The Last Mile: An examination of the implementation of urban consolidation centres.

In this research the barriers surrounding the founding of urban consolidation centres are explored. A case study of the hub of the HvA/UvA by interviewing key stakeholders found that the main barriers lie in the organisational and financial field. Main solutions seem to be signing public initiatives considering sustainability, expanding the concept nationally and provide clear contracts and adapted legislation.

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1. Introduction

Transportation has played a major role in shaping current urban areas. From the early days of shipping through canals followed by the major industrial revolution, which brought along railways and roads, resulting in the urban areas of today. These areas face multiple challenges such as congested roads by commuting and business traffic. These challenges are costing time and effort, recent rapports show that the growing amount of congestion is costing 3.7 billion annually (Het Parool, 2017). But this inefficiency also leads to extra pollution of the environment. The municipalities of Amsterdam and Rotterdam are even opting for a (partial) car-free inner city to combat these negative effects (NRC, 2018; Metro, 2015).

However, making the inner city completely car free also raises some logistical deficiencies. Shops, warehouses and other companies would still need to be supplied with their freight in order to conduct business. Besides these companies, consumers will also continue to have a need for the delivery of goods to their homes, especially considering the rise of e-commerce and online sales in the past decade. For a more sustainable and efficient delivery of goods to urban areas, a so called urban consolidation centre could be established.

An urban consolidation centre (UCC) provides a hub point in close proximity to the urban area. Here, goods can be sorted and consolidated, which will then be delivered to their final destination in the city. By making use of (partially) electric vehicles and/or electronically assisted tricycles, the delivery manner is more efficient and sustainable (Browne, Allen & Leonardi, 2011).

This method of transporting goods in urban areas sounds promising, is more efficient and is better for the environment. Carriers can save costs and increase efficiency by delivering to one central point, the environment is less burdened since electric vehicles will be used, and the end-receiver will still receive their goods (Simoni, Bujanovic, Boyles & Kutanoglu, 2018). If the costs of establishing an UCC are less or equal to the logistics costs saved by the consolidation of goods, and the end-receiver experiences no difficulty with receiving their goods, it seems like a win-win. If it is a win-win situation then why has not every major municipality adopted this policy? This leads to the following research question:

"Which barriers can be identified when implementing an urban consolidation centre in Amsterdam?"

In order to answer this research question two main methods will be used. Firstly, through a review of existing literature a framework will be established where the barriers can be categorized and their respective stakeholders and bottlenecks. (Nordtømme, Bjerkan, & Sund, 2015;Van Duin, Quak, & Muñuzuri, 2010;de Assis Correia, de Oliveira, & Guerra, 2012).

Furthermore, a case study will be done of the implementation of an urban consolidation centre by the University of Amsterdam (UvA) and 'Hogeschool' of Amsterdam (HvA). In this case study the established framework will be applied (Ploos van Amstel, Balm, Kramer & Doorman, 2014). Interviews will be held with key stakeholders in establishing this UCC. Key stakeholders in this process are the carriers to the UCC, the operator of the UCC itself, the company responsible for the transportation from the UCC to the customer, research institution/end-receiver UvA and HvA, and lastly the municipality of Amsterdam. In these interviews the decision-making process of each stakeholder in participating in this UCC will be explored.

Carriers might be concerned for the quality of their delivery process when a third party handles the consolidation and delivery of their goods. Local authorities might prefer off-hour delivery time frames in order to lessen the burden of congestion in the city. For private companies, the financial incentive could be a prerequisite in order to consider changing their current way of delivering goods.

2. Literature Review

2.1 Introduction

In this literature review, previous research considering transport policy and the implementations of UCC's will be discussed firstly. Moreover, a general description of the various types and aspects of UCC's will be given according to previous literature. Lastly, some cases of UCC's in Europe will be discussed in depth, London and Oslo respectively. Previous research on implementing transport policy successfully has aimed at providing tools for parties active in the policy forming department (Brand et al., 2002; Arampatzis et al., 2004; May et al., 2012). Implementing this transport policy in the real world has always faced several barriers. For example, May et al. (2006) states four main categories of barriers when implementing policy. These are: legal and institutional barriers, financial barriers, political and cultural barriers, and practical and technological barriers. Barriers in the legal and institutional world can often not be overcome so easily. Banister (2005) even did some empirical research and found 'resource barriers' most common, which are financial and physicical impediments that need to be overcome in order to complete the project. After resource barriers, institution/policy and

social/cultural barriers were most common. Most of these barriers were found to be manageable.

Lindholm (2010) shows that policy makers often deal with a lack of awareness and interest in transport issues among the general public and policy makers, which makes implementation of solutions more difficult. Therefore, attention should be paid to analysing the main stakeholders and the relations between them. The most relevant stakeholders are often identified as local authorities, carriers and end-receivers (Lindholm, 2010). Involving local private stakeholders in making the policy and also taking the local community and other circumstances into account are prerequisites for implementing transport freight policy successfully.

2.2 Urban Consolidation Centres

Implementation of UCC's started in the 70's mostly in the United Kingdom and France going by the term of 'transhipment centres'. In this time, it was already noted that the increasing amount of large heavy goods vehicles (LGV's) in urban areas should be reduced (Battilana & Hawthorne, 1976). Battilana and Hawthorne (1976) considered the use of smaller and lighter vehicles for the final delivery to the end-receiver. In this research, there was not yet accounted for the fact that using smaller and lighter vehicles would result in an increase of the amount of trips per vehicle, which might lead to a heavier impact on the environment and local traffic. In North-America, research had a different angle of approach. Here the goal was mainly to increase the loading factor of vehicles (McKinnon, 1998a).

In the 70's, only little of these UCC's were actually established as most research was theoretical and exploratory. The ones that were established were often not able to receive a sufficient amount of throughput in order to be profitable. Often these centres ended up being transformed into general industrial centres with functions as warehousing or other logistical activities (McKinnon, 1998).

In the 90's, Crainic, Ricciardi and Storchi (2004) examined the establishment of UCC's in Germany, where small freight operators and forwarders chose to cooperate in small urban environments. This was done by either establishing new infrastructure or utilizing existing logistical centres. Environmentally friendly political parties encouraged these initiatives sometimes by providing public financial aid. In 2005 only five of these UCC's were still operational (Nobel, 2005).

Among literature, various terms for UCC's are used. These include FCC's (freight consolidation centres), UDC's (urban distribution centres) or UTC's (urban transhipment centres).

General description UCC's:

The main aim of UCC's has been described in various literature. Below follow two statements considering the general purpose of an UCC:

To increase the loading factor for vehicles and to decrease the amount of vehicles in an urban area. This can be the city centre, the entire city or a specific site such as a shopping mall. Furthermore, to decrease the total mileage driven in a city and the associated environmental effects of these driven distance. The vehicles used for this do not have to be smaller in principle nor electrical. These vehicles can range from small muscle powered tricycles and electrical vans to large diesel trucks (Dunning, 1997; Exel, 2004).

"An UCC is a logistics facility that is situated in relatively close proximity to the urban area that it serves be that a city centre, an entire town or a specific site such as a shopping centre, airport, hospital or major construction site. Goods destined for these locations are dropped off at the UCC. The UCC operator sorts and consolidates these loads dropped off by logistics companies and delivers to the final destinations, often using environmentally friendly vehicles such as electric and gas-powered goods vehicles, and electrically-assisted tricycles" (Browne, Allen & Leonardi, 2011).

Allen et al. (2012) have found three types of UCC's:

1. *Urban Area UCC's*: UCC's that are predominantly orientated around the supply of retail or office products. Most often they are focused on retail products but sometimes they also supply restaurants and cafes. These UCC's are often orientated around a specific urban area with locations that possess streets not easily accessible due to historic layouts. This can lead to transport related issues such as congestion, too few parking spaces, demand for vehicle free zones or environmental air pollution. Usually, local authorities take initiative in introducing this kind of UCC in order to reduce social issues such as the congestion and environmental damages.
2. *Large site single landlord UCC's*: UCC's that are usually orientated around the supply of retail and food for restaurants and cafes. They can also be used for supplying healthcare related products. Large sites can refer to places such as hospitals, airports

and shopping malls. These UCC's may only deliver to one site, however said site could contain many different goods. The need for this kind of UCC usually stems from business owners who would like to minimize on-site storage and simultaneously maximize the available retail space (WSP, 2008). This type of UCC differs from the afore mentioned type for four main reasons. Firstly, the founding of such a site is usually coordinated and aligned with the development of the 'large site' to which it delivers the goods. Secondly, the landlord of the site has the ability to enforce the usage of the UCC by the business owners that operate at the large site. Thirdly, the delivery points of the large site tend to be in a custom designed delivery area with a single access route. Lastly, the UCC can potentially be made self-sufficient in financial aspects by charging the respective business owners of the large site a fee.

3. *Construction UCC's:* UCC's that are usually used for the consolidation of construction materials for large construction projects. This includes the building of office blocks, residential housing or even hospitals. This UCC can be used to serve a single or several construction projects. The characteristic of this UCC is that it is usually only operational during the time that a construction project takes place. The developer of the site or the construction companies may decide to use this kind of UCC, but it can also be enforced by contractual obligations of a tender.

2.3 Aspects/Effects of UCC's

For all the three types mentioned above it goes that they can offer the basic consolidation services, but can also carry out value-added logistics. These could include reverse logistics, waste collection, warehousing or labelling. Now, these three types will be analysed on four different levels: Traffic and environmental, organizational, financial, and operational.

Traffic and environmental

UCC's can reduce the total distance travelled in a certain area by improving the load factor of goods delivery vehicles. The reduction of greenhouse emissions and air pollutants is twofold, it is a consequence of the reduction of total distance travelled, but it can also be because of the use of low-emission vehicles. The fact that goods delivery vehicles have to travel fewer kilometres also has effect on traffic safety. The chance of confrontations between delivery vehicles and other road users may decrease, which increases the safety of pedestrians. From the aspect of congestion, the total time spent on the kerbside and the space occupied by delivery vehicles will also decrease. (Boudouin, 2006; Browne et al. 2005; WSP, 2008).

Allen et al. (2012) found from a combination of UCC studies that UCC's have the capability to improve the efficiency and hereby reduce issues of congestion and environmental issues. For Construction UCC's and Large site UCC's the increase of efficiency in freight activities can be considerable. For Urban Area UCC's these effects tend to be smaller since they tend to have a smaller scale of operation. In this case, the reduction in traffic and environmental benefits are dependent on the proportion of goods of the urban area that is being sent through the Urban area UCC.

Organizational

The successful implementation of an UCC is dependent on the relationship between the initiator, carriers and end-receivers. If the initiator is able to control or strongly influence carriers and end-receivers then the UCC has a higher chance of being successful. This is more the case with Construction and Large site UCC's than with Urban area UCC's (Allen et al., 2012). A good example of this is London Heathrow airport. The owner of the airport has been able to enforce usage of its consolidation centre by retailers operating in the terminals. Furthermore, the owner has also laid down ground rules for DHL, which operates the distribution centre (DHL, 2009). For construction sites the same situation can be achieved when a single developer is in charge. This situation of possessing strong influence can be achieved by any large site with a single landlord.

Kloppers (2008) noted that the local transport authority can also often implement regulations for goods delivery vehicles to encourage the usage of an UCC. Examples of the regulations are: loading time restrictions in pedestrian areas, lading factor requirements, vehicle pollution standards, permission for UCC vehicles to use bus lanes, prohibition of goods vehicles above a certain weight and lastly, the prohibition of goods vehicles in an entire area (Mollard, 2002; Patier, 2006). In the case of the city Vicenza, Italy, an UCC company is given a monopoly on delivery within the historic inner city, this however may face legal repercussions from the trade association existing of other carriers (Comune di Vicenza, 2011).

Financial

Quak and Tavasszy (2011) reported that there are concerns about the financial viability of UCC's as many UCC's schemes have failed in the past. Allen et al. (2012) state that in order for UCC's to be viable financially in the medium- to long-term, they must be self-sustainable. Public subsidies have proven to not be a desirable solution. It is also opted by Boerkamps and Van Binsbergen (1999), since UCC's are shown to result in traffic and environmental benefits,

that the revenues of congestion charging and road prices could be used to provide for the UCC operational costs. In this way benefits received by the entire society can be funded by societal means. TTR (2010) adds upon the subject of public funding, that without any feasibility studies or trials funded by central or local government an UCC is unlikely to succeed. However, this funding is less necessary when the founding of the UCC is linked to a major development.

McKinnon (1998b) points out that a common argument against UCC's is that they will lead to increased total handling costs since the goods are handled more frequently. Therefore Allen et al. (2012) advises to discuss the transport schemes with the road transport industry and potential customers. Costs can be reduced in UCC's in various ways: less time spent in congested areas by carriers, increased vehicle utilization, less time spent on journeys and sometimes it is even possible to deliver during night-time when traffic is at its lowest. In addition to this Browne et al. (2005) shows the possibility of value-added services provided by the UCC can lead to more revenue. Allocating these costs and benefits from the UCC as a whole is one of the key parts of the financial aspect.

As demonstrated before, besides organizational ease, construction UCC's and large site UCC's also provide financial opportunities. Since in these models the property developer or site owner is able to set demands through contractual agreements, it can arrange for the operational costs of the UCC to be met. This can be through fees for retailers in a Large site UCC or for Construction UCC, the site owner can reap the financial benefits of faster site development, less waste and a more secure place to consolidate building materials (DHL, 2009; Hapgood, 2009).

Urban Area UCC's are often initiated with the help of public funding. This funding could be to just cover the initial costs, but in some cases it is meant to cover long term operational costs. van Rooijen and Quak (2010) point out that it is usually the goal of an UCC to gradually decrease the public funding while the revenue earned from end-receivers gradually increases. This can be achieved by a larger throughput, utilizing economies of scale, or providing more value-added services at the UCC. TTR (2010) provides that in practice this goal is hard to achieve due to the fact that end-receivers are less known to switch over voluntarily and that the Urban Area UCC usually lacks methods of enforcing their end-receivers to utilize the UCC.

The municipality or local government could play a role in enabling these Urban Area UCC's by only allowing UCC vehicles in a certain area. In this way a competitive advantage can be realized for the UCC in comparison to non-UCC goods delivery services. However, local

unions or organizations can protest against these regulations. Another way for the municipality or local government to support the UCC is subsidies. However, the downside of subsidies is that they must be defended in times of economic crises and could be cut suddenly. An example of how to justify these subsidies can be found in Parma, urban freight transport systems are subsidized for the fact that they deliver environmental benefits (Ville et al., 2010). Allen et al. (2012) conclude that when designing an UCC scheme, the division of costs is something that should be clearly defined. Often end-receivers end up paying a surcharge in order to finance the UCC, while carriers also benefit from the UCC by not having to enter crowded urban areas. A solution is to let carriers pay for a part of the costs and let end-receivers only pay for e.g. value-added services. Lastly, it is also more efficient to let the UCC make use of existing infrastructure instead of building entirely new facilities. In these ways the UCC can be more financially independent in the long term and not require governmental subsidies.

Operational

McKinnon (1998b) recognizes that the principle of an UCC, transferring goods of a highly laden vehicle into multiple smaller vehicles, may cause additional traffic movements. With these additional movements, the environmental benefits would be unclear if only traditionally fuelled vehicles are being used. However, it is common practice within UCC's to utilize environmentally friendly vehicles such as electric cycles or small electric vans (Patier, 2006; Kloppers, 2008).

In all supply chain schemes the need for efficiency and optimization is high, the same goes for UCC's. The amount of vehicles that are driving around empty needs to be minimized. Especially on the side of reverse logistics towards the UCC, Browne et al. (2005) shows that to utilize the capacity of vehicles returning to the UCC, several options are available. These options include but are not limited to: transporting returned products, inter-company transfers and transporting damaged material or waste. Having these flow of return goods also provides opportunities for the UCC to fulfil additional functions, hereby creating a more valuable position in the supply chain (Browne et al., 2005).

The location of the UCC can be seen as a trade-off between proximity to the delivery area and distance from the crowded urban area. If the UCC is in close proximity to its destined delivery area, the UCC vehicles have to make a small amount of kilometres per trip. However, the UCC needs to have a certain distance from the crowded urban area in order to be attractive to carriers.

Since the benefit of an UCC for carriers is that they save time and kilometres by not having to enter the crowded urban areas (Browne et al. 2005).

In the following part, two cases of the implementation of an UCC will be discussed in detail: a case study of an UCC in London, which was successful. And a case study of the implementation of an UCC in Oslo, which was less successful.

2.4 UCC's in Europe

Case study London

Browne, Allen and Leonardi (2011) state, combining from various literature, that since an UCC can increase the lading factor of vehicles, the amount of distance travelled in order to deliver the goods will decrease. The reduction of both greenhouse gas emissions and local air pollutions that follows is caused by a reduction of the total distance and the usage of environmentally friendly vehicles. Furthermore, the total time the delivery vehicles spent in the city also decreases, therefore decreasing the amount of congestion that is caused. Lastly, there are social and environmental benefits such as greater pedestrian safety, noise reduction when using quieter vehicles and less conflicts between goods vehicles and other road users. This usage of an UCC also offers opportunities for logistical companies. By not having to enter the city centre, they save time and costs. At the actual UCC other value adding services can also be added such as unpacking or price labelling.

The UCC initiative, researched by Browne, Allen and Leonardi (2011), in London was mostly initiated by a major supplier of stationary and other office supplies. Their goal was to reduce the environmental impact of their delivery, increase their reputation on this part, and to reduce overall costs. The office supplier hired a company specialised in green urban freight to make this operation happen. The major changes this trial implemented were, firstly, the placement of a UCC in order to decrease the total mileage driven and the environmental impact, and secondly, the use of only electric vehicles in the customer area. The local government, Borough of Camden, made a small financial contribution to this trial considering London's unique position as a trial area for urban initiatives. All other costs were met by the office supply company and they expect the costs to be of a similar level as their current costs.

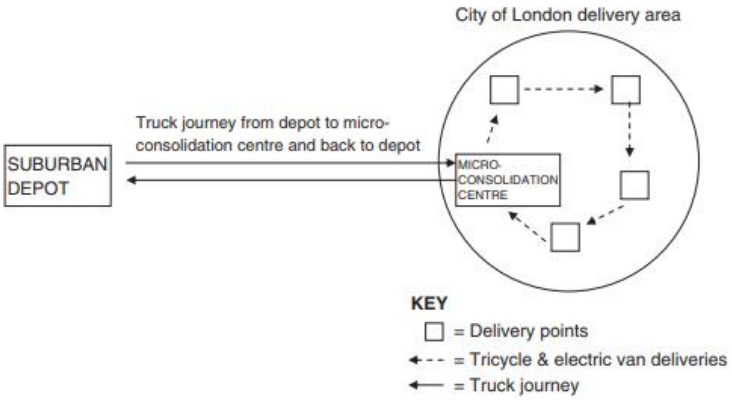

Figure 1: The new delivery schedule for the City of London (Browne, Allen & Leonardi, 2011)

In Figure 1 the schedule for the new delivery system in London can be seen. The micro-consolidation centre was used for the transhipment of parcels from the delivery truck onto the electronic vehicles and was also used to store the electronic vehicles overnight. This centre was operated by the specialised urban freight company. Between the suburban depot and the micro-consolidation centre a large delivery truck was used to transport large amounts of parcels. The electric vehicles were used to deliver from the micro-consolidation centre to the customers. No emission was generated by this process since they made use of green electricity.

During the trial, the amount of goods that was delivered through the new schedule was gradually increased. In the result section it can be noted that the total distance driven decreased with 20%. With this decrease of distance and the usage of electronic vehicles, the emission of CO_2 also reduced with 54%. The distance travelled between the suburban depot and the micro-consolidation centre decreased with 82% since this has become a one way route with only one truck. On the other hand, the total distance travelled in the city increased with 349% since the carrying capacity of electronic vehicles is less so more have to be used to meet the same delivering capacity.

Furthermore, electronic vehicles offer several other advantages in comparison to diesel vans. These include a lower tax, insurance and acquisition prices. They are also perceived as less intimidating and more convenient to park. The main disadvantages are the lower carrying capacity and action radius in which they can be used. The parameter of total distance covered is however not completely representable for the impact on other traffic since the electric vehicles occupy less space than diesel vans and the amount of time is spent differently. Controlling for these factors, the overall driving in the city of London decreased with 56%. This

being a higher amount than the 20% decrease of total distance driven. The amount of time the vehicles spent parked on the kerbside also decreased with 10%.

The costs of this project remained the same as before, specific amounts cannot be mentioned because of confidentiality. It can be indicated that the operation costs for the distribution centre increased, while all vehicle costs decreased except for the total driver wages. The total wages slightly increased because the total number of drivers increased while the hourly wage decreased.

In conclusion, the trial was a success for the company environmentally, financially and logistically. It shows that when choosing for electrical vehicles over diesel vans, there is a trade-off between environmental benefits and total distance travels since diesel vans have a larger capacity. The office supply company has continued to use this transport method in the city of London and is looking to expand it to other locations.

Case Study Oslo

Nordtomme et al. (2015) states that the key for any business project to succeed is the financial viability. A common argument against UCC's is that the extra transhipment costs make the effort less financially attractive (Verlinde et al., 2012). Often an UCC comes together with a collaboration between private and public parties, where the public parties provide (partial) subsidies. However Quak et al. (2014) have found that after these subsidies are withdrawn or expire, it becomes difficult to keep these centres financially viable. In order to increase the attractiveness of an UCC, Van Duin et al. (2010) proposes value added services. These services could range from handling return waste, labelling or mail services.

The City of Oslo was looking to implement sustainable urban transportation, hereby collaborating with private parties and authorities in Oslo in order to create a UCC in the city centre. This centre would serve a consolidating logistical function but also provide added value services. Several barriers have been identified by Nordtomme et al. (2015) that can arise when looking to implement sustainable transport policy and how these barriers can be overcome. These are divided in: Financial and practical barriers, social and cultural barriers, institutional barriers and legal barriers. Firstly, the main implementation process of the hub in Oslo will be discussed and then each barrier individually.

Implementation process

The City of Oslo tried to establish partnerships between private and public stakeholders in advance. It was observed that stakeholders had different preferences when it came to considering the implementation of an UCC. Public parties preferred more measures aimed at reducing congestion, such as delivery off peak hours, but end-receivers were opposed to this. End-receivers mostly agreed with carriers. They both wanted legal measures to be taken so freight distribution gains priority in the inner city. Carriers and end-receivers were not dispositioned favourably to the implementation of the UCC. The UCC was meant to be a trial. The location of an UCC is always a trade-off between proximity to the end-receivers and accessibility for the carriers. Here also, legal barriers such as public transport regulations and urban planning can come into play.

Some carriers did not participate for the following reasons: They had goods with strict temperature requirements which were not feasible for consolidation, they had a short trial period which requires additional integration costs, and/or they had concerns for sharing sensitive commercial information with third parties

The hub operator only wanted to participate if a minimal requirement of deliveries were guaranteed by the municipality. Recruiting end-receivers between private parties proved difficult since they were reluctant to change their current delivery system. For this reason, they turned to public parties for demand. In these parties conflict arose, the carrier was willing but the procurement department found legal issues in changing the current contracts. Lastly, also new traffic regulations needed to be developed specially for the hub. All the above reasons led to the hub not being implemented.

Financial and practical barriers

Firstly, no ‘clear-cut’ business case was defined on how costs would be financed and how the saved costs would be divided. Secondly, no private party wanted to take the burden of the investment and operational costs. And recruiting private and public customers for the UCC also proved difficult.

The solution for these financial and practical barriers would be to find a third party that wants to assume the responsibilities of the investment and operation costs. This third party can make revenue by providing added value services, which are demanded by end-receivers. In this case,

it does not have to be labelled as a trial, which makes it more attractive for potential carriers and end-receivers.

Social and cultural barriers

A resistance to change from stakeholders when benefits are not clear was observed. Adding to this, the stakeholders are already invested in existing infrastructure. The project was labelled as a 'trial' which made stakeholders uncertain because carriers would experience a wasted investment if the trial does not succeed. The carriers assessed the consequences of an UCC negatively. They wanted freight delivery to be prioritized in regulations and believe they consolidated their goods as good as possible in the current situation.

The solution for the resistance to change can be altered when there is a need for change. Municipalities can implement stricter regulations for carriers, if carriers have to deal with more congestion and regulations they will be more willing to look for solutions. A network with representatives from all stakeholders that come together to create more collaboration instead of pointing fingers to each other could also be beneficial. And the contractual issues for procurement departments need to be solved.

Institutional barriers

Many different public parties were involved with all their own priorities. The initiator wants to find solutions, procurement department want to maintain their service level and police wants to administer to regulations. All these priorities need to be aligned in some way. The solution could be to make sure 'higher up' parties are involved so there is enough mandate for the institution to be willing to implement the change.

Legal barriers

Public tender regulations when finding customers can cause difficulties for a public institution and can also cause bureaucratic issues, such as road sign regulations, which need to be handled efficiently. The solution could be to change tender and traffic regulations so these do not stand in the way of the UCC.

2.5 Methods and Research Framework

The literature review included academic journals, research reports and project publications. UCC's have often been referred to in non-academic work, these works therefore provided

valuable insights. Publications that discussed a sum of UCC's were taken into account but also publications that discussed only one UCC.

In order to get a in depth understanding of the working of the UCC of the HvA/UvA several interviews were conducted. These interviews were conducted face to face preferably, but also through phone for practical reasons. The specific parties that were interviewed remain anonymous but include the transport research department of the HvA/UvA, director of the hub operator, the last mile transport company and the city logistics department of the municipality of Amsterdam. Information was preferably gathered directly from the involved parties. However due to practical limitations, information on the experiences of carriers was passed on by the transport research department of the HvA/UvA, which could therefore contain some bias.

Research Framework

In order to analyse the information gained through the interviews and desk research, a framework will be used. This framework follows the four different levels of section 2.3 and can be seen in Table 1.

Table 1: Overview of the research framework used in section 3

Level	**Content**
Traffic and Environmental	*Location, vehicle usage, role of local authorities*
Organisational	*Relationship between initiator, carriers, hub operator, last mile transporter and end-receiver, amount of control and strength of relationship*
Financial	*Amount of subsidy, allocation of founding costs of hub, cost-effectiveness of hub, value-added services*
Operational	*Functions of hub, return flow of good to UCC, location, transhipment*

In section 3, the following will thus be discussed: the preliminary research by the transport research department of the HvA/UvA (3.1), the key stakeholders of the hub (3.2) and the framework will be applied (3.3-3.6).

3. Empirical Research

3.1 Preliminary research

Prior to the founding of the hub of the HvA/UvA, the transport research department conducted a research towards the current inbound and outbound logistics of the HvA/UvA (van Amstel, Balm, Kramer & Doorman, 2014).

It was found that 50% of the supplies are being delivered within a 30 kilometre radius. Considering the smaller action radius of electronic vehicles, this makes electric driving more feasible (Granovskii, Dincer & Rosen, 2006). It is also noted that almost 75% of the suppliers deliver less than 50 times a year. Thus, a small group of suppliers is responsible for most of the deliveries, also known as the '80/20 rule' (Viswanathan & Bhatnagar, 2005). Van Amstel et al. (2014) conclude by making three recommendations:

1. The combining of transport flows at the source and organizing all transport under one transport company decreases the amount of deliveries. However, this solution requires transparency in the procurement and planning process of the customer and supplier. Existing long term contracts could provide a risk for the implementation of this solution. Also, the existence of third party deliverers negates the financial incentives for the HvA/UvA
2. Creating a central delivery point on the outside of the city decreases the necessity for suppliers to enter the already congested city centre, which decreases transport costs and time. The bundling of goods at this point increases volume which allows for a profitable method of transporting further into the city. However, a part of cost reduction has to be allocated to this process.
3. Changing the procurement policy is the measure by which the HvA/UvA can have the most control. Internally bundling orders decreases the effort for suppliers and certain conditions could be set for these suppliers.

In the next section the key stakeholders will be discussed.

3.2 Key stakeholders

The most prominent key stakeholder in this process is the research department of the HvA/UvA which is the initiator of the project. Other key stakeholders are the carriers, the hub operator and the last mile transport company. The end-receiver is closely linked to the initiator, this is

the facilities department of the HvA/UvA. Additionally, some context will be given considering the role of the municipality and some stopped transport companies.

Initiator and end-receiver

As already stated in the section preliminary research, the research department of the HvA/UvA established that transport could be carried out in a more efficient manner. HvA/UvA approached their carriers with these findings and convinced some to participate in the project to improve efficiency. HvA/UvA set two demands for this project in advance: The amount paid for the goods by the HvA/UvA should not increase and the level of service provided to the facilities department should not decrease.

Carriers

The HvA/UvA has seven large carriers which deliver office supplies, vending machines and bathroom supplies. A term in the contracts between carriers and the HvA/UvA obliged carriers to take part in this project. However, the research department of the HvA/UvA did make effort to communicate with different departments of each carrier in order to align expectations. It can be noted that the carriers already noticed themselves that transportation was not carried out efficiently, but since their contractual obligation is to just deliver the goods, they did not feel an incentive to approach the end-receiver with their findings.

Last mile transporter

The last mile transport company is involved in the delivery of different types of goods. This includes bulk goods, such as mail and packages, and specialized delivery of goods, such as jewelry or medical equipment. Recently, the last mile transporter has signed an initiative to carry out all its transport activities emission-free within a certain timeframe. The incentive to collaborate with the hub partly stems from this emission-free initiative. On the other hand, this collaboration is also efficiency related by integrating IT systems and transport networks. Moreover, the last mile transporter is interested in seeking out the public discussion considering sustainable delivery.

The last mile transport company has tried to found hubs by themselves in the past. However, this has not been successful. Lastly, the hub of HvA/UvA lost their original last mile transporter and then approached the current company. This original last mile transporter will be discussed shortly at the end of this section. The main question for the last mile transporter with

implementing emission-free transport methods is how the costs can be divided, is an end-receiver willing to pay extra in order to get emission-free transport?

Hub operator

The hub operator's primary business model is a moving and warehousing company. They are located in proximity to the city of Amsterdam. The hub operator sees the UCC as a way of complimenting their current business model. By functioning as a hub, the company can fill the empty storage space at their location with fast moving goods. Moreover, the slow moving storage space in the current warehouse could be allocated to a less costly location. The hub operator is aiming to implement the concept of UCC in more cities in the Netherlands. They have created an alliance with the last mile transport company to promote and introduce their business model to other cities in the Netherlands.

According to the hub operator, the first prerequisite for this to be successful is to have a suitable hub present in the area. This hub needs to have a current income stream it can utilize, the ability to offer value-adding functions, a suitable location, available storage space and the possibility to expand or relocate their slow moving storage activities. An 'entrepeneurial' spirit is also deemed necessary since the addition of a hub to current location requires a change from current methods and behaviours. By adding the activities of warehousing or fulfilment the new hub can increase revenue on already existing infrastructure.

When a suitable hub is found, the hub must decide their approach. They are in the middle of the supply chain, between the carrier and the end-receiver. In order for parties to utilize the hub, the end-receiver needs to be convinced first. Then the end-receiver can approach their carriers to use the hub system. In this way, a relationship is established between the hub operator and the carriers.

Municipality of Amsterdam

The municipality of Amsterdam has a large agenda considering city logistics. This agenda focuses on how supply routes of goods within the city can be carried out in an efficient and sustainable manner, monitoring indicators such as the amount of carbon emission, congestion, and total mileage driven by companies. One of the measures in this agenda is to stimulate and facilitate the implementation of the hub that delivers to HvA/UvA. Some of the goods of the facilities department at the municipality of Amsterdam are transported through the hub of HvA/UvA. However, this is not the only hub in Amsterdam. As of now, there are five hubs that

deliver goods using electrical vehicles. Some of these hubs deliver fast moving consumer goods and/or require a mark-up for their services. This is in contrary to the HvA/UvA hub, whose aim is to keep the overall costs at the same level for the end-receiver. This will be discussed more elaborately in section 3.5. Within the municipality of Amsterdam, the department of logistics policy is the initiator and the facilities department is the end-receiver. The municipality chooses to pay the carrier less as they only transport to the hub. The municipality also cover the costs of the last mile transport from the hub to their location.

Previous last mile transporter

Lastly, the electrical car company Cargohopper was involved in the start of the founding of the hub. Cargohopper gained a lot of governmental subsidies but failed in the end to be profitable. The costs were too high and the company lacked customers. This is an example of a bad business case.

3.3 Traffic and Environmental

Transportation vehicles

The last mile transporter uses emission-free vehicles as a mode of tranport. Their fleet consists of electric vans and e-bikes. For the last mile transporter these vehicles were already used in other business activities so no large investment costs were made. The main barrier is acquiring a sufficient amount of cargo, this will be discussed more in section 3.6. Based on the prelimenary research, a reduction of the amount of distance driven by carriers is a primary goal of founding the hub. A secondary goal is to reduce the amount of congestion on the ‘ring of Amsterdam’ A10. Thirdly, the amount of carriers arriving at the HvA/UvA and causing local congestion and kerbside time is also sought to be reduced.

Location

Since the moving and warehousing company was already situated at their location, no selection was made on basis of a certain region. The selection process of the location looked more into which infrastructure was already present at a site. The hub is situated in proximity to the outer ring of the city centre of Amsterdam.

Municipality

According to the municipality of Amsterdam there is an urgent need for delivery hubs in the city as transport companies increasingly have more difficulty entering congested areas with

large trucks. It is likely that inner cities will soon start banning these large delivery vehicles. This further stresses the importance of utilizing UCC's in the delivery process of goods.

For construction in the inner city, the municipality of Amsterdam also works with construction hubs. Not only is the consolidation of all construction material more efficient, but the transport of these construction materials through the waterway is also more popular and sustainable. 'Economisch Meest Voordelige Inschrijving' (EMVI) is a tool used by Municipalities to indicate that demands for new possible suppliers are not solely based on the lowest price but that they are also focused on qualitative and other societal goals. A set of EMVI-criteria can be created for each project to meet their specific interests. For example, some projects want to strive for more sustainability and thus require an obligatory delivery through waterways or a certain cap on total mileage driven by transport companies. A barrier could arise if these legal tools are not available for a local authority.

3.4 Organizational

HvA/UvA

While designing the concept of an UCC, either private or public parties could be the end-receiver. The HvA/UvA transport research department found that incentivizing private parties with government subsidies for allocating their deliveries to a consolidation hub has not been successful in the past. This can be explained by the fact that government subsidies do not provide a financial incentive in the long-term. Using public parties as the end-receiver comes with two main advantages. Firstly, public parties often possess a larger internal demand providing possibilities for more economies of scale. With a small demand, a hub is often not profitable. Secondly, public parties are more likely to have direct social and environmental benefits from the successful implementation of a hub. For example, a university campus gains reputational benefits from being more clean and environmentally friendly. Likewise, if the inner city is less congested, the accessibility of a hospital increases.

On the contrary, private owners in a shopping street only receive direct benefits from the goods being delivered to them, with or without congestion and environmental damage. A disadvantage of public parties is that a public tender must be set out for projects which exceed a certain financial threshold. The HvA/UvA cannot prolong their contract indefinitely with the current hub operator/last mile transporter indefinitely due to these regulations. This brings an uncertainty for the HvA/UvA since the established relationships between current carriers and the hub operator/last mile transporter could disappear if a public tender brings forth another hub

operator/last mile transport company. However, a public tender also allows additional requirements to be set for a new candidate, such as certain environmental or public targets.

Hub operator

The relationship between the hub operator and the carriers is newly forged since the hub operator is an extra link in the supply chain. This is a source of uncertainty for the carriers since they are not sure if the hub operator/last mile transport company is able to deliver their goods with the same quality of service. Clear communication and establishing clear contracts is necessary in this case.

Last mile transporter

The last mile transporter is currently investigating if the hub of HvA/UvA can provide a new revenue model for the company that can also be implemented in other cities. The incentive for the last mile operator in theory is that they already have delivery processes that are entering the city. They can combine their cargo flow to the HvA/UvA in the hub with other end-receivers, making their process more efficient. Efficiency is also met through the consolidation of required resources, such as employees and transportation vehicles, at the hub itself instead of spreading around the inner city. This could provide a new business model for the last mile transporter.

The last mile transporter could receive benefits from consolidating their resources such as employees and transportation vehicles at the hub. The barrier that arises in this case is for the last mile transport company to convince their other clients to utilize the hub as well. The last mile transporter experiences that clients are often not willing to pay more for their current delivery. Some clients of the last mile transport company were only willing to switch over to delivery via the hub if the last mile transporter would offer additional services such as being able to deliver more rapidly.

The existing relation between the clients and last mile transporter plays a role in the willingness to participate of clients. A strong relationship makes it easier to convince clients to join the hub. However, attracting entirely new private parties to join the hub proves to be more difficult. It is often not a priority for private parties to completely alter their logistics when the current system is working. The HvA/UvA were able to get their current carriers to the hub because of these existing relationships.

Carriers

For carriers, it requires a lot of time and effort to reshape existing infrastructure in order to be able to utilize the hub. It differs here if a carrier has a third party that carries out their transportation or if they transport the goods internally. If there are third party transporters involved, contracts may have an expiration date and cannot be easily dissolved. For internal transport, there is existing infrastructure such as vehicles, personnel and vehicle facilities. This existing infrastructure cannot be dissolved easily, these are often long term strategy decisions for the carriers. For if they switch entirely to hubs, they would need to reshape their own transportation department. Here the national coverage of a hub operator would also make the switch easier for the carrier. One part of the existing infrastructure is also the information flows that need to be combined in one system.

The state of the relationships between the stakeholders can be summarized in the following Table 2.

Table 2: Summary of organizational relationship between stakeholders

Stakeholder	**Weak/uncertain relationship**	**Strong relationship**
Initiator (HvA/UvA)	Hub operator/ Last mile transporter	Carriers
Carriers	Hub operator, third party transporters	Initiator
Hub operator	Carriers	Last mile transport company, Initiator
Last mile transport company	Other clients	Hub operator, Initiator

3.5 Financial

Division of investment and operational costs

The site for the consolidation hub was already present. Therefore, there was no need for an additional cash flow from the initiator of the hub, nor any other department of the HvA/UvA, in order to cover any investment costs. Utilizing an already present private company for the consolidation of goods decreases the financial risk for the initiator of the hub.

For the operational costs, the consolidation hub provides the necessary infrastructure and allocates these costs to the respective carrier. The HvA/UvA does not carry any financial risks in this way. However, flexibility in the provision of service has been given in some cases to compensate the carriers. In the case of an undelivered good, HvA/UvA contacts the carrier who will then be expected to sort the issue with the hub operator. Information sharing with e.g. track and trace systems also provides benefits in this case.

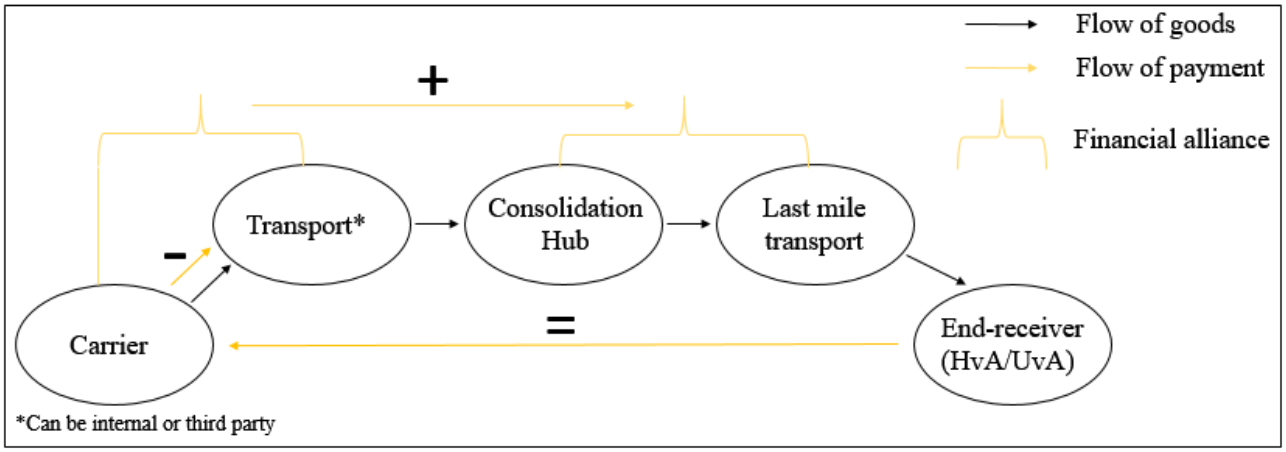

Figure 2: Overview of financial and transportation flow in the hub of HvA/UvA

Business case hub

In figure 2 an overview is given of all involved parties in the supply chain of the hub of the HvA/UvA. In order for the hub to be successful, all incentives along this supply chain need to be aligned. One party must not gain profit by being able to ‘dump’ their costs on another party. For example, the argument can be made that carriers want to deliver as often as possible, so they can calculate the extra transportation costs to the end-receiver, earning more revenue. However, in a transportation company the costs of transportation are often not specifically allocated to the amount of products that are delivered. The carriers get paid by the HvA/UvA for the amount of products they deliver, the amount of transport movements the carriers need

to complete this task is the responsibility of the carrier. Thus, it can be concluded that it benefits the carrier to keep the amount of transportation movements as low as possible. The costs that are saved by decreasing the amount of transport movements for the carrier can be used to finance the hub. This is displayed in Figure 2 by the 'minus symbol' from carrier to transport, and the 'plus' symbol from carrier/transport company to the hub/last mile delivery. In theory, these costs balance each other out, so the amount that the HvA/UvA pays for the delivery of their goods remains equal, displayed by the 'equal' symbol in Figure 2.

The assumption that it is beneficial for a carrier to have as few transportation movements as possible can however be contested when the transportation of a carrier is done by a third party. The incentive of the third party transportation company can be to 'take their time' since they can pass these costs on to the carrier. In order to prevent this, the carrier and third party transporter should establish contractual limits. In this case, the relative size of the third transport company to the carrier can play a part in the division of negotiation power.

It has also happened that a third party transportation company did not find it feasible to deliver directly to the hub without entering the inner city, since they combined these inner city trips with other deliveries. This shows that the size of the supply of public party is not always sufficient. After all, not all goods that enter the inner city are going to the hub.

Carriers

To be able to look at the costs that are incurred when using the hub, the carrier first needs to deliver to the hub, the so called 'first mile'. For some carriers the first mile costs of delivering to the hub and returning to their point of origin could be higher than just delivering to the end-receiver. This is because the hub is further away from their point of origin than the end-receiver is. These first mile costs could be lowered by decreasing the delivery frequency. Costs could also be reduced when the carrier has multiple stops in the inner city, and now only has to stop once to deliver to the hub. Reduction of the costs with the implementation of the hub differs a lot per carrier. The reduction in costs for each carrier needs to be noticeable and divided equally among the carriers.

Last mile transporter

The demand of cargo flow from B2B is perceived to be more of an equal flow than that of B2C, by the last mile transporter. Since the large cargo flow from intermediaries and the smaller cargo of end-receivers from the HvA/UvA is being combined in the hub, it is more difficult for

the last mile transport company to have an equal flow. Public parties, such as the HvA/UvA, have a certain seasonal pattern of ordering goods, with most activity seen during the academic year. This results in a partly unequal flow of goods. The last mile transporter needs to have a sufficient demand of other large cargo in order to balance this flow. In this way, the last mile operator can optimize her processes and not be dependent on just one party such as the HvA/UvA. For now, more demand is needed by the last mile transport company. To make the last mile transporting more profitable through hubs, a large enough scale needs to be present. Acquiring this larger scale takes time. Therefore, the expected benefits will arrive later than the expected costs, this transitional phase can prove difficult for the last mile transporter.

Financially, most added value seems to be in warehousing or fulfilment at the hub instead of cross-docking. These functions will be discussed more elaborately in section 3.6. The last mile transporter covers it investment costs since they signed the public initiative. For now, the scale is too small for the last mile transporter. Improving of this scale requires a lot of effort for end-receivers, which is difficult to incentivize.

Hub operator

The HvA/UvA hub differentiates itself from most hubs because it already has a current income flow from other activities, which makes the addition of cargo flow more practical. The infrastructure is already present and to add cargo flow is less intensive than building entirely new infrastructure. This provides the financial incentive for the hub operator. Most revenue is generated for the hub operator by warehousing, which is successful so far. A requirement for the hub to be profitable is to allocate its staff efficiently across the current and newly introduced activities. Additionally, as hub operator it is important to link all information systems of carriers and develop an efficient infrastructure to process the multiple incoming flow of goods.

3.6 Operational

After the first mile of the carriers, the hub has three functions in order to handle the goods. These functions are: cross-docking, warehousing and fulfilment.

Cross-docking

The term cross-docking indicates that the goods are delivered by the carrier and then directly processed by the last mile transporter. Processing of the goods includes unloading, scanning, and loading them onto the emission-free vehicles of the last mile transporter. The role of the hub operator is to handle these goods and the role of the last mile transporter is to configure

routes for each delivery. The hub operator is being paid for the entire handling of goods, even though the unloading task was already performed at the HvA/UvA itself before the hub was implemented. Thus, the extra handling costs paid to the hub and delivery costs of last mile transporter have to outweigh the reduction in first mile costs for the carrier. Here the added value of the hub is generally low since goods only enter and leave the storage facility and are just being processed administratively.

Warehousing

With warehousing, large deliveries by the carrier are less frequent. The goods can be stored in bulk at the hub and partially delivered when the HvA/UvA requires them. Here, the added value of the hub increases since the carrier can utilize more economies of scale when delivering. It depends on the origin of the carrier if the reduction of costs is sufficient. Lowering the frequency of delivery reduces costs more when the point of origin is further away (as discussed in section 3.5). However, it could also be that the storage costs at the hub are higher than the storage costs at the point of origin of the carrier. In this case, warehousing is less beneficial.

For the hub operator, the goal is to maximize the amount of turnover per square metre of storage. In the case of warehousing, it goes that the hub operator can utilize this activity to cover the 'empty' square metres, increasing their turnover while the costs of the facilities remain approximately on the same level. In short, for warehousing it goes that 'more is better'. When the capacity of the hub operator is reaching its maximum, the hub operator can allocate slow-moving storage space/archives to less costlier sites outside the city of Amsterdam. Most revenue for the hub is made for the warehousing function. This function is the most popular with carriers since it enables them to minimize their transportation costs to the hub by delivering large quantities less frequently.

Fulfilment

A local fulfilment centre is available for the hubs. Here, deliveries can be packaged, for example vending machines that require a customized order of goods. If the hub provides a reduction of costs here also differs per carrier. It might be more beneficial for a carrier to centralize their fulfilment in a regional or national fulfilment centre. A small fulfilment centre, however, does add flexibility in delivery times since the orders can be packaged in proximity to the end-receivers. Carriers can use data to make their fulfillment more efficient. In some cases, vending machines can automatically register how many goods are needed. In this way, the fulfilment can be done more efficiently.

Last mile transporter

In practice, the consolidation of people and delivery processes at one location goes well for the last mile transporter. One concern is the amount of cargo flow. The aim of the last mile transporter is to combine large cargo deliveries to other businesses, such as pallets and roll containers, with the relatively small deliveries of the HvA/UvA. This has not been achieved for two reasons. Firstly, the IT integration between processes is lacking, and secondly, the demand of cargo of certain end-receivers from the hub proves to be not predictable enough for the last mile transport company. The ideal situation for the last mile transport company is to have a predictable equal flow process (As discussed in section 3.5). When the cargo is distributed evenly, their electric vehicles can be utilized efficiently and be profitable. While the demand of large cargo deliveries, which the company wants to combine with the cargo of the HvA/UvA, is perceived to be more predictable, the demand of cargo from HvA/UvA is perceived to contain more peaks and valleys instead of an equal flow. This can cause the last mile transport company to have under capacity when the demand of the HvA/UvA peaks.

End-receiver

Many links are involved in the delivery process to the HvA/UvA. This requires that communication between several departments of different parties needs to be enabled. With the introduction of the hub, the frequency of office supplies deliveries was lowered from five to two times a week, but the amount of personnel able to order office supplies was not lowered. In this way the efficiency increased, while the perceived level of service by the end-receiver remained the same.

Besides the bundling of goods, the amount of transportation movements is also decreased by having a stock of goods present at the consolidation hub itself. Possibilities for bundling the service at the point of delivery are also being looked into so that the goods of several carriers can be handled by less people. However, the service requirements and regulations of each good have to be taken into account, such as hygiene and workload regulations.

4. Conclusion

4.1 General

In this thesis two main methods have been used. Firstly, a research framework of stakeholders and key aspects of UCC's has been established through an extensive literature review. Secondly, interviews have been conducted with the key stakeholders in establishing this UCC of the HvA/UvA in Amsterdam. The results of these interviews have been categorized according to the established research framework. In this thesis, the following research question has been stated:

"Which barriers can be identified when implementing an urban consolidation centre in Amsterdam?"

This research question will now be answered on the four different levels and policy advice will be given.

4.2 Main barriers and solutions

For the environmental and traffic section, no large barriers have been found, the usage of electronical vehicles goes well in practice. However, the municipality of Amsterdam currently uses "EMVI's" to promote sustainable methods in their tenders. It will be more difficult for other municipalities to promote sustainable methods if this or a similar tool is not available.
For the organizational section, the main barriers are with the HvA/UvA, the last mile transporter and the carriers. For the HvA/UvA, the existing contracts with their carriers have been a prerequisite to incentivize carriers to join the hub. Secondly, tender regulations could pose a barrier to a long term collaboration with the hub operator and last mile transporter. For the last mile transporter, they need to be able to convince their other clients to join the hub in order to be able to optimize their processes. Lastly, the carrier needs to be able to entrust the last mile transporter with the delivery of their goods and needs to be able to alter their current contracts with third party transporters.
For the financial section the main barriers seem to arise for the carrier and last mile transporter. If the reduction of the 'first mile' costs for the carriers are sufficient, largely depends on their point of origin, relative storage costs at hub, and existing delivery routes. For the last mile transporter, the amount of cargo flow is currently insufficient and therefore transitional costs need to be covered.

The main barriers for the operational section lie in the low added value of crossdocking, the lacking integration of IT processes, and not being able to bundle goods at the point of receiving at the HvA/UvA due to service and hygiene requirements.

In order to overcome these barriers some general and specific advice shall be given.

Advice

It takes effort to convince carriers to change their current way of working as it requires reshaping existing methods and infrastructure. A similar existing contract between the carriers and the HvA/UvA will not always be present. Therefore, a new way must be found to incentivize the carriers. As seen with the last mile transporter, they are partly motivated by signing a public initiative considering sustainability. Signing more of these public initiatives by carriers could help create motivation to alter their current way of working.

Furthermore, the hub operator and last mile transporter are trying to expand the concept of the HvA/UvA hub nationally. If this succeeds, it could be rewarding for several stakeholders. Carriers would be able to reshape more of their infrastructure nationally in one opportunity, increasing the chance that the reduction in the first mile costs will be sufficient. For the last mile transporter, it would provide more cargo flow and the opportunity to increase negotiation power when convincing their other clients to join their hub.

Moreover, as the municipality of Amsterdam has shown, carriers can also be persuaded to change their methods through legislation. Making this legislation present nationally provides opportunities for local authorities to promote the usage of hubs.

More specifically for the hub of the HvA/UvA, it might be an option to cover the transitional costs of the last mile transporter with the revenues of congestion charging and road prices as opted by Boerkamps and van Binsbergen (1999). Lastly, the trust issues between carriers and last mile transporter could be alleviated by establishing clear contracts.

4.3 Limitations and further research

In this research, several limitations are acknowledged. Firstly, van Amstel et al. (2014) acknowledge some limitations in their preliminary research. The research did not represent all suppliers, large suppliers were overrepresented and transport costs were not transparent for the procurement department of the HvA/UvA. Secondly, no interviews were conducted directly with the facilities department of the HvA/UvA, the end-receiver, and the carriers. The information considering these parties was gained through the transport research department of the HvA/UvA. This information could therefore contain some bias since this departments was

the initiator of the hub. Lastly, for the financial section the exact costs were not accessible due to competitive regulations.

Further research must look at the possibilities for costs to be covered in the transitional phase of a hub. A possibility could be to consider the feasibility of funding these costs in the transitional phase with the revenues of congestion charging and road prices as opted by Boerkamps and van Binsbergen (1999). This does however require more involvement from local authorities. Moreover, the current hub operator is also looking to expand the concept across the Netherlands. A comparative research can be done between these hubs to identify the barriers and solutions for hubs in the Netherlands. Lastly, specifically for the hub of the HvA/UvA, the possibilities for more value adding services at the hub could be explored since these are now not fully presented while these services do seem to generate more revenue according to Browne et al. (2005).

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