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Critical Factors for Viable Business Models for Urban Consolidation Centres

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Abstract

Although urban consolidation centres (UCC) worldwide have improved urban freight distribution and reduced externalities, other UCC initiatives have not materialised due to, e.g., business model limitations. All the same, researchers have rarely described business model components relevant to city logistics. In response, the purpose with this article is to analyse critical factors for viable business models of city logistics initiatives involving UCCs. Following an extensive literature review and multiple-case study of five initiatives with UCCs, we identified seven critical factors of viable city logistics business models: the ability to scale up and down the UCC solution; an ability to continuously develop and adapt to a dynamic environment; the important entrepreneurial role of the initiator as well; the acknowledgment of society; ability to innovate new services; logistics and supply chain management competence; and the ability to take full advantage of advanced IT. All seven factors describe continuously redeveloped business models seeking to seize new and unexpected opportunities, yet also indicate that city logistics systems require local authorities and municipalities to act as initiators, enablers, and customers. The models also underscore differences between purely commercial and purely municipal city logistics initiatives.

Keywords: Urban logistics, business models, critical factors, urban consolidation centres

(Suggested JEL: *R410, R480, R110, R120, R400*)

1. Introduction

Although freight transport in general and urban freight transport in particular (also known as last-mile delivery) are necessary for urban development and cities' financial viability, urban freight poses numerous problems, including pollution, noise, and congestion (Allen, Browne, & Holguín-Veras, 2015). Furthermore, given the expanding populations of cities worldwide, the negative effects of urban freight have only worsened. Since urban freight operates within the domain of city logistics, city logistics initiatives face the challenge of resolving the many economic, social, and environmental problems in today's urban areas. (Lindholm, Björklund, Abrahamsson, Behrens, etc., 2014)

Business models are often identified as playing a key role for city logistics initiatives, and as often, their absence poses a major barrier to the implementation of such initiatives (Malhene, Trentini, Marques, & Burlat, 2012; Quak, Balm, & Posthumus, 2014). However, many of today's city logistics initiatives are not business driven, but technologically driven and focus on the technical, environmental, and operational feasibility. Although the consideration of financial feasibility in these initiatives is commonly weak (Quak, 2011), the

long-term survival of city logistics solutions requires viable business models that also consider financial feasibility (Quak et al., 2014).

Following a review of city logistics literature addressing business models, Björklund and Abrahamsson (2015) concluded that knowledge about what actually constitutes a business model in city logistics remains scant. To produce viable city logistics solutions, it is not enough to only consider all components in business models. More importantly, city logisticians need to examine how those components are designed and why. To that end, initial developers have to determine several aspects of their initiatives in designing corresponding business models, including viable collaborators, potential customers, preferred value offerings that can generate revenue, essential resources, and organisational arrangements and roles therein. This is not only a knowledge gap with regard to city logistics. After reviewing more than 600 articles on business models in general, Wirtz, Pistoia, Ullrich, and Göttel (2016) conclude that the knowledge obtained thus far on essential success factors of a business model is rudimentary.

To form our sample, we specifically targeted city logistics initiatives representing urban consolidation centres (UCC), characterised as systems that decouple long-distance transport, typically with large trucks, and last-mile transport within urban areas, often with vehicles designed for urban transport.

In this article, we strive to generate knowledge about why some business models for UCCs are viable and why others fail. We are using the term viable in this study to describe if the city logistics systems, over time, provide the values and goals defined by the owners/initiators of the system. This is either the city administrators (UCC systems initiated by a municipality) or the part owners (private UCC initiatives). The purpose of this article is: *to analyse viable business models of UCCs initiatives in order to identify and describe critical factors in these models.*

2. City Logistics Business Models

Defining an appropriate city logistics business model is arguably foundational for stakeholders in city logistics initiatives such as UCCs (Macário, Galelo, & Martins, 2008). Indeed, before identifying components of city logistics business models, it is critical to form a proper understanding of what business models for city logistics can be. Although literature on city logistics and urban freight offers no formal definition for business models for city logistics, much less models for UCCs in particular, a business model in general can be defined as:

“[A] conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams” (Osterwalder, Pigneur, & Tucci, 2005, p. 10).

Despite the importance of business models described in recent city logistics research (cf. Malhene et al., 2012; Quak et al., 2014), few researchers have provided profound insights into the design of viable business models. However, two studies have provided insights into the content of city logistics business models. First, in identifying business models as one of five parts in the taxonomy of city logistics projects, Benjelloun, Crainic, and Bigras (2010) posited that city logistics projects need to address critical aspects regarding, for example, financing and management. Second, based on the nine components of the business model canvas proposed by Osterwalder and Pigneur (2010), Turblog (2011) presented an urban

logistics business model canvas that, in addition to the component of externalities (e.g., value proposition for society), identified the components of key partners, key activities, key resources, revenue streams, cost structure, customer segments, customer channels, customer relationships, and value proposition to customers, as explained in what follows.

2.1 Actors, initiators, and owners

Different stakeholders are involved and interact with each other in city logistics initiatives (cf. Anderson, Allen, & Browne, 2005). In the city logistics system proposed by Benjelloun et al. (2010), the five stakeholder groups put forward are: shippers; carriers and warehousing companies; the city; the government; and others such as citizens, consultants, and universities. In a similar way Taniguchi, Thompson, Yamada, and van Duin (2001) put forward four key stakeholders involved in urban freight transport: shippers (manufacturers, wholesalers, and retailers); residents (consumers); freight carriers (transporters and warehouse companies); and administrators (national, state, and city level). This shows the large variety of different stakeholder that can be involved.

The stakeholders' role(s) in different initiations can vary largely. Lindholm (2012) present two forms of stakeholders: those who have a direct interest or effect on urban freight transport and those who have an indirect interest or effect on urban freight transport. The roles of having an indirect or direct interest and effect could also be applicable when it comes to the roles of different actors in the business models for city logistics. There are some actors in the business model such as key partners and key customers (cf. Shafer, Smith, & Linder, 2005) that can be seen as directly involved in the business models ("need to make an agreement with") and other actors who have to be informed/listened to, but are not directly involved.

However, actors in a city logistics business model might not be the same actors involved in or affected by the city logistics initiative. In describing business models for city logistics, Benjelloun et al. (2010) stated that a city logistics project needs to address critical issues of financing and viability in light of four criteria: infrastructure financing (i.e., Who finances?), operation financing (i.e., Who finances and when?), management (i.e., Who is the manager?), and competitive advantage. By answering those questions and fulfilling those criteria, the roles and activities of more directly involved actors can be better specified.

Research in the field often presents business models for city logistics initiatives without clearly identifying the owner in the model. However, it is critical to pinpoint whose model it is—that is, the owner of the model or the firm or company that uses the model—in order to define roles and requirements. To that end, in urban freight systems in particular, three different groups are commonly described as capable of implementing changes: public policy makers; freight transport companies; and receivers (Allen et al., 2015; Awasthi & Chauhan, 2012; Cherrett et al., 2012; Malhene et al., 2012; Österle, Aditjandra, Vaghi, Grea, & Zunder, 2015). Muñuzuri, Larrañeta, Onieva, and Cortés (2005) adds goods owners, who could also be the senders, as another group of potential actors. However, logistics companies, authorities, and goods owners differ widely regarding, for example, resources such as competence and equipment. Since key resources are a major component in the business model, business models might differ depending on the initiator and to what extent initiators influence how the models are characterised.

2.2 Activities and resources

A business model can be described as 'the set of *which* activities a firm performs, *how* it performs them, and *when* it performs them as it uses its resources to perform activities, given its industry, to create superior customer value (Afuah, 2004). For UCCs, warehousing, handling, and distribution are arguably the first activities that come to mind. In business

models for city logistics, the management, planning, and development of initiatives can also be described as important activities.

Meanwhile, Abrahamsson, Aldin, and Stahre (2003) have posited that the management and control of logistics performance are activities engaged by central actors in logistics platforms. This makes the city logistics business model similar to what in literature is described as “logistics-based business models”. A logistics-based business model incorporates activities along the entire supply chain, including internal as well as external coordination of the flow of goods. In consequence, the design of the logistics platform as well as the management and control of the logistics performance are central characters for the company’s performance and so is the integration between logistics activities and market aspects and to the IT-function (Sandberg, Abrahamsson, & Kihlén, 2011).

Many resources are highlighted in studies of UCC-based solutions, including UCC and transport resources used. One resource critical for decreasing environmental impacts in cities is the use of more environmentally friendly vehicles such as electric vehicles (Allen, Browne, Woodburn, & Leonardi, 2014; Lebeau, Macharis, van Mierlo, & Maes, 2013) and bicycles (cf. Browne, Allen, & Leonardi, 2011). Larger companies, including major logistics service providers (LSPs), often operate on a larger scale and, with a well-developed information technology (IT) system used throughout the organisation, can facilitate, for example, the planning and efficiency of transport (Dezi, Dondi, & Sangiorgi, 2010).

2.3 Value proposition and customers

Activities, together with the use of resources and the operative platform, including capabilities, processes, and resources, to use the terminology of Kindström (2005), are important components of value creation (Shafer et al., 2005). In consequence, the customer value included in the services provided has to propose to customers in different forms of value offerings.

Implementing a UCC can result in regular services such as consolidation and distribution (Nordtømme, Bjerkan, & Sund, 2015), which as a result can allow larger shipments to be divided into smaller ones and thereby change the delivery frequency to better meet receivers’ needs (Triantafyllou, Cherrett, & Browne, 2014), as well as increase the reliability of delivery (Browne et al., 2011; Österle et al., 2015). UCCs can also offer a wide range of value-added services, including improved return logistics, inventory control, brokerage, and consignment (Browne et al., 2011; McKinnon, 2015; van Rooijen & Quak, 2010). In that sense, value-added services are important terms of business models often viewed as a means to generate a flow of finances for the UCC in the form of payment from stakeholders who benefit from them (Browne et al., 2011; Malhene et al., 2012; Marcucci & Danielis, 2007).

Value propositions that target different customers as well as attract the interest of larger groups of customers are thought to be fundamental in generating the revenue streams necessary to cover costs associated with UCC setup and operations. Multiple authors have also pointed out the importance of attracting enough customers to UCCs (Allen et al., 2014; Lin, Chen, & Kawamura, 2014; Triantafyllou et al., 2014). Along similar lines, Ville, Gonzalez-Feliu, and Dablanc (2013) have underscored the significance of selling services to attract customers, whereas Allen et al. (2014) have stated that it is vital to reduce costs per unit handled by UCCs in order to make costs comparable to traditional urban distribution systems—costs that can be reduced by achieving economies of scale by serving enough customers. In line with that argument, Finnegan, Finlay, O'Mahony, and O'Sullivan (2005) added that a strategy to expand the scope of activities is necessary to secure a sufficient volume and enough customers to cover costs generated by the UCC.

Most business models of companies focus on the value proposition presented to customers, customer segmentation, customer channel selection and design, and relationships formed with customers as important aspects in market-positioning a city logistics system (Björklund & Abrahamsson, 2015; Quak et al., 2014). However, the value proposition to society is another component that distinguishes city logistics business models from many others. Environmental and social aspects are often cited as reasons for implementing city logistics initiatives (e.g., Björklund & Gustafsson, 2015; Culliane & Edwards, 2015; Lindholm et al., 2014; Patier & Browne, 2010); however, knowledge regarding the extent to which and how social and environmental components (e.g., external costs) are considered in existing business models remains limited. Bakos, Bóna, and Foltin (2012) have mentioned that external costs should be included in models, yet do not explain how. That same year, (Alessandrini, Site, Filippi, & Salucci, 2012) forecasted a decrease in external costs generated by implementing a UCC for seafood transport in Rome using the European Commission's Handbook on the Estimation of External Costs in the Transport Sector. In response, they suggested that savings in monetary values can be used by the government to provide incentives for the LSP to use the UCC (Alessandrini et al., 2012).

3. Method

We identified literature on business models in the context of city logistics by combining research terms such as 'business model', its major components such as 'value offerings' and 'market positioning', and its roles, with terms such as 'urban freight' and 'city logistics'. Our review resulted in the identification of components in business models relevant in a city logistics context, as presented in Section 2.

Our empirical data derive from a multiple-case study of five business models targeting the same number of UCC initiatives—that is, one business model per initiative. Four criteria were applied in the selection of UCC initiatives to study: (1) The business models have been recognised by its owner as being highly important; (2) The cases are described as viable by their owners, providing the values they were looking for when initiating the systems, which in many cases is a mix between environmental, social and financial values; (3) The initiatives are recognised as good examples also by other organisations; and (4) Striving to have large variety in the selected cases regarding, e.g., the initiator and system owner or manager, the country, type of goods transported, geographical span, and year of implementation, ranging from 2007 to 2014. This variety was selected as we strived to increase the external validity of the result. This selection of cases leads to the results being more representative with respect to the overall number of still operating UCCs that have recognised the important role of the business model.

In accordance with selection criteria 2, we are using the term viable in this study to describe the UCC systems that, over time, provide the values and goals defined by the owners, including financial values (e.g. profitability or total cost reduction for a municipality), environmental values (e.g. decreased CO₂-emissions and less congestion) and social values (e.g. more attractive and safer cities). Accordingly, only time can tell if a business model is viable or not. By selecting cases that have been in operation for some time, we have strived to capture business models that have been viable over time. However, none of the business models studied have been static during the time the initiative has been in operation. In our aim to identify critical factors for viable models, we have therefore looked for aspects that have also been present in the previous forms of the business models studied. To capture this, we have a two-step analysis. First, we analyse the cases based on critical issues and priorities the initiators have focused on to make their UCC initiative viable (Chapter 5). Second, we analyse how this is supported in business model literature in order to define critical factors for UCC-based city logistics business models (Chapter 6).

For each initiative, we targeted the people responsible for the initiative's strategy/the project leader. In all five cases studied, those actors were also the initiators and are the owners of the systems. Since the business model belongs to either one company (see definitions in Section 1) or, as in three cases, the municipality, our collection of empirical data was limited to that organisation. In consequence, the perspective of viability in this study is the perspective of the owner/initiator of the city logistics system, which are the city administration or the part owners of private initiatives, managing the system and deciding about continuation of the initiative. That limitation is common in studies on business models (e.g., Sandberg, 2013) since the target perspective is the owner's.

For two of the cases (Lucca and Eskilstuna; the cases of which are described in chapter 4), we conducted onsite visits and talked to organisational personnel. However, it soon became evident that the interviews with personnel other than the project leader (i.e., the person responsible for the initiative) provided information that merely confirmed and never contradicted information provided by the project leader, which also occurred for Björklund and Gustafsson (2015) in their investigations of similar initiatives in Sweden. Even if onsite visits allowed a more profound understanding of the initiatives themselves, they did not add any information about the critical factors for the viability of the business models applied. Based on those experiences, we interviewed only the project leader for the initiatives in the remaining three organisations. One of those initiatives (i.e., Österlen) has been studied and well documented in textbook form (Moen, 2013) by a consultant who followed the development and implementation of the initiative. Since the business model was to some extent described in that publication, it was also a source of information for that case.

Interview questions were largely guided by the canvas of business models for city logistics (Quak et al., 2014; Quak, Balm, Posthumus, & Bruening, 2012). The canvas was expanded to include additional aspects identified in the literature review, including questions addressing competitive strategy, and the management, development, and control of the initiative. Before applying the expanded canvas, we tested it in workshops with three different groups of participants: 15 respondents representing different stakeholders in city logistics; four researchers of sustainable logistics; and eight members of organisations representing the reference group in an overall research project on city logistics business models. Some minor changes were made as a result of testing; we clarified what is entailed with the term "value proposition to society", situated coordination as an aspect regarding relations, and highlighted planning and management as examples of key activities. Another interesting finding from the tests was that no component was identified as being of very little or no relevance to city logistics business models. Altogether, the descriptive and explanatory aim of our study aligned with our selection of case study research and interviews (Ellram, 1996; Yin, 2003).

4. Description of the UCC-initiatives

Early in the case selection, it became evident that the owners of the studied business models differed. For one, three were municipalities (Österlen, Lucca, and Eskilstuna). In Gothenburg, by contrast, the business model was owned mutually by the part owners Innerstaden Gothenburg AB, the inner city of Gothenburg Ltd., and a local trade organisation and property owner. In ECO₂CITY, the business model was owned by a non-profit organisation. The cases are further described in table 1 and in the following sections.

//Insert table 1 here//

4.1 Österlen

The case of Österlen involves the coordinated freight distribution system of three municipalities in southern Sweden's Österlen region: Ystad, Tomelilla, and Simrishamn, with the initial goal to reduce CO₂-emissions for city distribution. Since frequent transport occurs among the cities, its concept is similar to a UCC. This initiative encompasses the transport of food, items, chemicals, and office materials of municipal facilities (e.g., schools and day care centres). The municipality purchased the logistics service (i.e., the distribution unit and its operation, trucks, and drivers) from a local logistics supplier as part of Sweden's Public Procurement Act. The three municipalities purchase the transport warehouse services at a price of 4 M€ a year to facilitate distribution with 2 trucks four days a week to more than 200 receivers generating in total 9000 stops/yearly. The municipality in Ystad (the one that are in charge of planning the transports) has reached financial break-even as the price for the products has decreased, due to the last mile transport is not any longer included in the product price, resulting in decreased total costs for the municipalities. The profitability could increase if one more municipality is added or goods volumes increase in the present system. Furthermore, the price for the products is likely to decrease even further as some suppliers have not yet decreased their prices as much as expected.

4.2 ECO₂CITY

ECO₂CITY and Binnenstadtservice, BSS, a commercial concept in which ECO₂CITY is a non-profit umbrella-organisation, responsible for research and development, to which local and operational BSS organisations is connected as partners. BSS offer logistics services to primary local retailers, who redirect their inbound deliveries via a local UCC. The concept was initiated in the city of Nijmegen in 2004 and is now represented in 15 cities in the Netherlands and in some cities outside the Netherlands. The environment was a key value in the beginning of this initiative, but has now to a large extent been replaced by a need to strengthen the financial viability of the initiative. The size of the initiatives in the cities are very different. However, the persons responsible for ECO₂CITY do also run the BSS in Nijmegen and in Maastricht. These are described as one small (Nijmegen) and one large (Maastricht) example. The turnover at BSS Nijmegen in 2015 was 65.000 € The turnover at BS Maastricht in 2015 was 225.000 € Both cities had a small surplus of 2.5%. To improve profitability, the number of delivery addresses in Nijmegen has reduced from 160 (at the top) to 55 today, as all the customers were not able to fully pay for the services provided. In Nijmegen one natural gas truck and a local bike courier company deliver the volumes. In Maastricht there are 4 trucks, but they also operate for others. ECO₂CITY do not count the number of parcels or volumes in the system.

4.3 Lucca

The municipality of Lucca, Italy, implemented an initiative that offers two alternatives to transport companies seeking to enter the city centre. On the one hand, they may use the logistics service known as Lucca Port and leave the goods at their UCC, after which Lucca Port reloads the goods into smaller, more environmentally friendly modes of transport and distributes the goods to receivers. On the other, they may pay a city entry tax, the amount of which depends on, for example, vehicle size and engines used. The goal was to reduce congestion and CO₂ –emissions in the city centre and to make the city more attractive. The turnover is approximately 115.000 € and is today lacking 20 % to reach a financial break-even and to become financially viable, thus not in need of the financial support from the local authority. 8000 deliveries are on a yearly basis distributed by four vehicles (three electric and one diesel) to 350 receivers.

4.4 Gothenburg

The UCC in Gothenburg, Sweden, is managed by several interacting companies and organisations, including the municipality, property owners, and a trade organisation representing the city's stores, with the goal to obtain a more sustainable city logistics system. All logistics operations are outsourced to an LSP. The initiative has a turnover on approximately 0,2M€ and is today lacking 15% to reach a financial break-even and to become financially viable. To reach the break-even they are now considering more revenue from commercial advertising, higher prices for the services and the use of larger vehicles. The number of receivers is approximately 500, although 100 receivers represent the majority of the transports and they receive approximately 5000 parcels a year. For the transports three small electric trains on wheels (one car with two wagons) are used five days a week.

4.5 Eskilstuna

The UCC in Eskilstuna, Sweden, is similar to Österlen's insofar as it stemmed from the idea that municipalities should coordinate and consolidate the delivery of goods to their own facilities, to reduce the number of trucks for these deliveries to get a cleaner and safer environment, e.g. for school children, and an improved work environment for the personnel at the schools. Coordinated goods distribution in Eskilstuna targets all municipal properties such as schools, day care centres, and offices, and the municipality outsources actual deliveries from the UCC to recipients, to a LSP. The turn-over is 1.3 M€ a year and has generated a surplus of over 0.08 M€/year, equal to a profit margin on about 6%. The initiative has 452 receivers and three bio-gas vehicles are used five days a week. They have about 1300 inbound deliveries a year equal to about 120 ton of weekly. Outbound they have 11200 parcels a year delivered from the UCC, which is a decrease from 25000 parcels before the initiative was implemented.

5. Priorities for viability identified in the cases

This section analyses the cases based on critical issues and priorities focused on in order to make their UCC initiative viable over time.

5.1 Scaling up and continuous development

An important part of the continuous development occurring in all of the cases is the sustained endeavour to scale up to achieve the advantages offered by a larger scale and scope of the operation. In the business model for ECO₂CITY, the potential of scaling by using the same concept in many cities, thereby making it possible to share costs for research and development, IT systems, and the formation of better agreements with large customers (e.g., national retail companies with stores in many cities) is prioritised. That end is achieved by the partnership model, in which local UCC operators apply the concepts and standards provided by the ECO₂CITY foundation, a setup that allows the company to develop connections with new partners, both in and outside the Netherlands. However, that component was not part of the initial business model, but was subsequently identified as necessary for the initiative to grow, from the perspectives of both cost and the environment, to thereby attain financial viability. In this UCC, the commercial issue with clear financial conditions has been pivotal to fulfilling the founders' initial environmental goals.

After managing the Lucca Port in-house for several years, in 2015 the municipality of Lucca decided to outsource the UCC's management and distribution service to a local logistics company. The decision to outsource the management of its logistics activity to an LSP was partly because customers who used the UCC instead of paying the city taxes had stagnated at a low level. The LSP possessed not only the logistics knowledge to improve the UCC's performance, but also a more extensive understanding of the needs of customers—above all, external LSPs (i.e., LSPs operating outside the city, including inbound transporters

to the UCC)—in delivering to the city, as well as contacts and memberships in networks with other LSPs. All of those capabilities increased the potential to scale up the initiative by expanding its customer base.

The need to scale up the system was an important point of departure in designing the UCC initiative in Österlen. The small size of the cities included, with populations ranging from 6,000–18,000, has made it financially infeasible to have a separate UCC in each city. An important part of the Österlen initiative is to consolidate deliveries to three municipalities that are geographically close to each other from one common UCC, thereby giving them a larger logistics system to optimise, in terms of more drop-points and larger volumes.

Eskilstuna and the three cities in the Österlen case also participate in an ongoing discussion among Swedish municipalities regarding the potential to scale up initiatives by inviting other municipalities, and adding private actors to their system, which however has been deemed difficult given the Public Procurement Act and laws regarding disturbance of the competition.

The Gothenburg case highlights the importance of including LSPs, which are also financiers of the UCC. Given imminent regulatory strictness in the city, it also stresses the expansion of scaling up to include LSPs to a larger extent, which can in turn increase the number of customers of the UCC.

The continuous development of new services, as in Eskilstuna and ECO₂City, is another way to scale up. All initiatives are more or less under development and belong to the actor responsible for both the system's development and the strategic management of the UCC. In this context, strategic management refers to the involvement of management in the design and long-term development of the system, which involves, for example, adding new services. Operational management, by contrast, refers to the involvement of management in daily operations at the UCC or in, for example, route planning and route optimisation. The level of responsibility of the operational management differs among the initiatives studied, although all owners of the initiative studied are in charge of the strategic management and future development of the system.

The initiator plays a major strategic role and minor operational role in managing the initiative in ECO₂CITY, Lucca, and Gothenburg. The owners of the initiatives studied set the framework in which entrepreneurs in ECO₂CITY, the LSP in Lucca, and UCC personnel in Gothenburg can develop and design their own operations. Developing the concept in those cases is performed in separate organisations—the ECO₂City foundation, the LuccaPort Lab, and by an external consultant financed by Gothenburg city—which clearly distinguishes strategic development and daily operations.

In the Österlen and Eskilstuna cases, by contrast, the owner of the initiatives play large strategic and operational roles in the management and control of the initiatives. Although they outsource transports, they nevertheless establish route planning, time of delivery, and the number of deliveries, which gives them control over both the system and mandates to develop it.

5.2 New collaborations, roles, and organisational forms

Identifying appropriate partners and designing roles have been crucial in several of the initiatives. However, since the initiatives differ widely regarding key partners, besides the internal LSP, and given the organisational form, it is clear that the appropriateness of partners and organisations largely depends on the type of solution and its context. In what follows, we go beyond the obvious regarding e.g. the importance of the internal LSP as a partner. The organisation of actors and their roles have been important issues in cases with multiple actors (i.e., ECO₂CITY, Gothenburg, and Österlen), in which the division of existing roles and

creation of new ones have been crucial to the initiatives and even yielded new organisational forms.

In Österlen, a strategic management group was formed with representatives from all three municipalities involved. The group has ultimately been crucial in not only developing the collaboration and design of the shared distribution system, but also in identifying a fair division of costs and responsibilities among the three municipalities.

To better organise relations between founders and ongoing operations in the different cities, ECO₂CITY now works as a non-profit foundation that is responsible for developing the concept and marketing it, while the partners (former franchisees) perform all operations and local sales.

The most critical part of the business model in Gothenburg is the organised counterpart: the local trade organisation. According to the respondent in this case, it would be impossible to listen to and negotiate deals with more than 300 receivers; it is therefore highly beneficial to have a single counterpart that can compile the receivers' interests and represent them. The local trade organisation also plays a critical role in the development of the IT/IS, in which they, along with the persons responsible for the IT/IS, have regular meetings in which they discuss the IT-system's development, among other topics.

5.3 Innovative service offerings and customer types

Using innovative value propositions has provided important revenue streams in all of the initiatives. Concerning the generation of revenue in the UCC solution in Gothenburg, one of the most important services has been advertising space on the transport vehicles. Those vehicles, which are used for city distribution, are small, environmentally-friendly electric 'trains' on wheels, as the interviewee put it, which is seen as both positive and unique by the city's denizens and is thus highly attractive to several companies. External LSPs also want to be associated with that transport solution and have gladly paid the extra fee to use the UCC instead of managing transport in the city themselves.

The partner concept developed in ECO₂CITY encompasses several principles, concepts, and structures, including where the UCC should be located, its operating hours, and its equipment (e.g., trucks). This already developed concept can be conceived as a service offered to entrepreneurs in the different cities, one that increases the potential for new cities and entrepreneurs to participate. The partner concept also entails fees to be paid to ECO₂CITY, which has resulted in a revenue stream. A small part of the fee—approximately 250€ per month—is fixed and covers administrative costs, while another part, based on 10% of turnover, is used to market the concept to other cities and entrepreneurs, as well as to develop the concept. Another service generated from the concept that targets external LSPs, above all, is the homogenisation of demands from receivers. To explain, LSPs cannot conduct business with every city; even then, it can be challenging for an LSP that delivers to several cities to meet shifting demands from receivers and different municipal regulations. Since the partner concept imposes the same demands regarding the UCC's location—that is, in a non-environmental-zone of the city without restrictions about truck type, fuel used, or hours of delivery—the LSP does not have to modify its fleet or delivery times to accommodate each city's regulations. Such services also result in revenue from external LSPs. Before ECO₂CITY, the BSS concept laid groundwork for identifying value-added services that receivers were interested in paying extra for, including consolidated deliveries, fixed delivery times, storage space, and handling, which improved logistics services for receivers and made it easier to run a store in the city centre.

The case in Eskilstuna provides good examples of how new, innovative services can be developed and implemented in an existing solution. Since the terminal used is an old building, there is far too much space than needed for the UCC solution. In striving to generate

more revenue and increase the use of the building, the organisation is always seeking new businesses for the terminal. Two examples of services already implemented are storage and inventory control of furniture no longer in use in the municipality, as well as the storage of new and used equipment for the elderly (e.g., medical beds and portable toilets). Previously, furniture such as visiting chairs and office tables were stored in the individual school and office buildings, or else thrown away, and there was no supervision. As a result, if someone needed furniture but it was not in storage at the site, new furniture was purchased. Now, all abandoned furniture is stored at the UCC, and all municipal employees can browse images and prices of available furniture online. Consequently, the municipality's costs of purchasing furniture have decreased by 100,000-200,000 € annually, and a revenue stream for the UCC representing approximately 20% of that sum has been created. To some extent, the UCC space is also used to store new equipment for the elderly, since the purchase price offered by suppliers can greatly depend on the volume of equipment purchased. Other advantages of the two services are that, first, they create job opportunities when the UCC experiences low activity levels, which is common during a few midday hours, and second, that the vehicles can be used to distribute furniture when not being used to distribute other goods to municipal units.

The Österlen case also emphasises the potential for improved services in terms of product quality, since the initiative facilitates the distribution of more local food to receivers (e.g., schools and retirement homes). Although local farmers do not have the resources to distribute their products to several municipal units, the UCC does. However, the municipality has no plans to impose fees for that service, or the improved delivery service to their own units, since doing so would not help to finance the UCC. Instead, both Österlen and Eskilstuna are financed through price reductions offered by product suppliers in light of cheaper deliveries for suppliers. In that sense, the sender can also be conceived as a customer of UCC solutions.

5.4 Value for society and citizens

Societies can also be viewed as customers of the initiatives and thereby provide revenue streams to finance the UCCs. Indeed, value for society has been a chief driver of all initiatives studied. Improved traffic safety and safety around schools, as well as decreased environmental impacts due to less transport, are important aspects in both Österlen and Eskilstuna.

The driving force and overall goal of the Lucca Port initiative has been to improve the quality of life for citizens, tourists, and visitors in terms of reduced emissions, congestion, and heavy transport in the city, all while fulfilling the logistics service demands of the city centre. With its narrow streets, the old historical centre is an important tourist attraction that depends on its many small stores. Conversely, the former transport situation posed significant environmental problems and safety risks.

In ECO₂CITY's case, the need for more environmentally friendly transport with fewer greenhouse gas emissions was the original driving force. However, commercial issues are now the primary focus of the initiative. Nevertheless, ECO₂CITY perceive more environmental benefits as their system grows, and their overall vision continues to provide eco-friendly city distribution. Another driving force in ECO₂CITY, Lucca, and Gothenburg has been to create attractive city areas for inhabitants by reducing the amount of freight transport in the cities. Representatives of those three cases also mentioned decreased congestion in the city areas to be a value for society.

When the projects began, the municipalities contributed public funding, yet over time, they have prioritised reducing the amount of public funding. In Österlen, Gothenburg, and Eskilstuna, the UCCs' operational sides have been self-financed, though the municipality has

paid the salary of the project managers. ECO₂CITY was initially funded in part by the municipality to cover start-up costs, but is now fully commercial.

5.5 Two critical resources: Logistics competence and an IT system

Together with logistics and supply chain knowledge, we and all respondents singled out an advanced IT system as being the two most important resources for a viable UCC-initiative. Indeed, logistics and supply chain competence is important in many ways.

In Eskilstuna, for example, the person responsible for the initiative plays a major role in designing and developing the system, as well as in identifying, designing, and managing new services described in Section 5.3. This person's extensive experience with establishing large terminals around Europe has been crucial in identifying and designing services and all activities involved therein.

The person responsible for ECO₂CITY's initiative demonstrated knowledge of the important roles of transport conditions applied and how changing them can be crucial to the future development of the solution. She has been able to visualise and comprehend the entire supply chain and the division of costs and responsibility along the chain, from suppliers via external LSPs to entrepreneurs in the UCC and beyond, to internal LSPs operating in the city—that is, involved in outbound transport from the UCC—and ultimately receivers. Furthermore, she has gauged how changes in costs and responsibility along the entire chain have influenced the revenue stream for the UCC. Her understanding of both value-added logistics and the delivery service needs of receivers in the city, as well as of external LSPs' situations, has been pivotal in developing the partner concept. Moreover, her supply chain knowledge has resulted in the identification of a city logistics solution built around a so-called 'Triple-X model', in which X stands for cross-docking, meaning that the three Xs represent the physical flow, information flow, and financial flow. This model, considered to be crucial for financial viability, is based on the logic that inbound transport to a single UCC should be cheaper than traditional last-mile transport to multiple receivers in the city and that costs can be cut in the supply chain on the whole. To change the conditions and pricing of inbound transport upstream in the supply chain, however, the UCC's ability to finance services downstream remains a major challenge.

Lucca has also identified a lack of logistics competence as a hindrance to further scaling up the initiative and therefore has led the initiative to outsource the logistics operation to an actor competent in logistics.

Taking full advantage of IT is another aspect that distinguishes the cases studied. IT systems have not only facilitated operational management, but also played a central role in developing the initiatives. The importance of IT systems and their usefulness in both everyday operational management and the strategic development of initiatives are in line with the general focus on sharing information as a key activity, as identified in all five cases. However, IT systems differ among the cases and are used in different ways.

The most critical part of the business model in Österlen, as expressed by the respondent, is transparency of transport information. The municipalities have taken control of information regarding transport operations (e.g., vehicle km, time driven, and speed data) and built up their own competence within their municipalities in using such data to optimise delivery. The municipalities have increased their competitive strength as their knowledge of transport demand has grown. That knowledge has enabled the municipalities to make better tenders and negotiate with LSPs in more professional ways. The IT system has also been used to plan routes and monitor routes travelled in order to pay the LSP based on real data. The IT system has also served an important role in identifying inefficiencies in distribution, as well as in optimising the distribution system.

By some contrast, Lucca has used its IT system to acquire information regarding transport situations in the city, analyse them, and develop an economic means of control to manage development in a more sustainable manner. LuccaPort Lab, a special partner and organisation for the research, development, and experimentation regarding new solutions and services aiming to optimise city logistics processes for Lucca and other small and mid-sized historic towns, builds cases regarding how different forms of regulation and economic means can influence the type of vehicles entering the city and congestion at different hours, among other things, based on actual data from the city. Lab personnel communicate their findings to the city of Lucca, which uses them in further developing means to control traffic in the city.

In ECO₂CITY, the IT system is crucial, not only to track goods and handle logistics information and monetary flows, but also to define a new financial logic for sharing costs for last-mile delivery between actors. The limitation in its current IT system—used to scan the goods when delivered to the receivers—is also one of the largest potential areas of improvement identified by the initiative’s representatives, since the use of different IT systems among external LSPs hinders the integration of data and thus the aim to cross-dock information.

In Eskilstuna, the IT system serves an additional function as an interface between the UCC and receivers. That interface represents an e-commerce service provided by the city logistics system to receivers in the municipality.

5.6 The importance of supporting city regulations

One important issue has been to what extent traffic-related financial and legal incentives have been applied, which support the use of the UCC.

In Lucca, financial conditions and incentives are vital to the initiative, represented by a fee for transports wishing to enter the city centre without using Lucca Port. The fee is dependent on several aspects, such as the size of the vehicle, engines used, and access time. The financial incentive provides a means for the LSPs to switch deliveries to the city centre from standard transport to smaller electrical vehicles used in the city logistics concept of Lucca Port.

Since Gothenburg municipality is part of the Gothenburg initiative, it has also identified the potential of further developing urban traffic regulations for the city’s centre that can support the initiative, such as restricted access time and a fee for entering the city area. As the respondent stated: ‘Urban freight regulations are important enablers to make this system and similar systems financially sustainable’.

6. Analysis

In this section, the critical issues and priorities focused on to make their UCC initiative viable (chapter 5) is analysed and supported by the business model literature (chapter 2), in order to identify critical factors for viable UCC based city logistics business models.

6.1 The ability to scale up and continuously develop the system

Economies of scale and scope are considered to be important to achieve financial viability. However, this is not the same as the operations have to be large – most of the initiatives studied are designed to be small scale. It is more about to achieve high utilization of existing resources, mainly the UCC-terminal, which explains the profit margin for Eskilstuna on 6%. In consequence, the fixed costs in most of the concepts are rather low and scaling up- and down in volume is done on variable costs. This means that also small operations like Nijmegen with only 65.000 € in turnover can be profitable as profitable as larger concepts like Maastricht with a turnover that is 3.5 times higher (ECO₂CITY). To

improve this even further, they have changed their earlier franchise agreement with the local BSS's, with a fee-structure including both a fixed and a variable fee, to a partnership with only variable fees.

However larger scale is important for another reason, attractiveness. For ECO₂CITY it is important to be represented in many cities to attract large retailer chains to use the network of local BSS-operations. For that reason, they have recently formed a national network of BSS and other city logistics initiatives in the Netherlands and is planning to do the same on European level.

In ECO₂CITY, Lucca, Österlen, and Gothenburg, a critical factor has been to increase the number of users and customers of the UCCs. A few of those cases' representatives added that it is necessary to scale up the initiative in order to attain financial viability, an idea in line with Lin et al. (2014), Triantafyllou et al. (2014), and Allen et al. (2014), all of whom have stressed attracting a customer density that can achieve economic equilibrium. Allen et al. (2014) have also pointed out the need for a sufficiently high number of customers in order to render the cost per unit passing through the UCC comparable to that of traditional urban distribution systems. Another type of scaling up entails the shared used of resources—for instance, a common IT-system, as in ECO₂CITY, Österlen, and Eskilstuna. *One critical factor is thus to achieve high resource utilisation, keep fixed costs low and to be able to over time scale up and down the UCC operation to variable costs to be more attractive for other stakeholders and to achieve economies of scope.*

Another important aspect presented in the cases is the ability to change the business model over time in order to adapt to new conditions. For example, ECO₂CITY completely changed its strategy by adopting a partner model, and Lucca chose to outsource management to a LSP with the appropriate knowledge to attract new customers. Both examples illustrate the importance of being able to adjust the business model to changing conditions in order to make it possible to, e.g., attract new customers and offer new innovative services (which will be further discussed in section 6.3). It is also necessary to recognise the importance of developing the initiative and to include this R&D in the business model. Furthermore, in line with Benjelloun et al. (2010), managing the responsibility of both the strategic and operational sides is critical in order to achieve viability, as made clear in all of the business models studied. Viability can also be achieved by adjusting the business model to the current rules of the specific city in which the UCC operates. For example, we found that municipal traffic regulations and taxes considerably influence the degree to which external LSPs will be willing to use the UCC even though doing so it is not mandatory. *A second critical factor is an ability to continuously develop and adapt the business model to a dynamic environment, e.g., in terms of new potential customers, services, and city regulations.*

6.2 The ability to identify key roles and supporting organisational forms

Our cases show that the different actors involved in logistics solutions are similar to those identified in the literature (e.g., Benjelloun et al., 2010). From a business model perspective, those actors can be partners or customers (Shafer et al., 2005). Only the internal LSP is described as a key partner in all five cases. Instead, most stakeholders are described as customers: for example, the receivers (shippers and entrepreneurs) in ECO₂CITY, external carriers in Gothenburg and Lucca, and the government, given the municipalities' units, in Österlen and Eskilstuna.

Our empirical findings stress the importance of defining new roles and responsibilities. Four of the business models studied include new organisations especially designed to meet new needs. In three of the cases, the new organisations formed are also responsible for the overall strategic management and development of the system. The design

of new organisations takes the commonly described need for the involvement and interaction of different stakeholders (e.g., Anderson et al., 2005) to a new level.

Another important role is that of the initiator. Our cases indicate potential initiators other than those commonly found in city logistics literature, including logistics companies, authorities, receivers (Allen et al., 2015; Awasthi & Chauhan, 2012; Cherrett et al., 2012; Malhene et al., 2012; Österle et al., 2015), and senders (Muñuzuri et al., 2005). ECO₂CITY adds a fourth actor that can initiate UCCs, which is a small local entrepreneur within a partner network supported by a non-profit organisation. Even if the municipalities in the cases of Eskilstuna and Österlen can be deemed local authorities, they implement the initiatives in their role as goods owners. Lucca, by contrast, implements the initiative in its role as a local authority. Gothenburg adds two more interesting actors to the list of potential initiators: property owners and trade organisations. The initiator has in several of the cases acted in a very entrepreneurial way. The way the initiator in ECO₂CITY first develops a UCC concept based on the receivers need, and then develops this into a partner concept requires entrepreneurial ability and endurance. In the Eskilstuna case as well as in the Gothenburg case the initiator has identified new services that, as far as we know, is entirely new to the field. The initiators in both the Österlen Case and in Lucca shows entrepreneurship by developing a system that provides them with information regarding the actual transport activities in their system. This is information that they then can use as a basis for developing economic incentives for more environmentally-friendly transport. Accordingly, *a third critical factor is the important entrepreneurial role of the initiator as well as the ability to develop organisational forms that can play all the roles needed for city logistics concepts.*

All cases were similar in offering a clear value proposition to society, in terms of environmental sustainability and traffic safety in distributing goods, thereby cultivating a more attractive city. The value proposition to society can also be viewed as a chief driver of the initiatives and their overall goal: to make it possible to use eco-friendlier delivery vehicles for last-mile distribution. However, Quak et al. (2014) and Ville et al. (2013) have argued that financial support for a UCC from local authorities has been counterproductive, for UCCs have often dissolved when government support ends. However, introducing a tax could help to finance UCCs by securing their financial viability in the long run. Using business model terminology, it is time to conceive society as a customer of initiatives and to express benefits for society as decreased external costs to better justify authorities' long-term contributions in taking part in financing initiatives. In that light, *a fourth critical factor is the acknowledgment of society (e.g., the municipality or local or national authorities) as a natural part of the city logistics concept and even as customers that generate revenue for the UCC.*

6.3 The ability to innovate new services

As stated earlier, financially viable UCCs go hand-in-hand with continuous development, meaning that it is important to be aware of innovative value proposition in the form of services to customers, largely in order to create revenue streams for the UCC. The cases studied offer services to customers mentioned in the literature—for example, stockholding (Browne et al., 2011; Nordtømme et al., 2015)—and change delivery frequencies (Triantafyllou et al., 2014). However, the cases also exhibited services not mentioned in the literature—for example, Gothenburg's vehicles with advertising and Eskilstuna's stocking and selling used furniture via an IT system. These services can also be an important aspect in financing a UCC (Malhene et al., 2012; Marcucci & Danielis, 2007).

When defining customers for a UCC, receivers are commonly mentioned among the customer base (e.g., Gonzalez-Feliu, Malhéné, Morganti, & Morana, 2014; Lin et al., 2014; Pamučar, Gigović, Ćirović, & Regodić, 2016). Yet, all stakeholders that benefit from a UCC can be conceived as customers. In Gothenburg, all stakeholders that buy advertising space on

delivery vehicles can be seen as customers of the UCC. In Eskilstuna, the municipality is the receiver and therefore a customer, though a different part of the municipality benefits (e.g., municipal offices and the elderly). Furthermore, the ability to identify the needs of different groups of existing or potential customers, to segment them, and to develop attractive services is also a competence critical for viability. Accordingly, *a fifth critical factor is an ability to innovate new services for customers that generate revenue.*

6.4 Acknowledge the importance of logistics competence and supporting IT systems

In every business model, key resources are central, since firms use their resources to perform activities to create customer value (Afuah, 2004; Shafer et al., 2005). Research on UCCs often focuses on the resources of environmentally-friendly vehicles (e.g., Allen et al., 2014; Browne et al., 2011; Lebeau et al., 2013) and the UCC terminal, both of which are important in the cases we studied as well, given their potential to generate environmental benefits. However, in terms of business models, two other resources were singled out in the five cases as being critical to their initiatives' viability: logistics and supply chain management competence and the IT systems applied.

However, concerning the type of logistics or supply chain competence needed, the cases show great differences. In ECO₂City, knowledge about incoterms (international standard containing a series of pre-defined commercial terms) and freight conditions along the supply chain is crucial to be able to split transport costs along the entire supply chain differently; in Eskilstuna, by contrast, skills in central warehousing were vital for value creation. Identifying the importance of the role of logistics and supply chain management competence fills a gap in the literature, as well as calls for more research on developing logistics skills for city logistics. *A sixth critical factor is thus logistics and supply chain management competence in order to access potential value streams in the supply chain.*

IT systems constitute another critical factor identified in our empirical data. In literature on business models, IT and information systems are commonly advanced as potential key resources; however, when it comes to the type of IT system or information that is important, our cases demonstrate considerable differences. In Österlen, the IT system has been crucial for being a more professional buyer of logistics services, whereas in Eskilstuna the system was used for new service development. In ECO₂CITY, the IT system has been important in optimising the supply chain according to the Triple-X model. Yet, common among all cases are efforts to take full advantage of advanced IT/IS in both the management and development of their systems. This is in line with the findings of Dezi et al. (2010), which indicate that a well-developed IT system can enable the organisation and increase the efficiency of transport. Based on that finding, *a seventh critical factor is the ability to take full advantage of advanced IT and information systems in both designing and developing the city logistics concept over time.*

7. Conclusions

Knowledge in research and from practical experiences about the content and design of business models for city logistics remains scarce, and several city logistics initiatives have been discarded due to lack of or poor business models. All five business models studied have considered all components and dimensions of business models. That confirms that business models for city logistics are complex, involve many stakeholders, and demonstrate a mix of business-oriented factors and societally oriented factors (Figure 1).

//Insert figure 1 here//

Our empirical data show that system complexity and the number of key partners are related to the owner of the system; systems with private owners have more partners and are more complex, whereas systems with municipal owners are simpler and have fewer key partners. Comparing the two extremes in our study—namely, commercial (e.g., ECO₂CITY and Gothenburg) and municipal city logistics (e.g., Österlen and Eskilstuna)—it is clear that a city logistics business model designed by a municipality in order to provide services to municipal facilities is more straightforward than a commercial business model for city logistics. Not only are the customers different, but the number of active actors involved is fewer, and the freight conditions are easier to manage and control in municipal city logistics. However, most of all, the system does not have to be financially profitable to be viable (Table 2).

// Insert Table 2 here //

In consequence, it is critical to recognise the complexity of the system and to have the ability to design a business model for city logistics, considering all its complexity – there is no “standard” business model that can be used in all UCC-initiatives. However, viability in city logistics can be achieved by using appropriate business models that recognise and include several critical factors. In this study, the cases were described as viable by their owners as they provide the values they were looking for when initiating the systems. By adopting a cross-case, pattern-matching approach and conducting an extensive literature review, we contribute to both research and practice by identifying seven critical factors for viable business models for UCC based city logistics solutions:

1. The ability to scale up and down the UCC operation to variable costs to achieve economies of scope
2. An ability to continuously develop and adapt the business model to a dynamic environment, e.g., in terms of new potential customers, services, and city regulations
3. To maintain the entrepreneurial role of the initiator as well as the ability to develop organisational forms that can play all the roles needed for the city logistics concept
4. The acknowledgment of society (e.g., the municipality or local or national authorities) as a natural part of the city logistics concept and even as customers that generate revenue for the UCC
5. An ability to innovate new services for customers that generate revenue.
6. Logistics and supply chain management competence in order to access potential value streams in the supply chain
7. The ability to take full advantage of advanced IT and information systems in both designing and developing the city logistics concept over time

The critical factors identified are quite different in nature and spans from more structural characteristics to those supporting the future development of the system and the importance of the 7 factors in the different cases varies, see table 3.

//Insert Table 3 here //

Our analysis shows that three factors are of high or very high importance in all our cases: scaling up to variable costs; logistics competence to access potential value streams; and the ability to take full advantage of advanced IT (factors 1, 6 and 7). ECO₂CITY is driven by financial values, which gives the factors regarding continuous development, innovative thinking, and new service development (factors 2, 3, and 5) a more central role.

Österlen, Lucca, and Eskilstuna are, on the other hand, furthestmost driven by environmental values, which makes the acknowledgement of the society (factor 4) more important in these cases. However, despite that Eskilstuna and Gothenburg are driven by environmental values, factors 2, 3, and 5 do have a large presence here as well. One explanation to this is that these initiatives, has started to transform to also become more financially driven—this is a change made in the case of ECO2CITY some years ago.

The different importance of the factors in different initiatives also provide some guidance with regard to the external validity of the findings of this study. In the selection of cases we strived to capture different forms of initiatives with regard to initiator, business model ownership, country, type of goods transported, and geographical span. All factors are not of equal importance and above we identify differences with regard to the initiator and owner of the business model. However, we have not found any clear differences with regard to e.g. country or type of goods when it comes to the importance of the seven critical factors identified. In terms of generalizations and lessons learned, we have not identified any causalities between individual factors or group of factor and viability. Instead viability is about understanding the business environment and the complexity of a city logistics system and continuously adapt the business model over time. This is in line with Teece (2010) arguing that designing a business correctly, and define a commercially viable architecture is essential when the enterprise is first created, but keeping the business model viable is a continuing task.

This study contributes to the literature by adding initiators to those already found in extant literature on city logistics (i.e., logistics companies, authorities, and goods owners) – a small local entrepreneur within a partner network supported by a non-profit organisation, property owners and trade organisations.

Another lesson learned for practitioners in their efforts to improve the viability of UCC-based city logistics, is that it is time to: (A) Consider city logistics as a highly entrepreneurial field and arena for new logistics services posing both financial and societal opportunities; and (B) Recognise the three roles for society or the municipality: that of initiator, by creating platforms for greener vehicles for city distribution; that of enabler, which is crucial in smaller cities in particular where the number of customers and volume is insufficient for purely commercial solutions (e.g., a tax for large trucks entering the city centre); and that of customer, in order to benefit from new services developed and directed to society as a means to better justify their long-term contribution in taking part in financing the establishing of UCC initiatives.

Lastly, research on sustainable business models for city logistics and urban consolidation centres is still in its infancy and the need for future research is large. Although value for society is an important point of departure in all of the cases studied, and though the financing from local and national authorities is or has been present in all models, the value for society and citizens (e.g., making cities less polluted and congested) has not been expressed in monetary terms in any of the models. Moreover, very few studies have quantified in monetary terms the changes in external costs that a UCC can achieve. Accordingly, this area is one that requires more support and guidance, as it promises considerable potential for future research. Another interesting area for further research regards how to successfully implementation these business models. In this study, we use the term viability to represent the systems that, over time, provide the values and goals defined by the owners. However, a large challenge to address in future research is to investigate to what extent these models also are viable from the perspective of other influenced actors or with regard to other values and goals than those defined by their owners. Furthermore, in this study we have targeted cases that have succeeded in their endeavour to implement urban consolidation centres. There are many who have failed and the lack of viable business models

has been singled out as one explanation. The critical factors identified in this study can constitute an important point of departure for future research aiming to provide deeper insights to why some UCC initiatives fail, investigating cases who have failed instead of succeeded.

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Figure 1. The complexity of a city logistics system that business models have to consider.

Table 1. Characteristics of the cases

UCC	Österlen	ECO₂CITY	Lucca	Gothenburg	Eskilstuna
Owner/Initiator	Three municipalities	Private company	The municipality	Private consortium	The municipality
Turnover	4 M€for 3 cities	0,06 – 0,22 M€ per city	0,115 M€	0,2 M€	1,3 M€
Financial viable	Yes	Yes	No	No	Yes
Goals	Env./Soc.	First Env. Now Financial	Env./Soc.	Env./Soc.	Env./Soc.
No. of cities	3 in one set-up	15 cities	1 city	1 city	1 city
Main customers	Municipal facilities	Retailers	Retailers	Retailers	Municipal facilities
No of receivers	200 in 3 cities	55 – 200/ city	350	500	150
Vehicles used	2 diesel trucks	1-4 gas trucks + bikes per city	1 diesel and 3 electrical trucks	3 electric “trains”	3 gas trucks
Deliveries/year	9000	NA	8000	5-6000	11200

Table 2. Differences between commercial and municipal city logistics

Issue	Commercial city logistics	Municipal city logistics
<i>System type</i>	Open system for independent customers in which use is optional	Closed system for municipal facilities in which use is mandatory
<i>Customer type</i>	Active customers who buy services; requires active sales and value creation	Passive customers; service is provided and no sales are required
<i>Number of actors involved</i>	Large number of customers and partners	Limited number of partners and only internal customers
<i>Volume</i>	Volume defined by number of customers	Volume defined by the municipality
<i>Type of goods and freight conditions</i>	Mixed goods in both inbound and outbound deliveries makes incoterms and freight conditions more complex	Only municipal goods make incoterms and freight conditions easier
<i>Profitability</i>	Financial profitability is needed for viability according to business principles	No financial profitability is needed; value for society and citizens can be enough for viability
<i>Expansion</i>	The service can be expanded to any customer in the market	The service cannot be offered to private customers, given competition laws for public organisations

Table 3, Importance of the 7 factors in the cases (Low, High, Very high)

UCC	Österlen	ECO₂CITY	Lucca	Gothenburg	Eskilstuna
Factor 1	High	Very High	High	High	High
Factor 2	Low	Very High	High	Very High	Very High
Factor 3	Low	Very High	High	Very High	High
Factor 4	Very High	Low	Very High	Low	Very High
Factor 5	Low	High	High	Very High	Very High
Factor 6	High	Very High	Very High	High	Very High
Factor 7	Very High	Very High	High	High	Very High