Sustainable Business Model Innovation in Last Mile Logistics

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SUSTAINABLE BUSINESS MODEL INNOVATION IN LAST MILE LOGISTICS

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CBS COPENHAGEN BUSINESS SCHOOL
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TABLE OF CONTENT

TABLE OF FIGURES AND TABLES

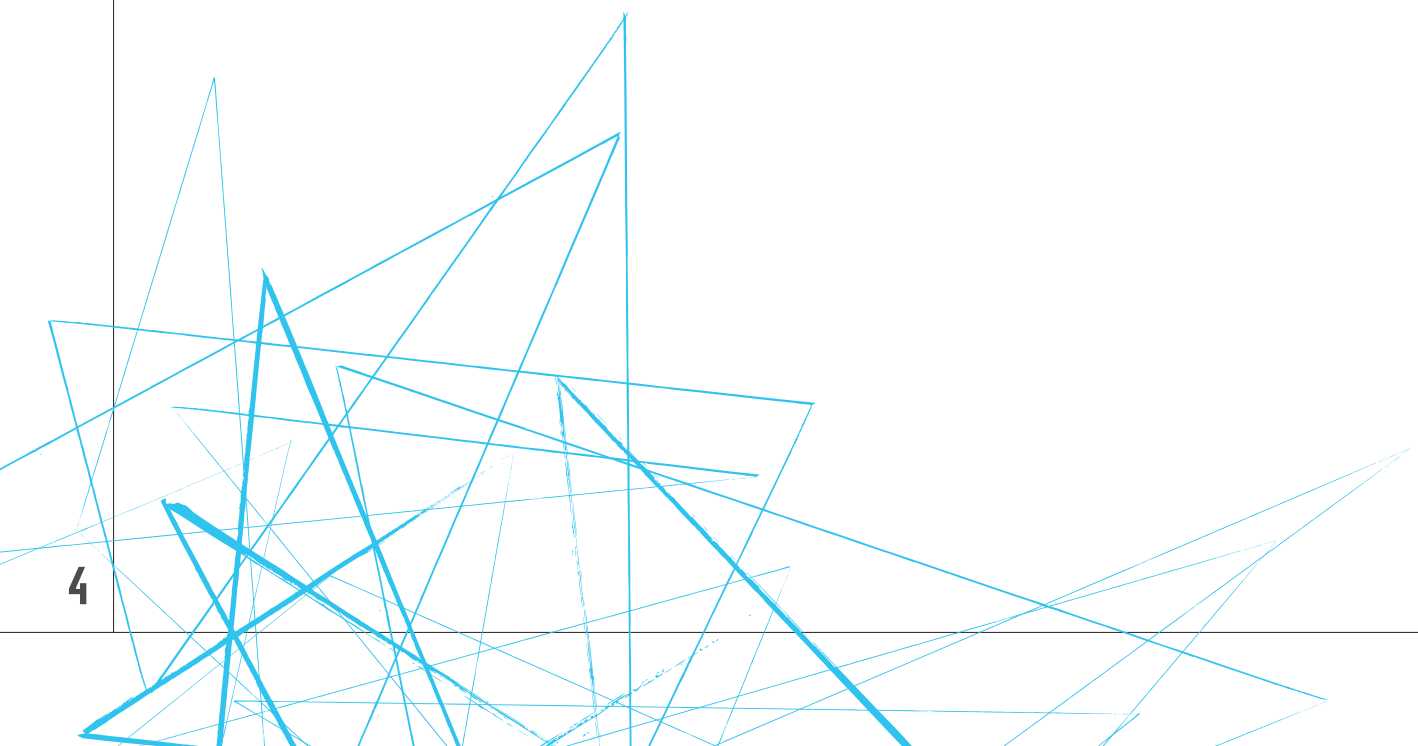
ACRONYMS

LSP Logistics service provider
BMI Business model innovation
VCC Value co-creation
CO2 Carbon dioxide
EV Electric vehicle
UCC Urban consolidation center

ABSTRACT

This comprehensive report investigates business model innovations in the logistics service industry. The strong growth in e-commerce causes many complex operational and environmental issues to stakeholders in the last mile system. The increasing volumes of deliveries coupled with a demand for fast delivery, puts especially logistics service providers under pressure to carry out the last mile in a cost-efficient manner while minimizing negative environmental and social externalities. Additionally, the Danish government and the municipality of Copenhagen have formulated ambitious plans. Copenhagen has pledged to become the first carbon neutral capital by 2025. Potential future regulations as well as growing consumer awareness on sustainability issues, necessitate LSPs to take action by innovating their business models to tackle the complex issues at hand and position themselves to be more competitive in a way that does not come at the expense of the environment and society.

Based on an extensive literature review of academic sources, industry reports, and interviews, a list of last mile innovations have been reviewed. These innovations have then been reviewed through the lens of two theoretical concepts, business model innovation by Amit and Zott (2012) and value co-creation by Prahalad and Ramaswamy (2004), to derive a business model innovation catalogue that can help practitioners and representatives of last mile stakeholders to get an overview over different innovations and make informed decisions about choosing the ones around which they can innovate their existing business models. The key takeaway is that a variety of different last mile innovations needs to be implemented into new business models in order to solve the issues regarding economic, environmental, and social sustainability.



1. INTRODUCTION

The logistics service industry has endured continuous pressure from consumers, particularly in e-commerce, demanding faster, more flexible services at the lowest possible cost. Retailers, on the other hand, are demanding more complex, fully integrated service solutions with everything from warehousing to distribution.

While the increase in e-commerce has provided LSPs with a growing revenue stream, delivering to individual households rather than to a retail store or a warehouse has dispersed deliveries to a wider geographical area. Single deliveries combined with a demand for faster services encumber full capacity utilization as consolidation becomes more difficult to achieve. Scale has thus become increasingly important in order to stay competitive and profitable.

Industry challenge

The intense competition of the industry combined with the entry of big players, such as Amazon, has put logistics service providers under additional pressure. Thus, the competition does not only emerge from entry of other LSPs, but also from large industrial or retail customers integrating logistics in their own operations. This makes the competitive landscape increasingly complex and more difficult to manage and navigate. This fierce competition that characterizes the industry together with rising customer expectations has led to low margins (Do Trung & Norrell, 2020).

The logistics sector is facing both challenges and opportunities, where digitalization is expected to be the most immediate and impactful trend (PwC, 2016). Logistics service providers could benefit from embracing digitalization, by making operational and contractual processes more efficient. Digitalization also provides the opportunity to create better customer experiences, and thus provide increased value to users and customers.

Yet, parts of the logistics sector are slow to embrace innovation. A significant challenge for transportation and logistics companies concerning digitalization, is the lack of a digital culture and training, which could prohibit the digitalization of the industry to reach its full potential. This, in turn, could pave the way for more technologically innovative start-ups competing for market share, further complicating the competitive landscape for established LSPs (Do Trung & Norell, 2020).

Consultants at IBM interviewing 765 corporate and public-sector leaders worldwide, found that firms that were financial outperformers put twice as much emphasis on business model innovation as did underperformers (IBM Global Business Services, 2006). Business model innovation is therefore a potential source of competitive advantage and improved financial performance. In an industry like the logistics industry, with low average operating margins and fierce competition, business model innovation can prove to be valuable.

Sustainability challenge

Moreover, LSPs face pressure about the sustainability of their operations, as its externalities primarily cause air pollution, congestion and noise in the urban environment. 57% of logistics and transport sector emissions are caused by road freight transport, and hence reducing emissions remains crucial in ensuring the future sustainability of urban freight (He & Haas, 2019). Those performing the last mile have an important role to play, as they have to fulfil the customer demand of fast and on-time delivery while keeping operating costs down in a complex environment that is plagued by congestion. Given the increase in e-commerce and assuming that the system of operation stays the same, LSPs have to make more delivery trips in order to cater to that growing demand. More trips will lead to more traffic, and in turn more congestion and pollution.

This, however, directly interferes with the municipality's goal of a green and livable city with low pollution and congestion. However, if they were to operate more sustainably by consolidating more and using e-vehicles and cargo bikes only, this would have severe effects on their service levels (as there are capacity and reach issues with sustainable transport means) as well as their operating costs (since investing into new vehicles is expensive and capacity would be an issue, too). It could also lead to customer dissatisfaction as the speed of the deliveries might be hampered. This could have a significant impact on their bottom line given the fierce competition and ease of switching LSPs from the consumer point of view.

Since both the LSPs and the consumers have an interest in fast delivery and thus have a conflict with the municipalities. The retailers also benefit from a faster delivery since it adds value to their customers if their products are delivered faster. However, the consumers are also citizens that live in a city and are thus also aligned with the municipalities on lowering congestion and pollution. Perhaps unknowingly, consumers are part of causing an issue that they would at the same time like to avoid.

Even though market demand for green delivery is low, LSPs should already look for ways to innovate their business models in ways that allow them to become more profitable but also more sustainable instead of making profit at the expense of the environment or work conditions. Focusing on sustainability can in fact pay off. As is argued by several scholars, being sustainable can lead to a competitive advantage (Carter and Rogers, 2007; Lubin and Etsy, 2010). Moreover, in light of potential new regulations and a growing public consciousness for sustainability, being on the forefront of innovation becomes crucial for LSPs (Kim & Lee, 2011).

Structure of the report

Firstly, the literature search strategy is presented. The strategy is important in providing readers with the transparency needed to scrutinize or verify our research and findings. It thus also provides the basis for future research to use this paper as a point of departure.

Secondly, we will explain the two theoretical frameworks before presenting a catalogue of different last mile distribution innovations around which LSPs can innovate their business models. In this report, we will primarily draw on two different theoretical frameworks, business model innovation (BMI) by Amit and Zott's (2012) and value co-creation (VCC) by Prahalad and Ramaswamy (2004). The former describes the drivers behind business model innovation while the second highlights the importance of providing value through more inclusion and participation of consumers.

Thirdly, once the theoretical concepts are established, a business model catalogue is presented in chapter four. Based on the main problems regarding last mile delivery, we will explain which last mile innovations can be used to solve certain issues, how they fit certain business strategies, and how they can be analyzed through the lens of BMI and VCC.

In the fifth chapter, we will put the different innovations into perspective by seeing how they fare in solving last mile issues and where they work in a last mile "supply chain". This chapter will further help managers and practitioners to make informed decisions. Lastly, this report draws attention to the sustainability imperative and the need for all actors to take action in light of the climate change and global warming crises.

2. LITERATURE SEARCH STRATEGY

The literature sources of this report are diverse and cover a range of media and topics. In order to delimit the literature, the topics of urban logistics, last mile delivery, sustainability and business model innovation were taken as points of departure. By combining different topics with each other, a comprehensive keyword search was conducted in order to find relevant academic papers. Moreover, we used non-academic sources such as industry reports, websites and magazines as sources for statistics and current last mile interventions, innovations and trends. In addition, interviews were conducted as part of the Master's Thesis *Exploring Barriers, Tensions and Dilemmas to Sustainable Development of the Last Mile Delivery System: A case study of the last mile system and its stakeholders in Copenhagen* by Do Trung & Norell (2020), that will also be utilized in the report. To organize and analyze the found literature the paper will employ two main theories: business model innovation (Amit & Zott, 2012) and value co-creation (Prahalad & Ramaswamy, 2004). These theories will help in putting the empirical data into perspective and synthesizing it with the other sources to create a catalogue of different sustainable business model innovations for LSPs.

As knowledge production in the field of last-mile delivery and distribution innovations is accelerating at a tremendous speed, it becomes important to remain at the forefront of new ideas and research. This is why utilizing literature review as the form of research methodology can be highly relevant (Snyder, 2019). As the aim of the report is to showcase new forms of innovation for logistic service providers, the report requires more creative collection of data, combining both academic and grey literature, to ensure that the report remains current and applicable. The report thus utilizes an integrative literature review approach (Torraco, 2005), that aims to allow for the emergence of new understandings of the topic through the synthesis of existing academic and grey literature in the field. The synthesis and analysis of the literature and sources reviewed will be guided by the theoretical frameworks of business model innovation (Amit & Zott, 2012) and value co-creation (Prahalad & Ramaswamy, 2004; Vargo et al., 2006).

As the integrative research strategy has few specific standards for forms of literature review, a detailed description of the review approach is necessary. An outline of the scope, search terms and inclusion criteria that guided the process was done first, that are outlined in Table 1. After defining the scope and the keywords and inclusion criteria, the paper selection was done through reading of title and abstracts to make selections, removing the papers not directly related to the wider research aim of the report. The articles that were identified as relevant were added to a database and were then evaluated to ensure their suitability through a full-text reading and analysis. Hours of reading, close evaluation and addition of new literature to the database was done to ensure a refined and comprehensive set of literature. Table 1 outlines the initial review design used for academic publications.

ITEM	DESCRIPTION
Main keywords	City logistics, urban logistics, last mile delivery, business model innovation, distribution innovation, value
Inclusion criteria	Logistics, transportation and urban logistics, business models, innovation
Document types	Journal articles
Language	English
Time interval	2007-2020
Databases used	Ebscohost, Libsearch, Scopus

Table 1. Paper selection. Source: Authors

Furthermore, "grey" literature search (see Table 2) utilized in the paper was guided by the main concepts found in the academic literature research, mainly, distribution innovations, thus utilizing forward snowballing as a review approach. To gain a better overview of such distribution innovations the report utilized both customized Google search and targeted websites that were guided by the concepts found in the literature review. The paper mainly utilized grey literature in relation to different distribution innovations, to gain an understanding of current state of the art in last-mile delivery in relation to innovations and to aim to bridge the gap between existing scholarship and company implementation. Main grey sources that the paper relied on were reports such as the Last-Mile Delivery by World Economic Forum.

ITEM	DESCRIPTION
Main keywords	City logistics, urban logistics, last mile delivery, distribution innovation, value
Inclusion criteria	Logistics, transportation and urban logistics, distribution innovations, last mile delivery
Document types	Industry reports, Masters theses, case interviews, websites, magazines
Language	English
Time interval	Cross-sectional (Accessed between March-December 2020)
Databases used	Targeted Google searches, company websites

Table 2. "Grey" literature selection. Source: Authors

3. BUSINESS MODEL INNOVATION FOR LOGISTICS COMPANIES

The LSP business sector has been argued to suffer from a lack of innovation (Liu et al., 2020). Innovation is crucial to achieve due to the several factors that put pressure on LSPs, such as the strong projected growth of e-commerce and thus parcels to be shipped, higher customer expectations, and an increasing competitive environment. Moreover, since LSPs contribute significantly to environmental externalities in cities with their current business models, it is important for them to look for ways in which they can resolve the last mile in a sustainable manner (He & Haas, 2019).

In order to identify avenues for business model innovation, the theoretical concepts of business model innovation by Amit and Zott (2012) and value co-creation by Prahalad and Ramaswamy (2004) are being used.

3.1 BUSINESS MODEL INNOVATION

In order to reap the benefits of business model innovation, an understanding of the concept is essential. Amit & Zott (2012) defines a business model as a system of interconnected and interdependent activities that determines the way the company "does business" with its customers, partners, and vendors. It's an activity system aimed at satisfying the perceived needs of the market, together with a plan on who should perform which activities and how these respective activities are connected (Amit & Zott, 2012).

Similarly to product or service innovation, business model innovation seeks to create additional value for the consumer. But unlike product or service innovation, business model innovation does not require a significant up-front investment and can therefore work as an alternative or complement to product and service innovation. So, how can value be created through innovation in business models? Amit, Massa & Zott (2011) identify four drivers for value creation through business models; *novelty, lock-in, complementarities and efficiency.*

Novelty refers to how innovative a business model is. It is about finding new ways in which an activity can be performed, or new ways of linking existing activities together. The novelty presented by a new business model can lead to superior value creation (Morris et al., 2005).

Lock-in refers to the ability of a business model to create switching costs for the user of the company's services or products. Creating switching costs will in turn lead to returning customers who will choose one product or service over the other despite other factors, such as higher prices. Since there is a great focus on costs, and thereby efficiency, in the transport and logistics industry, the ability to create switching costs can become a source of increased margins. We are currently in an era of increasing e-commerce, where the end user of a product bought online can freely choose between logistics providers from a retailer's website. By creating switching costs, LSPs could form a more loyal customer base, thus diverting the focus away from speed and costs to other activities which are adding value to the end user.

Complementarities refer to the creation of enhanced value by combining a set of activities. The value of one activity is thus only enhanced in the presence of another. The complementarities aspect is already pursued by some LSPs, especially third-party logistics providers who have integrated many of the logistics activities traditionally pursued by retailers and other customers. By vertically integrating, logistics providers can offer value-adding services to their customers. It can also be argued that when performing several complementary activities, efficiency can be improved. For example, labeling and other warehouse activities become consistent throughout the chain, reducing the potential risk of efficiency losses when operations of two different actors intersect.

Efficiency refers to cost-savings through the interconnections of the activity system, and as previously mentioned, efficiency has been a main focus of LSPs much due to the characteristics of the industry in terms of competition and customer/receiver demands. Efficiency can often be achieved through internal process changes. A classic example would be to schedule shipments in a way that leads to better capacity utilization and consolidation.

3.2 VALUE (CO-)CREATION

For the competitiveness of a company, it is crucial to be able to innovate, to develop new products, as well as being responsive to customer demands (Flint et al., 2005). These abilities are especially important due to several converging developments in the global economy. Due to globalization, outsourcing and the convergence of markets, it is harder for companies to differentiate themselves from one another (Do Trung & Norell, 2020). Therefore, consumers would rationally choose the cheapest option if the difference in the product offering between companies is marginal. Moreover, the trend towards mass customization and the growing e-commerce sector lead to supply chains becoming more consumer-driven. As a result of increased awareness, information and agency of the consumers, consumers are demonstrating their increased agency and their possession of unique resources within supply chains (Vargo et al., 2008). This is a challenge and opportunity alike as a successful interaction with customers can create a competitive advantage for firms (Prahalad and Ramaswamy, 2004). By cooperating with retailers or consumers, LSPs can identify how activities can be reorganized or how new value-adding activities can be introduced, which could ultimately result in business model innovation. According to Vargo et al. (2008) the relationship between producers and customers becomes more vital as customers increasingly become co-creators of the products and important contributors to the supply chain. By actively involving the customers into the value creation process, companies can better adjust to the needs of their customers and therefore differentiate themselves from their competitors (Bahn et al., 2015). A graphical representation of this new paradigm of value creation is found below in Figure 1.

Such global trends have led to a general shift from goods-dominant logic to service-dominant (S-D) logic, in which instead of the purpose of economic exchange to make and distribute goods to be sold, the basis of economic exchange becomes the service itself. In S-D logic, knowledge and skills are the key resources for competitive advantage, that is created in collaboration with the firm's customers and network partners in a process in which customers become active participants in the value creation constitutes what Prahalad & Ramaswamy (2004) coin as 'value co-creation'. Hence value is co-created through the integration of firm provided resources with the ones offered by the customers and public authorities, as a combination of public and private resources (Vargo et al., 2008). The concept of service thereby reflects the use and importance of human capital, which is used to provide value to other partners, with the presence of "value-in-use" of the service instead of merely "value-in-exchange" that is central to goods-dominant logic (Vargo et al., 2008). Value is thus added in a dynamic and collaborative process of integration of intangible resources.
Here the firms play an intermediary within the value creation process, through the proposition of value and provision of service, and the value itself is created at the intersection of the service provider and end consumer, where the value is ultimately defined by the beneficiary (i.e. the consumer) (Vargo et al., 2008). From the perspective of service-dominant logic, purpose of value should thus not be to solely increase wealth for the firm, but to increase the adaptability, survivability and system wellbeing through the service that is produced in collaboration with all network partners (Vargo et al., 2008). Furthermore, context also plays a role in the co-creation process, providing valuable resources to the process (Lusch et al., 2006). Vertical collaboration, traditionally seen as a link between LSPs and other actors in the supply

chain, can thus be revisualized as an ecosystem or network around the LSPs in which knowledge and resources are exchanged, hence providing an essential source of value co-creation (Wang et al., 2016). These co-creation networks rely on transparency, access to information and dialogue as well as the calculation of risk-benefits (Prahalad & Ramaswamy, 2004). Through such cooperation, stakeholders of a specific supply chain can generate better service offerings, ultimately benefiting the customers (Gammelgaard et al., 2016). Service systems thus co-create value through an interdependent service-for-service exchange, where consumers can act as a driving force behind the cooperative creation of value, in response to firms' value propositions. Hence, firms that adopt S-D logic can become dynamic learning organizations, that value collaborative knowledge for continuous improvement to enhance their ability to stay ahead of their competition and to sustain their competitive advantages. Such shift of focus from profit maximization to learning from outcomes, can ensure the firm's ability to serve their customers in the long run (Bahn et al., 2015).

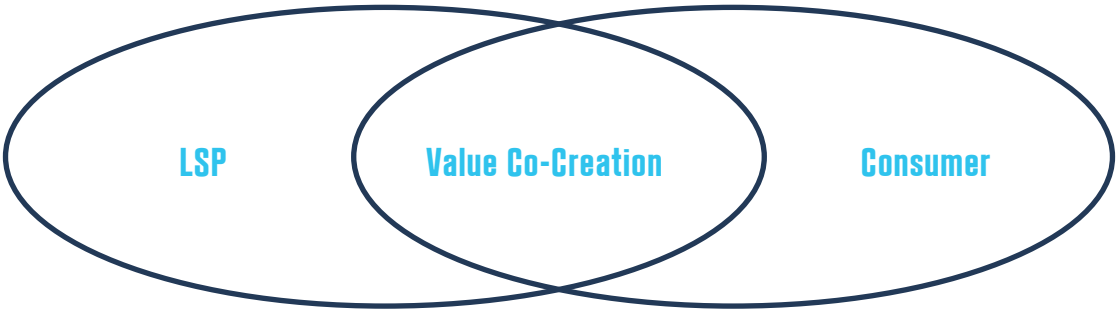


Figure 1. Value Co-Creation. Source: Adapted from Prahalad & Ramaswamy (2004)

Value co-creation within as part of last-mile delivery

With the proliferation of B2C e-commerce and the growing agency of consumers as a result, logistics has witnessed the increased conceptualization as possessors of unique knowledge, resources and co-creation capability (Wang, 2018). Consumers are actively shaping the last-mile through their purchase and delivery decisions, in some instances performing the last mile themselves by picking up the product from a brick-and-mortar store, or demanding logistics providers to perform this when ordering online through e-commerce channels, in the latter case, the logistics company creates value by delivering the goods to a consumer on time and to the right place, becoming part of the value creation process (Yazdanparast et al., 2010). The increased agency of consumers highlights the need for active collaboration of end-consumers and LSPs. Bahn et al. (2015) point out this agency, identifying *consumer logistics,* the activities in which consumers engage in the improvement of effectiveness and efficiency of the performed distribution tasks. Encouraging customer participation in the co-creation of service value can thus enhance the LSPs competitive advantage, and especially last-mile logistics is offering innovative solutions in which resources of the end-users are utilized in bettering how the last-mile is being performed, through the use of e.g. parcel lockers (Wang et al., 2018; Vakulenko, Hellström & Hjort, 2018).

Because the involvement of consumers improves or even defines the service level (Vakulenko et al., 2018), LSPs must find ways to better understand the values that consumers can extract from their services. Vakunlenko et al. (2018) studied value co-creation in connection with parcel lockers and argued that that particular innovation can lead to four different types of customer value. These are functional (i.e., utilitarian value), emotional (i.e., experiences, feelings and emotions), social (i.e., absence or presence of other humans), and financial (low prices). In addition to the financial value in terms of low cost, there is also the aspect of value for money. While some consumers would simply choose the cheapest option, others demand other service offers. Consumer's willingness to pay according to the convenience level a service provides in terms of speed or convenience must therefore be considered as well. In addition to the particular competencies of the participating parties in the value creation process, the context in which the value creation takes place plays an equally important role (Vargo et al. 2008).

Utilization of untapped resources

Co-creation takes place in its specific environment and the surrounding resources are integrated and also partly relied on in the value creation process. Because of the importance and potential to add value, LSPs should also be aware of underutilized or untapped resources in conceiving new opportunities for business model innovation and value (co-) creation. To fully take advantage of co-creation possibilities, LSPs should not only conceive innovating inside their own organizational boundaries but think about resources that are publicly accessible and are either underutilized or untapped within different company ecosystems. Such resources can be thought of along the dimensions of time, man-made and natural infrastructure, and cooperation, for instance.

TIME

Because most people are at work during the delivery hours, shifting the hours might have an effect on the rate of failed deliveries (CIVITAS, 2020). A good example for using alternative delivery hours is Burd who only deliver in the evenings and DAO who specialize in night delivery (Burd delivery, n.d.; Dao, n.d.).

INFRASTRUCTURE

Instead of only perceiving roads as the only avenue to transport goods, LSPs can look for other ways of transport. Land-bound alternatives include cargo bikes who use bike lanes, delivery robots who use pavements, or public transport vehicles such as trains, buses and metros. In addition, the elements of air and water can also be utilized through innovations such drones and urban waterways logistics.

COOPERATION

Even though LSPs operate in a cut-throat industry, all LSPs suffer from similar issues, such as low capacity utilization. In some areas however, for example in Belgium and Netherlands, LSPs have been found to collaborate in horizontal logistics partnerships (Cruijssen et al., 2007). Horizontal cooperation refers to the collaboration of enterprises in different SCs, between different LSPs. Through cooperation LSPs can together aim at increasing productivity, and subsequently their competitiveness by pooling their resources, knowledge and learning to achieve optimal outcomes (Cruijssen et al., 2007). Examples of such horizontal cooperation can be optimizing capacity utilization, urban consolidation centers and multi-brand parcel shops (WEF, 2020). Through such collaboration LSPs can increase their productivity e.g., by optimization of vehicle capacity and cut costs by focusing on their core activities (Cruijssen et al., 2007).

Another approach to cooperation, yet in a more vertical way, is through the sharing economy. According to Le and Ukkusuri (2019) the sharing economy "includes the shared creation, production, distribution, trade and consumption of goods and services by different people and organizations". They distinguish between two forms of sharing in transportation, which are passenger and freight transportation. The latter is termed crowdshipping and is usually a service enabled by an app that leverages unused resources of people by asking them to participate in delivering parcels. People can thus contribute either by using their equipment (e.g., bike, car) or train where people that normally would use the train for non-transport related reasons would deliver parcels (Rantorp, 2020).

Now that we have reviewed the theoretical concepts, we will dive into how specific last mile problems can be solved through specific distribution innovations.

4. THE CATALOGUE OF BUSINESS MODELS

Before a catalogue for business models can be created, the issues surrounding the last mile must be addressed. These issues combined with several external trends and factors necessitate LSPs to innovate their business models. Afterwards we will review how last mile innovations can fit into generic business strategies and how they relate to each of the last mile problems. Then we will review how each major last mile issue can be mitigated by implementing last mile innovations. By looking at the innovations through the lens of business model innovation and value co-creation, it will allow practitioners to see these innovations in a new light and make more informed decisions about which innovations they should create their business models around and which they should not include.

The purpose of this report is not to formulate new business models. Rather it is to present current last mile innovations and highlight them from the perspective of the concepts of "business model innovation" and "value co-creation". Understanding how these concepts can lead to new innovations in business models and distribution methods can empower LSPs to become more competitive while also contributing more to the sustainability of the last mile system.

4.1 WHY IS THERE A NEED FOR LSPS FOR BUSINESS MODEL INNOVATION?

Solving the main issues of last mile delivery

From literature and interviews with LSP representatives, and a set of reports on the challenges facing Urban Freight Transport, we have identified the following four main issues pertaining to the last mile: high delivery costs, inefficiency, pollution, and congestion (OECD, 2003; CIVITAS, 2020; WEF, 2020) The need for LSPs to innovate their business models becomes apparent as they are involved in all major issues as either a problem owner or problem originator. A problem owner is confronted with or suffering from a specific issue whereas a problem originator causes an issue through their behavior or actions. This information is summarized below in Table 3. Some of the issues that LSPs face can be solved through business model innovation, especially those in which LSPs are the problem originators, and have thus theoretically more control over a specific problem. However, there are other issues that must be solved in cooperation with other last mile stakeholders, such as the lack of parking infrastructure or the insufficient support of the government to promote a specific modal shift (Do Trung & Norell, 2020). For such issues, the value co-creation concept is useful. In order to tackle the problems most effectively, the problem drivers must be considered and tackled.

PROBLEM	PROBLEM DRIVER	PROBLEM OWNER	PROBLEM ORIGINATOR
1. High delivery cost	Failed deliveries, emphasis on speed prevents consolidation, delivery capacity not fully utilized (e.g. trucks not full)	LSPs	Retailers, consumers
2. Inefficient, low capacity utilization (He & Haas, 2019)	Emphasis on fast delivery	LSPs	Retailers, consumers
3. Pollution (He & Haas, 2019)	Delivery with diesel vans	Municipality	LSPs
4. Congestion (He & Haas, 2019)	Emphasis on fast delivery	Municipality, LSPs	LSPs

Table 3. Main problems within last mile delivery.

Exogenous trends

Additionally, there are numerous exogenous trends that either incentivize or pressure LSPs to innovate their business models. First and foremost, the strongest driver for change is the sustainability agenda and the move towards greener and more sustainable ways of conducting business in face of climate change and global warming. The Danish government has announced ambitious climate goals (Ministry of Foreign Affairs of Denmark, 2020), whilst Copenhagen seeks to become the first carbon neutral capital by 2025 (City of Copenhagen, 2012). In general, consumers are also becoming more aware and conscious about their choices. This trend is encapsulated in the term green consumerism and has manifested in a demand for more transparency and more sustainable and ethical production processes (Kim & Lee, 2011; Wang, 2019). On the one hand, LSPs should see such developments as a chance and incentive to become greener since sustainable practices might become profitable in the long run when consumers broadly demand sustainable delivery and are willing to pay for it. On the other hand, public authorities might impose regulations that force sustainable delivery practices and would harm LSPs that are not prepared and did not act in time.

Differentiation factors

What makes this task complex is that LSPs have to create business models that not only solve their own operational challenges in terms of cost, speed, as well as convenience. Especially the latter two are becoming increasingly more important in terms of differentiating an LSP's service offering to that of their competitors as well providing consumers with more value. Having a short lead time between the time of order and the time of delivery, is a very important selling point for online retailers. Convenience in terms of giving the end consumer more control over time and place of delivery, providing them with a variety of different pick up options, is especially important in an attempt to create better relationships with the end consumer and inspiring brand recognition and ultimately some loyalty (Do Trung & Norell, 2020; WEF, 2020). In addition, LSPs also need to optimize for environmental and social issues such as pollution, noise and safety (He & Haas, 2019).

4.2 GENERIC BUSINESS STRATEGIES TO INCREASE ISSUES OF LOW MARGINS

A large issue for LSPs is the cut-throat market in which they operate. Due to the competitiveness of the industry and marginal differentiation between LSPs and their services, they have mainly been competing on price and advances in efficiency and cutting costs have been channeled into further cutting costs and undercutting the prices of competitors. In order to increase margins LSPs can choose from Porter's generic strategies: 1) cost leadership, 2) differentiation, and 3) focus, which pertains to providing specialized services to in a focused market.

LSPs can either continue with their current dominant strategy of cost leadership by reducing the cost of delivery or differentiate their offering through other means, e.g., speed or convenience. Both these strategies apply to a broader market. In the focus strategy a company identifies a niche market which it provides with particularly well-suited products and services. Although the growth opportunities in the niche market are more limited, companies can inspire more customer loyalty.

Cost leadership

As for cost leadership, LSPs need to find ways to reduce their costs. A significant cost driver is the rates of failed deliveries due to people not being home at the time of delivery. Therefore, LSPs could change the delivery times (e.g. night delivery, optimized delivery tracking) or the destination (e.g., parcel lockers, office delivery). Another efficient way to reduce delivery cost or unit costs is through consolidation or by using IT solutions to optimize the delivery routes (e.g., dynamic re-routing) (WEF, 2020; Bringg, n.d.).

Differentiation

Differentiation allows LSPs to demand higher prices by providing products and services that are perceived as more unique. Value is added by allowing for more factors other than cost such as speed and convenience. Speed can be enhanced by a variety of ways. One such way is to shift delivery to transport modes that use infrastructure not affected by congestion on roads, such as cargo bikes (bike lanes), waterway logistics (water), and drones (air). The delivery speed can also be enhanced by shortening the distance, which can be done through innovations such as parcel lockers and mobile depots. Parcel lockers would also help in terms of convenience as end consumers have more control over the time and place, they want to pick up the package.

Focus

A focus strategy provides additional value beyond just cost by singling out a specific niche. The niche can be a specific population or a very specific service that is tailored to a specific use case. Examples could include focusing on the needs of older people only who cannot go outside to parcel lockers, very busy professionals who spend little time at home and would pay a premium for office delivery, or offering a service that is geared toward extreme speed on par with food delivery, or creating an experience around the delivery process by using drones that will attract younger and technophile people.

4.3 SOLVING LAST MILE ISSUES THROUGH THE USE OF LAST MILE INNOVATIONS

Problem 1: Cost of delivery - How can LSPs make the last mile cheaper?

One of the most significant issues that LSPs face regarding the last mile is the cost of delivery. The last mile alone can account for about 28 percent of the total transportation costs and is thus an area that LSPs need to make more efficient (Goodman, 2005). One of the main reasons for the high costs is that LSPs face very high rates of failed deliveries since many people are at work during the delivery times. Another reason is the variety and high number of stops over a wider geographical area during one delivery run, which makes it hard to find optimal and efficient routes.

As illustrated in the cost leadership strategy section above, cost can be mainly reduced by either tackling the issue of failed deliveries or making the last mile shorter. Regarding the first option, LSPs can change the destination of the delivery such that they are not dependent on people being home during the delivery. Parcel lockers (e.g., Nordic Infrastructure) and parcel shops (e.g., GLS) decrease the failed deliveries because LSPs deliver the parcels there instead of an address. Moreover, these solutions shorten the last mile and decrease the number of stops. Instead of having to deliver to several households spread over different streets within a neighborhood, they would deliver to one parcel shop or locker that caters to a specific neighborhood, which saves costs. Alternatively, LSPs could deliver to offices since the reason why many deliveries fail is that people are at work.

Another solution to the failed delivery issue is to shift the actual time the delivery is being carried out. Burd Delivery provides same day delivery from numerous established Danish retailers. Orders placed by customers before 14:00 will be delivered the same evening. By introducing evening delivery, Burd circumvents the congestion that characterizes the traffic during the day. Evening delivery has also resulted in a delivery rate of 96% since the receivers are more likely to be at home during the evening.

Parcel lockers can be implemented without a large disruption to current LSP business models as they do not need to be owned and effectively only shorten the last mile rather than transforming it. LSPs can simply book space in parcel

lockers that are provided by parcel locker providers such as Nordic Infrastructure when they need it. From a BMI perspective, integrating parcel lockers into the last mile conforms with the efficiency driver for value creation as it reduces the cost of delivery. Moreover, it also creates value through complementarities by integrating the transportation processes of the LSPs with the storage space of parcel locker providers.

Evening and night time delivery also create value through efficiency through reducing failed deliveries and costs. Complementarities are achieved through a better match of timing the delivery with people being at home to accept the delivery. Night deliveries, however, are controversial as the noise of the delivery process can disrupt neighborhoods. Since LSPs have to carry the final handling equipment over longer distances, this can lead to additional legal and safety issues (Regue & Bristow, 2013).

From a value co-creation point of view, parcel shops and especially parcel lockers award a lot of agency to the end consumer in that they are able to choose time and place of delivery. In doing so, the consumer co-creates part of the value of the delivery service, which is beneficial and important to LSPs because they can delegate part of the responsibilities to the end consumer. To the consumer parcel lockers can create functional and financial value due to the control of time and space of delivery and the cheaper prices of deliveries to parcel lockers (Vakulenko et al., 2018).

Problem 2: Delivery efficiency - How can LSPs make the last mile more efficient?

LSPs face a significant dilemma between efficiency and speed. On the one hand, the ability to deliver goods as fast as possible is becoming increasingly important and a valuable and essential way of differentiation for LSPs. The demand comes from both retailers and end-consumers but is especially pushed by retailers as delivering the goods as quickly to end-consumers as possible, makes their service more competitive. This is especially evident with Amazon who have been pushing fast delivery heavily in the market, which improved their service offering as a retailer.

Capacity, on the other hand, is a key performance indicator for LSPs as it indicates how many parcels, they can deliver per delivery run. Having a higher capacity in theory translates to higher efficiency if the capacity is utilized efficiently. Such a scenario can save time and money as more parcels can be delivered at once. However, this becomes increasingly challenging due to the emphasis on speed as it complicates the process of consolidation. In general, there are several ways to improve the capacity utilization of deliveries. LSPs could either move closer to the end consumers, use IT solutions to optimize the navigation and routing of their delivery runs, for example, through dynamic re-routing, or cooperate and share capacities with competitors.

One way of balancing speed and capacity could be then to deploy smaller vehicles that are, however, faster. An example would be cargo bikes that have a much lower capacity. If paired with a mobile hub, cargo bikes could be deployed closer to the end-consumers and might be quicker than ordinary vans, especially if there are high levels of congestion on the roads. In Copenhagen DHL already set up a city hub through which the company carries out bike deliveries in the city center. Even though the company must carry out more delivery runs due to the lower capacity of cargo bikes, the speed might even out in terms of parcels delivered per hour.

On the spectrum of the speed vs capacity spectrum, there is the aspect of horizontal collaboration. As such, LSPs can share capacities during transport or even engage in cross-docking services as a form of horizontal collaboration (DB Schenker, n.d.; DHL Logistics of Things, n.d.). An impactful solution in this regard is the adoption of an urban consolidation center. CityDepot in Belgium presents a suitable example of currently operating UCCs, presenting itself as a fierce competitor to traditional LSPs (CityDepot, n.d.). Pilots on multi-brand parcel shops are still rare, however one such example is one in Hamburg, that is witnessing the collaboration between DPD, GLS, UPS and Hermes ("Multi-level parcel shop opens in Hamburg", 2018). All these solutions, however, require significant levels of cooperation and, in the case of UCCs, relinquishing some control, which is why many LSPs are hesitant towards such solutions (Do Trung and Norell, 2020).

Micro-hubs paired with cargo bikes would make the delivery process more complex than for example the adoption of parcel lockers as there is the final distribution point is shifted closer to the end consumer coupled with a modal shift for

the last mile. However, the gain in speed could potentially offset the increase in the costs of operating such a last mile and could also be seen as a novelty. Especially once public consciousness on green transportation picks up, LSPs that carry out their deliveries by bike, can hope to attract consumers through a novel approach like this. Since the consumers technically decide where, how and when the delivery takes place, they can make an active choice to co-create value by demanding and promoting bike deliveries through a dialog with LSPs. In such a case, they could derive an emotional value from bike deliveries knowing that they deliberately chose a green delivery option. Moreover, the speed increase of such a set up could also result in financial value to the consumer in terms of paying for a fast delivery.

Horizontal cooperation in the form of UCCs or multi-brand parcel shops would innovate LSPs' business models towards efficiency as they would be able to save costs through consolidation and become more efficient. By using each other's capacities and resources, they would also achieve complementarities. Both solutions would result in more efficient and cheaper delivery, with cost savings potentially passed on to consumers. The consumer value would therefore be of financial nature. Multi-brand parcel shops also have a functional value similar to parcel lockers in that the consumer can decide when and from which shop to pick up their parcels. In addition, there might be a social value, too. In this regard, it must, however, be stated that social value can differ between people. While some people might prefer the absence of other people, as is the case with parcel lockers, others might prefer the company of other people. Value co-creation here pertains more to horizontal cooperation among LSPs.

Problem 3: Pollution - How can LSPs lower the levels of pollution?

At first hand, emissions and noise and air pollution within cities do not directly affect LSPs and their operations. However, they contribute significantly to urban emissions by using diesel vans to carry out deliveries and should therefore seek to internalize these due to the reasons mentioned above. Additionally, if LSPs seek to be sustainable and want to convey good business practices and a responsible and green image, actively tackling emissions is vital.

Similarly to emissions, noise that originates from the delivery process in cities, does not directly affect LSPs' ability to fulfill their value proposition. Delivery vans can cause noise during the process, which can lead to city residents perceiving the deliveries as a nuisance and creating a negative association of the LSPs whose vans they see. This in turn could hurt an LSP's brand value. Therefore, in terms of both emissions and noise, an LSP's visibility through branded vans could in fact hurt them if people associate a certain LSP brand with emissions and noise pollution.

The issue of emissions can be solved in various ways: 1) through a vehicle shift to more sustainable fuels such as EVs, hydrogen cars or other alternative sources, 2) by decreasing the number of cars through consolidation and horizontal cooperation between LSPs, 3) by changing the destination, and effectively shortening the last mile through parcel lockers, shops or office delivery, or 4) by optimizing the routes through IT solutions.

Electric vehicles are often mentioned as solutions in the last mile. Compared to other solutions, however, they do not solve many last mile issues. Since adopting EVs would only mean a shift from diesel fuel to electric energy, they would only solve the pollution issue within cities but not the number of cars on the streets. Even though it is a "one-to-one" vehicle shift, there would still be a slight disruption to existing business models as EVs require an extensive infrastructure of charging stations to be deployed with the same efficiency as current diesel vans. This can also be argued though as there are concerns about the capacity and range of EVs. By carrying out deliveries with EVs, LSPs could provide emotional value to consumers by providing a sustainable transport option. In terms of value co-creation, it is similar to the cargo bike example mentioned above, in which consumers would actively demand, promote and pay for the use of more sustainable transport modes.

Problem 4: Congestion - How can LSPs lower congestion?

Being stuck in a traffic jam negatively affects LSPs' operations and can negatively affect the speed of the delivery process and the fulfilment of their value proposition. Therefore, it should be in LSPs' interest to pursue solutions that either lower the cars on the streets to lower congestion or use IT solutions to optimize the delivery routes and capacities.

Other options include using modal shifts to other transport modes that do not use the road network. Such options include drones, public transit logistics and waterways logistics as well as the aforementioned cargo bike delivery. These solutions would use already existing infrastructures that are not as prone to congestion as road delivery modes.

Waterways logistics are contingent on having large and navigable bodies of water in the city but offer a totally new delivery option in cities that do. It has received attention as option capable of alleviating congestion and emissions (Diziain et al., 2014). DHL Express already carries out part of its deliveries in Amsterdam and Venice. In Paris, the company Vert Chez Vous uses barges in connection with cargo bikes. While LSPs could use this to gain experience in intermodal operations, which could give them a competitive advantage in the future, there are challenges regarding the high investment costs, the weather conditions, and building new infrastructure in cities such as docks and storage spaces (Diziain et al., 2014).

Waterways logistics could be seen as an efficiency business model innovation driver since they avoid congestion and have a very high capacity compared to trucks. Since waterways logistics operate as a transshipment option, it still necessitates the use of a truck or another mode of transport for the final last mile. Thus, if the appropriate docking infrastructure is present, including delivery via waterways can also result in complementarities. In terms of value, this option can potentially lower costs, and therefore provide financial customer value.

Drones are a great option in rural areas with sparse infrastructure but face many obstacles for implementation in cities due to safety and legal concerns and technological uncertainty. In theory, drones provide LSPs with a very fast option for delivery since they operate in air space. They are also a very innovative and exciting option of delivery, which is why adopting drones into the delivery process would constitute a novel approach that can attract not only customers that value the speed of delivery but also ones that are curious and value technological innovations. Thus, drones would provide emotional, by providing a delivery experience, and financial customer value, by carrying out super-fast delivery.

As opposed to the other options, IT solutions do not require heavy investments into physical infrastructure, which reduces the financial risk in terms of maintenance and potential underutilization for LSPs. Consequently, such solutions are less disruptive to existing business models. One effective solution that can potentially lower congestion, or avoid running into congested roads, is to make the delivery process more efficient through solutions such as route optimization or dynamic re-routing. Choosing to implement such solutions adheres to driving business model innovation through efficiency and add customer value through making deliveries potentially cheaper as well as faster.

In terms of IT, the role of customer apps is a way to further engage with end-consumers and build better relationships. While this option does not lower congestion or pollution, it provides LSPs with a tool to potentially create a lock-in effect through relationship building, transparency and engagement, which are among the building blocks for value co-creation. By combining IT solutions with one another or with other last mile distribution innovations, LSPs can provide significant consumer value in various ways. Being able to offer functional, emotional, social and financial value, can enhance the visibility and brand value and ultimately lead to more loyalty and financial returns.

Speed of delivery - How can LSPs increase the speed sustainably?

In addition to the four main issues, we must discuss the main drivers for issues in the last mile. The most significant and influential driver is the increasing demand for speed, which begs the question of how LSPs can increase speed in a sustainable way as well as how that trend can be mitigated.

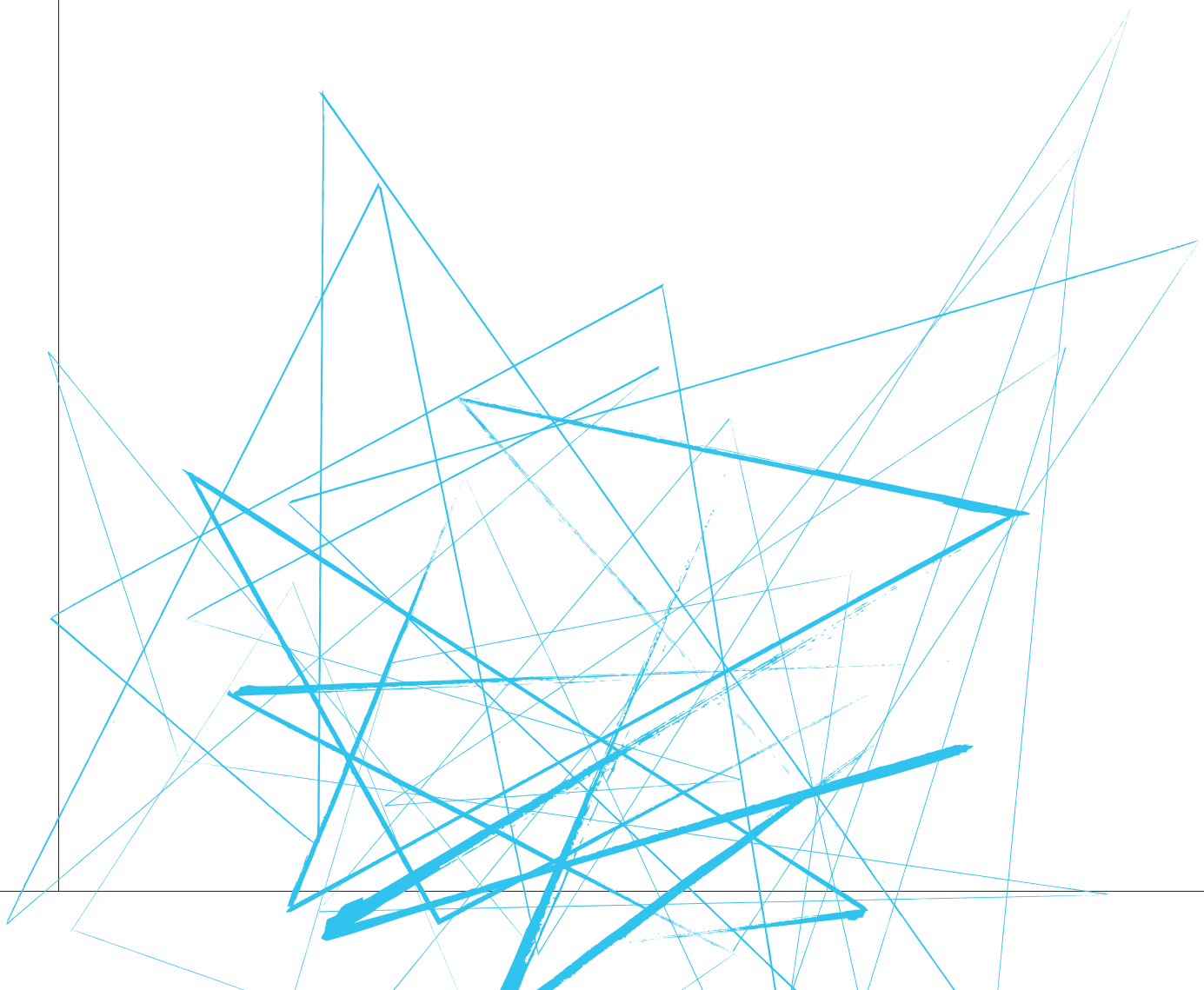
As mentioned before, UCCs constitute a solution that provides several benefits as they increase efficiency, congestion and pollution through consolidation. However, as stated by many representatives of LSPs, they fear that they would give up control over the value proposition and therefore would not want to engage in such a scheme. DHL, for example, is concerned that they would be unable to guarantee their end-to-end supply chain or delivery if they were not in charge of the last mile anymore. Since the last mile is one of the few ways for LSPs to directly engage with and be visible to the end-consumers, giving up control of the last mile is largely undesirable for them. However, there have been several attempts of an UCC that worked out well for the LSPs as they were able to achieve significant cost savings. It can be

argued that such savings might be able to be pooled into better and more efficient ways of customer engagement and brand building than having branded vans driving through the city. This could include expanding the capabilities of an app or devoting more resources into targeted marketing campaigns.

Moreover, as many interviewees explained, many LSPs are cost focused as the margins are low and argue that consumers are not willing to pay extra for green delivery. However, as the Danish e-commerce interest group FDIH has identified in a survey, many e-commerce consumers that care about sustainability rather care about green packaging or the green production of a product rather than green transportation (FDIH, 2020). In order to change people's perception, engaging in continuous dialogues with consumers and providing transparency about their operations, intentions and strategies should enable and educate people on the adverse effects of last mile delivery and e-commerce. Effectively, LSPs thus provide the basis to co-create a more sustainable last mile together with the end-consumer. The goal should be to empower consumers to make informed decisions and eventually demand more sustainable transport options.

Building business models to directly tackle issues

The examples mentioned above are especially useful to LSPs that are already established in the market and need to innovate their business models in order to stay competitive or become more competitive or hedge against future trends. Given how low the entrance barriers are in the logistics market, there have been new entrants into the market that carved out a share of the market by using new business models. A good example of this is Burd Delivery who saw the issues surrounding failed deliveries, congestion and safety and built on a sharing economy approach (Do Trung, Norell & Gammelgaard, 2020). Instead of reacting to issues and innovating an existing business model to fit contemporary issues, Burd created a new business model to directly counteract some of the issues regarding the last mile.



4.4 THE BUSINESS MODEL CATALOGUE - BUILDING ON LAST MILE INNOVATIONS

Based on the discussion above, we have created a business model catalogue as shown below in Table 4 which shows what elements each innovation brings to a business models in terms of novelty, complementarities, lock-in, and efficiency, the consumer value of each innovations, the value co-creation aspect, which last mile issues every innovation tackles, and case examples of companies that are using or experimenting with certain innovations. Since there are innovations that can alleviate or solve several last mile issues at once, this catalogue can be a useful tool to get an overview of relevant last mile innovations and how they can be useful in innovating existing business models.

DISTRIBUTION INNOVATIONS	LSP BUSINESS MODEL INNOVATION	CONSUMER VALUE CREATED	VALUE CO-CREATION	ISSUE SOLVED	CASE EXAMPLE
Vehicle change:					
EV	Complementaries	Emotional (sustainable)	Modal shifts can be supported by consumer participation and knowledge integration	Emissions	DHL, Citylogistik
Delivery drones	Novelty	Emotional, financial (through speed)		Speed	Amazon Prime Air
Cargo bikes	Novelty	Emotional (sustainable), financial (speed)		Speed, emissions, noise	DHL, Burd
Customer movement:					
Parcel locker	Efficiency, Complementaries	Functional, financial	Consumer performs the last mile, delivery time and place customized	Cost of delivery, speed	Nordic Infrastructure, PostNord and Swipbox
Office delivery	Efficiency, Complementaries	Functional, financial		Cost of delivery	JD.com
Multi-brand parcel shop	Efficiency, Complementaries	Functional, social	Horizontal collaboration, value creation among LSPs	Cost of delivery	Multi-brand parcel shop in Hamburg (DPD, GLS, Hermes and UPS)
Consolidation:					
UCC	Efficiency	Financial	Integration of public and private resources to create value	Cost of delivery, emissions, noise, congestion	CityDepot in Belgium, Binnenstadservice in Netherlands
Load-pooling	Efficiency	Financial	Horizontal collaboration, value creation among LSPs	Cost of delivery, emissions, noise	Saloodo! (DHL), Coyote Logistics (UPS)
Last leg change:					
Public transit logistics	Complementaries, Efficiency	Financial	Integration of public infrastructure and private resources to create value	Cost of delivery, emissions, noise, safety, congestion	CarGo Tram in Dresden, CargoTram in Zurich, CityCargo in Amsterdam
Waterway logistics	Efficiency, Complementaries	Financial		Cost of delivery, emissions, noise, safety, congestion	DHL Express in Amsterdam and Venice, Vert Chez Vous
Mobile depot	Efficiency	Financial (speed)		Emissions, noise	TNT Express
AGV (on street)	Novelty	Emotional		Cost of delivery (labour costs, high fixed costs)	BoxBot
Droid (on pavement)	Novelty	Emotional		Costs of delivery (operational, high maintenance and fixed costs)	Starship, Amazon Prime
Delivery environment:					
Dynamic re-routing	Efficiency	Financial	Integration of public and private resources to create value	Cost of delivery, speed	ILOS: Intelligend Freight Logistics project in Vienna
Night time delivery	Efficiency, Complementaries	Functional, financial	Integration of public and private resources, synchronization of time windows	Cost of delivery, speed	Barcelona night-delivery scheme (CIVITAS MIRACLES), Dublin night-delivery pilot (Niches, EU project)

Table 4. Last mile business model catalogue. Source: Authors

5. PERFORMANCE INDICATORS FOR LAST MILE INNOVATIONS

As is evident from the review so far, there is a myriad of different distribution innovations in last mile delivery. This begs the following questions:

- Which ones should LSPs prioritize and pursue regardless of where in the supply chain an innovation takes place?
- And how can LSPs implement solutions that are effective in solving last mile issues and be sustainable at the same time?

5.1 FINDING THE RIGHT MIX OF INNOVATIONS FOR NEW BUSINESS MODELS

To answer these questions, we have created a performance indicator matrix below in Table 5. It combines indicators that cater to an LSPs ability to solve operational issues such as speed and capacity (economic sustainability) as well as more societal issues such as pollution and noise (environmental and social sustainability). The matrix is based on the extensive literature review performed by He & Haas (2019) that has identified the most relevant and researched distribution innovations in urban freight logistics. The matrix has chosen to exclude taxi logistics as very little practical implementation of the distribution innovation has been done, and it remains more suitable for delivery of post instead of retail logistics (He & Haas, 2019).

While some performance indicators are more relevant to LSPs than others, they should have an interest in implementing solutions and build business models around ones that fulfill as many indicators as possible. While congestion inhibits a LSPs' ability to deliver parcels in a timely manner, emissions are not directly affecting them and their operations. However, since they are one of the main emitters of CO2 inside cities (He & Haas, 2019), they should take responsibility in internalizing and mitigating the environmental side effects of their operations, especially given the growing awareness of the public and looming regulations.

From Table 5 it should become apparent that there is no single innovation that fulfills all criteria in creating a sustainable and efficient last mile. Having this overview will help LSPs to not only to deliberately choose which innovations to pursue strategically and build new business models around but to view the last mile system holistically. That is, LSPs and other last mile system stakeholders need to be aware that they all operate inside an ecosystem, in which the actions of one party affect the others and vice versa. To this end, the World Economic Forum (2020) suggests three different transition scenarios to a more sustainable development of the last mile system, which are the sustainability, economic, and multiplayer ecosystem scenarios. Each of these scenarios includes different innovations and have different "success" trajectories. Whereas the economic scenario prioritizes the reduction in cost of delivery and congestion, it reduces pollution less than the other scenarios. It is built around a combination of parcel lockers, express lanes, dynamic re-routing, and load-pooling. The sustainability scenario relies on a mix of night delivery, EVs, and double-parking areas and enforcement. Such a scenario would yield better results in terms of emissions but would be slightly less effective in reducing the cost of delivery and the level of congestion. However, given the nature of the solutions, it would result in less disruptions towards business models. Lastly, a multiplayer-scenario would have the most fundamental impact

in terms of congestion, emissions and cost of delivery by combining different last mile innovations such as EVs, night deliveries, parcel lockers, and IT solutions. Integrating such a wide variety of different solutions, however, requires extensive cooperative efforts from various stakeholders in terms of behavioral and regulative changes as well as significant investments.

The takeaway is that LSPs are part of such transition scenarios and must coordinate efforts with the stakeholders to achieve a more sustainable development since not all interventions inside these scenarios lend themselves towards LSP business model innovation.

PERFORMANCE INDICATORS:	CONGESTION	EMISSIONS	NOISE	SPEED	CAPACITY	COST OF DELIVERY
Single innovations:						
E-vehicles (EV)		●	●			
Cargo bikes (CB)	●	●	●	◑		
Delivery drones	●	●		●		
Parcel lockers	◑	◑	◑	●		●
Delivery robots	●	●	●			
Urban consolidation center (UCC)	●	●			●	●
Public transport logistics (PTL)	●	●	●			
Waterway logistics	●	●		◑	●	
Night time delivery	●	●		●	●	●
Route optimization	●			●		●
Load pooling	●	●			●	●
Combinations:						
UCC + EV	●	●	●		●	●
PTL + parcel locker	●	●	●	◑	●	
Mobile depots + CB	◑	●	●	●	●	
EV + parcel locker	◑	●	●	●		●
UCC + Mobile depots + CB	●	●	●	●	●	
Measurements:	cars/km	CO2/km	decibels	min/parcel	parcels/delivery run	costs/parcel
Bottom line:	Economic	Environmental	Social	Economic	Economic	Economic

Table 5. Sustainability and effectiveness of different last mile innovations.
Source: Authors, based on CIVITAS (2020), Christian et al. (2015), Diziain et al. (2014), Dong et al. (2018), He & Haas (2019), Iwan et al. (2016), Kelly et al. (2017), Lenz & Riehle (2013), McKinnon (2017), McKinsey&Company (2017), Melo & Baptista (2017), Mitrea & Kyamakya (2017), Molfino et al. (2014), Paddeu (2018), Regue & Bristow (2013), Schliwa et al. (2015), Vakulenko et al. (2018), Vleugel & Bal (2017), Zhang et al. (2019), WEF (2020).

The thought of having to combine several distribution innovations in order to achieve triple bottom line sustainable development of the last mile, is supported by several other papers. According to the World Economic Forum, the last mile cannot be "solved" through one intervention alone (WEF, 2020). Neither can it be solved by one party alone. Rather stakeholders in the last mile should recognize that they operate within an ecosystem in which the actors affect each other and need to formulate and implement solutions jointly. As evident in interviews with various representatives of logistics service providers and last mile industry experts, there is an emphasis on electrifying the current delivery fleets (Do Trung & Norell, 2020). Even though EVs would reduce the pollution inside the city, they would not solve other last mile-related issues such as congestion. Therefore, interventions must occur at different stages of the last mile.

5.2 DISTRIBUTION INNOVATIONS AND THE LAST MILE SUPPLY CHAIN

He (2020) conducted a comprehensive literature review on urban freight distributions innovations. He argues that there is a need for research to study the combination and integration of different distribution innovations into a network or urban freight system because relying on a few methods alone will not be sufficient to achieve an efficient and ultimately sustainable urban freight scheme. According to He (2020), most studies that focus on integrating different distribution schemes into network schemes focus on three specific combinations: a) EVs and cargo bikes, b) public transit and EVs or cargo bikes, and c) mobile depots and cargo bikes. However, there are other distribution innovations that have not been sufficiently studied in conjunction with urban freight network design, which include autonomous vehicles, delivery robots, delivery drones, urban waterway logistics, ICT solutions, parcel lockers and taxi logistics (He, 2020).

These innovations, however, work on different levels inside an urban freight system (UFT). To properly understand how these solutions work, we must distinguish between the level of a network and the phase during which a specific distribution innovation takes place. Scholars distinguish between a single, two-, and multi-tier urban freight network (see figure below). Smaller cities usually adopt single tier networks that only consist of hinterland transport and last mile delivery. In larger cities, the network becomes more complex, which includes additional steps in form of transshipment transportation, i.e., transporting goods from a hub outside the city to a depot inside the city where it gets prepared for the last mile delivery to the end consumers. Depending on how many hubs there are, the network employed is either a two- or multi-tier network.

Moreover, some innovative distribution methods only work in the phase of transshipment, such as public transit systems (i.e., bus, tram, metro), while other solutions function solely on the level of last mile distribution such as cargo bikes, drones, mobile depots or parcel lockers. There are, however, also solutions that can be deployed both during the transshipment as well as the last mile distribution phase, e.g., EVs, AVs, ICT solutions. In addition, the solutions can be separated into "transport mode" and "stationary" solutions. While EVs, AVs, cargo bikes, drones and public transit are different transportation methods, solutions such as a UCC, mobile depot are alternative ways of consolidating and distributing the packages on their way to the end consumers.

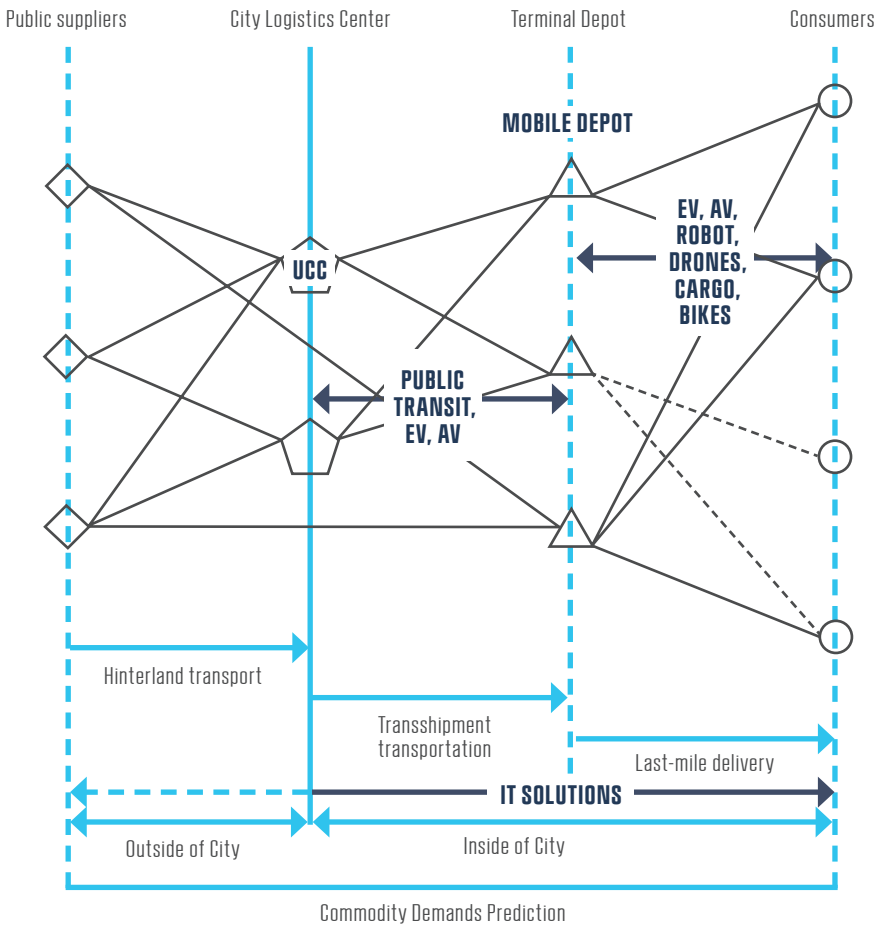


Figure 2. The supply chain of a two-tier urban freight network. Source: Adapted from He (2020)

In conclusion, in order to make urban last mile systems more sustainable, a variety of different innovations need to be implemented. Different innovations solve different problems and cater to different performance indicators. Moreover, distribution innovations operate in different stages of the urban freight system. All in all, these factors necessitate the combined efforts of all ecosystem stakeholders.

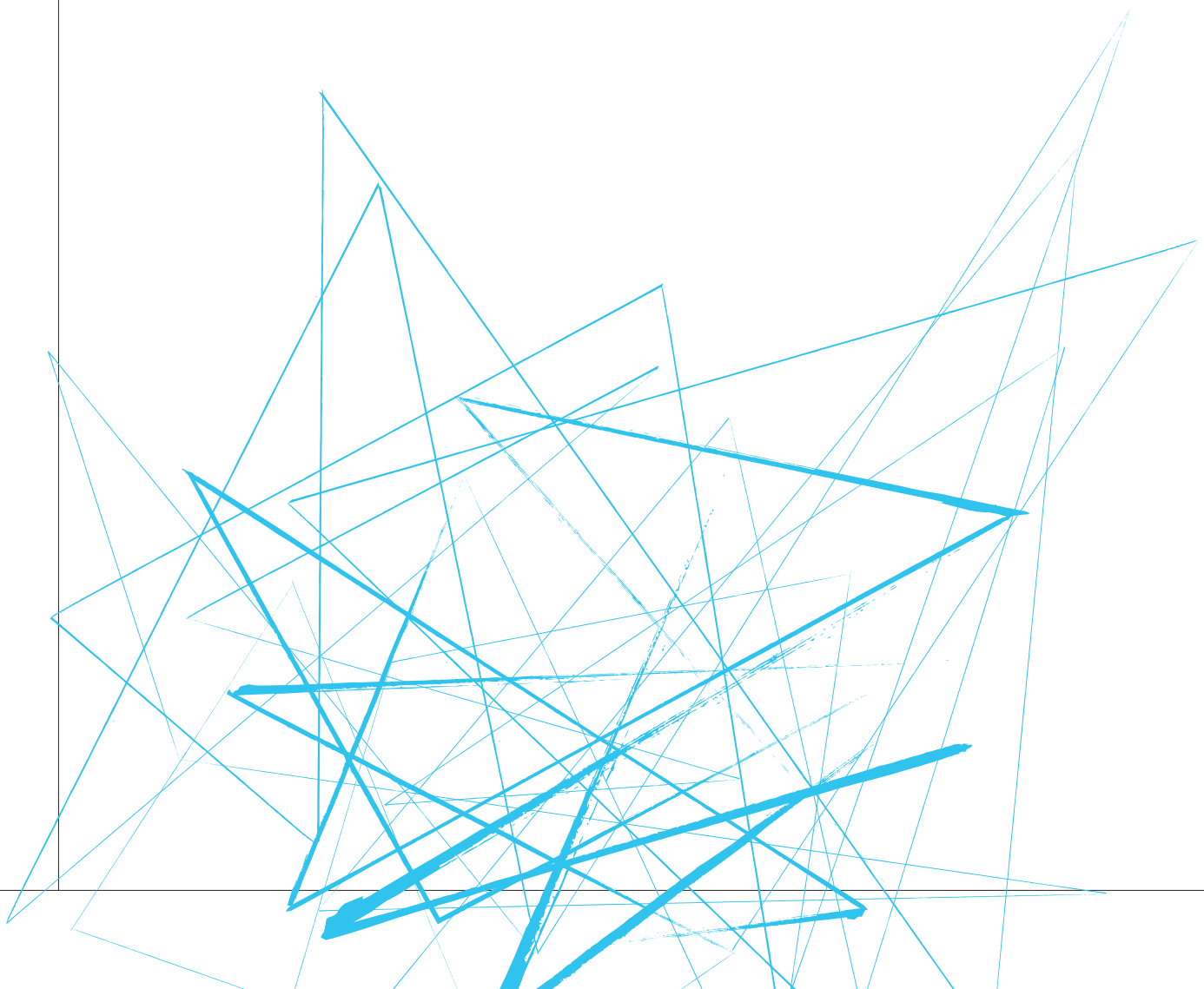
5.3 IMPLICATIONS REGARDING IMPLEMENTABILITY

It remains crucial to note that the level of reliability of the performance indicators and implementability of different distribution innovations in the matrix varies. Substantial asymmetries exist between distribution innovation research of academia and development projects of companies, and hence the number of pilots from which performance indicators and implementability evaluations are derived from, can differ extensively. For example, studies on the delivery robots have received relatively little attention in research but have been more actively experimented with among logistics companies, hence realistic performance evaluation can be considered less reliable and conclusions are harder to draw. Alternatively, less asymmetries in terms of research and implementation exist with regards to EVs and cargo bikes, with both high academic investigation and company implementation status, enhancing the reliability of performance indicators and the implementability of these distribution innovations (He & Haas, 2019).

In addition to lack of research of the performance of different emerging innovations, implementability can vary widely due to many exogenous factors. Despite the effectiveness of different innovations in mitigating social and environmental externalities, several obstacles can challenge their practical implementation. LSPs must regard elements such as cost of implementation, regulatory environment, policies that can incentivize certain solutions as well as the technological

maturity the time for implementation. A combination of such external elements determines the timeline of implementation and the *mass-market readiness* of different innovations (WEF, 2020). The implementation status of different distribution innovations in urban freight transport, differ widely between distribution innovations. EVs and parcel lockers are already widely used by major LSPs such as DHL and UPS and are thus also seeing the gradual emergence of a supportive policy and regulatory environment (He & Haas, 2019). Alternatively, innovations such as drones and delivery robots remain in the development and testing phase, still in need of extensive investment and lack the regulatory and infrastructural changes necessary for their effective implementation. Hence, the mass-market readiness of different distribution innovations still varies widely (WEF, 2020). However, solutions that rely less on new technology such as UCCs, can also be hard to implement due to LSPs unwillingness to relinquish control over the last mile to an UCC (Do Trung & Norell, 2020).

These different factors feed the uncertainty in the willingness of logistics enterprises to transition to new emerging technologies. This was apparent in our interviews, in which many LSPs in Denmark expressed that they felt that there was too much uncertainty surrounding the implementation of EVs as they were missing supporting policies or subsidies and commitments by policymakers to build the necessary infrastructure. Indeed, although 73% of companies have approved of emerging technologies, 50% indicated a "wait-and-see" attitude towards these innovations' uncertain environments and insufficient practical application and supporting research (He & Haas, 2019). Furthermore, the implementability of different innovations varies widely depending on the structure of the cities and their suitability to their urban environments. This also adds to the uncertainty of different innovations, as effective solutions elsewhere might not offer locally feasible alternatives (He & Haas, 2019). No "one-size-fits-all" solution exists in relation to the innovations, and hence best solutions can be created through the creation of effective combinations of diverse distribution innovations (Kelly, Marinov, Tyne, & Light, 2017).



6. SUSTAINABILITY – REITERATING THE IMPORTANCE OF TAKING ACTION

In order to make their own operations as well as the last mile ecosystem more sustainable, LSPs must be aware of several factors that complicate the process of a sustainable development. Even though resolving differences in objectives is a complex task, the importance and urgency is imminent as will be discussed in the following chapter.

6.1 RECONCILING OPPOSING FORCES

In order to formulate effective strategies for innovation, LSPs and other last mile stakeholders need to understand the inherent complexity of the system, the main opposing forces within must be mentioned. Firstly, there is the main conflict between the objectives of public and private stakeholders. Because stakeholders such as retailers or LSPs are private companies, their main priority is economic profitability. Public authorities such as municipalities on the other hand focus on all three triple bottom line aspects, i.e. ecology, society and economy. The resulting conflict can be formulated as individual profitability versus collective utility. Because of this base conflict, finding common solutions is a difficult and complex task.

Differing stakeholder objectives – individual profitability versus collective utility

It is crucial for LSPs to be aware of the stakeholder interrelationships within urban logistics because the significant increase in e-commerce will lead to market changes that can only be solved through coordinated efforts, which improve the flexibility of logistical processes and improve the last mile system as a whole. Synchronizing decisions and exchanging information and knowledge, can help last mile stakeholders to increase operational performance and better achieve common goals (Simatupang et al., 2002).

In terms of stakeholders within city logistics, there are many different actors with differing objectives (Witkowski and Kiba-Janiak, 2012). These interrelationships between the players provide opportunities for potential value adding behavior as well as some challenges that come in the form of the differing interests. In the last mile, we can identify three distinct stakeholder groups (Harrington et al., 2016; Wohlrab et al., 2012), which are the public authorities, private companies such as retailers and logistics providers, and end consumers. Ballantyne et al. (2013) divides parties with a stake in urban logistics into actors and stakeholders with actors having the ability to influence urban logistics while stakeholders hold a more passive role. Their classification is very similar to one outlined above, but instead of three stakeholders, they identify four different ones, namely: Authorities, customers, shippers and freight transport operators. These stakeholder groups behave accordingly to their objectives in the frame of city logistics, so whenever city logistics introduces new regulations the stakeholders are set to follow what is to the best of their own interests (Taniguchi and Tamagawa, 2005). In order to achieve a more sustainable development of urban logistics, stakeholders need to be aware of and understand how crucial a factor cooperation is for such a development (Österle et al., 2015). Gammelgaard et al. (2017) also

emphasize the importance of coordination, interaction and cooperation in urban logistics. They argue that all stakeholders and their respective needs and objectives need to be taken into account in order to successfully implement solutions to urban logistics issues (Gammelgaard et al., 2017).

LSPs usually deal with the most significant conflict and face trade-offs with the other actors. In the last mile, they have to fulfil the customer demand of fast and on-time delivery while keeping operating costs down in a complex environment that is plagued by congestion. Given the increase in e-commerce and assuming that the system of operation stays the same, LSPs have to make more delivery trips in order to cater to the growing demand, materializing in more traffic, and hence congestion and pollution. This, however, directly interferes with the municipality's goal of a green and livable city with low pollution and congestion. If LSPs were to operate more sustainably by consolidating more and using e-vehicles and cargo bikes only, this would have severe effects on their service levels (as there are capacity and reach issues with sustainable transport means) as well as their operating costs (since investing into new vehicles is expensive and capacity would be an issue, too). It could also lead to customer dissatisfaction as the speed of the deliveries might be hampered. This could have a significant impact on their bottom line given the fierce competition and ease of switching LSPs from the consumer point of view. Therefore, both the LSPs and the consumers have an interest in fast delivery and thus have a conflict with the municipalities. By extension, the retailers would also benefit from a faster delivery since it adds value to their customers if their products are delivered faster. However, the consumers are also citizens that live in a city and are thus also aligned with the municipalities on lowering congestion and pollution. Perhaps unknowingly, consumers are part of causing an issue that they would at the same time like to avoid.

Global versus local

Another factor that contributes to the complexity of the system is that it consists of players that operate on different levels of "governance". Whereas municipalities operate exclusively on the municipal level, retailers and LSPs can be regional, national or even multinational. For example, DHL as a global company pursues vehicle solutions that can be implemented in any city they operate in regardless of the country (M. Rosolen, Personal communication, October 29, 2020). Being global therefore incentivizes them to experiment and develop vehicle technologies by themselves and disincentivizes cooperative efforts in terms of innovating on a local level. Due to these factors, close contact and constant communication between stakeholders is crucial.

6.2 TOWARDS SUSTAINABILITY

Movement towards sustainability within last-mile logistics hence directly aligns with the differing stakeholder objectives, and the stakeholder pressure resulting from that. In line with Elkington's Triple Bottom Line the environmental focus of firms should not be solely to comply with environmental guidelines, but rather to create socially responsible entrepreneurship that is needed to evolve to new and more sustainable forms of wealth creation (Elkington, 1997). Indeed, to move towards a more sustainable future, firms should be willing to absorb or internalize some of the environmental and social externalities that their processes are creating as internal parts of their business models. Figure 3 outlines the centrality and connections of diverging stakeholder pressures and all three bottom lines of sustainability in Last Mile Logistics.

LSPs continue to face increasing pressure from their stakeholders both from consumers and civil society but most pressingly from public authorities in the form of regulations etc. Furthermore, significant global trends are showing that sustainability is becoming an increasingly important aspect among consumers (Raska & Shaw, 2011). Elkington's model shows itself as highly relevant as investing in social and environmental bottom lines also carries significant benefits for the firms' economic bottom lines. In the face of increasing trends and pressure for sustainability from stakeholders, adopting more ecologically and socially sound business models can enhance the economic viability and long-term survival of LSPs. The adoption of more sustainable urban freight can allow for the mitigation of conflict between LSPs and the city, as the active sustainable engagement of LSPs can alleviate the negative impacts for urban environments (He & Haas, 2019). Studies have shown that adopting ecologically oriented cultures as integral parts of their business models,

LSPs will be more likely to notice environmentally critical signals that might be crucial for their survival and respond to the external changes in stakeholder pressure (Kim & Lee, 2011; Wang, 2018). Such awareness and integration of sustainability as a central part of their business models can allow LSPs to ensure long-term economic benefits (Carter & Rogers, 2004).

Furthermore, adopting an environmentally oriented culture can significantly improve the ability for LSPs to innovate and move towards business models that benefit from value co-creation. As the role of consumers and LSPs is increasingly interdependent and reciprocal, consumer participation can have a strong impact on the formation of values within logistics, and thus support sustainable development of the logistics industry (Wang, 2019). As highlighted by Prahalad and Ramaswamy (2004), what is essential for consumers to want to actively engage in value co-creation is transparency and information. The concept of *green skepticism* (Mohr, Eroglu, & Ellen, 1998) has been increasingly discussed in relation to the establishment of a co-creation relationship with consumers (Wang, 2018). Green skepticism refers to the disbelief and skepticism consumers might have for the true engagement of companies in their green efforts, that can be diminished through improving the perceived sincerity of firms' environmental commitments (Raska & Shaw, 2011). In the context of LSPs, attempts to offer green alternatives might not be convincing enough to consumers, as they seek assurances that their co-creation efforts are actually materializing to genuinely green purposes, not solely in enhancing the LSPs economic bottom line. Hence, true commitment to green efforts will allow for LSPs to enhance trust amongst their consumers and potentially build a better co-creation relationship through increased information and transparency in the LSPs green efforts (Kim & Lee, 2011; Wang, 2018). By adopting a truly committed eco-oriented culture, through the transformation of their business models LSPs can become more future oriented and responsive to increasing green stakeholder pressure in the form of e.g. environmental regulation, but also create a more trusting and collaborative co-creation relationship with their consumers through increased transparency and information also improving the company's image (Raska & Shaw, 2011). Incorporating the social and environmental bottom lines as integral aspects of the LSPs business models hence shows itself as crucial in also ensuring the future health of the economic bottom line.

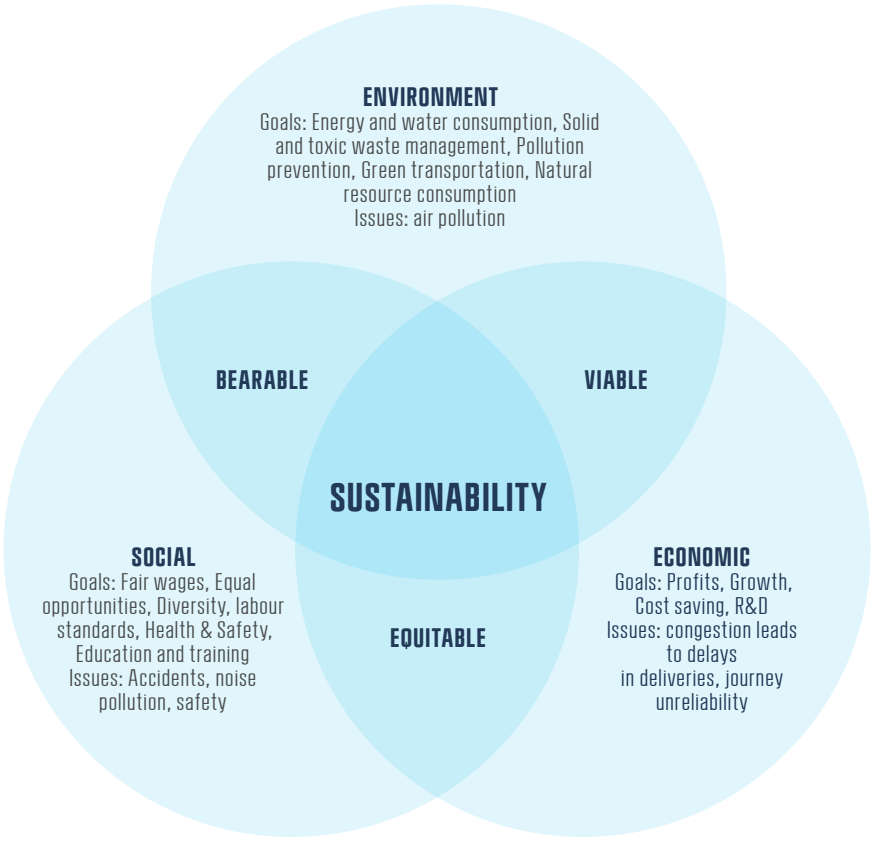


Figure 3. Triple bottom line including goals and issues within each bottom line. Source: Do Trung and Norell (2020)

7. CONCLUSION

The strong projected growth in e-commerce puts LSPs and their existing business models under enormous pressure. Not only do they need to perform in their own rights as private transportation businesses, but they also have to adhere to ecological and social performance measures as they cause negative externalities in the cities, they operate in. Coupled with the competitive last mile delivery industry and the simple nature of the delivery service, LSPs need to innovate their business models. Cooperation and co-creation are vital elements in doing so because LSPs operate in an ecosystem in which all stakeholders affect one another and in which the problems at hand are so complex that sets of different solutions must be implemented jointly in order to solve economic, social and environmental problems.

While this sounds daunting, these developments offer a wealth of opportunities for LSPs to stay at the forefront of innovation and sustainability. This report has highlighted the main issues plaguing the last mile and used the concepts of business model innovation and value co-creation to provide insights into how LSPs can innovate their business models through the inclusion of distribution innovations. Although many distribution innovations are effective in solving or improving last mile issues, we have shown that there is no remedy that solves all issues at once. Therefore, new business models should ideally include several innovations at once in order to be fully sustainable. The catalogue in Table 4 can help LSPs to choose which innovations to pursue, while the inclusion of the concepts of BMI and VCC helps managers and practitioners to see innovations in a new light. All in all, the catalogue combined with the application of the theories, and the performance matrix provides help to practitioners to make informed decisions.

This topic is also of great significance from a larger societal point of view in light of climate change and global warming. For a green transition to happen in last mile systems in cities around the world, change has to come not only from LSPs but also from the regulatory as well as the demand side. While the demand for green delivery is still meager (Do Trung & Norell, 2020; FDIH consumer surveys, FDIH, 2020), this will hopefully change with consumers having more access to information and becoming more aware and therefore supporting and demanding green delivery more. Coupled with more government support, LSPs will hopefully be able to carry out the last mile in a more sustainable manner in the near future.

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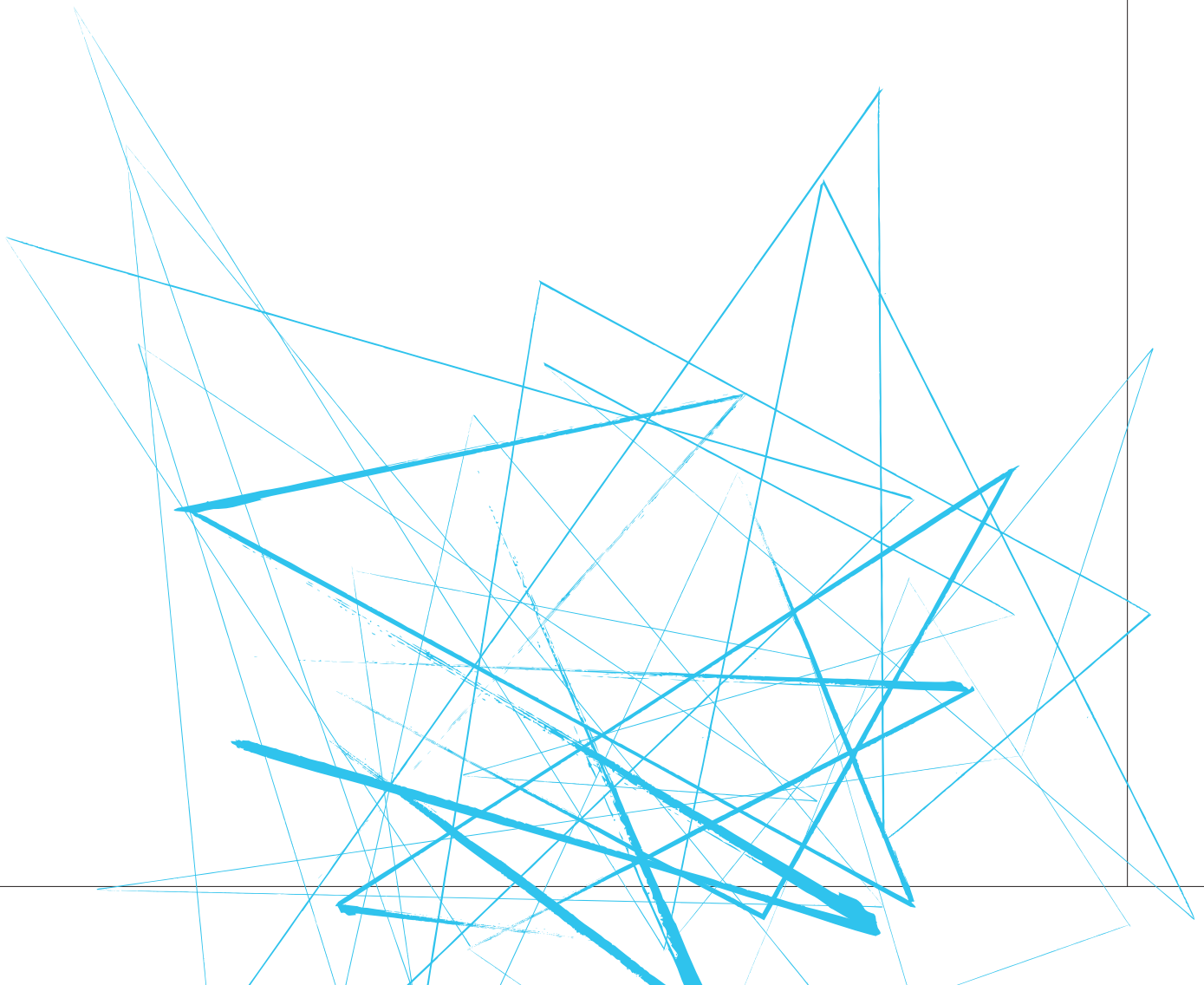

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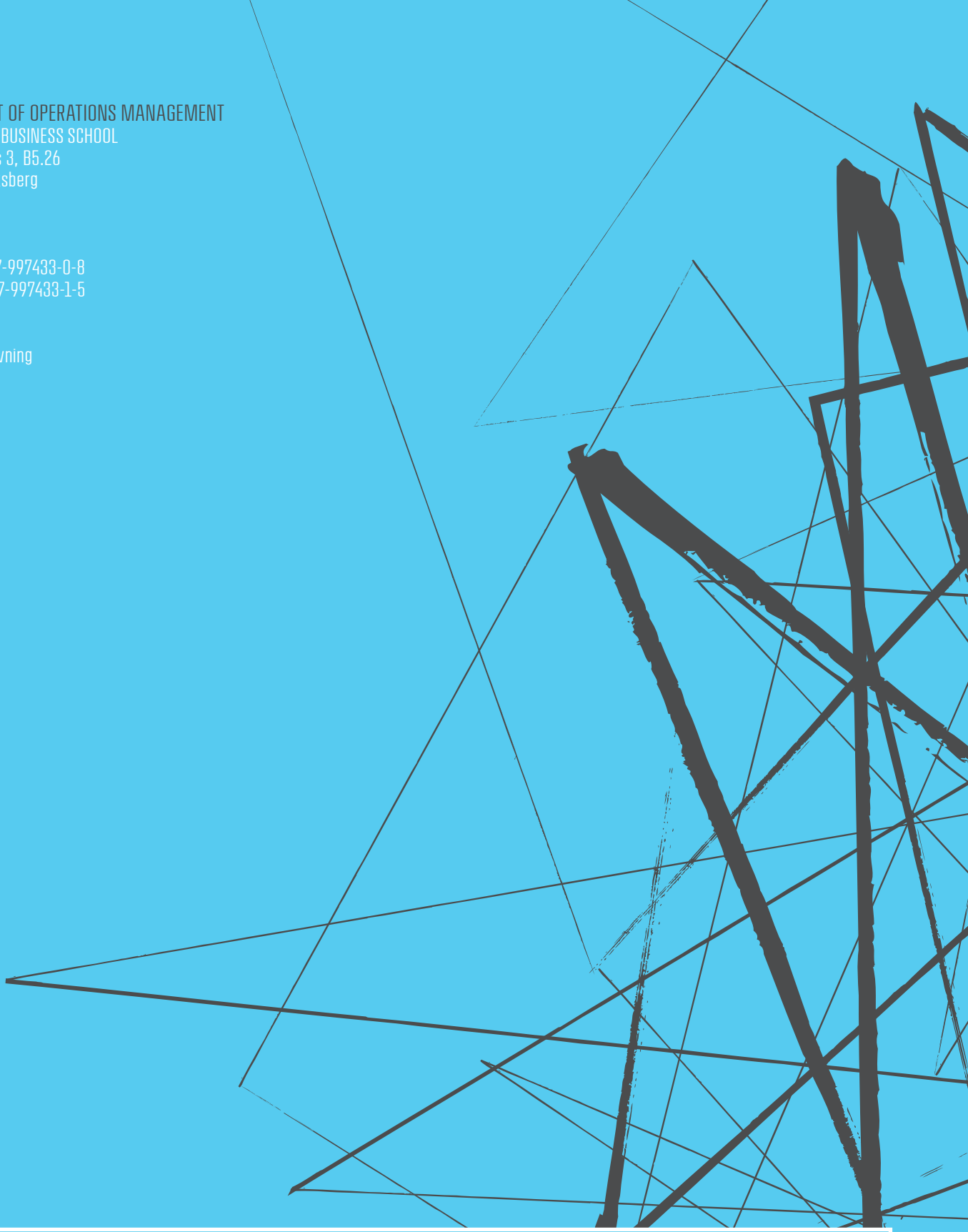

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