of how an organisation can create, deliver, and capture value, in financial, social, cultural, environmental, accounting or other contexts (Nosratabadi et al., 2019). To that end, a business model is used to describe the business potential of an organisation or firm (Seddon et al. 2004; Osterwalder et al., 2005) and its business strategy (Clegg et al., 2017). A business model can also be used by key partners to explore the potential for future development or to adopt to future challenges (Geissdoerfer et al., 2018).

The current literature presents various frameworks on business models including: Margretta (2002), Teece (2010), Zott and Amit (2010), Osterwalder and Pigneur (2010), Lüdeke-Freund (2010), Garetti and Taisch (2012), Boons and Lüdeke-Freund (2013), Beattie and Smith (2013), Beltramello et al. (2013), Wirtz et al. (2016), Foss and Saebi (2017).

These perspectives and frameworks provide diverse interpretations of what a business model is. For Margretta (2002), Zott and Amit (2010), Beattie and Smith (2013), a business model is *“how a firm and/or an organisation does business”*. Whereas, for Teece (2010), a business model articulates how a firm or an organisation will convert key resources and key activities into value. Specifically, for Teece (2010),

a business model is the organisational and financial “architecture” of an organisation that includes implicit assumptions about customers and their needs, as well as revenue streams and cost structure. Zott and Amit (2010) take an activity-based perspective of the business model. They consider a selection of activities and their structure as well as who performs the activities. For a viable business model, Richardson (2008) proposes a consolidated view of the value proposition, the value creation and the value capture. According to Rasmussen (2007), a business model is normally concerned with how a firm or an organisation defines its competitive strategy through the products and/or services it offers to its market niche and customers.

Despite the varieties of views on what a business model is, scholars agree on four core components that should always constitute a business model: *value proposition*, *value creation*, *revenue streams*, and *customer relationships* (Osterwalder and Pigneur, 2005; Shafer et al., 2005).

Value proposition refers to the value a firm or an organisation promises to deliver to its customers when the customers purchase the firm’s products or services (Osterwalder and Pigneur, 2010). The value proposition can provide tangible environmental and/or social benefits in tandem with economic benefits (Boons and Lüdeke-Freund, 2013). Typically, the value proposition involves the product and service offering to generate profitability (Boons and Lüdeke-Freund, 2013). According to Johnson et al. (2008), there are four components of a value proposition: customers, revenue streams, key resources, and key activities.

Value creation shows how a firm or an organisation gains value by expanding on new market niches or encounter opportunities and new revenue streams (Beltramello et al., 2013; Teece, 2010).

Revenue streams represent the profit a firm or an organisation makes from their customers (Osterwalder and Pigneur, 2010).

Customer relationships are the type of relationships a firm or an organisation establishes with its specific customer segments (Osterwalder and Pigneur, 2010) and show how a firm can receive profits from the provision of goods, services and/or information to customers (Teece, 2010).

Osterwalder and Pigneur (2010) introduced a conceptualising approach to business modelling that they call the “*business model canvas*”. It consists of nine components presented as building blocks. They argue for the importance of the presence of all of the components for the viability of the model. The business model canvas is a lean, strategic management template for developing new business models and their content (DeReuver, 2013) or for documenting existing ones. The dissertation found that this more detailed categorisation of components as building blocks was necessary to meet the objectives of the research. The nine components are presented in the next section.

3.3 Business Model Canvas

Osterwalder and Pigneur’s business model canvas consists of a visual chart with nine components that describe four business areas: value proposition, infrastructure,

customers, and finances (Osterwalder and Pigneur, 2010). The nine components are illustrated in Figure 2.

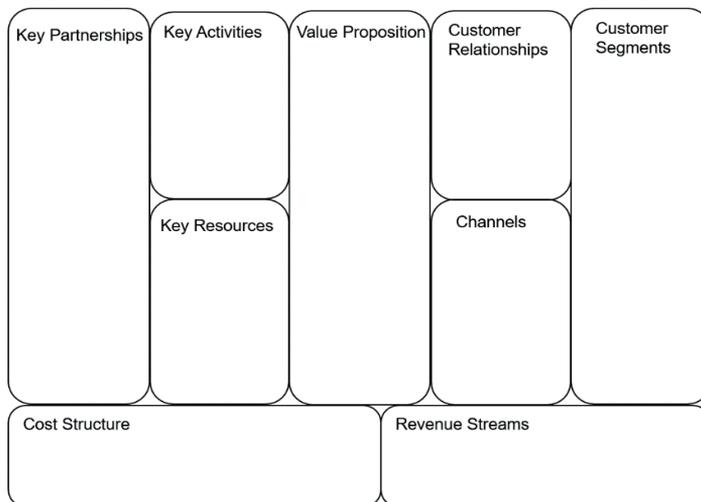


Figure 2. The nine components of Osterwalder and Pigneur's (2010) business model

The business model consists of the key partnerships that make it work. *Key partnerships* develop expertise, methods, processes, policies and structures that will form the business strategy. Since a company or organisation seldom owns all the *key resources* needed to perform every key activity, it needs to develop relations (partnerships) with key partners (other firms and organisations) that can provide the expertise.

Key activities are the most important activities resulting in the value proposition of an organisation. They include design, manufacturing, quality control, production, problem solving and network.

Key resources are all the necessary resources for a value proposition. They are an asset since they are needed to sustain a firm or an organisation and include knowledge, licences and access to customers. Specifically, they can be categorised as physical resources (manufacturing facilities, machines systems and distribution network), financial resources (stock holdings, checks), human resources (knowledge) and intellectual resources (brands, patents and copyrights).

A *value proposition* is a business and marketing statement that shows why a consumer should buy a company's product or use a service, according to Osterwalder et al. (2005).

An organisation or company can deliver its value proposition to its customers through *channels*. These channels distribute the value proposition in the most cost-effective way. It is important to understand which channel is optimal for a company to reach its customers.

In order to build a viable business model, an organisation must clarify which customers it tries to serve. Various sets of *customers* can be *segmented* based on their

common needs. Nevertheless, a company or an organisation must define the *customer relationship* they want to create with every customer. Without customers, no profit is to be had.

Cost structure describes the most important monetary consequences while operating under a business model. There are fixed costs that relate to all the expenses that remain the same regardless of the production volume, and variable costs that heavily depend on the volume of output that is produced. Usually, fixed costs are referred to as overhead costs, while variable costs are referred to as operational costs.

Revenue streams are the profits a company or an organisation makes from each customer. A business model distinguishes between one-time payment revenues and recurring revenues, both of which deliver the value proposition. The revenue streams can be generated in several ways such as from licencing, usage and subscription fees, marketing and advertising as well as from pricing mechanisms.

3.4 Business Models in City Logistics Literature

Business models have received substantial attention in the city logistics literature where it has increasingly been suggested that the business model is key to the success of viable city logistics initiatives (Benjelloun et al., 2010; Quak et al., 2014; Björklund et al., 2017; Moen, 2019; Zenezini et al., 2018).

The current literature generally frames the business model for city logistics initiatives in the context of a broad range of informal and formal descriptions that represent the initiative's core aspects (Benjelloun et al., 2010). These include the scope and mission of the initiative (Cagliano et al., 2016), policies and strategies (Benjelloun et al., 2010). The business model also revolves around the concept of the governance of the infrastructure and the different roles of stakeholders, such as municipalities, local governors and transport operators (Macário et al., 2008). According to Björklund et al. (2017), the owner of the business models should be defined. They state that it is critical to do this in order to define the roles of the stakeholders and the requirements of an initiative. The owner of the business model for city logistics should be either a stakeholder involved in the initiative (Browne et al., 2019) or a firm that uses the model (Björklund et al., 2017). To that end, Allen et al. (2015), Awasthi and Chauhan (2012); Malhene et al. (2012) and Österle et al. (2015) highlight three stakeholder groups as possible owners of the business model for city logistics because they are capable of implementing it: policymakers, freight transport firms, and receivers.

Several scholars report that the long-term survival of city logistics initiatives requires financially viable business models (Macário et al., 2008; Benjelloun et al., 2010; Quak et al., 2014) or redeveloped business models seeking to seize new and unexpected opportunities (Björklund et al., 2017). Benjelloun et al. (2010) demonstrate that a business model for city logistics needs to address crucial financial aspects that are related to the initiative's infrastructure and operations facilities, policies, management and core responsibilities. Björklund et al. (2017) complement this and indicate that a business model for city logistics needs to describe how an initiative can gain financial

benefits. This usually includes UCCs and value-adding logistics services (Nordtømme et al., 2015). These value-adding services include off-site stockholding, consignment, unpacking, preparation of products for display and price labelling and are important for making a business model for city logistics viable (Browne et al., 2011). Within this scope, Allen et al. (2014) state that a financially viable business model for city logistics should consider economies of scale. This is because the overhead costs of a city logistics initiative can be divided into many delivery units, such as parcels (Allen et al., 2014; Triantafyllou et al., 2014). The strategy for securing sufficient goods flows and enough customers is essential for the long-term success of a city logistics initiative (Finnegan et al., 2005).

A growing body of research addresses externalities in correlation with business model (e.g. TURBLOG, 2011; Quak et al., 2014; Ranieri et al., 2017). Although the cost of transport-related externalities is addressed and considered in several city logistics initiatives, TURBLOG (2011) stresses that these externalities represent not only a cost, but also a value proposition for the initiatives. To that end, TURBLOG (2011) and Quak et al. (2014) presented a business model for city logistics that was inspired by the business model canvas of Osterwalder and Pigneur (2010) in which externalities are considered a core component of the business model for city logistics.

Finally, several scholars have agreed that the value proposition should constitute the business model for city logistics (Pålsson, 2014; Benjelloun et al., 2010; Allen et al., 2014; Goldman and Gorham, 2006; Russo and Comi, 2011; Quak et al., 2014). Benjelloun et al. (2010) identify three major approaches to the value proposition for city logistics business models. The first approach corresponds to private initiatives. These involve unconstrained co-operation regarding consolidation and distribution among carriers with little involvement of governmental regulations and no subsidies and are supposed to become profitable due to increased logistical efficiency. The second approach is based on strict licencing practices where local and central governments play leading roles. The third approach is to make city logistics a public service where large trucks are not allowed in city centres. Allen et al. (2014) and Triantafyllou et al. (2014) demonstrate that the value proposition is in generating revenue streams that cover all the costs from key activities and key resources. This implies that an initiative should generate enough revenue by setting the right price on its services to cover the costs (van Duin et al., 2016). However, this will happen when the services offer something that has real benefits for the customers (Zenezini et al., 2018).

3.5 The Role of Stakeholders in Business Model

An appropriate business model for city logistics is foundational for stakeholders' involvement in the initiatives (Macário et al., 2008 and Zenezini, 2018). However, the business model as a concept fails to depict the dynamics of stakeholders at a firm or organisational level, and fails to guide in principle the decision-making of the stakeholders (Zenezini et al., 2018). This becomes even more cogent in cases where a broad network of stakeholders is included, such as in city logistics where several

stakeholders with diverse goals affecting the implementation of the initiatives are involved (Zenezini et al., 2018). Consequently, the business model for city logistics should include a design of the collaborative scheme that promotes the interaction between stakeholders (Zenezini et al., 2018).

City logistics initiatives include various stakeholders who often have conflicting stakes and goals for participating (Quak et al., 2018; CIVITAS policy note, 2015; Taniguchi et al., 2001). A synthesis of the categories of the stakeholders in city logistics results in five general categories: shippers, freight carriers, administrators, residents, and others (e.g. Barceló, 2005; Benjelloun et al., 2010; Taniguchi, 2001). Others can include NGOs and property owners (Benjelloun et al., 2010). The stakeholders share the same physical space and therefore interact, even though they do not have direct business relations (Lindholm, 2010).

Each stakeholder has a distinct role to play in city logistics initiatives (Awasthi and Proth, 2006; Gatta et al., 2018). Shippers are commonly interested in time and cost-efficient deliveries; freight carriers are interested in business and in performing cost-efficient deliveries; administrators are primarily interested in minimising the environmental impacts of city distribution and in achieving a vibrant and attractive city through financial performance; residents are affected by the city logistics solutions (Benjelloun et al., 2010); others (NGOs and property owners) play a key role in implementing city logistics solutions (Gatta et al., 2018). All these stakeholders interact with each other in a city logistics initiative and with the customers involved (Browne et al., 2019). The stakeholders' interactions are significant for implementing the key activities of a city logistics initiative (Quak, 2008; Browne et al., 2019).

Stakeholder interaction can facilitate efficient city logistics (Taniguchi and Tamagawa, 2005), form mutual goals, and strive in the same direction (Bertolini et al., 2005). Modelling the behaviour and thus the interaction of stakeholders has become important (Taniguchi and Tamawagawa, 2005; Holguin-Veras et al., 2015; Le Pira et al., 2017; Guerlain et al., 2019) because the individual stakeholder groups have different and most of the time diverse goals for participating in the initiatives and conflicts may arise (Taniguchi et al., 2001). Most of the conflicts are due to the diverse and conflicting goals of the participants and/or to the implementation of the city logistics provisions (Guerlain et al., 2019; Anand et al., 2012; Taniguchi and Tamagawa, 2005; Lindholm and Thalenius, 2006). Few studies have examined the interaction between stakeholders in city logistics, but the ones that have address the great challenges in implementing city logistics initiatives due to the diversity of the stakeholders and their conflicting goals (Alves et al., 2019; Guerlain et al., 2019; Anand et al., 2012; Taniguchi and Tamagawa, 2005; Lindholm and Thalenius, 2006).

4 Summary of Appended Papers

This section presents a summary of the appended papers. Each paper mainly addresses one of the research questions posed in Chapter 1. The papers contribute to the overall purpose of the dissertation.

4.1 Synthesis of the Appended Papers

Business models are increasingly suggested to be a key to the business success of city logistics initiatives (Moen, 2019; Zenezini et al., 2018). Business models are significant and broadly discussed and yet their components in terms of city logistics are the least understood (Björklund et al., 2017). This reflects a theoretical problem that complicates the implementation of business models for city logistics initiatives, resulting in a practical problem: the lack of viable initiatives.

The five appended papers have in different ways and from different perspectives elaborated on how to achieve viable city logistics initiatives. **Paper 1** describes how previous city logistics initiatives have considered the business model content. The challenges of a business model for city logistics vary according to its low profitability component, which can be increased through economies of scale (**Paper 2**), and through the inclusion of the cost of externalities in the overall transportation costs and revenues in the initiative (**Paper 3**). **Papers 4** and **5** elaborate on stakeholders' interactions. They present studies that investigate the types of interaction between stakeholders when implementing city logistics initiatives and their goals for participating. Together the five papers present a coherent picture of how to achieve viable city logistics initiatives. The combination of the findings from the papers are placed in the larger context of city logistics in Chapter 5.

4.2 Paper 1

Towards a conceptual business model for city logistics: A review identifying its content

Purpose

Various city logistics initiatives have been implemented, the results of which are showing a high risk of failure due business model limitations as one of the main reasons. Even though many initiatives have failed, there are several initiatives that have succeeded, which provide great learning exemplars. To increase this understanding, **Paper 1** reviewed how twenty city logistics initiatives have considered business models. These initiatives in practice have had different scope and different approaches in how to use and apply different business models. **Paper 1** aims to seek patterns from different business models for city logistics in order to describe a conceptual city logistics business models. In particular, the paper takes the business model canvas as the basis to study how city logistics considers and addresses the content of business models.

Findings

Paper 1 presents the content of the business model for city logistics that was extracted in the process of reviewing the initiatives. The content was derived by synthesising the extracted information. **Paper 1** summarises how each one of the twenty initiatives addressed the content of the business model by following the categorisation of the business model canvas and adding externalities as a final component. **Paper 1** has identified the core stakeholders that could be the owner of the business model. The business models of the initiatives differed because of the differences in stakeholder groups, type, scope and mission of the initiatives, customer focus, value proposition, cost structure, and revenue streams. Hence, these initiatives represent different types of business models that also considered the different characteristics and needs of the cities resulting in solutions and approaches to similar problems, such as the reduction of negative environmental impact.

Implications

The description of the business model components led to the creation of a conceptual business model for city logistics that captures the key business entities of the initiatives. The conceptual business model summarises the empirical evidence of the content of business models for city logistics. This helped to draw conclusions about the content. The **Paper 1** findings can assist practitioners in the implementation of the business model in their respective initiatives and in exploring the business potential of the initiatives. When practitioners are brainstorming on how to implement a city logistics initiative, they can run a preliminary test of the business model. Such a test provides guidance to new opportunities or challenges and is a means of improving the business model.

4.3 Paper 2

Viable Business Models for City Logistics: Exploring the Cost Structure and Economy of Scale in a Swedish Initiative

Purpose

The long-term survival of city logistics solutions requires viable business models that also consider financial feasibility. To that end, **Paper 2** investigates the relative importance of various cost, revenue and goods volume variables for the profitability of a city logistics initiative. A better understanding of these variables can help measure the current conditions and analyse the financial requirements in various scenarios under different conditions.

Findings

Paper 2 presents a detailed cost structure for SamCity and emphasises the processes and activities for which the initiatives need to be financially viable. The findings indicate that the key to cost efficient city logistics is efficient terminal handling. A specific insight for SamCity to achieve total cost efficiency is to focus more on terminal efficiency in the UCC than on distribution efficiency. **Paper 2** also presents new insights into the economy of scale for viable business models for city logistics. A sensitivity analysis highlights the impact of goods volumes and pricing on the financial performance of the business model.

Implications

Paper 2 presents a detailed cost and revenue structure for SamCity. This has increased the knowledge of revenue streams and cost structures of city logistics initiatives because it emphasises the processes and activities in which city logistics initiatives need to be efficient. **Paper 2** also presents new insights into economy of scale for viable business models for city logistics. In the SamCity case, key to cost-effective city logistics is to be efficient in terminal handling in the UCC. Further, in the SamCity case, the UCC represented about 75% of the operational costs, whereas the delivery costs represented about 25%. It would be financially beneficial if the goods in the UCC can be integrated with other goods to obtain economy of scale. Practitioners should embrace the fact that each city has its own characteristics. But the general patterns for economies of scale, the break-even point, and the cost and revenue structures of this case contributes to an overall understanding. The paper can assist practitioners in planning and setting up their cost structures in other city logistics initiatives.

4.4 Paper 3

Environmental Impact and Costs of Externalities of Using Urban Consolidation Centres: A 24-hour Observation Study with Modelling in Four Scenarios

Purpose

The literature presents a considerable number of practical experiences of UCCs and some estimates for reduction of vehicles. Still, there is limited knowledge about the potential reduction of negative environmental impacts and the related externality costs of consolidation. **Paper 3** evaluates the environmental impacts of consolidation in four scenarios of combinations with and without of a UCC and a micro-terminal. It aims to estimate and discuss how the transport-related externalities in the different combinations can be included in the financial evaluation of city logistics.

Findings

Data regarding all freight deliveries and freight vehicle movements within the city centre were acquired for a week. The data captured unique vehicle registration in a 24-hour period. **Paper 3** identifies patterns in the environmental impact and the costs of externalities of consolidating urban freight in a micro-terminal, either with or without a UCC. The results show that the costs of externalities follow patterns similar to the environmental impact in the case of SamCity: the highest reduction in the costs of externalities is when a micro-terminal is combined with a UCC. The results show that there can be a substantial reduction of the costs of externalities with the implementation and use of the UCC and the micro-terminal. Including this cost reduction in a business model for city logistics increases the likelihood for a financially viable business model. Thus, the costs of externalities are considered to be a critical factor for viable business models for city logistics. **Paper 3** presents estimates and discusses how the transport-related externalities can be included in the financial evaluation and business models for city logistics.

Implications

Paper 3 increases the understanding of costs of externalities related to consolidation in a UCC and micro-terminal by quantifying the reduction in these costs in the four scenarios. It also estimates and discusses how transport-related externalities can be included in the financial evaluation and business models of city logistics. From a practical point of view, the four scenarios provide insights into the effect of consolidation on the environmental impact of city logistics in different set-ups of a UCC and micro-terminals. **Paper 3** also shows that the environmentally preferable set-up is to combine a micro-terminal with a UCC.

4.5 Paper 4

Importance of Stakeholders' Interaction: Comparative, Longitudinal Study of Two City Logistics Initiatives

Purpose

Stakeholders move the initiatives from inception to successful completion through their decisions and actions. Hence, the interaction between them is important and needs to be further explored. The study presented in **Paper 4** does that. It explores the importance of stakeholders' interaction in the different stages of the implementation process, and assesses the extent to which interaction can vary between two apparently similar city logistics initiatives.

Findings

The analysis revealed a variety of patterns of stakeholders' interaction. They ranged from rather classical ones with limited stakeholders' interaction, to complex collaborative ones. The analysis also identified six criteria for stakeholders' interaction: knowledge dissemination, consultation, stakeholder diversity, stakeholder interest, existing collaborations, and information. In particular, the findings show that more intense interactions were needed at the beginning or end of the different stages of the implementation process in order to raise awareness, to jointly frame the problem, to make decisions, and/or to bring the results to fruition.

Implications

The patterns of stakeholders' interaction, as well as the six criteria provide insights on how to engage stakeholders and establish interactions between them. More precisely, it showed how the interaction affects the outcomes of the initiatives, the decision-making process, and hence, the implementation process as a whole over time. **Paper 4** also demonstrates the dynamics of stakeholders' relationships, which are essential for the viability of the initiatives.

4.6 Paper 5

A Multi-Criteria Decision Model for Stakeholder Management in City Logistics

Purpose

The study presented in **Paper 5** develops a multi-criteria decision model to support stakeholder management in city logistics by prioritising among the diversity of their goals. **Paper 5** discusses the relative importance of stakeholders' goals and the value concerns that need to be considered for each stakeholder. This is numerically evaluated by the analytical hierarchy process method in order to rank alternative goals and their importance in a stakeholder value matrix.

Findings

Paper 5 describes the development and application of a multi-criteria decision model to support stakeholder management in city logistics by prioritising among the diversity of stakeholders' goals. The decision model was applied and tested in a longitudinal case study of a city logistics initiative in Sweden with ten stakeholders. The study confirmed that the goals need to be fulfilled to various extents for the different stakeholders. The decision model also shows that the stakeholders are interested in similar goals to a great extent, but their focuses vary. Overall, the multi-criteria decision model showed that for SamCity, the single most important goal was the municipality's desire to improve the environmental efficiency of freight transport in the city. The second most important was to reduce the number of trucks in the city and make use of smaller ones. The results showed that transport providers need to obtain economic efficiency and that stores need economic efficiency and high delivery quality.

Implications

The proposed multi-criteria decision model provides a structured approach to managing multiple stakeholders in city logistics and their goals. The model helps to identify the overall goals that need the most attention and which ones need to be considered for each stakeholder and to what extent. This paper presents a multi-criteria decision model for stakeholder management in city logistics, something that is lacking in the literature.

5 Discussion of Research Findings

This chapter addresses the business model for viable city logistics initiatives based on reflections of the main findings of the research relative to the research purpose and research questions presented in Chapter 1. The chapter follows the logic of the research questions. A discussion about the content of the business model is followed by a discussion about the cost and revenue structure and the economy of scale. The role of externalities in the business model context is also discussed. The chapter concludes with a discussion about the stakeholders' interaction.

5.1 The Content of Business Models for City Logistics

A business model should capture the key business entities (i.e. stakeholders, concepts, events), as well as the relationships between them (Nosratabadi et al., 2019; Geissdoerfer et al., 2018). Based on that argument, this research demonstrates that a business model for city logistics should facilitate the interaction between stakeholders, provide a structure for the entities of the initiatives, and be flexible in adaptations. A continuous reflection on up-to-date information, challenges and the organisational needs of the initiatives is necessary, and provides a structure for the entities of the initiatives. A business model should also enhance the understanding of the city logistics systems.

The findings of **Paper 1** indicate that the business model is context dependent and when brought into the setting of new city logistics initiatives, it needs to adapt to the business or organisational environment of the initiatives. As Mazzarol and Reboud (2019) stress, a business model cannot work immediately in every setting, so adaptations are required. This means that the business model can be implemented in a different scope, engaging all sub-systems within the city logistics system, which is in line with the propositions of Macário et al. (2008). According to findings of **Paper 1**, these adaptations are related to the different needs of the initiatives – such as the need to include particular customer segments or to adapt to technological changes – and to the particular characteristics and needs of the cities.

The **Paper 1** findings show that the content of the business model is also determined by its owner, another reason why the business model varies among city logistics initiatives. Even if the owner was the same stakeholder group in all initiatives (e.g. local governors), variations would still occur in the business model. This is due to the different perspectives they have on how to implement city logistics and meet the characteristics and needs of the cities in which the initiatives are implemented. Thus,

the identification of the owner of the business is core to understanding the strategies for determining the requirements and the roles of the stakeholders and the scope of the initiatives. In this regard, the owner of the business model can also be determined by the degree of their participation in making business decisions and resource ownership (Björklund et al., 2017).

A business model for city logistics needs to be adapted to fit the conditions in the organisational settings. Thus, to make a real transition in city logistics, a business model needs to include relevant components and define their content. This is in line with Quak and Tavasszy (2011) and Björklund et al. (2017). Both stated that the components of the business model for city logistics are significant for the viability of the initiatives.

To that end, **Paper 1** provided a detailed overview of how twenty city logistics initiatives have considered the content of the business model. This led to the creation of a conceptual business model for city logistics. In the business model, the initiatives determine:

- Who should be their key partners.
- What other partnerships they need to form.
- How responsibility should be shared among collaborating stakeholders.
- What will become the main source of revenue.
- Which consumer segment city logistics should focus on.

The content of the business models also has a significant impact on city logistics initiatives' preparedness for the economic, political and technological changes they constantly meet.

The business model canvas was used to investigate the business models of these initiatives. Hence, **Paper 1** builds on the use of Osterwalder and Pigneur's (2010) categorisation in the business model canvas and presents the content of the business model relevant to city logistics. In particular, it describes each component presented in the canvas, with the externalities, being the final one, which according to TURBLOG (2011) and Quak et al. (2014) should be a tenth component for business models for city logistics. To that end, Section 5.2 provides more insights into the cost structure and revenue streams of a business model for city logistics and presents patterns for other initiatives to imitate. Section 5.3 provides more insights into the role of externalities in the business model context. Section 5.4 presents the role of the stakeholders in the business model for city logistics.

Finally, **Paper 1** reports that the business models of the initiatives studied differed due to differences in core stakeholders, type, scope and mission of the initiative, customer focus, value proposition, and cost structure and revenue streams. Hence, these initiatives represent different types of business models. They also considered the different characteristics and needs of the cities resulting in solutions and approaches to similar problems (e.g. the reduction of negative environmental impact). According to Creswell (2013), the sample is good to illicit perceptions and draw general outcomes about the components and the content of the business models that lead to the creation of a conceptual business model for city logistics.

5.2 Cost, Revenue Structure and Economy of Scale

Research on financially viable business models for city logistics is limited. Most of the studies focus on technical and operational feasibility, whereas the financial considerations are limited (Quak et al., 2014; Melo and Baptista, 2017; Brotcorne et al., 2019). The starting point of this research is that the current literature indicates that the long-term survival of city logistics solutions requires viable business models that consider the revenue streams and cost structure (Quak et al., 2014). But only 4% of the previous city logistics initiatives provide a cost-benefit analysis (Gonzalez-Feliu, 2012). However, the studies conducted on the revenue streams and cost structures of business models for city logistics highlight the need for economy of scale (Allen et al., 2014). This includes the necessity of critical goods volume in order to generate sufficient revenues and to minimise the fixed costs per delivery unit (Brotcorne et al., 2019).

This research increases the knowledge of revenue streams and cost structures of city logistics initiatives. In particular, it provides insights into the relative importance of cost and revenue variables, and variables that determine the economy of scale. The analysis includes costs and revenues for consolidating and delivering both private and municipal goods through a UCC to stores and municipal facilities in the case of SamCity; both costs and revenues for private goods were evaluated, while the municipal goods were mainly evaluated based on costs since the revenues came from a subsidy. The initiative attracted a number of stores to use the consolidation services; hence the results of the analysis are promising. This provides insights into the value proposition in business models for city logistics because the variables can be used to measure current conditions and can be altered in a sensitivity analysis to forecast the financial effects. This can be done in order to provide insights for many initiatives into the potential for profitability. To that end, the findings provide practical insights into the profitability of SamCity. Its profitability was estimated in order to evaluate the initiative's ability to generate earnings compared to its costs during the six-month pilot implementation study. The cost-benefit analysis of SamCity that was carried out at that time provides good insights into the circumstances and assumptions under which the initiative could be financially viable. The current literature revealed that although several of the initiatives have shown interesting results in the pilot implementation phase, they were unable to survive once the support from public subsidies stopped (Gonzalez-Feliu, 2008). This makes them financially unviable. According to Lin et al. (2016), financial viability is important for scaling up initiatives. Hence, the general patterns for the cost and revenue structures and profitability of SamCity case can provide practitioners in other city logistics initiatives with a holistic perspective and assist them in planning and setting up their cost structures. Practitioners can also gain support from SamCity regarding the pricing levels and costing structure.

The study of SamCity shows that the relationship between goods volumes and profitability is not linear. This shows that the goods volume needed to achieve economy of scale, and for which goods volumes the effect of economy of scale levels off. In the case of SamCity, it was more important to prioritise efficient handling in the UCC over efficient distribution to achieve a viable business model. This was because its cost

structure distinguished between costs for the UCC and the deliveries, and costs for overhead. The first category consisted of about 75% urban consolidation costs and 25% delivery costs. Thus, in the study presented in **Paper 2**, the attempt was to combine private and municipal parcels in the UCC to increase the total goods volume. In the business model context, this also means that in the beginning of this curve the subsidy is important and continues to remain important until the scale up of the initiatives is managed.

However, adding logistics services to the initiative further on would potentially enable a reduction in the delivery prices, thus making the initiative more financially attractive for customers. This is in line with the findings of Browne et al. (2012) who demonstrated that logistics services are often viewed as a means to generate a flow of finances and are also able to reduce the negative outcomes of freight transport. The benefits and costs of the valued-added services are transparent to the stakeholders (van Duin et al., 2016). In that sense, such value-added services are important in terms of business models and are often viewed as a means to generate a flow of finances in the form of payments from the stakeholders who benefit from them (Browne et al., 2011).

As mentioned in Section 5.1, the ability of the business model to adopt new organisational and business conditions is important. This adaptation can both attract more customers and provide new and/or innovative services, hence leading to economy of scale. Benjelloun et al. (2010) demonstrated that managing the responsibility of both the strategic and operational sides of city logistics initiatives is critical in order to achieve financial viability in them. This can also be achieved by adjusting the business model to the characteristics or policies (including rules and regulations) of the specific cities in which the initiatives are implemented.

Overall, the findings provide insights on how other city logistics initiatives can plan and set-up their cost structures and cost levels. Since the private goods volumes were low in the SamCity, meaning that the fixed costs had to be distributed among a few parcels, the profitability per parcel is likely to increase in a full rollout with more goods. Finally, the findings of the SamCity case study increased the understanding of the cost structure of city logistics initiatives and showed that the economy of scale and cost structure are not linear. But in order to gain further understanding, the insights gained in the SamCity case need to be tested in more city logistics initiatives to gain a holistic perspective.

5.3 The Role of Externalities in a Business Model for City Logistics

In order to tackle the challenge of coming up with financially viable business models for city logistics, this research shows that the cost of externalities needs to be included in the evaluation of city logistics. This is something uncommon for city logistics (Bakos et al., 2012; CIVITAS, 2017; TURBLOG, 2011). By including the costs of externalities

in the business model, the model is more likely to be financially viable. Including the costs would also better reflect reality (Björklund et al., 2018).

This research identifies patterns in the environmental impact and the costs of externalities of consolidating urban freight in different set-ups where a micro-terminal and a UCC were used in different combinations. A challenge in using a UCC is to absorb increased costs from terminals, vehicles and administration. One way to cover these increased costs is to compare the costs of externalities in the overall financial evaluation of a city logistics initiative. More precisely, in **Paper 3**, the reduced costs of externalities were calculated in the different consolidation set-ups, which adds new insights to the understanding of the relative financial potential of these costs.

There can be a substantial reduction of the costs of externalities with the implementation and use of a UCC and a micro-terminal. Including this cost reduction in a business model for city logistics increases the likelihood of a business case and, accordingly, a financially viable business model. Thus, the costs of externalities are a critical factor for viable business models for city logistics, and should be added to the seven critical factors for viable business models identified by Björklund et al. (2017). In an evaluation of other city logistics initiatives that use different consolidation set-ups, the reduced costs of externalities in each combination should be compared to the additional costs of terminals, personnel, vehicles and administration in the same set-up.

The **Paper 3** findings increase the understanding of costs of externalities in urban consolidation and can assist other initiatives. Previous literature has only identified ways to reduce these costs through consolidation and reduced traffic congestion (CIVITAS, 2006; Browne et al., 2007; CIVITAS, 2012; de Marco et al., 2016), but have not provided patterns for this reduction for different consolidation set-ups. Specifically, in the case of SamCity, the reduction of costs of externalities and the reduction of environmental impact follow similar patterns. This indicates that the highest reduction in both the costs of externalities and environmental impact is when a micro-terminal is combined with a UCC. However, given that the different environmental indicators (CO₂, NO_x and PM) have different levels of reduction and different costs per kilogram, the pattern of the reduction in the costs of externalities is somewhat different from the pattern of reducing the negative environmental impact.

Nevertheless, the analysis conducted in **Paper 3** for the two different consolidation set-ups (1. a micro-terminal combined with a UCC, or 2. a micro-terminal with external consolidation in the transport providers' respective terminals) indicated that both were financially feasible. Compared to the current situation of no consolidation in the city, the findings showed that the greatest reductions of both the environmental impact and the costs of externalities were in the first consolidation set-up. In the second set-up, both the environmental impact and the costs of externalities decreased by approximately half compared to only using a UCC. Only implementing a micro-terminal increased both the environmental impact and the costs of externalities compared to the current situation of no consolidation. However, no matter what the consolidation set-up of city logistics initiatives, the externalities should be included in the business model because they reduce the overall costs of the initiatives. The SamCity findings increased the understanding of the cost of externalities and environmental impact, but for greater

understanding, these insights need to be tested in more city logistics initiatives and in quantitative studies to gain a holistic perspective.

From a practical point of view, this provides insights into the effect of consolidation on the environmental impact of city logistics in different consolidation set-ups. It also contributes to the challenge of reducing vehicle movements and externalities in the urban area. Consolidating freight in the UCC and the micro-terminal can reduce the calculated distance travelled. This can also be insightful for policymakers in their efforts to develop policy measures that correspond to the costs of externalities.

5.4 Stakeholders' Interaction in a Business Model for City Logistics

We need to understand the interactions between stakeholders and their goals for participating in initiatives before city logistics activities can be implemented and evaluated. Different stakeholders can hold different points of view to improve the whole system and conflicts of interest can arise (Taniguchi et al., 2001). Due to the complexity and the challenges of city logistics systems, conflicts between the different stakeholders are common (Holguin-Veras, 2015). Many of the conflicts arise due to their diverse and heterogenic goals (Taniguchi and Tamagawa, 2005; Anand et al., 2012; Taniguchi, 2014; Alves et al., 2019; Guerlain et al., 2019) that can be barriers for stakeholders' interaction (Taniguchi, 2014). A lower degree of heterogeneity in terms of goals among the stakeholders will increase the likelihood of a successful business model (Evans et al., 2017). The likelihood will also increase if more stakeholders interact and share more knowledge (Evans et al., 2017). Thus, this research uses this as a motive to further study stakeholders' interaction and to develop a multi-criteria decision model for stakeholder management in relation to the business model for city logistics. In particular, there is an emphasis on the importance of the interaction between the stakeholders and their different needs and constraints.

This research shows that stakeholders continuously interact with each other and this reflects not only their behaviour but helps them form mutual goals as they strive in the same direction. This is a concretisation of the Lindholm et al.'s findings (2013), where they demonstrated that key freight partnerships have fostered mutual understanding among stakeholders for city logistics. It is also in line with the findings of Quak et al. (2016) that stakeholder interaction is a success factor for achieving viable city logistics initiatives. They state that without a common understanding of how stakeholders interact, it can be difficult to achieve long-term solutions for city logistics.

To that end, the findings of **Paper 4** reveal a variety of patterns of stakeholders' interaction. These patterns range from rather classical ones with limited stakeholders' interaction, to complex collaborative ones in which stakeholders were part of the team that framed the problem and made the decision. The analysis identified six promising criteria for stakeholders' interaction: (1) *knowledge production*, (2) *consultation*, (3) *stakeholder diversity*, (4) *stakeholder interest*, (5) *existing collaborations*, and (6)

information. The **Paper 4** showed that some criteria call for consistently lower or higher intensity of interaction, while others call for varying intensity according to the needs of the implementation process of city logistics initiatives.

The research also reveals that relevant stakeholders may not always be engaged to sufficient degrees in city logistics initiatives, something that supports the findings of Hu et al. (2019) and Brotcorne et al. (2109). This lack of engagement creates difficulties in the implementation of the business model as well as in the decision-making process. For instance, in the SamCity and Stadsleveransen initiatives, the municipalities did not consider the involvement of the transport providers in the decision-making process and thus disregarded their prerequisites in urban development. The municipalities only considered them for the implementation of certain activities, such as freight transportation. According to Browne et al. (2007) this can happen in many initiatives because transport providers are considered to be more of an obstacle to decision-making than a core stakeholder group. The key findings presented in **Paper 4** are that city administrators and the managers of the initiatives should be unbiased, should maintain a balance between the different stakeholders, and should understand how these stakeholders can facilitate the implementation of the activities of city logistics and of the business model. Acting this way will encourage the stakeholders' interaction and form dynamic relationships between them.

Multi-criteria Decision Model

Key findings of the research show that stakeholders involved in a city logistics initiative have different levels of competencies and varying degrees of influence on the business models. This creates a relative complexity in the business model. This is why the interaction and the goals of stakeholders need to be managed in the context of the business model. For that reason, this research developed a multi-criteria decision model for stakeholder management.

The multi-criteria decision model makes it possible to determine the extent to which each stakeholder needs to be considered in city logistics initiatives. The model identifies the overall goals that need the most attention and the goals that need to be considered for each stakeholder and to what extent. Thus, it enables the managers of city logistics initiatives to manage the stakeholders involved and shows that a deeper understanding of their goals is required for their long-term participation. The decision model complements other decision models used in the current literature because it highlights that what is key to understanding the inefficiency of decision-making in city logistics is to understand the way the heterogeneity of goals.

The multi-criteria decision model also helps decision makers to follow a logical path by guiding both strategic and operational decisions in the direction of fulfilling the overarching goals of the city logistics initiative. This can affect the urban freight systems and the public sector, which has a major role in developing policies, rules and regulations for city logistics initiatives according to Taniguchi (2014).

The multi-criteria decision model was applied in the SamCity initiative and can assist other initiatives in doing the same. In SamCity, the application showed that the goals

cannot always be aligned. The study considered the findings of other studies (i.e. Banister, 2005 and OECD, 2003) stating that as a starting point, the stakeholders' goals need to be fulfilled to various extents in order to achieve a viable initiative. A multi-criteria decision model was created to support the accomplishment of this. Stakeholders with their diverse goals undoubtedly create forces in city logistic initiatives that affect its business potential (Taniguchi, 2014) as well as the business model implementation (Evans et al., 2017). Stakeholders are able to shape the business model according to their goals, interests or ways of interaction. Because of this, the multi-criteria decision model applied in the business model context can help co-ordinate the stakeholders' goals and facilitate the interaction between them. To that end, the multi-criteria decision model provides a platform for communication between stakeholders about incompatible goals and helps find a balance between various stakeholders and their goals. Overall, the knowledge that is gained from the multi-criteria decision model is in the form of information about the extent to which the stakeholders and their goals should be addressed and managed in the business model context. The knowledge gained from the decision model showed that the stakeholders were interested in similar goals to a great extent, but their focuses vary.

6 Conclusions and Future Research

This chapter concludes the dissertation and outlines its theoretical and practical contributions. As a final step, directions for future research are presented.

6.1 Concluding Remarks

The research supports the idea that the business model for city logistics assists in the fundamental reconception of viable city logistics initiatives. Based on the knowledge gained from past research in the area, this dissertation has increased the understanding of the financial continuity, of how to include externalities, and of the role of stakeholders in business models for viable city logistics initiatives.

The analysis conducted in this research confirms that logistics needs to include relevant components and to define their content. Knowing what a business model is and the types of different models that exist is the basis, of course, but in order to move towards creating a conceptual business model for city logistics requires the identification of its content. The nine components of the business model canvas together with externalities as a tenth, were combined to create a complete overview of a conceptual business model for city logistics. Each component and its content are at the core of the construction of an overall business model for city logistics initiatives.

The research increases the knowledge of revenue streams and cost structures of city logistics initiatives. In particular, it provides insights into the relative importance of cost and revenue variables. A specific insight from the SamCity initiative that can assist other initiatives in working toward total cost efficiency is to focus more on terminal efficiency in the UCC than on distribution efficiency. This implies that it would be financially beneficial if the goods in the UCC can be integrated with other goods to achieve economy of scale.

The research also shows that the cost of externalities needs to be included in the evaluation of city logistics to increase the financial viable of the business model. To this end, the research identified patterns in the environmental impact and costs of externalities when consolidating urban freight in the different consolidation set-ups. This showed that no matter what the consolidation set-up of city logistics initiatives, the externalities should be included in the business model because they reduce the overall costs of the initiatives. This contributes to the challenge of negative environmental impact and externalities in the urban area, which in the current literature is usually assumed without further analysis or quantification.

Stakeholders' interaction is important for the implementation of city logistics initiatives as it reflects stakeholders' behaviour and can lead to aligned motives and goals. This can help stakeholders strive in the same direction as they avoid the conflicts and implement effective solutions for city logistics. For that reason, the research identified a variety of patterns and six promising criteria of stakeholders' interaction. It also developed a multi-criteria decision model for stakeholder management in the context of a business model. The research shows that according to the needs of the implementation process of city logistics initiatives, the patterns and the criteria of interaction varied, several of them called for a consistently lower or higher intensity of interaction, while others called for varying intensity. To that end, the multi-criteria decision model makes it possible to determine the extent to which stakeholders interact and to which each stakeholder and their goals need to be considered for city logistics initiatives. This enables the management of stakeholders in city logistics initiatives, and shows that a deeper understanding of the stakeholder's goals is required for their long-term participation in a city logistics initiative.

6.2 Contributions

Because the field of city logistics is just emerging, knowledge is required that connects the relevant existing studies and their overall contributions. This research has added to the scientific and practical knowledge by investigating the business model in city logistics.

6.2.1 Theoretical Contributions

One contribution has been to specifically describe how the business model can contribute to viable city logistics. The research findings demonstrate how the business model captures the key business entities, such as cost and revenue structures, economy of scale, cost of externalities and stakeholders' interaction, as well as the relationships between these entities.

Another contribution is the identification of the content of a conceptual business model for city logistics, and how the content leads to the model's creation. Such a model needs to be adapted to fit the conditions in the city logistics initiatives' organisational settings. This complements the gap identified by Björklund et al. (2017) that in order to make a real transition in city logistics, the business model needs to define its content.

A third contribution is new knowledge from the detailed SamCity cost and revenue structure. It emphasises the processes and activities in which city logistics initiatives need to be efficient. New insights into economy of scale for viable business models for city logistics are presented. The cost structure in **Paper 2** helps to better understand how it is affected by economy of scale. A key to cost-effective city logistics is to be efficient in terminal handling in the UCC. This is in line with Allen et al. (2014) and Triantafyllou et al. (2014) who demonstrated that the strategy for securing sufficient goods flows and

enough customers is essential for achieving economies of scale and the viability of city logistics initiatives. The findings also indicate that there can be a substantial reduction of the costs of externalities as a result of efficient consolidation. This cost reduction for city logistics increases the likelihood that the business model will be financially viable. Thus, the costs of externalities is a critical factor for viable city logistics business models and can be added to the seven factors identified by Björklund et al. (2017).

Still another contribution of the research is that it identifies the patterns of the stakeholders' interaction as well as the six criteria for stakeholders' interaction during the different stages of the implementation process. There was a variety of patterns of stakeholders' interaction, ranging from classical patterns with limited stakeholders' interaction, to complex collaborative ones. The prerequisites for implementing city logistics solutions is stakeholders' commitment and a comprehensive understanding of the relationship dynamics between stakeholders and how they can be involved in the decision-making process. This can determine both their level of interaction and the dynamics of their relationships.

Finally, to fill the gap in the literature about stakeholder management in city logistics (a gap identified by Awasthi and Proth, 2006; Stathopoulos et al., 2012), the research proposes and tests a multi-criteria decision model based on stakeholder theory and analytical hierarchy processing. The decision model is a novel way to understand the multiple stakeholders in city logistics and their goals. It ranks the relative importance of the goals that need to be considered for each stakeholder. It thus offers a structured approach to prioritising because it enables stakeholders' management from a holistic perspective through systematic rankings and comparisons of relative importance.

6.1.2 Practical Contributions

Practitioners, policymakers and policy planners can find evidence to strengthen and stimulate the development of new and improved guidelines that are helpful for the implementation of city logistics initiatives.

Key research findings show that practitioners can implement business models in their initiatives, models that will assist in exploring the business potential of the initiatives. To implement a city logistics initiative, practitioners can preliminarily test the business model when brainstorming and improve it so that it can provide guidance to new opportunities or challenges. Practitioners can get ideas from the content of the business model described in **Paper 1**.

The research findings provide practical insights into the profitability of the six-month pilot implementation of SamCity. Practitioners should embrace the fact that each city has its own characteristics, but the general patterns for economy of scale, the break-even point and the cost and revenue structures of the SamCity case provide an overall understanding. **Paper 2** can assist practitioners in planning and setting up their cost structures. The curve in Figure 4.3 in **Paper 2** is helpful in showing the goods flows necessary for economy of scale with their costing and revenue figures. This gives insight into the goods volumes needed for profitability, the effects of further increases in goods volumes, and the profitability sensitivity for goods volume reductions. A specific insight

is to focus more on terminal efficiency than on distribution efficiency for total cost efficiency. It would be financially beneficial if the goods in the UCC can be integrated with other goods to obtain economy of scale. In SamCity, the intention was to obtain economy of scale by combining private and municipal goods. Practitioners can gain insights on how to manage efficient terminal handling.

The key findings of the research provide insights into the effect of consolidation on the environmental impact of city logistics in different consolidation set-ups. This contributes to the challenge of reducing vehicle movements and externalities and their costs in urban areas. Consolidating freight, for instance, in the UCC and the micro-terminal and distributing the same amount of freight can also reduce the calculated distance travelled by the vehicles. This provides insights into the policymakers who can then develop policy measures that correspond to the costs of externalities. Through this, the actors implementing a UCC and/or a micro-terminal can reduce the costs of externalities.

The outcomes of the research can help practitioners to facilitate interaction between stakeholders and co-ordinate their conflicting goals. This in turn contributes to an increased viability rate of city logistics initiatives. This can help the managers of initiatives to create a communication and network strategy for stakeholder engagement. The specific insights of **Paper 4** provide a guideline for stakeholder interaction that is applicable to other city logistics initiatives. The multi-criteria decision model can also help practitioners to co-ordinate goals and facilitate interaction between stakeholders. Initiative managers can apply it to find a balance between various stakeholders and their goals. The outcomes of SamCity show that the multi-criteria decision model in **Paper 5** helps to make informed trade-offs between stakeholder goals and the extent to which various goals should be prioritised. Thus, the decision model provides a platform for communication between stakeholders about incompatible goals.

6.3 Future Research

There are a number of interesting paths for future research to follow.

This research focused on the content of the business model without considering external influences. Future research can look into the external influences on the business model and also do this in combination with the stakeholders' influences. For instance, researchers could investigate the wider political, social, technological and economic changes required to make the business model "mainstream", and how the business model may evolve and be configured accordingly over time. Future research could apply agent-based modelling to the business model in line with other research topics that aim to set the theoretical foundation for enhancing the evaluation of city logistics initiatives, both qualitatively and quantitatively (i.e. Zenezini et al., 2018; Moen, 2019; Dablanc, 2019; Browne et al., 2019). Agent-based modelling is a suitable simulation tool to integrate the proposed business model by modelling city logistics through a set of inter-connected stakeholders and their mutual goals.

A limitation of this research is the number of the stores involved and their proximity. A future study could examine the spatial area of the city where the initiatives have been implemented to see how efficient it is to deliver to all the stores, since their number is related to the number of parcels being delivered. This involves comparing the total cost against the total expected benefits. The research highlights the relative importance of financial and goods flow variables. This can help understand the challenges of achieving a successful city logistics business model. The critical variables identified in this research constitute an important point of departure for future research that aims to provide deeper insights into why some initiatives fail by thoroughly investigating those cases instead of the successful ones.

Inspired by the different consolidation set-ups, future research can investigate the relation of goods flow and the different consolidation set-ups for a longer period of time or in a number of cities. This type of research can provide general statistics on the environmental impact, the costs of externalities and the effects on vehicle kilometres and number of vehicles responsible for freight consolidation. This would also capture the picture of the entire route of vehicle movements and create a more realistic image of the freight flows and vehicle movements in the city centre. To that end, a spatial analysis or spatial statistics would help to gain a broader understanding of the general situation and of the actions that need to be implemented.

Although a holistic approach to the stakeholders' interaction was captured in the research, it is difficult to know if the extent to which stakeholders interact can vary between completely different initiatives or between initiatives from different countries. Thus, an in-depth investigation of this is required, since stakeholders affect the success of an initiative. It would be worthwhile to explore such similarities or differences in terms of the services implemented and the stakeholders involved from different countries and/or more initiatives. This could demonstrate if there are any particular differences at national levels and would determine if the findings can be generalised since the limitation of this research is that it focused on similar mono-national or single-country cases (SamCity and Stadsleveransen).

In future research, it would also be useful to highlight the importance of the networks of stakeholders and communication strategies to find ways to solve problems that have not yet been addressed. However, future research needs to make a clear account of the existing and ongoing stakeholder engagement that takes place in a city. In this regard, future research needs to map the existing freight transportation networks and patterns of stakeholder interaction. There are many overlapping networks and initiatives, some of which extend beyond the freight and logistics sphere; hence, finding ways to engage them with ongoing work is essential in fostering new initiatives and creating strong stakeholders' interaction.

Finally, to supplement the findings of this research, future research should see if the results can be generalised by applying the multi-criteria decision model to a number of different city logistics initiatives to gather general statistics on stakeholder goals in order to quantify stakeholder management. To do so, it is essential to define and discuss the goals of stakeholders' beforehand and to ensure that the stakeholders interpret the goals in the same way.

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Appendix A: The SamCity Case

This appendix presents the SamCity initiative that is the basis of the research presented in this dissertation. The SamCity initiative had a specific timeframe and fulfilled its purpose.

SamCity Initiative Description

SamCity is a city logistics initiative that was carried out in the City of Malmö, Sweden, a commercial city centre undergoing a transition from being an industrial city to a city of knowledge. Its strongest sectors are logistics, retail and wholesale trade, construction, and property.

Since the City of Malmö has been interested in how to consolidate the freight flow in the city centre for many years, the focus of SamCity was to create a co-ordinated freight consolidation and distribution system with logistic services in the city centre. The SamCity initiative examines whether this system is financially and environmentally viable. Specifically, the SamCity idea evolved into a business model through a pre-study that included an examination of user needs, stakeholder collaboration, and inspiration from public conferences and seminars. To support this, a number of stakeholders participated in the initiative in order to develop and implement a concept for city logistics: the municipality (M), two transport providers (TP1 and TP2), a property owner (PO), a city co-operation organisation (CCO), a haulage organisation (HO), the Confederation of Swedish Enterprise (CSE), a retail consumer organisation (RCO), the stores (S), and citizens (CZ). Each organisation had a representative in the initiative. The citizens were represented by the RCO and the stores by the CCO. The municipality, which promotes the financial, environmental, and social development of the city, was the driving force of the initiative. TP1 is a leading logistics company with a focus on innovation, quality, safety, and the environment. TP2's core competence is recycling; they collect, treat, and recycle waste and residues from industry, organisations, and households throughout Sweden. PO is a trade association of real estate entrepreneurs. It has 2300 members that together manage over 7000 properties. Its task is to create the best possible conditions for the real estate business. CCO is a platform for supporting business in the city through various projects and initiatives in collaboration with other partners. The goal is to create and maintain an attractive and vibrant city centre. HO is a haulage organisation dedicated to promoting a sustainable and profitable development of the haulage industry. It is engaged in various haulage issues related to transport and social policy to strengthen the Swedish haulage trade, competitiveness, and improve the conditions for trucking companies. CSE represents the businesses in Sweden. Their long-term goal is to ensure that all companies in Sweden shall have the best possible conditions to operate and grow. CSE represents almost 60,000 small, medium, and large businesses. RCO is a co-operative association founded in 1899 based on the idea of excellent food at reasonable prices. This idea has developed to consider the creation of economic benefits, while making it possible for members through their consumption to contribute to sustainable development for citizens and the environment. There are about

665 RCO stores throughout Sweden, which are owned by 3.4 million members in 32 consumer associations. S are the stores offering a wide range of consumer goods in different product categories. Some of them are part of a retail chain, while others are independent retailers. The opening hours of the stores in the city centre differ, which makes transportation challenging. The citizens (CZ) live in the city and are affected the most by city logistics initiatives.

Weekly and monthly meetings were held throughout the whole implementation process. They incorporated perspectives and feedback of different stakeholder groups. The meetings had different foci and were shaped to enable intensified interaction between the stakeholders in order to establish and maintain trust and provide encouragement. Since the City of Malmö was the driving force behind the initiative, it interacted with all stakeholder groups in every stage of the implementation process in order to develop the initiative. Property owners interacted mainly with the municipality, the city co-operation organisation, and the transport providers due to their main aspiration of improving the attractiveness of the city. The two transport providers interacted with one another and with the municipality, the property owners, and the city co-operation organisation, as the city is dependent on freight transport and thus the transport providers.

More precisely, TP1 took the initiative for SamCity's effective co-ordination of transport. Its terminal was used as the urban consolidation centre. The unique co-operation is embedded in a smart logistics solution that involves co-load of both private and municipal freight for SamCity. The freight was transported by SamCity's vehicles, powered by renewable fuel. Specifically, one heavy vehicle with a high load factor and smaller footprint was used for the delivery of freight from the local transport provider's terminal to the micro terminal, which was located in the city centre. The usage of this vehicle minimised the trips in the city centre, as a similar amount of freight would typically require more vehicles to deliver the freight. The freight to be shipped in the city centre was collected and delivered from SamCity's micro-terminal with an exhaust emission-free and quiet electric vehicle.

Timewise, the initiative was carried out from May 2013 to August 2016; the first stage was carried out from May 2013 to January 2014. In May 2014, the SamCity initiative was granted additional funds, which lead to a pilot implementation in 2015. This represents the second stage of the initiative, and lasted from 2014 until 2016, embracing the same initiative constellation as the first stage.

Five sub-projects were carried out in parallel during the period SamCity was operating. Sub-project one was the one-year pilot project, which focused on testing a business model for co-relocation. Sub-project two focused on fossil fuel vehicles and their applicability. In sub-project three, a modelling was made showing the effects of the sampling model. Sub-project four, joint procurement, looked at legal possibilities and obstacles to a joint procurement of local/private flow operator/distributor. Sub-project 5 looked at how traffic control can support co-load.

SamCity was part of Vinnova's challenge-driven innovation and operated with funding from VINNOVA (Sweden's Innovation Agency). In May 2014, the initiative was granted additional funds from Vinnova to test the business sampling model in Malmö in a pilot test in 2015.

Appendix B: Interview guide for Paper 4

The interview guide used for the semi-structured interviews in the stakeholders' interaction is presented below. The interviews were conducted with the managers of the two initiatives.

Interview Guide: SamCity/Stadsleveransen Stakeholders

Purpose

This interview guide will result in a representative study of the stakeholders' interaction. The study will be a comparative, longitudinal study between the stakeholders of the SamCity initiative in the City of Malmö, Sweden, and stakeholders of the Stadsleveransen initiative in the City of Gothenburg, Sweden. The interview guide consists of questions about the roles and strategies for stakeholder interaction, methods and best practices, opportunities for stakeholders' interaction and criteria for interaction. These kinds of questions were asked so that the data collected will be highly suitable for the study.

1. General information

Can you please provide the following information:

Name:

Your current position:

How long have you been working with SamCity/Stadsleveransen?

What are your responsibilities in SamCity/ Stadsleveransen?

2. Roles and strategies for stakeholder interaction:

2.1 What is your own perspective and understanding of stakeholder interaction in the initiative?

- a. Was the interaction important to you as the manager of the initiative?
- b. What were the possibilities to engage with stakeholders in the different stages of the implementation process?
- c. What were your objectives relating to stakeholders interaction?
- d. What did you do as the initiative's manager to develop the capacity and skills of effective stakeholders' interaction in the different stages of the implementation process?
- e. How did you monitor and evaluate the interaction activities?

3. Methods and best practices

3.1 What methods or best practices did you find most helpful and effective regarding the stakeholders' interaction? Were the different types of meetings in the initiatives and their frequency beneficial for the stakeholders? Did the meetings consider the most important issues on the agendas for discussion and action?

3.2 What other methods would you suggest improving communication and interaction with stakeholder groups in city logistics initiatives?

3.3 From your perspective, did the interaction of stakeholders change through the different stages of the implementation process? Was the stakeholders' interaction higher in the beginning, for instance?

4. Opportunities with stakeholders' interaction

4.1 Do you believe you have had an impact on the stakeholders?

4.2 Do you foresee any benefits from your collaboration with the other stakeholder groups? Do you foresee any benefits for further collaboration?

4.3 Were you able to use their network or are they able to use yours?

4.4 Was it possible for you to make your own decisions?

5. Criteria for interaction

5.1 What criteria provide indications of promising stakeholders interaction in SamCity?

Knowledge –production

Consultation

Problem framing

Informing

Stakeholders' diversity

Stakeholder interest

Existing Collaborations

Stakeholder motives and goals

5.2 Do you feel that interactions were affected by the stakeholders' motives and goals for participating in the initiative? Or was it due to existing collaborations?

Appendix C: Interview Guide for Paper 5

The interview guide used for the semi-structured interviews is presented below. The interviews were conducted with at least one representative of each of the stakeholders of the SamCity initiative.

Interview Guide, SamCity Stakeholders

Purpose

This interview guide will result in a representative study of the stakeholders' goals for participating in city logistics initiatives. The interview guide consists of general information questions and questions about activities and processes, the motives, goals and incentives as well as experiences, challenges and problems of stakeholders. These kinds of questions were asked so that the data collected will be highly suitable for the study.

1. General information

Can you please provide the following information:

Name:

Your current position:

How long have you been working with SamCity?

What are your responsibilities in SamCity?

2. Company background

2.1 Can you please provide the following information:

The core business of the organisation

The presence of the company in Sweden

Number of employees

2.2 Can you please tell me about the company's business? Goals, missions, values?

3. Activities and processes

3.1 How are the decisions taken within your organisation for SamCity? Are they aligned with the decisions from other stakeholders?

3.2 What is the process like with external stakeholders?

3.3 With whom do you collaborate the most within SamCity?

3.4 How long does it take to get approval for a new idea?

4. Motives, goals and incentives

Describe the motives/goals and incentives for being one of the stakeholders of the initiative:

What are the main motives:

- Financial
- Environmental
- Marketing advantage

- Benefits/profits
- Development
- Ability to utilise your own idea

4.1 Do the long-term motives and goals of your organisation fit with the purposes of SamCity?

4.2 Are there any common incentives between your organisation and other stakeholder groups for being involved in the initiative? Or are they heterogenetic and result in conflicts?

4.3 Are there any further goals for achievement?

4.5 Are there any comparisons regarding the other stakeholders' motivation?

5. Experience

Walk us through your experience so far.

5.1 Tell us about the most important moments you have had during your participation in the SamCity.

5.2 What did you see as your organisation's strengths by being one of the stakeholders in SamCity?

5.3 What did your organisation accomplish in SamCity?

5.4 How do you think SamCity will help your organisation improve your skills in your area of focus?

6. Challenges/ Problems

6.1 Can you describe the challenges, problems, barriers you have experienced with SamCity:

Time it occurred

Reason

How did you overcome the problem?

What did you learn from that?

6.2 Are there any risks to be dependent on?

6.3 What are your expectations in general from this initiative?

7. Stakeholders

Since the rest of the stakeholders have different objectives and different perspectives from yours regarding urban freight transport, co-ordination amongst all the stakeholders is required to make progress towards a more sustainable and liveable city. So can you describe your experiences with the other stakeholders?

7.1 Can you please tell me how the other stakeholders were affected by your decisions and actions? How were you affected by the other stakeholders' decision and actions?

7.2 Do you believe you have had an impact on the stakeholders?

7.3 Do you foresee any benefits from your collaboration with the other stakeholder groups? Do you foresee any benefits for further collaboration?

7.4 Are you able to use their network or are they able to use yours?

7.5 Is there any possibility to make your own decisions?

About the author



Konstantina Katsela studied International Economics and Business Relations in the Democritus University of Thrace, Greece. In 2012, Konstantina moved from Greece to Sweden to attend the Master's program of Economics in Umeå University. Konstantina has always been curious on how logistics and freight distribution affects the economic growth and development both in local and in national level. Hence, in order to quench her thirst Konstantina attended extra courses related to logistics such as Economics of Logistics, Spatial Analysis and Relationships and Geographic Information Systems, which made her thirst for research within the logistics domain only increase. Therefore, in 2015, Konstantina was able to pursue her Ph.D. in the Division of Packaging Logistics, Department of Design Sciences, Faculty of Engineering, Lund University. By entering the Ph.D. Konstantina was able to explore her initial ideas further.

This doctoral dissertation is the outcome of Konstantina's research in the domain of city logistics. This dissertation aims to increase understanding on how business model can contribute to viable city logistics initiatives. To increase this understanding, this research reviewed twenty city logistics initiatives, carried out a longitudinal case study on a business model implementation in the city of Malmö, and conducted a comparative study of two city logistics initiatives in Sweden. The studies analysed different aspects of business models for city logistics, such as the cost structure, externality costs, the inclusion and management of stakeholders.

