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Publication date
2019

Document Version
Final published version

Published in
Proceedings of the 11th International Conference on City Logistics

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RUNNING AN URBAN CONSOLIDATION CENTRE: BINNENSTADSERVICE 10 YEARS BACK AND FORTH

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KEYWORDS: Urban consolidation centre (UCC), city logistics, business model

ABSTRACT

Urban consolidation centres (UCCs) have been discussed over many years in city logistics literature. The amount of successful UCCs in the long-run were, and are, very scarce, though. Little is published on the practical issues and experiences of actually running a UCC and offering UCC-services. In the Netherlands, Binnenstadservice (BSS) runs UCCs and UCC services for over a decade now. This contribution discusses development and the experiences of running a UCC in practice in the form of seven lessons, including the evolvement of the business model and organisation model, as well as the development from offering 'only' the cross-dock of physical flows, to that of the full triple cross-dock, including financial and information flows. Next, UCCs can be the answer to future challenges, such as zero emission city logistics and fit perfectly in the Physical Internet vision.

INTRODUCTION

Before the Brundtland-commission (1987) put sustainable development on the agenda, already many urban consolidation initiatives started and disappeared often quickly after their startups (e.g. Cadotte & Robicheaux, 1979; TRID,1971; McDermott, 1975). The goalsetting was mainly on consolidation as a way to create economies of scale in (urban) transport for the operating transport company, rather than sharing a common minds-setting among different type of stakeholders to gain more sustainability in our cities.

Later, in the beginning of this century, the setup of the Best Urban Freight Solutions (BESTUFS) European network organisation gave a strong impulse to bundle the knowledge

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and experiences between academics, practitioners and managers of different European cities on urban freight transport (Browne et al. 2005). Dedicated topics were addressed in workshops in which also the experiences with urban consolidation centres were widely shared. Ever since, many definitions of UCCs have been provided but very often they are vague or ambiguous. BESTUFS 1 reported (Allen et al., 2007, pp. 61) that a UCC could be best described as: '*A logistics facility situated in relatively close proximity to the geographic area that it serves (be that a city centre, an entire town or a specific site such as a shopping centre), to which many logistics companies deliver goods destined for the area, from which consolidated deliveries are carried out within that area, in which a range of other value added logistics an retail services can be provided.*' Thanks to the BESTUFS's recommendations the role of UCCs had emerged to a certain extent, with a series of clearly established guidelines (Huschebeck & Allen, 2005; Stantchev & Whiteing, 2006). In spite of the increase in both knowledge, in the form of guidelines, workshops, reports and papers, as well as the (political and societal) interests, the amount of successful UCCs in the long-run were, and are, very scarce (see Browne et al. 2005; Quak, 2008; Van Duin et al., 2016; Bjorklund 2017). The objectives to set-up a UCC developed and included environmental and social advantages.

Recently, the concept of UCC revives expansively as both a logistics solution for Zero-Emission (ZE) zones in cities (so that carriers or shippers without ZE vehicles in their fleet can use the UCC services to deliver in ZE zones), and as a decoupling location for conventional vehicles and ZE vehicles. Many cities in the Netherlands have signed the Green Deal ZES (zero emission city logistics) agreement. The Green Deal ZES is a mutual agreement or covenant under private law between a coalition of companies, civil society organisations and local and regional government to aim for zero emission zones in 2025. This is also an objective for more than 30 cities in the Netherlands in the Dutch (draft) climate agreement (see GDZES, 2019; Klimaatakkoord, 2019).

URBAN CONSOLIDATION CENTRES: MANY WORDS, LITTLE PRACTICE?

Over the years many papers and studies have been published on UCCs, going back already decades ago. A Scopus analysis illustrates the recent increase in publications on UCCs during the last decade, i.e. 44 out of the 71 papers that include 'urban consolidation centre' in the title, abstract or keywords were published between 2016 and 2019. Although, there seems to be a remaining, or even an increasing, interest in UCCs, the number of reports on successful operating UCCs does not follow the same trend. Following, Holguin-Veras et al. (2019) "UCCs have a very poor track record", due to several obstacles, such as competitive pressures that push suppliers away from participating; increase in overall costs (once the UCC's space costs are included); and the difficulty of finding enough suitable space. As a consequence, public subsidies are often necessary, and if the subsidies stop, most UCC operations also come to an end (see also Van Duin et al., 2016). The consensus is that a UCC is more likely to be successful if there is a strong public-sector regulatory mandate for its use; significant congestion and/or pollution problems within the area; and other complementary policies(s) are in place, such as penalties for not participating carriers. It is not our aim to provide a full review on obstacles to operate a UCC, nor to describe the full UCC business concept (including the customer model, value network, organisational architecture, and the financial model), see STRAIGHSTOL (2014, pp. 98-104), as this can be found in existing literature. Our contribution adds to the growing UCC knowledge base by providing insights from practice. During the 10-years Binnenstadservice (BSS) has been operating, the business model considerably changed due to external developments and the lessons learned from operating a UCC in practice. This contribution discusses this Dutch UCC case in depth in order to learn from the experiences and to contribute to the growing UCC literature with practical insights. In the next section, we shortly describe the BSS narrative, next the main lessons are discussed, and a specific case

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illustrates BSS's transformation. This contribution then examines future UCC directions and wraps-up in the conclusion.

DEVELOPMENTS IN BINNENSTADSERVICE'S UCC MODEL

BSS's first consolidation centre in the Dutch city of Nijmegen was located about 1.5 kilometres away from the city centre. In the early days BSS focussed on receivers (i.e. shopkeepers) rather than on carriers as customer for their services. In this model, the small and independent retailers payed a standard fee for BSS's basic service, i.e. receiving goods and delivering these goods to the store at the time the store-owner likes. BSS deliberately focused on small and independent retailers, since their deliveries are usually not optimised, in contrast to those of retail chains (see Van Rooijen and Quak, 2009 for local impacts). In this model, the receivers changed the destination of the deliveries, so their freight was delivered to the UCC and not to their actual addresses. This model attracted quite some customers, in several cities where BSS was operating UCCs via a franchise-model. These first UCCs were very often supported by local authorities' providing start subsidies, and as a result the customers' fees were low (and not always cost-effective). Very often, the franchisers were asset-owning carriers, who already possessed a depot/hub from where the UCC operations were undertaken. Still in practice it was hard to convince all the needed shopkeepers to use this service to obtain sufficient revenues.

Nowadays the strategy has changed: the focus is on the larger retailers and logistics service providers (LSPs) who operate in Dutch cities as BBS now organises (city) logistics operations more at a national scale (called: Goederenhubs, which includes BSS's franchisees and partner companies that perform locally similar activities, but under a different company name). Research showed that LSPs and large retailers are the main beneficiaries from a national operated network of UCCs. Goederenhubs forms a "neutral body" that concludes contracts with various carriers and distributors (without affecting free competition) to carry out the urban transport locally. In this model, deliberately more than one distributor is contracted because bundling with other flows is the only way to achieve the necessary cost efficiency when urban and non-urban transport is decoupled. In this model, it is beneficial to have joint partnerships in many towns and enough transport volumes can be a guaranteed. Today the UCC only serves receivers as a customer segment to which they offer the following extra services: home-deliveries (for large goods), delayed cross dock, stock holding facilities, value-added logistics including return logistics (of for example clean waste). Contrary to the early days, BSS has outsourced their distribution activities to a carrier who delivers the goods in the city centre. In this way BSS was not seen as a competitor to other carriers anymore (Van Duin et al., 2016). To reduce the emissions these local companies use electric bicycles and low- or zero emission vans or trucks. In the start-up phase (2008) 20% of the small Nijmegen's shopkeepers signed their interest and became customer of BSS, since then the business model changed and new hubs only have local customers in case these local customers are delivered by the hub because of a national customer.

EXPERIENCES: SUCCESSES AND FAILURES (WHAT DO YOU LEARN BY ACTUALLY RUNNING BSS FOR 10 YEARS)

In the change of BSS's model over the years one can observe the 'hard' factors to survive. Next to that, this contribution focusses on the 'soft' (process) factors based on a thorough interviews with the founders of Binnenstadservice. Especially these soft factors are very often not well recognised in the reports and evaluations of UCC-initiatives. This section is based on in-depth interviews with BSS management and several cooperative research projects during the last decade where academics and BSS cooperated.

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Lesson 1: *Subsidy mystifies the real added values* - As can be found in literature receiving an initial subsidy seems to be a good instrument to start a UCC. In the first year BSS received an initial subsidy of 100K euros. At that moment the retailers were free to join the BSS-initiative. Everything went well and after one year BSS had well over 100 customers. Every participating shopkeeper was satisfied with the service provided and none of the shopkeepers wanted to quit service. All participating partners trusted BBS in delivering the goods to the shops. Still, the problem of paying the last mile was not solved, because initially this was covered by the subsidy. The total turnover was just 10K and didn't cover the cost.

The initial subsidy actually provided covering in the wrong way. One fails to search for the real added values and fails to keep track on the turnover. In the best situation about 160 shopkeepers were really serviced by BSS and they were adaptive to make real changes in their distribution. As the subsidy diminished, and shopkeepers were confronted with a payment for the last-mile delivery, the number of participating shopkeepers dropped down to 45. Although, BSS's services were appreciated, changing from a free service to the same service and paying for that, turned out to be difficult. BSS was almost a failed UCC-initiative like many others. On the other hand, reaching out to many customers, as BSS did in the first years, is time-consuming, and without the initial subsidy the UCC would maybe never have started. However, the main lesson is that it is difficult to let people pay for something they received for free earlier.

Lesson 2: *Search for real added values: a launching customer and value added services* - After this first deception the focus became more on the provisioning of added values for the receivers. In the books one teaches to find your first customer. In cities a logical customer is often the municipality itself as a launching customer (in contrast to providing subsidies only). Unfortunately the city of Nijmegen was – at the moment BSS started – not ready to position themselves as a responsible customer with attention for negative externalities of their distribution patterns, this also accounted for the other cities where BSS started about 10 years ago. New UCC services developed (by others) during the last years could count on the local authorities as launching customer (see Quak et al., 2019). Public procurement, also by local authorities, and the resulting city logistics operations to deliver the procured goods to the city's location(s), can be a good basic volume to start UCC operations with.

For the remaining 45 companies – the original BSS Nijmegen receivers –other paid services were developed (as they really had difficulties with paying for the basic service (delivery to the shop) that they received for free the first year). Often they were willing to pay for the parcels they send, send back deliveries, and return residues like paper, plastic and Styrofoam. The UCC also provided some storage keeping activities, handling activities (like pricing) and some goods could be straight delivered to the shopkeepers' customers instead of delivering it first to the shop. These services were perceived as real extra values for the shopkeepers.

Lesson 3: *Change of client perspective part 1* - As the interest of many shopkeepers remained, the willingness to pay remained still low. Besides, more in-depth analysis showed that the savings could be collected by logistics service providers (LSPs) and / or carriers that operated mainly partial loads (less-than-truckload deliveries). For example, carriers valued the BSS's UCC in Maastricht, where strict time-windows are in place and relatively limited (un)loading space is available, and the city is located in the far south in the Netherlands. Based on these experiences, and the first enthusiastic carrier/LSP-customers that joined (also from their motivation to be sustainable), BSS changed their client focus to the carriers and LSPs. Next, BSS changed their position from an own carrier to a service point with the transport outsourced, the carriers and LSPs were content with service of BSS (as it now was no longer considered as a subsidised competitor, but as a company that offered services and hired existing local carriers). In their talks with BSS they expressed their appreciation, however at the same time they were

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complaining about other cities without a service like BSS and different regulations. As an answer to that BSS proposed a service network of UCCs based on a franchise construction for other cities. The basic idea was to unburden the carriers and LSPs in the same standardised way for all cities. This model eventually evolved even further in a partner model (Goederenhubs, see also lesson 7). Next, also the legal form of BSS changed; BSS started as foundation. Especially larger private organisations turned out to have difficulties in setting up cooperation or contracts with a foundation as a business partner. Therefore, the legal form changed and BSS was put under the legal form of a private company (called Goederenhubs).

Lesson 4: *Perception management and finding the right partners* - Just after starting services in Nijmegen, BSS was invited for a national event with local governments to discuss about the opportunities to start-up an national network of UCCs and start local UCCs in the different cities, as many of the cities were really happy that there finally seemed to be (a market-driven) solution to solve their city logistics issues. Every municipality embraced the concept of BSS, however in practice there were no local partners available yet to actually operate the UCC services at their cities. The national attention was a bit too early and lot of expectations of municipalities needed to be tempered. It takes a long time to find appropriate partners in other cities who are willing to cooperate on a franchise (or partner) construction. After a couple of years BSS became a last mile service provider in 14 cities in the Netherlands. Locally the BSS offices were very busy establishing connections with local shopkeepers and carriers.

Lesson 5: *Change of client perspective part 2* - In the first years BSS managed two national carrier contracts. Research showed clear benefits on the application of BSS at a national scale for all participating partners. For carriers, there are several advantages to deliver via a BSS UCC, especially if they no longer have to enter the city centre (or even the city), and can therefore use larger vehicles and make their route planning more efficient. These benefits are: not bothered by (different) local regulations, such as time-windows, car restrictions and environmental zones; one point of contact for all deliveries (in different cities participating in BSS); wide window times (no municipal restrictions or shop requirements); sufficient space for loading and unloading and facilities for drivers (like coffee and a toilet), and no search for available loading areas; and making several deliveries in one time. Table 1 shows the effects of scaling up the BSS concept to multiple cities. For the two carriers with whom BSS had a contract back in 2009, we calculated the route planning for the delivery of the stores for the different scenarios for one week. In these calculations we have assumed that all deliveries in the city where made at the local BSS UCC. It is therefore about maximum achievable savings for carriers. Significant savings can be made for both carriers in the different scenarios (compared to no BSS branches).

Table 1: Effects of scaling up the BSS concept to multiple cities (Quak and De Ree, 2009)

Scenario	*saving in:*	***Carrier 1*** *distance, time, euros, CO_2*	***Carrier 2*** *time, euros*	***Carrier 2*** *distance ,CO_2*
base scenario (no BSS branch)		0	0	0
scenario 1 (6 cities with a BSS branch)		6%	7%	6%
scenario 2 (20 cities with a BSS branch)		15%	15%	13%
scenario 3 (41 cities with a BSS branch)		25%	22%	17%

The differences in cost-savings between the carriers can be explained by the different distribution characteristics: carrier 1 makes many small deliveries (on average 25 per route) and uses small trucks, whereas carrier 2 plans a limited number of larger deliveries in large trucks.

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Carrier 1 can, as its route is limited by the time save routes, as it can add extra volume in its trucks (due to time savings at the deliveries), see for more information Quak and De Ree (2009).

Unfortunately the economic crisis in 2008 changed the retail landscape in many Dutch cities, and many carriers decided to keep their last mile deliveries (including the turnover) to themselves instead of outsourcing to BSS. As transport volumes decreased during the crisis many carriers were happy with the remaining turnover they had, and were not willing to outsource part of their activities to a last mile specialist (i.e. BSS), even if this would reduce costs. Besides, many carriers turned out to have no clear insight of the costs for the last mile deliveries. Therefore scaling up to a national network of UCCs turned out to be impossible at this time. The carriers had severe problems maintaining the use of their assets due to the strong reduction of transport demand. At that moment BSS was again perceived as a competitor taking a part of their market. Therefore BSS put their client perspective on the clients of the carriers: the shippers.

Lesson 6: *Triple cross-dock: physical, financial and information flows* – The problem of finding interested shippers is there are so many, and the shippers are spread widely (whereas receivers are clustered in the city centre). The initial talks with shippers made the SCM-position of these companies clear. The shippers were talking about Incoterms® and realtime proof of delivery (how can we trust you). Before, in contacts with receivers and later with the first carriers these issues were not a matter of negotiation, but the shippers really demanded these services to the product. At that time all data entries were done by hand (no EDI, no APIs). At this time, BSS developed, what they called the 'triple-X-vision'; i.e. a triple cross-dock was necessary. This implies not just the physical transfer of goods, which BSS basically did the first years of their existence, but also provide an easy way for transferring the financial- and information flows. In order to offer this triple cross-dock, new software was needed to professionalise the operations in order to guarantee the delivery of goods to the final customer. But such a system with end-to-end visibility in the supply chain was not available. After some in depth studies on potential software packages, BSS started testing with, what is now called, the Goederenhubs IT platform sometime early 2017. Via this system, it is now possible to handle all final deliveries from the hub with one device, e.g. the system can deal with deliveries from different suppliers made at one address, but also with an incoming pallet on which different suppliers are bundled (by for example DHL). New local UCC partners have to work with this system.

Next, the other issue that BSS learned was about the way shippers were used to hire carriers: the existing Incoterms® ('International Commercial Terms', a set of standard delivery conditions that determine the rights and duties of buyers and suppliers) does not easily facilitate the financial cross-dock, i.e. deliveries via a UCC. Basically, for national transport only EXW (Ex Works) and DDP (Delivered Duty Paid at named destination place) are commonly used, which means that goods are either sold with full transport (and a as result the transport costs are not transparent as these are included in the procurement costs) to the destination or without transport at all. There is no standard condition that allows shippers easily to decoupling the transport assignment between transport from an origin to a UCC and transport from the UCC to the final receiver. As this distinction is not explicit, this turns out to be a barrier for shippers, as they are to determine how to divide (transport) costs between two service providers themselves. Many UCC examples implicitly face this issue, as did BSS in the earlier models; as they either focus on carriers (and hope that these stakeholders can and are willing to make the distinction) or on receivers (and hope that the receivers are able to pay for services, whether or not in combination with lower costs for procurement at shippers). BSS alone is not able to change this situation, but found one way to deal with it for some of their shipping customers, which we will illustrate based on the description of how BSS deals with transport for one of its customers. This illustrative - and anonymised - case (in box 1) shows one of the difficulties of

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BSS faces in servicing a shipper, in the existing situation where no standard conditions are available to make a distinction for a shipper in outsourcing these two types of transport

One shipper was using the BSS services to supply its (franchise) store in several Dutch cities, called 'shipper' in this illustrative narrative. Shipper decided to start working with BSS after some of its franchisers were enthusiastic about BSS services (note, this came from the old days, when receivers were customers), and shipper wanted to be more sustainable in its transport operations. As shipper had a good (and long-lasted) relationship with its transport operator, shipper arranged with its transport operator that for all cities with a BSS UCC the deliveries should be made to the UCC and from there, BSS is responsible. Shipper arranged this financially with its operator and BSS. In this arrangement, no signatures for reception where required and deliveries were not traceable at all. Shipper had now two service providers, and basically in case of any irregularities it was extra difficult to find out where the problem was. After running business like that for a couple of years, shipper's transport operator sold its business to another transport operator. By then, shipper was already unhappy about the fact that it had two service providers, but based on the existing relationship shipper did not change the situation. However, after the sale it finally decided to ask BSS (Goederenhubs) for all transport services, including the transport between the shipper and the UCCs. Nowadays, BSS is orchestrating all distribution for shipper, but hires a transport operator for the line haul services from the shipper to the UCCs (as well as for the areas in the Netherlands where BSS does not have a UCC.

Box 1: Illustrative case of shipper as BSS customer

Lesson 7: *Choose the right scaling strategy* - Every new partner is obliged to use the platform for their activities. In the Netherlands now 6 BSSs are connected to the platform (and some 'old' franchisees still run operations on the old way, but this model is phased out). The new partners have changed a bit compared to the early days. In the early days BSS looked for local entrepreneurs with a mix of local network and sustainable capital. Nowadays they find their partners with companies who have already some past performance in this field. Slowly growing should be the target while meanwhile the focus will be on creating multi values leading to both societal and financial gains. The new model does not have franchisees anymore, but partner contracts. In the partner contracts, the areas the partners can serve (based on zip-codes in the Netherlands) are determined for a certain time (at the moment this is done on a yearly frequency), so that the partner can invest in the hub, transport means and the Goederenhubs IT platform. The partner-contract allows some freedom for local entrepreneurs, but requires the use of Goederenhubs IT platform, opening hours form at least 7:30-17:00, a minimum of two (preferable four) cross-dock doors and the service level agreements of the national customers), in return they receive services like administration, sales and IT support). This partner model is not only used to expand services in the Netherlands, but in entire Europe.

THE BRIGHT FUTURE OF UCCS

Next to the lessons of actually operating UCC services in practice, we also see a couple of developments, that could positively contribute to the development of more UCC services in the near future.

Enabling ZE city logistics: UCCs could be the logistics answer to allow urban residents a sustainable environment in the near future in order to provide efficient and nuisance-free freight transport to the inner cities. As cities of the future will strive more and more for a zero emission environment the UCC can play an important role to facilitate the modality change: from a large truck to zero-emission (ZE) transport, such as ZE tractors, trucks and vans, and cargobikes.

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Using a UCC perfectly overcomes the problems of limited range (batteries) of ZE deliveries due to its location. (see Quak et al, 2018). Especially the policy objective to realise zero emission city logistics by 2025/2030 and by 2030 in Europe could give the use and necessity of UCCs a boost, as the ZE UCC services can enable (some) carriers and shippers to comply to ZE zones' requirements, without having to invest in (currently both expensive and not yet largely available) ZE vehicle fleets (FREVUE, 2017). Although, currently most UCCs specifically look at retail, private and catering industry, but in the long run other sectors could be provided too like construction logistics (there are already specific construction UCCs in several cities, usually related to a single construction site, but sometimes also serving several sites), service management and, when capacity available, also B2C parcel delivery (where a neighbourhood hub could serve a specific neighbourhood and bundle B2C deliveries from several companies for a household). It appears that the requirements set by the UCC from these target groups are comparable, making delivery from the same (type of) hub possible.

Physical Internet: A promising vision on the future city logistics system is the application of the concept of Physical Internet (PI). This PI vision is based on the digital Internet metaphor. Characteristics of this vision are container modularisation through the use of PI containers and their routing over a transportation network by specialised intermodal cross-dock facilities called PI hubs. As a result of container modularisation the actual transfer (i.e. cross-dock) at the PI hubs becomes quicker and less expensive. Also the PI hub can facilitate the consolidation of loads from various parties allowing for quicker dispatching and efficient routing through the network. The philosophy of the PI hubs favours shorter movements of containers from hub to hub on their way from the source to destination. The idea of PI is greatly conceived by Crainic and Montreuil (2016). Their visions of hyperconnected city logistics should be developed for real cities of multiple sizes and types, holistically instantiating an integrated city logistics system, depicting and describing it so that it is vividly graspable by all stakeholders and can be analysed, challenged, and further engineered. In this vision the PI hubs are crucial, implying a great need for UCC-type of cross-dock facilities in the future.

The introduction of a 5G-mobile network can support the PI development, but it will also provide new opportunities for precise sense and respond. The elements of the logistics systems such as packages, pallets, roll containers, (autonomous) vehicles, batteries etc, are much more able to communicate about their states, where they are and where they are going to. As a result, the Internet of Things will definitively grow and all kind of smart applications allow better sharing among resources, making the transfer at the cross-dock easier, as more local information is available in the logistics system.

Sharing Logistics: within the logistics sector, the sharing logistics economy is regarded as one of the disruptive developments, e.g. like UBER or AIRBNB in their branches. The sharing of unused and/or underused sources/capacities can yield to improvements in efficiencies in the logistics value chain. The benefits in logistics can contribute to higher efficiency, lower costs, lower congestion, lower emissions and seem easy to achieve for both industry and society if the ownership of the capital goods is used differently (Gesing, 2017).

CONCLUSION

The narratives as described in this contribution and summarised in seven lessons showed how Binnenstadservice developed its UCC model over the last decade in practice. It is not possible to generalise these experiences to an standard set of guidelines, as the developments are – to a large extend - the result of interactions with a changing environment full of different stakeholders and stakes. As such, a UCC development is not completely makeable; however, the examples and lessons indicate that UCCs can add value in city

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environments and to the different stakeholders in practice. These practical lessons do not only apply to the Dutch context, but can are useful everywhere where UCC concepts are developed.

ACKNOWLEDGMENTS

We would like to thank Binnenstadservice for the cooperation in this publication as well as in various research projects. This work was partially funded from the VREF Center of Excellence for Sustainable Urban Freight Systems.

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URBAN CONSOLIDATION CENTER WITH AN ECONOMIC WELFARE APPROACH: A CASE STUDY

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KEYWORDS: Urban Consolidation Center, Economic Evaluation, Welfare Economics, Social and Environmental benefits, The Kaldor–Hicks Criterion

ABSTRACT

An Urban Consolidation Center (UCC) is a city logistics solution that contributes to reducing traffic congestion and the negative effects of transportation activities, but few UCCs have been implemented fully. Financial sustainability is commonly mentioned as a constrain to their implementation. This study conducts the UCC economic evaluation from the point of view of Welfare Economics, which considers stakeholders` benefits derived from delivery optimization, a reduction in the time spent by the local population in traffic congestion, and a reduction in GHG emissions by cargo vehicles. From the viewpoint of the Kaldor–Hicks Criterion, if the stakeholders´ benefits were high enough to compensate for the cost of an UCC operation, its implementation would be justified. In this case, the Kaldor–Hicks Criterion is applied to data from a study of an UCC implementation in Curitiba, Brazil and used to gauge its impact on stakeholders.

INTRODUCTION

Urban freight distribution is a challenge for many cities worldwide but especially for those in developing countries, such as Brazil. Brazil is lacking in transport road infrastructure

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