Designing sharing logistics as a disruptive innovation in city logistics

van Duin, Ron; Quak, H.J.; Anand, N.; van den Band, N.

Publication date
2020

Document Version
Final published version

Citation (APA)
van Duin, R., Quak, H. J., Anand, N., & van den Band, N. (2020). *Designing sharing logistics as a disruptive innovation in city logistics*. 1-10. Paper presented at 4th International Conference Green Cities 2020 (Virtual/online event), Online event, Poland.

GREEN CITIES
GREEN LOGISTICS FOR GREENER CITIES

4th International Conference Green Cities 2020 – Green Logistics for Greener Cities, 3-5 June 2020, Szczecin, Poland

Designing sharing logistics as a disruptive innovation in city logistics

Van Duin, J.H.R.[a,b], Quak, H.J.[c,d], Anand, N.[a], van den Band, N.[a]

[a]*Rotterdam University of Applied Sciences, Heijplaatstraat 23, Rotterdam 3089 JB, The Netherlands*
[b]*Delft University of Technology, Jaffalaan 5, Delft 2628 BX, The Netherlands*
[c]*Breda University of Applied Sciences, Monseigneur Hopmansstraat 2, Breda 4817 JS, The Netherlands*
[d]*TNO, Anna van Buerenplein 1, Den Haag 2595 DA, The Netherlands*

Abstract

Today, companies recognize that the opportunities derived from the on-demand economy are becoming too big to miss. Like all major disruptions, on-demand economy start-ups are challenging industry incumbents with new business models and new ways of engaging customers. Existing companies need to embrace the on-demand economy and transform their service and delivery systems to meet consumer demand. The largest 750 cities in the world are responsible for more than 57% of the global gross domestic product (GDP) and this share is expected to increase to 61% by 2030. At the same time, in today's increasingly global and interconnected world, the share of e-commerce of total global retail sales is also expected to continue to increase, from 7.4% in 2015 to 15.5% in 2021. Furthermore, consumers have higher service expectations than ever before. E-tailers are stimulating and exploiting these service expectations by offering fast delivery options as a means to compete. The population growth and urbanization, the explosion of e-commerce, and the proliferation of fast delivery options, require innovative solutions and business models to ensure cost-effective, but also environmentally and socially friendly, transportation of goods. Within the logistics industry the sharing economy could be a disruptive development that could ideally render a major contribution in reducing the CO_2 intensity of its operations . Sharing unused and/or underutilized resources, can unlock new efficiencies in the logistics value chain in an industry where efficiency is the name of the game. This paper addresses three practical sharing initiatives in the field of city logistics, shows the potential of sharing logistics in the domain of city logistics, and contains a description of a methodology how sharing concepts can be designed.

Keywords: disruption, sharing economy, city logistics, methodology

1 Introduction

Today, companies recognize that the opportunities derived from the on-demand economy are becoming too big to miss and too risky to ignore. Like all major disruptions, on-demand economy start-ups are challenging industry incumbents with new business models and new ways of engaging customers (Colby & Bell, 2016). The on-demand or 'sharing' economy is a term that describes digital platforms that connect consumers to a service or commodity through the use of a mobile application or website (Cockayne, 2016). Existing companies need to embrace the on-demand economy and transform their service and delivery systems to meet consumer demand. The strong economy means shoppers want more of everything, and thanks to Amazon and other big companies, 70% of them want it delivered fast, leading to many small deliveries and average shipment size decreases.

55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 (UNESCO, 2019). Residents, commercial establishments, commuters and visitors demand more goods. It furthermore contributes to employment, businesses to thrive, the functioning of services such as waste collection, and economic growth in general (Dablanc, 2011). This demands for more space for logistics activities in cities which is becoming more absent due to accommodating the growth of people in cities. This pushes logistics real estate out of the city and less space remains for storage in the city. As a result, the average shipment size reduces and the number of delivery vans in cities increases.

At the same time the climate change and air pollution in inner cities force the city logistics practice to emit zero emissions by the year 2025/2030 in the Netherlands. The largest city logistics flows can be found in hospitality, construction, retail and facility products (CE Delft, 2016); these account for more than 50% of the freight vehicles in the city. The parcel sector accounts for 5% of freight traffic in cities and is rapidly growing through the digitisation of order methods used by consumers (B2C) and businesses (B2B). To accomplish these ambitions, it is necessary to make a switch towards more efficient and environmental-friendly logistics operations (Web1, 2018). Currently logistics parcel services are investing in zero-emission vehicles for delivery. Still the number of

deliveries does increase leading to many transport movements of the vans combined with often unsuccessful deliveries of not being home (van Duin et al. 2016a). The city logistics industry urgently needs to investigate new tracks.

In order to realize emission free transportation networks, the National Research Agenda (Web1, 2018) has formulated a number of knowledge questions, such as:

'*What are the effects of trends, innovations and game changers in transportation systems and behaviour on the volume (ton-km's)?'*

'What are the effects of future disruptive developments on more sustainable deployment of resources?'

Within the logistics industry the sharing economy is considered to be one of the before mentioned disruptive developments. Many new logistics initiatives arise based on the principles of sharing resources by crowd participation. Resource sharing or the so-called term 'Sharing Economy" was first mentioned in 2008 and denotes the collaborative consumption made by the activities of sharing, exchanging, and rental of resources without owning the goods (Lessig, 2008). Sharing unused and/or underutilized resources, could unlock new efficiencies in the logistics value chain in an industry where efficiency is the name of the game. The advantages of applying sharing economy concepts in logistics in terms of higher efficiency, lower costs, lower congestion, lower CO_2 emissions seem straightforward for both industry and society (Gesing, 2017).

In transportation, sharing vehicles and routes would enable logistics companies to move more freight for less money in a way that is fast, convenient, and more environmental-friendly. It would allow transportation and logistics professionals to make better use of underutilized resources to optimize routes, streamline scheduling and reduce carbon emissions. Next to increased operational efficiency, sharing unused and/or underutilized resources could also help overcome other issues plaguing the industry, such as (urban) congestion and shortage of qualified drivers. In warehousing the Sharing Economy stands to augment utilization and billing in existing shared customer warehouses. Finally, the Sharing Economy presents new and creative ways to do business and realize internal efficiency gains with on-demand staffing models and logistics data sharing.

Though a promising opportunity for new business creation, the Sharing Economy is not without its challenges. Risk liability, insurance, transparency and workforce protection issues could hinder the progress of the Sharing Economy. Most difficult of all is that the pace of technological innovation and social change has often outpaced regulatory frameworks, resulting in banned services and protests from those working in traditional industries. Therefore the (lack of) social change as such is one of the toughest challenges for logistics companies in adapting new technological and social innovations (like the Sharing Economy). This is also what Oeij et al. (2018) conclude in their report: 'Social innovation is required in order to accelerate the innovation capacity in the logistics sector'.

Although the advantages of applying sharing economy concepts in logistics for both industry and society seem straightforward, i.e. increased efficiency, reduced costs, increased revenues, reduced congestion, reduced carbon emissions, new value creation and profitable business models cs. it is still unsure what the effect will be of the Sharing Economy on the logistics sector. Although there already are some promising Sharing Economy initiatives in the field of logistics in the Netherlands (Quicargo, Stockspots etc.), recently a logistical start-up Synple (cargo sharing) had to file for bankruptcy. Despite investments of more than 1 million euros, they were not able to develop a financially feasible business model based on the Sharing Economy concept. Besides the logistics industry itself is rather conservative, which might be the reason for their bankruptcy.

From a scientific perspective emerging streams such as business models for sharing, incumbent responses to sharing economy start-ups, the role of information and communication technologies (ICTs) as an enabler of sharing, the importance of and mechanisms for the development of trust in sharing economy initiatives, and the potential social, economic and environmental benefits from sharing economy activity remain unexplored in management and sustainability literature (Cohen & Muñoz, 2016). Ocicka & Wieteska (2017) indicate the following strategic success factors for sharing development:

- the need of linkages between business strategies of partners participating in sharing projects;
- collaborative relationships management, including partnership with external partners, like logistics services or technology providers;
- integration of economic, social and environmental objectives in logistics and supply chain management to achieve long term sustainable performance.

However, to our opinion the aspect of sharing in cities is still under-researched and therefore it is interesting to explore the range of sharing from highly commercial to non-monetary, community-based in line with McClaren and Agyeman (2015) broader interpretation of the emerging space in the city context (Geissinger et al., 2019). Geissinger et al. (2019) also stress that it would also be interesting to explore in-depth the sustainability impact of the sharing economy on the meta level. The spread of the sharing economy into new sectors, reasons for patterns of spread, and how new platforms emerge are further routes for interesting future studies.

Therefore the following research question is formulated: '*How can we use sharing economy concepts on existing urban freight transport themes (i.e. city logistics, construction logistics, transportation & warehousing, health care and service logistics) in order to improve sustainability, quality of service and efficiency?'*

This paper starts in Section 2 showing three practical examples of sharing, Section 3 aims to sketch the research potential of the sharing economy in city logistics by showing the values for the urban freight issues. Section 4 illustrates a methodology to do the empirical research in this field. Section 5 contains some conclusions and recommendations for future research.

2 Successful sharing economy practices in urban freight transport

In this chapter three examples of resource sharing are demonstrated.

2.1 Sharing use of electric business vans

The best example of a 'sharing logistics company is found in Germany. UZE Mobility, a new start-up from Aachen in Germany, wants to turn the city into the unofficial e-mobility capital of Germany (Manty, 2018). Unlike other start-ups, UZE Mobility wants to offer their services to users free of charge because they think they have found innovative revenue streams with a different business model.

Fig 1. Streetscooter electric delivery van

The idea is to rent out StreetScooter electric vans to customers free of charge. Unlike other car sharing services, UZE Mobility will not charge consumers any costs, but hopes to sell enough advertising for their 'mobile billboards (see the digital side panel in Figure 1). By using the digital side panels, the advertisements can be adapted to each area (and time) through which the electric van passes. UZE also tries to sell location-related data. This is not about the personal data of their users, but purely about the data collected by the electric vans of an environment. UZE says that local authorities have shown an interest in information such as the state of roads, i.e. holes in the road or indications of (non) regular traffic jams.

The founder of the company Alexander Jablosvki declares to cooperate in the great goal that many cities set themselves to be by 2025 an emission-free city. According to him we will only succeed in this if we succeed in motivating people to switch to electric vehicles. They recently started their first trial in the Rhineland. Customers can then book one of the 50 electric StreetScooter vans free of charge via the app. Interesting to mention here is that the technology for the digital key is based on blockchain.

2.2 CargoHitching

Another example of sharing project is Cargo Hitching meaning that cargo hitches a ride on a vehicle transporting persons, or persons hitching a ride on a vehicle transporting cargo (Van Duin et al., 2019). Public transportation service providers are interested in financial benefits and on-time performance (Mouwen & Rietveld, 2013; Boitani et al., 2013). Although two bus lines are relatively well utilised, there is an opportunity to share bus capacity in off-peak hours for parcel delivery. In March 2017 a project was setup with a logistics service provider, a public passenger transport service and a social care organisation that provides job opportunity for people with difficulties in doing normal jobs. At the logistics hub parcels arrive from different carriers are sorted and packed

into a roller bag or a parcel trolley, and transported to the central station where the busses depart. Employees from the social organisation transport the parcels from the central station to the local service point as private luggage by the public bus (wheelchair location in the bus is often used). When the bus arrives at the final destination the employees take the parcels out of the bus and hands them over to the local service desk. No extra time is needed for taking out the parcels. The local service desk is close to the bus stop. The final receivers of the parcels can take their parcels at designated hours (late evening and weekends).

Like Arvidsson et al. (2016) it can be concluded that integrating passenger and freight transport in urban areas is a promising sharing approach. Capacity sharing projects have been attempted in different places. According to their findings, stable economic sources can ensure the viability of the project. Also the inclusion of some social values, such as the jobs for the (semi)-literate people in the Dabbawala system, seems to be an important factor for the long term viability. According to Austin et al. (2006) the economics of a social entrepreneurial venture often makes it difficult to compensate staff as competitively as in commercial markets. In fact, many employees in social entrepreneurial organizations place considerable value on nonpecuniary compensation from their work.

2.3 Stockspots: Where do my goods sleep tonight?

For many years the concept of sharing warehouse capacity is a proven concept in practice and theory of supply chain management. The literature defines these systems as so called pooled warehouses. According to Pan et al. (2013) logistics pooling involves sharing physical resources (warehouse, platforms, trucks), and organizations (logistics schemes), but also data necessary for managers to improve economic performance and supply chain environmental impact. Logistics pooling is defined as 'pooling of logistics resources, organized by several actors, to group their flows to a single destination via transport and warehousing' (ECR France, 2013). The pooled warehouse is characterised by its management mode (participation of all actors, sharing decisions and knowledge), shared VMI, pooled order picking, and pooled docks. These specificities highlight the complexity of pooled warehouse management at strategic, tactical and operational levels. This type of collaboration requires a long-term partner commitment with the aim of developing new modes of organization, and adapted information systems to facilitate information sharing.

However, the long term perspective with strategic collaboration holds for supply chains with big retailers like Albert Heijn. For the SMEs the story is rather different as the demand for storage space is less predictable. Marchi & Parekh (2015) showed in their practical research that it could be observed that an important resource is often underutilised and forms the trigger to make the change to a sharing approach.

Therefore the concept of 'on-demand' logistics spaces is becoming increasingly popular as space in cities is becoming an expensive good (Coolen & Meesters, 2012). As retailers and logistics companies want to become more agile to meet the expectations of their customers. The sharing principle of Stockspots is straightforward. Not all of the logistics operators use their storage spaces at full capacity. In fact, data shows that more than 30% of all storage space remains unused. Moreover, Karim et al. (2018) suggest that these companies should rent the unused space to a third party with the same type of business to avoid mixed environments. At the same time, there are companies such as retailers, manufacturers, wholesalers who need extra space for a certain period and a specific location. This might be for various reasons: promotional campaigns, the storage of seasonal goods or even an excess of production numbers. Stockspots managed to see the potential of this opportunity, bringing forth a new 'matchmaking' service between supply and demand, similar to how Airbnb works, plus a couple of trade advantages. Based on the same principle and with the mission to optimize available storage spaces, Stockspots, also referred to as the 'Airbnb of warehousing', matches companies with available storage space to companies that need storage solutions for a limited period of time.

With +500 warehouse locations in 17 countries Stockspots is already present and visible in the most attractive logistic regions of Europe. The world and logistic processes are continuously changing, at Stockspots we follow our customers and market demand, therefore in the past months we expanded our warehousing Network with Germany, Spain and UK. For the moment we are looking to extend further to Eastern Europe. Romania, Poland and Czech Republic are on the agenda for further geographical expansion.

3 Urban freight themes

This section will provide a motivation why the urban freight themes city logistics, construction logistics, transportation & warehousing, health care logistics and service logistics could benefit from sharing principles.

3.1 City logistics

The largest 750 cities in the world are responsible for more than 57% of the global gross domestic product (GDP) and this share is expected to increase to 61% by 2030 (Oxford Economics, 2017). At the same time, in today's increasingly global and interconnected world, the share of e-commerce of total global retail sales is also expected to continue to increase, from 7.4% in 2015 to 15.5% in 2021 (eMarketer Editors, 2017). Furthermore, consumers have higher service expectations than ever before. E-tailers are stimulating and exploiting these service

expectations by offering fast delivery options as a means to compete (Savelsbergh and Van Woensel, 2016). The population growth and urbanization, the explosion of e-commerce, and the proliferation of fast delivery options, require innovative solutions and business models to ensure cost-effective, but also environmentally and socially friendly, transportation of goods. Innovative solutions are more than welcome here. Therefore, the focus of this theme is to investigate in which way sharing (unused and/or underutilized) logistics assets and resources could contribute to an improvement of the quality of life by reducing congestion, reducing noise pollution and carbon emissions, and reducing the number of vans in neighbourhoods (increase of traffic safety).

3.2 Construction logistics

Most of the carbon emissions in the construction sector are originated from energy consumption. Construction building consumes a large amount of energy and generates a great deal of CO2 (Stern, 2007). Given the volume of new buildings to be constructed due to increasing urbanization and growing population, serious effort should be attributed to make the building production process more carbon conscious and sustainable (IPCC, 2014).

The signing of the Green Deal Sustainable Logistics in the Construction industry on 2nd October 2017 (Hibin, 2017) shows that the ambition to achieve an efficient and sustainable building logistics is shared by the leaders in the construction chain. Efficient building logistics, however, is related to social and economic interests and good cooperation, which means that the right logistics coordination can take place. The intended results are fewer transports and efficient transport movements. Two big branch organisations (TLN and Bouwend Nederland) have strong interest in this research.

3.3 Transportation and warehousing

In transport and warehousing related to urban freight one can observe three trends. The first trend is with the recent rise of ‘mega-DC's’ with more than 500,000 square feet as Dablanc (2014) mentions this becoming most challenging. The warehouses and related transport activities strive to become less dependent from labour forces by automation of their processes. This in turn has important implications for balancing the positive, at the same time a rise of (mini) hubs can be observed in the cities because of the electrification of transport to the inner cities and inspiring concepts by the physical internet such as hyperconnected city logistics as mentioned by Crainic and Montreuil (2016). In transport one can observe stronger restrictions on the vehicle types or the time windows for the last-mile delivery due to zero-emission goal setting of many cities (GreenDealZES). Handoko and Lau (2016) show that collaborative urban logistics in Singapore based on shareable order leads to cost reduction and keeping privacy preservation at the same time.

3.4 Healthcare logistics

The increasing trends of shorter hospital stays and an increase of treatments and surgeries in clinics (OECD, 2014), present new challenges for the supply of goods. The rise in patients in hospitals, and consequently the increase of treatments and surgeries, cause a growth of material usage and goods movement (Fragane et al. 2018). A rising concept trend in health care logistics is the establishment of Home Health-Care (HHC) to reduce pressure on inpatient hospital beds by providing care to patients at home. Although HHC is developing due to the increasing hospitalization costs coupled with an aging population, it benefits less from published researched in comparison to classical health-care problems. Flexibility in both nurse planning and materials planning are essential for the stability of these HHCs (Rodriguez-Verjan et al. 2018).

3.5 Service logistics

Service Logistics orchestrates every aspect of the “after-sales service” from the purchase to the end of the life cycle of the product or the service. The challenge lies especially in the interconnectivity of all the individual elements, like: call centres, (remote) diagnostics, maintenance engineers, spare parts, tools, forward and return logistics, repair and recycling. In service logistics the main goal is to guarantee the availability of systems to delivery of vital goods and services (Topan et al., 2019). Service logistics consists of activities in maintenance, cleaning, installation and repair. Delivering of a service is the key activity, but materials or tools are also required. Most of these services are carried out by diesel vans (Butrina et al., 2018). The focus of the research in this theme is on which way sharing information between all the before mentioned individual elements of the service logistics value chain can improve its efficiency and effectiveness in combination with the ‘servitization’ of service logistics. This project should result in new concepts and tools for sharing inventory of spare parts, for last-buy problems and for proactive maintenance based on event logs of capital goods.

4 Methodology cross thematical analysis

The research approach of the sharing logistics project is a typical practice-oriented design research. The design-oriented research has a flow of knowledge that is built up with a literature study that contributes to (generic) solutions (Aken & Andriessen, 2011). The main research principle is that inter themes comparison will provide us obtain more generic insight in the value of different sharing concepts. Deeper understanding/learning of generic

insights and triangulation among these themes helps to identify the conditions under what kind of circumstances the new sharing concepts could work in practice. Concepts which have proven their value already in one theme, might be interesting for application in other themes. Finally, this will lead to more generalized knowledge on the application of sharing concepts.

Likewise, we follow the same research protocol within the themes. A multiple case study has been chosen as the research method. Case studies as methods fit the exploratory nature of this research (Yin, 2009). When the theoretical basis for research is still limited, which is the case for sharing concepts, case studies are generally a suitable method (Edmondson & McManus, 2007). The participating companies are investigated as separate cases, after which the insights and results of the different companies are compared in cross-case analysis. This method fits optimally with the nature of the question, because in the first-place in-depth knowledge is needed to answer the research question. The definition of case study is used as stated by Robson (2002): "a strategy for conducting research that uses empirical research from a certain contemporary phenomenon within the current context. " This context is crucial (Yin, 2009) and is primarily investigated from the perspective of the company and its position in the supply chain. The methodology (Figure 2) is described in the following subsections.

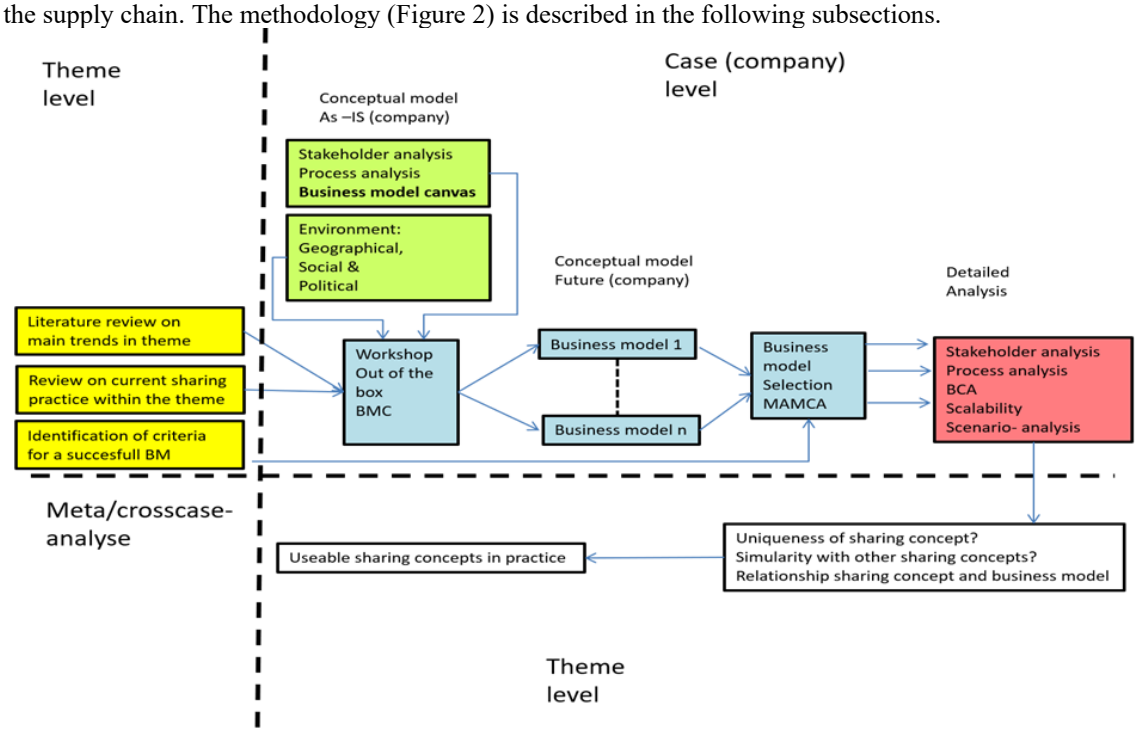

Fig 2. Methodology for the development of sharing concepts

4.1 Desk/field research at theme level (= yellow part in Fig. 2)

The first phase consists of 3 research activities. First the main trends within the themes are identified. It is good to have knowledge of these trends as they can be the driver of change to position companies in a new (niche) market. In some themes, for example construction logistics, sharing concepts already have been common practice for many years. Therefore, it is necessary to identify the main sharing concepts in the themes and to observe how successful they can be in practice by studying the resource usages and the value propositions to their customers. To be able to select appropriate business models it is good to identify the main criteria for selection. Which conditions/criteria are hard/important (must haves) and which conditions/criteria are more soft (nice to have). This can form the input for the business model selection. As a reference Kumar et al. (2018) show behavioural and technological factors leading to the sharing economy. The following research methods form the case study protocol as the standard way to inquire (Yin,2009).

4.2 Field research at company level (= light green part in Fig. 2)

Before making any changes to the logistics environment of a company, it is crucial to perform a stakeholder analysis. A stakeholder analysis is the process of assessing a system and potential changes to it as they relate to relevant and interested stakeholders. It is important to position and understand the power relations among the actors (Eden and Ackermann, 1998). If some stakeholders have too much power, they are able to block any innovation in the market. It is obvious that this kind of knowledge is important for the development of new business models based on sharing.

The logistics concept defines a way how the use the resources most efficiently to produce a product or service to the market. Therefore, the knowledge of how the processes are organised/managed are crucial for identifying

new solutions. To provide insight in the processes and their related information flows one can make use of SIPOC-diagrams (Voehl, et al., 2013), IDEF0 (Knowledge Based Systems Inc., 1993), or Value Stream Mapping (Voehl, et al., 2013). Next research activity is to provide insight into the current business model canvas. The Business Model Canvas is a business tool used to visualize all the building blocks of starting a business, including customers, route to market, value proposition and finance (Ostwalder et al., 2010).

Beside the knowledge of the stakeholders, processes and the business model it is also important to understand the geographical, social and political environment of the company. In order to have a clear view on these elements one could develop a SWOT-analysis (Amstrong, 1996). After finishing all the above research activities there is a clear picture of all the relevant issues d for the selected company.

4.3 Generating business models at company level (= light blue part in Fig. 2)

First research activity in this phase is the generation of new business models. Rethinking the use and ownership of resources and its related customer relationships forms the essential step to support the creativity in designing new business models. In the literature two interesting approaches can identified to generate new business models: business model roadmapping & the sharing business model compass.

De Reuver et al. (2013) define business model roadmapping as an approach to define the transition path from a current to a desired business model. Their approach relies on core concepts from business model literature as well as technology roadmapping. According to the De Reuver et al. (2013) the merits of business model roadmapping not only lie in defining a road map of actions and business model changes, but also in identifying and discussing trade-offs between strategic business model issues and operational activities. Especially if an organization still has to choose between different alternative business models, business model roadmapping may help to identify overlapping paths, path dependencies and points of no return.

Muñoz & Cohen (2018) have developed a compass for navigating sharing economy business models. As an actionable framework, the Compass helps elucidate the multiple, innovative forms sharing economy businesses are adopting. As a generative tool, it enables entrepreneurs, investors, incubators, and incumbents interested in entering the sharing economy to create, present, and evolve a compelling sharing business model as well as evaluate its extent of robustness (which can already eliminate some models or can also be latter applied as a part of the scenario-analysis). As an outcome of these research activities there will be a selection of N business models.

4.4 Selection of business models

In this research activity Multi-Actor Multi-Criteria Analysis (MAMCA) will be applied to select and score the best business models. MAMCA is a decision-making model (Macharis et al., 2009) to enable the simultaneous evaluation of alternative policy measures, scenarios, technologies, and so on. Frequently, organisations use decision-making models to make faster and better decisions. MAMCA is extremely well suited for complex decision-making processes such as those involved in mobility policies and transport sectors where many stakeholders from several areas and backgrounds are involved. It allows decision makers to arrive at a comprehensive and coordinated vision with regards to complex scenarios. Based on the identified criteria each actor can define its own criteria (in terms of different weights) and can provide its own scores.

4.5 Practice based research (= red part in Fig. 2)

For the selected business models, it is important to redo the stakeholder analysis. The current stakeholder positions could have changed completely leading to new power relations within the field of the stakeholders. Examples of these disruptive changes in the power relations can be observed by the market entrance of Uber and Airbnb. Also, the logistics processes can be completely changed by the introduction of a new business model. This means that all the processes and the related information flows need to be specified. The models and techniques are identical to the techniques applied in the phase of field research.

A new research activity in this phase is the use of Benefit Cost Analysis. BCA is a systematic approach to estimating the strengths and weaknesses of alternatives used to determine options which provide the best business model. The BCA is used to estimate (or evaluate) the value against the cost of the new sharing concept/business model.

To obtain more insight into the scalability of business models the scalability model of Stampfl et al. (2013) will be applied. The model is used to test, predict and improve the scalability of business models on five central factors: user orientation, network effect, technology, cost-benefit structure and adaptability to legislation and regulations.

Ultimately it is still possible that some stakeholders are not willing to cooperate in the new sharing concept. Therefore, it is important to identify the main uncertainties. Based on these uncertainties it is possible to design future scenarios. This is called Risk-aware roadmapping. In a workshop with important stakeholder one can develop a dynamic adaptive plan resulting in strategic action lists for each scenario. With this analysis it is possible to draw some conclusions about the robustness of the new business plan (Haasnoot et al., 2013; van Duin et al., 2016b).

4.6 Valorisation/dissemination (= white part in Fig. 2)

The last research activity focusses on the cross-case analysis, which is typical in the Yin study protocol. In this part the uniqueness of the case is determined by executing pattern matching among the other business models and logistics concepts among the other cases. If the case is not unique, it strengthens the internal validity of the found empirical business models and related sharing concepts. The final research activity is to execute a meta-analysis among the themes. Pattern matching, and classification are the research activities. Special research will focus on the issue whether business models and sharing concepts can be adopted to other themes.

5 Conclusions

According to Pan et al. (2013) logistics pooling involves sharing physical resources (warehouse, platforms, trucks), and organizations (logistics schemes), but also data necessary for managers to improve economic performance and supply chain environmental impact. Logistics pooling is defined as "pooling of logistics resources, organized by several actors, to group their flows to a single destination via transport and warehousing" (ECR France, 2013). In the shown sharing examples one can observe that an important resource is underutilised and forms the trigger to make the change to a sharing approach. Therefore a dedicated methodological approach is needed to learn from the experiences in practice. The value proposition setting and resources usages form the departure to identify the sharing potentials. Several sharing alternatives can be generated by the application of the business model compass. Selection of the sharing alternatives can be made by the application of MAMCA. Further elaboration of the sharing concept sharing service can be defined by the application Benefit Cost Analysis, the scalability model and risk-aware roadmapping. By applying the methodology a robust sharing concept can be designed. The first promising sharing concept is recently designed for temperature controlled warehousing setup by a fruit and vegetable wholesaler (van der Elst, 2020).

Acknowledgements

We thank TKI-Dinalog for funding our project entitled 'Sharing Logistics in Urban Freight Environment', project 2018-2-116TKI.

References

Aken, J.E., Andriessen, D., (2011). Handboek ontwerpgericht wetenschappelijk onderzoek: wetenschap met effect. Boom Lemma uitgevers. The Hague.

Armstrong, M. (1996). *Management Processes and Functions*, London.

Arvidsson, S., Givoni, M, & Woxenius, J., (2016). Exploring Last-Mile Synergies in Passenger and Freight Transport. *Built Environment 42*(**4**), 523-538. https://doi-org.proxy-um.researchport.umd.edu/10.2148/benv.42.4.523

Austin, J., Stevenson, H. and Wei-Skillern, J. (2006). Social and Commercial Entrepreneurship: Same, Different, or Both?. *Entrepreneurship Theory and Practice 30*, 1–22. doi:10.1111/j.1540.

Boitani, A., Nicolini, M., & Scarpa, C. (2013). Do competition and ownership matter? Evidence from local public transport in Europe. *Applied economics 45*(**11**), 1419-1434.

Butrina, P., Sheth, M., Goodchild, A. & McCormack, E., (2018). Measuring the Cost Trade-Offs Between Electric-Assist Cargo Bikes and Delivery Trucks in Dense Urban Areas. *Proceedings of the Annual Meeting Transportation Research Board,* Washington DC.

CE Delft (2016). *De omvang van Stadslogistiek*, Delft

Cockayne, D.G., (2016). Sharing and neoliberal discourse: The economic function of sharing in the digital on-demand economy, *Geoforum* (77), 73-82.

Cohen, B. Muñoz, P., (2016). Sharing cities and sustainable consumption and production: towards an integrated framework. *J. Clean. Prod.*, **134**, 87-97

Colby, C. & Bell, K, (2016). The On-Demand Economy Is Growing, and Not Just for the Young and Wealthy. *Harvard Business Review*. Website https://hbr.org/2016/04/the-on-demand-economy-is-growing-and-not-just-for-the-young-and-wealthy visited at 17th February 2020.

Coolen,H. & Meesters, J., (2012). Private and public green spaces: meaningful but different settings. *J Hous and the Built Environ* **27**, 49–67. DOI 10.1007/s10901-011-9246-5

Crainic, T.G., and Montreuil, B., (2016). Physical Internet Enabled Hyperconnected City Logistics. *Transportation Research Procedia* (**12**). 383-398

Dablanc, L., Ogilvie,S., Goodchild, A., (2014). Logistics sprawl: differential warehousing development patterns in Los Angeles, California, and Seattle, Washington. *Transportation Research Board 93rd Annual Meeting*, p. 17

De Reuver, M., Bouwman, H. and Haaker, T., (2013). Business model roadmapping: A practical approach to come from an existing to a desired business model. *International Journal of Innovation Management*, 1-18

ECR France (2013). *Collaborative logistics barometer*

Eden, C. and Ackermann, F. (1998) *Making Strategy: The Journey of Strategic Management*, London: Sage Publications.

eMarketer Editors, (2017). A Brief Overview of the Global Ecommerce Market. Retrieved from https://tinyurl.com/y7txkfkk at November 2019.

Fragapane, G.I., Bertnum, A.B., Hvolby, H.H., Strandhagen, J.O., (2018). Material Distribution and Transportation in a Norwegian Hospital: A Case Study, *IFAC-PapersOnLine 51*(**11**), 352-357

Geissinger, A., Laurell, C., Öberg, C., Sandström, C., (2019). How sustainable is the sharing economy? On the sustainability connotations of sharing economy platforms. *Journal of Cleaner Production* **206**, 419-429

Gesing, B., (2017). *Sharing Economy Logistics: Rethinking logistics with access over ownership*. Troisdorf: DHL Trend Research.

GreenDealZES, website https://www.greendealzes.nl/en/testing/retrieved at 15 May 2019

Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. *Global Environmental Change, 23*(2), 485-498. doi: http://dx.doi.org/10.1016/j.gloenvcha.2012.12.006

Handoko,S.D., Lau, H.C., (2016). Enabling Carrier Collaboration via Order Sharing Double Auction: A Singapore Urban Logistics Perspective. *Transportation Research Procedia* **12**, 777 – 786

Hibin, (2017). Website: https://www.hibin.nl/bestanden/Green%20Deal%20-%20complete%20tekst.pdf visited at 11th February 2020

IPCC, (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability.* Working Group II Report

Karim, N.H., Noorul Shaiful Fitri Abdul Rahman, N.S.F.A. & Shah, S.F.S.S.J., (2018). Empirical Evidence on Failure Factors of Warehouse Productivity in Malaysian Logistic Service Sector. The Asian Journal of Shipping and Logistics 34(2), 151-160, ISSN 2092-5212, https://doi.org/10.1016/j.ajsl.2018.06.012.

Knowledge Based Systems, Inc. (1993). *Announcing the Standard for Integration Definition for Function Modelling (IDEF0)*.

Kumar,V., Lahiri, A. & Dogan, O.B., (2018). A strategic framework for a profitable business model in the sharing economy. *Industrial Marketing Management* (**69**), 147-160, https://doi.org/10.1016/j.indmarman.2017.08.021

Lessig, L., (2008). *Remix: making art and commerce thrive in the hybrid economy*, Penguin, New York.

Macharis, C., Witte, A. D., & Ampe, J. (2009). The Multi-Actor, Multi-Criteria Analysis Methodology (MAMCA) for the Evaluation of Transport Projects: Theory and Practice. *Journal of Advanced Transportation*, 183-202.

Manty, N., (2018*). Electric van sharing free of charge coming to Germany*. https://www.electrive.com/2018/10/14/electric-van-sharing-free-of-charge-coming-to-germany/, accessed Feb 6th 2020.

Marchi, A., Parekh, E.J., (2015). How the sharing economy can make its case. In*: McKinsey Strategy & Corporate Finance.*

McClaren, D., Agyeman, J., 2015). *Sharing Cities. A Case for Truly Smart and Sustainable Cities*. MIT Press.

Muñoz, P. & Cohen, B., (2018). A Compass for Navigating Sharing Economy Business Models. *California Management Review 61*(**1**), 114-147.

Mouwen, A., & Rietveld, P. (2013). Does competitive tendering improve customer satisfaction with public transport? A case study for the Netherlands. T*ransportation Research Part A: Policy and Practice* (**51**), 29-45.

Ocicka B., Wieteska G., 2017. Sharing economy in logistics and supply chain management. *LogForum 13* (**2**), 183-193.

OECD, (2014). *OECD Reviews of Health Care Quality: Norway 2014: Raising Standards*

Oeij, P.R.A., Putnik, K., Van der Torre, W., Dhondt, S., & De Vroome, E.M.M., (2018). *Innovatie-adoptie door sociale innovatie in Logistiek*. Leiden: TNO.

Osterwalder, A., Pigneur, Y. & Smith, A., (2010*). Business Model Generation*, Wiley

Oxford Economics, (2017). Future trends and market opportunities in the world's largest 750 cities. Executive Summary, Retrieved from https://tinyurl.com/y8u5rcra at 3rd February 2020.

Pan, S., (2010). Contribution à la définition et à l'évaluation de la mutualisation de chaînes logistiques pour réduire les émissions de CO2 du transport : application au cas de la grande distribution. PhD thesis. Mines Paris Tech.

Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner Researchers*. Blackwell Publishing, Oxford UK.

Rodriguez-Verjan, C., Augusto, V. & Xie, X., (2018). Home health-care network design: Location and configuration of home health-care centers. *Operations Research for Health Care* (**17**), 28-41.

Savelsbergh, M. W. P. M., & van Woensel, T. (2016). City Logistics: Challenges and Opportunities. *Transportation Science*, *50*(2), 579-590. DOI: 10.1287/trsc.2016.0675.

Stampfl, G., Prügl, R., & Osterloh, V. (2013). An explorative model of business model scalability. *International Journal of Product Development 18* (**3**/**4**), 226-248.

Stern, N.H., (2007*). The Economics of Climate Change: The Stern Review*. Cambridge University Press.

Topan, E., Eruguz, A.S., Ma,W., van der Heijden. M.C. & Dekker,R., (2020). A review of operational spare parts service logistics in service control towers. *European Journal of Operational Research 282*, (**2**), 401-414.

Van der Elst, K. (2020). The views of DMU's of temperature-controlled warehousing companies and experts on the feasibility of the implementation of sharing logistics concepts. *Bachelor thesis Rotterdam University of Applied Sciences.*

van Duin, J.H.R., De Goffau, W., Wiegmans, B., Tavasszy, LA., & Saes, M. (2016a). Improving home delivery efficiency by using principles of address intelligence for B2C deliveries. In E. Taniguchi, & R. Thompson (Eds.), Proceedings of the 9th international conference on city logistics*. Transportation Research Procedia (12*), 14-25

van Duin, R., Bauwens, J., Enserink, B., Tavasszy, L., & Wong, K. J. (2016b). Risk-aware roadmapping for city logistics in 2025. In *Proceedings of 6th International Conference on Information Systems, Logistics and Supply Chain.*

van Duin, R., Wiegmans, B., Tavasszy, L., Hendriks, B., & He, Y. (2019). Evaluating new participative city logistics concepts: The case of cargo hitching. *Transportation Research Procedia*, *39*, 565-575. https://doi.org/10.1016/j.trpro.2019.06.058

Voehl, F., Harrington, H.J., Mignosa, C. and Charro, R., (2013).*The Lean Six Sigma Black Belt Handbook: Tools and Methods for Process Acceleration.* CRC Press

UNESCO, (2019). As urbanization grows, cities unveil sustainable development solutions on World Day. UN NEWS, 30 October 2019 (Website https://news.un.org/en/story/2019/10/1050291 visited at 12 November 2019)

Web1, (2018). Dutch National Research Agenda. Website: https://wetenschapsagenda.nl/wetenschapsagenda/ visited at 3-2-2020

Yin, R.K. (2009). *Case Study Research: Design and Methods.*4th ed. Thousand Oaks, CA: Sage Publications Inc.