# A Theoretical and Evidence Based Assessment of the Economics of Last Mile Delivery Consolidation

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## Introduction

Much research literature surrounds the idea of last mile consolidation measures as a tool to improve the sustainability of road freight, particularly within the urban context. Hence individual carrier loads coming from outside the urban context would be consolidated at a point short of the town/city centre, to enable them to be delivered as one consignment over the last mile. An often cited added benefit is that this would represent a significant improvement in efficiency over what is “the highest cost” element of the whole supply chain (Ref). Through such actions, the main externalities arising from urban freight, primarily air pollutants and the intrusion of public space, would be minimised. Quak and Tavasszy (2014) for example highlight that urban freight impacts negatively on the three sustainability P’s of planet, people and profit. The planet, or natural environment, is negatively impacted through polluting emissions, people through the adverse effects on public health, noise, road accidents and visual intrusion, stench and vibration. Finally profit is affected through the impacts of congestion and decreasing city accessibility (Quak, 2008). In many sense, what this represents is the counter of Elkington’s idea of the triple bottom line (Elkington, 2002).

Despite a large body of academic literature proclaiming such advantages of last mile consolidation however, few initiatives in practice have proved to be either commercially viable or economically sustainable. Björkland et al (2017) further highlight that few researchers have actually provided profound insights into the design of viable business models for UCC success, and hence the underlying reasons for such failures remain unclear. Both factors can be corroborated by the literature review undertaken for the current research topic.

One issue that to date has perhaps surprisingly been completely overlooked by the body of research are the barriers that underlying economic principles may present to last mile consolidation. Given that freight transport generally operators along free market principle lines with limited invention in the form of policy or legislation, the profit incentive remains the prime driver and hence in an ‘efficient’ market this will always look for the lowest cost solution that meets the basic need.

This paper therefore attempts to identify the key economic principles surrounding last mile consolidation through a combination of secondary evidence (research literature) and primary case study research.

## Methodology and Analytical Framework

As stated, the research undertaken is a combination of desktop and primary research, and summarised in figure 1.



*Figure 1: Summarised overall research framework,*

Hence an extensive literature review was undertaken which examined over 60 research papers on the topic of last mile deliveries. This enabled the type of research that has been undertaken to be identified and the main findings/issues arising from these studies which either have a direct or an indirect relevance to last mile freight economics. As such, this covered a broad range of research literature, particularly given that last mile logistics needs to be viewed in the wider context of the whole supply chain as well as local supply side conditions, particularly those relating to policy.

In terms of specification of formal inclusion criteria, it was considered following Johanson and Björklund (2018) and only include papers that had been peer reviewed. Whilst in a certain sense this would provide a control over academic quality, in practice it was found that much useful material, either directly or indirectly, was found to be contained in non-peer reviewed articles, specifically those published in Research Procedia, which is a compendium of conference papers. It was therefore decided to set no specific limits on articles that were included, but rather incorporate those that would provide an overview of the full range of research into final mile logistics, and then from the key themes that emerged from the process, identify and develop the underlying economic principles.

This was supplemented with primary research undertaken investigating a series of pilot projects which had the common theme of consolidation over the last mile. These were located in four cities across northern Europe, specifically Edinburgh in Scotland, Groningen in the Netherlands, Mechelen in Belgium and finally Borås in Sweden. These all constituted the Smart Urban Freight Logistics Hubs (SURFLOGH) project funded by the North Sea Region of the EU Interreg Directorate. In depth interviews with the key stakeholders in each of these initiatives were held over a period of 18 months, and totalled 25 in total. These provided a valuable practical insight in the main themes and economic principles identified from the literature review.

## Supply Side Issues

Presented below are the main supply side issues that arose from the research carried out.

### 3.1 Road Freight: Fixed v Variable Costs

One question mark regarding the financial viability of UCCs is the proportion ‘the final mile’ represents of the total logistics chain. In simple logical terms, by its very nature, this is a relatively small proportion of the total distribution chain from manufacturer/vendor to the retailer/final customer. Any cost savings therefore are likely to be of small proportions. Ogden (1992) for example quotes Parson’s study undertaken in Chicago who estimated for the collection and delivery of freight below 450kg between cities, the use of a UCC was estimated to produce cost savings in the order of 3.5%. In a similar study, in Los Angeles savings for deliveries below 230kg were estimated to be of the order 5.6%.

Even given the relatively small scale of such savings, the extent that these can actually be realized is further compounded by the structure of road haulage costs, particularly the split between fixed and variable. The few studies that have examined the issue suggests that the proportion of fixed costs are around 25 to 30%. Sherry (1978) for example indicated that 25% of road haulage operator costs were fixed, whilst interpretation of a later study by Gagné (1990), suggests a 30% share of capital costs versus a 70% combined share of fuel, labour and material costs. More recent work by Cowie (2017), suggests the proportion of fixed costs has changed little over the years, with calculations based on 2015 figures roughly produced estimates of around 28% for fixed costs. In the current context therefore, any saving on the last mile leg would only lead to a reduction of around 70 to 75% of operator costs for that part of the trip. This is further diluted by the introduction of an additional economic agent, i.e. the UCC operator, and their requirement to make a profit. Approximating these with road haulage figures, ‘normal’ profit levels are around 5% of revenues (Cowie 2017, Transport Canada 2006). This would reduce the above figure further to 65 to 70%. In a worst case scenario therefore, any UCC would have to undertake the last mile delivery for 65% of the cost of the original carrier. As a starting point, this does not seem conducive to successful commercial operation, and probably even more critically, as an initial loss maker would act against the process of establishing the business in order to create a viable critical mass. Even ignoring the counter consolidation issues (see below), this has to bring into question just how much could be saved on a commercial basis; at the very least it would suggest that any commercial operation could only be achieved through high volumes, which in itself presents a major barrier to entry, and also brings into question the efficiency of the whole operation and that size may compromise the ability to consolidate deliveries.

To return to the basic distance issues, as trip distance increases, then the proportion of cost saving to be gained by using a UCC reduces, which is graphically shown in figure 1:

Examining figure 1, then it is clear that from around 45 kilometres and beyond the last mile only represents around 4% of the distance and 3% of the total cost. This brings into issues of the trade-off between cost and other considerations in the whole supply chain process, such as reliability, punctuality, security, etc.

This would also appear to suggest that UCCs are more likely to make commercial sense for very short haul deliveries, but this may not only run into the counter consolidation problem outlined below, but also bring into question the real value that could be added over such a short distance. Nevertheless, Browne et al (2011) do present a case that is a short haul model, with the distance from depot to delivery area of 29 kilometres, which was split into a UCC ‘hub’ and a single spoke to the depot. Whilst that did appear to produce some ‘success’, the whole initiative only concerned a single supplier, hence the extent to which this actually represented a ‘consolidation’ centre rather than a restructuring of the company’s supply chain, is very much open to debate.

Further research by Janjevic and Ndiaye (2016) investigated cost relationships of urban consolidation centres for their users, and in particular, undertook a comparative analysis between using own account vehicles and a UCC. This was based on an underpinning model of the two scenarios, and applied to a hypothetical case in Brussels. The base line scenario suggested that use of a UCC could result in cost savings of up to 20% of the total, hence suggesting that the supplier would be better off abandoning their own account service (for the last mile) and using the UCC. It should be stated however that 20% was the best case, and existed under the unlikely scenario of only one delivery per trip. When this rose to seven, cost savings fell to 3%, and beyond seven the supplier was cheaper using own account. Even returning to the best case, given the supplier still requires own account to transport goods to the UCC, then in line with the above, the UCC needs to offer the service at 65/70% of the cost (rather than the 80% ‘best’ case), as the supplier will still incur the fixed costs of own account transportation. In simple terms, that appears to be very unlikely.

To extend the argument further and apply to the context of a 3rd party carrier, then it could be argued that the vehicle time savings could be utilised in the delivery to other (new) clients. The obvious counter is that this would be done anyway if that business was there. The real problem however is that any gains (in operating time) are incremental, and from the operators perspective, can only be evaluated on an incremental basis. On a case-by-case basis therefore, this action is very unlikely to be undertaken. Nevertheless, some success has been found in this area, where Cowie and Fisken (2019) report that the link-up between a cycle logistics operator (Zedify Edinburgh) with a PCS operator (TNT), has enabled the latter to reduce the fleet size servicing the centre of Edinburgh by one van. Such actions therefore are possible, but may be fairly limited in scope for reasons outlined later in the paper.

### 3.2 Delivery as an intermediate/complementary good

Delivery as such is not a ‘normal’ economic good, but rather is part of the supply process and hence an intermediate good, and as such, demand for the service is a derived demand from the primary demand for the good. Furthermore, as with all goods that are traded, the ‘utility’ derived from its production is shared between the supplier and consumer. To take a simple two agent model, the consumer benefits directly from consumption, whilst the supplier benefits from the monetary gain as a consequence of the trade. This is the whole premise of trade, it is never a zero sum game. One of the issues with delivery services however is that whilst the ‘benefit’ of the service is shared between the supplier and the receiver, the service is usually procured by the supplier, thus there is no direct market connection between the receiver and the provider. In the context of UCCs this creates a problem in the market, as the main private benefit, that of consolidated deliveries, accrue to the receiver but the service is procured by a range of different suppliers. For consolidation to be wholly ‘successful’ therefore, the UCC needs to successfully negotiate with not only the receivers of goods but also the suppliers, with consensus obtained from all agents. This considerably complicates the issue, as what is required is almost a double co-incidence of wants, otherwise the full benefits will never be realised. This not only makes the task of creating a critical mass more difficult, and hence represents a direct barrier to entry, but also considerably increases the transaction costs of the whole service.

An added issue is that it has been argued that one of the benefits of a UCC is that it can offer ancillary services, such as stock holding facilities, cross docking, reverse logistics, waste collection, improved inventory control, packaging services and so on (Browne et al, 2011; Triantafyllou et al, 2014; Van Roojen and Quak, 2010). Whilst some, if not all, of these are perhaps arguable as ‘real’ benefits of a UCC (e.g. there is little supporting empirical evidence), the problem is that the extent to which such advantages can be exploited will be limited, as due to the ‘split’ nature of the market this again runs into the problem of requiring a double coincidence of wants. Hence any UCC needs to negotiate with the supplier to deliver the last mile and then match this with the receiver as regards ancillary services. Some success has been achieved in this area, with Van Rooijen and Quak (2010) highlighting the case of the Dutch initiative Binnenstadservice (BSS). This operates on the basis of a zero charge for the final mile delivery but revenue generation is derived from the provision of ancillary services, and the whole initiative has grown considerably over the years from an initial single hub in Nijmegan to ten further cities across the Netherlands. Nevertheless, BSS still remains uncommercial and heavily subsidised.

The rapid growth of ecommerce provides a further complication. Allen et al (2018) highlight that with the continued development of this form of commerce, online retailers are striving to offer consumers increasingly responsive (and costly) last-mile delivery services in their efforts to increase sales and hence often fail to cover the costs of these operations. The net outcome is that end consumers perceive deliveries in many respects as costless due to the failure to be given adequate price signals. This in turn fuels a demand for ever-faster and more responsive delivery arrangements which retailers feel committed to providing in order to maintain market share. Put in very simple terms, there is no longer a market for deliveries, it is entirely driven by the primary demand of consumer sales. The net result is that it becomes impossible to achieve economic efficiency, and hence there will always be a significant over-provision of deliveries (as the cost to the consumer is perceived as zero), hence the market no longer operates along market principles. We have, in other words, complete market failure, primarily due to imperfect information, with the only potential solution through regulatory intervention in order to control the level of deliveries.

The authors further highlight that the delivery options offered by retailers is becoming a key factor in the purchase decision, hence if it is assumed that (primary) prices in a competitive market will not vary, then the key issue becomes the delivery service, and hence the most successful retailer will be the one that delivers at the lowest cost. As past practice strongly suggests, this is not by a UCC, otherwise existing supply chains would adopt such a model (Ogden, 1992), hence the development of ecommerce has further compromised the potential development of UCCs.

### 3.3 Economies of Scope/Counter consolidation

Olsson and Woxenius (2014) highlight that in the case of transport for larger firms, which would include retail chains, transport operations and terminals are ‘efficient’ (in whatever terms that is defined) because relatively large trucks are used and are often fully loaded (Browne and Allen, 1998). As such, there is little if anything to be gained from the use of a UCC. Improvements therefore are seen to lie outside of that sector, identified by Allen et al (2000) as the decentralised sector, where deliveries are undertaken from a range of different suppliers using small to medium sized vehicles, and where it is often assumed that the current provision is inefficient in the distribution of goods (Duin et al, 2010). Quak and Tavasszy (2014) do acknowledge however that many store deliveries are already consolidated in some form, particularly with regard to retail chains and for most parcel and express deliveries, hence ‘consolidation’ is optimal from the retail chain or the for-hire carrier’s perspective, but they argue not from the wider city perspective. That however is open to debate, as it tends to take the view of consolidation from only one perspective, that at the point of delivery, and is generally based on opinion. Browne et al (2011) however, in a before and after (a UCC) study of the complete network, showed that the establishment of the UCC did not actually reduce the number of city centre delivery trips. Furthermore, a primary census undertaken by Cherrett et al (2012) found that most deliveries in the decentralised sector were undertaken by a single logistics provider and that dwell times for vehicles were no shorter than those from a centralised system, suggesting similar load consolidations. Whilst only providing limited evidence, this may suggest that the decentralised sector is not as ‘inefficient’ as has been assumed to date.

Whilst it is has long been recognised that urban freight transport problems are complex and compound, and thereby one solution for one actor forms the basis of a new problem for another (Browne and Allen, 1999), this logic appears to be forgotten when the issue of UCCs is considered. In this case what gets overlooked is that large volumes of freight are already consolidated in terminals as part of a forwarder’s business, hence a UCC in many cases would constitute a second tier of consolidation, and this may substantially limit the possibilities under which it could be successfully employed. To put another way, research into UCCs tends to almost exclusively focus on ‘consolidation’ at the point of delivery, and hence overlooks consolidation at the point of origin. Following this argument through, as loads are progressively consolidate at the delivery end, at some point this will become counterproductive with consolidation at other points along the whole supply chain. Add in the issue of the PCS operators, who generally operate a fixed capacity system and mop up any remaining business that may be left, then this only leaves limited opportunities for UCCs to establish a critical mass (Allen et al, 2005, more refs).

There is also to some extent a chicken and egg issue, certainly with regard to small road hauliers (SRH). Although the whole role of SRHs in the urban freight distribution system is considerably under researched and hence generally overlooked, in one of the very few pieces of research on the sector Olsson and Woxenius (2014) found that in terms of weight a high number of SRHs had very high load factors, with 70% found to have load factors of 70% to 100%. A major factor driving such high utilisation is high competition levels within the industry (Cowie, 2018), thus in order to make a profit, high load factors are essential. This in itself represents consolidation. In some ways, there is a whole issue that potential consolidation is being targeted at the wrong area, as it is the deliveries to the SRHs that need to be considered. The authors also found that 75% of these were forwarded either through haulier associations or forwarders, with the remainder coming from direct shipper contracts. SRHs are therefore in effect acting as UCCs due to high competitive pressures to do so. ALSO THE ISSUE OF THE LAST MILE, THIS IS NOT GEOGRAPHICALLY OR AGENT DEFINED FOR THESE OPERATIONS, BUT CONSTITUTE A COMBINATION OF THESE IN ORDER TO MAKE UP VIABLE LOADS.

The research also shows that the number of deliveries (on a daily basis) to the de-centralised sector tends to be very low. Olsson and Woxenius (2014) found that 44% of SRHs had delivery runs of between 1 to 5 stops, whilst a further 24% had runs of 6 to 10 stops. Faccio and Gamberi (2015) in a study of retailers in the Pedemontana Veneta area of Italy, found across the four cities surveyed, the average delivery interval ranged from a high of 5.82 days, to a low of 4.65, which actually produces an overall weighted mean of just under 5 and half days (5.33 to be precise). These figures do seem however to be unrealistically low, and difficult to consider as representative of the general case. Research into the deliveries to retailers in Manhatten carried out by Holguín-Veras and Sánchez-Díaz (2016), found that the average number of deliveries per retailer was in the order of just over 3 per day, with a surprisingly high number (40%), receiving one or less. This significantly reduces the possibilities to consolidate loads, and hence the main advantage of a UCC, that of a single rather than multiple deliveries, is neutralised. Given the difficulties of creating a critical mass, this potentially knocks out a significant number of potential clients.

NOT SURE THIS NEXT PARA FITS IN THIS SECTION

UCC Fixed v Variable Costs

Janjevic and Ndiaye (2017) in a study of the financial viability of UCCs, based loosely on an ‘average’ of previous UCC studies, breaks down the costs as 75% staff costs, 5% equipment, 7% vehicles, 4% infrastructure and 9% overhead. In the general context of business practice, this would appear to underestimate the material and maintenance running costs, as certainly it is very unusual to see a labour share of costs above 70% (e.g. see Cowie, 2010). What it does strongly suggest however, is that a high proportion of UCC operating costs are variable. The significance of this is that it would strong suggest that from a cost perspective, barriers to entry are lower (although note, other strong barriers may still exist), and that from an operational perspective, this makes things easier as costs generally occur when in revenue earning service. It also means that expansion can tend to be incremental and does not require any great investment. NEEDS MORE AND DEVELOPED. NO PLACE IN THIS PAPER FOR THIS AS YET

### 3.4 The cost of last mile delivery as a decisive factor

Whilst some research suggests that the last mile is the most expensive in the whole supply chain (Lindholm and Blinge, 2014, citing Chopra 2003 and Munuzuri et al, 2005), very little research exists on the importance of cost in terms of the wider context of freight transport issues. Cost however is only one of a number of different considerations in the choice and form of supply chains to use, with the current research identifying the other main issues relating to reliability and speed of service, flexibility with regard to just-in-time and security of consignments.

Whilst not directly assessing the importance of cost to the haulier, the FTA annual Logistics Reports includes a survey of members on their views on what should be the priorities for government. In the latest report (I quote 2016 here), cut in fuel duty only ranked third (behind investment in roads and greater recognition for the industry) in terms of priorities. Whilst suggesting cost is still a high priority for hauliers, it does nevertheless indicate that it does not have the highest priority. Interestingly, ‘ensure towns and cities promote ‘freight-friendly’ policies’ rated fifth. One possible reason that cost related factors do not have the biggest concern, is that given the highly competitive nature of the industry, then competitive rates in some senses can be taken as a given, hence what results is a situation akin to Bayesian probabilities. Or put in plain English, the question alters to one of given low haulage rates, how important are reducing haulage rates? The response appears to have been that although still important, there exist other issues of greater concern.

In relation to the cost specifically over the last mile, Strathopoulos et al (2012) highlight, albeit within a policy context, that the price elasticity for carriers over the last mile (NEED TO CHECK THIS) is highly inelastic, and hence the implication is that any (policy induced) pricing strategy aimed at increasing the cost of final mile deliveries would fail to shift anything other than insignificant levels of traffic, as the added cost would simply be passed from the carrier to the final customer (i.e. the retailer). In some ways, this is part of the economics of UCCs, as the importance of other factors, particularly reliability and punctuality, means that any carrier will be relative price inelastic over the final mile, hence making it even more difficult to successfully consolidate deliveries over the last mile (not sure there is really much to this point…). SO WHAT IS THE PIONT?

### 3.5 Freight as a ‘Private’ Good

One completely overlooked obstacle to any form of collaboration in urban freight deliveries, irrespective is this surrounds a consolidation initiative or not, is the idea of freight as a private good. This is a concept that emerged out of one of the forums conducted during the course of the current research surrounding economic viability. Whilst all goods that are purchased can be viewed as ‘private’ goods, in other words, are purchased for the sole benefit of the individual consumer, in the provision of freight services this idea appears to be particularly strong. To put in basic terms, the individual operator feels a very strong personal/corporate responsibility to ensure that all items in their possession are delivered to the final customer, and hence is extremely reluctant to delegate (on whatever terms) this function to a third party. This is reflected in the results of surveys carried out by Regan and Golob (2005) and Holguín-Veras et al. (2008), in which both estimated carrier’s willingness to participate in UCC initiatives to be very low, in the range of 16%-18%. Whilst other factors could be highlighted as the cause, specifically the limited cost savings to be achieved, the need for an extra handling stage and the loss of control over the last mile, the last two are very strongly linked to the idea of freight as a private good. One further reason for such ‘possessiveness’ is the importance of company reputation, which Cowie (2010) highlights plays a key role in the road haulage sector, particularly for smaller operators. As a consequence, such companies are likely to be risk adverse to any form of collaboration in order to ensure that final deliveries primarily remain under their own direct control rather than become dependent on the performance of a third party.

In the research literature, evidence of the idea of freight as a private good however is very limited, but where it is found, as an idea, it is very clear. Schliwa et al (2015) examined the key factors behind the successful operation of cycle logistics providers, and found in the cases studies researched that in all three cases these were heavily reliant on partnership working with existing PCS providers, where the cycle logistics operator delivered over the last mile. Nevertheless, a key barrier to further growth was the reluctance on the part of the PCS for deliveries to be mixed with parcels from different courier companies. Whilst again partly speculative, this suggests that the highly competitive nature of the sector at all levels will tend to lead to ‘protectionist’ measures in different shapes and forms, and a distinct reluctance to contribute to any collective measure for fear of losing part or all of the company’s client base.

## Demand Side Issues

### 4.1 The paradox of last mile consolidation

Key to success in any last mile consolidation venture, particularly a UCC, is the ability to create a market that is sufficient to sustain the operation commercial, i.e. as minimum, return normal economic profits. It has long been recognised that creating such a critical mass is key to the success of any such initiative (for example Browne et al, 2005; Triantafyllou et al, 2014; Morganti and Gonzalez-Feliu, 2015). In the current research, based on costs and revenue flows, it was estimated that for the Groningen hub it would require 80 deliveries a day, which in turn was estimated to require a retailer base of around 200 shops. The actual initiative fell considerably short of this total.

One major issue acting against the establishment of such a critical mass however is what has been identified as the paradox of the UCC (Cowie and Fisken, 2019). Olsson and Woxenius (2014) highlight that in the case of transport for larger firms, which would mainly represent retail chains, terminals are ‘efficient’ because large trucks are used and are often fully loaded (Browne and Allen, 1998). Under such circumstances, there is little if anything to be gained from the use of an UCC. This fits in with Allen et al (2000) division of the urban supply chain system into three sub-divisions labelled centralised goods supply systems (goods are received from a single point of dispatch), decentralised goods supply systems (goods are received from several points of dispatch which could include a variety of different suppliers), and finally a hybrid goods supply system, which has a centralised supply system at its base, but is supplemented with goods received on an adhoc basis through decentralised networks. Centralised goods systems are likely to be larger stores that belong to a retail chain, and the limited research on the topic suggests that this could represents as high as 75% of the total retail sector (van Rooijen and Quak, 2010). The potential market therefore is considered to lie outside of the centralised goods system, specifically in the form of independent and small retailers, a facet generally found in the literature and corroborate by the current research. Browne et al. (2005) identify these retailers as the major potential beneficiaries of a supply chain based around the idea of last mile consolidation. What this suggests is a potential paradox of last mile consolidation, which in simple terms relates to the fact that the elements of the retail sector that could actually benefit from the use of consolidation services, tends to be a small proportion of the whole potential market, and hence in the majority of cases is insufficient to constitute a critical mass.

One interesting further facet identified by Marcucci and Danielis (2008) was that businesses with frequent, differentiated and high volume deliveries were less likely to use UCC services. This was also found to be the case for larger (independent) retailers, but the two groups probably have a high degree of cross over. Taken together however, this underlines the paradox of the UCC. These are the very retailers UCC are aimed at, as the use of a UCC would consolidate deliveries and hence have a significant impact on reducing delivery traffic and the externalities associated with it. Furthermore, from a commercial perspective, capturing such retailers makes the task of establishing a critical mass considerably easier, and thereby would significantly reduce transaction costs, yet these are the very retailers who are less likely to use a consolidation service. This therefore makes the task of establishing commercial viability far more difficult.

### 4.2 Economies of scale and the paradox of city size

Paddeu (2017) highlights the economies of scale argument with regard to UCCs, and cite research by both Kin et al. (2016) and Lin et al. (2016) that the demand for UCC services is heavily influenced by the size and density of the retailer base (the critical mass argument) and the complexity of the deliveries within the area. The strong implication is that the larger and denser the customer base, the larger to potential market. Whilst the larger the city would seem to make sense in order to create a critical mass, from the perspective of last mile consolidation it is not convincing that larger city size is always better, or certainly not in strictly linear terms. With size comes increased demand and increased sophistication regarding supply chains, and given that consolidated consignments are primarily based on less than truckload (LTL) traffic, this very factor could act against last mile consolidation. The danger would be that although with size a critical mass could be created, in larger cities the percentage share of deliveries going through a consolidation hub (UCC) would be considerably lower, as the increased size of the retailer base means that a higher percentage of the established supply chains will be operating at maximum efficiency levels. Thus while some cities may be too small to financially support a UCC (the paradox of the UCC), others may be too large to require consolidating initiatives. The ‘optimal’ range of city size therefore that last mile consolidation initiatives can be commercially successful, may be very limited.

### 4.3 Bottom Up v Top Down

This is a key issue that has arisen out of the current research, particularly with respect to the commercial viability of the projects examiend. In some respects, last mile consolidation measures could critically be viewed as a solution searching for a problem. Whilst the wider issues of pollution, noise, congestion and so on are well recognised, all supply chain decision are based on private benefits, and hence (as in any imperfect market), externalities have no influence on the decisions made unless there is some private benefit to be gained (e.g. a green image, a strong social corporate responsiblity). What this leads into is the need to provide a solution to the wider problem that is established through integrating into the existing urban freight network, hence the idea of a bottom up approach. This is in direct contrast to a measure which is imposed from above by the local authority. In some senses, this idea encapsulates all of the issues surrounding the economics of last mile deliveries. To make clear, in order to be successful, any UCC needs to build the business. It goes back to Ogden’s core idea that if UCCs were significant cost savers, then why is no one doing them (Ogden, 1992)?

An overlooked but key work in the area of the last freight mile is the research undertaken by Morganti and Gonzalez-Feliu (2015), in a case study on the establishment and operation of a Food Hub in Parma. Measures taken before the food hub was established principally surrounded the creation a strong partnership (Tavolo di Concertazione) involving trade associations, logistics companies, transport operators, suppliers, producers and local retailers. What this did was to allow the local government to define and implement an effective scheme that optimised all stakeholder needs. This was primarily pursued through the adoption of principles that closely mirror Elvington’s idea of the triple bottom line (Elvington, 1999), and what it led to was the revitalising of the role of the wholesale produce market. Hence the whole project did not attempt to impose a logistical framework that was radically different from what already existed before, hence re-enforcing a bottom down approach.

In the course of the current research, strong evidence was found of the bottom up approach. In the case of the Edinburgh pilot, Zedify Edinburgh, this was founded on the same principles applied to the Glasgow market. Operations began at the lowest possible level. Initial business was established through what can only be described as a modified form of the door-to-door foot salesman approach. Specific sectors were identified, particularly legal practices and local printers, and potential clients approached directly by the company, which at the initial stage constituted a one-person sole trader. Over time, this basic approach to business has been complemented by increasing levels of partnership working, particularly with key clients in the form of a major PCS provider and a magazine distributor. One factor however identified by Schliwa et al (2015) is that due to the heavy reliance on PCS providers, combined with the issue of ‘private’ goods, I.e. the inability to mix parcels from different couriers, means that future growth of such enterprises is inevitably tied into to the future growth of the prime contractor. The current primary research also suggests that the size of the market that such ventures are able to access may be limited, and that this limit take place at a relatively low level. This in turn impacts upon the size of such ventures,

## Policy Framework

Whilst it may seem surprising to have an albeit brief but specific section on the policy framework in a paper focused on the (free market) economics of urban freight, it is nevertheless insightful to consider the policy framework under which such economic principles act. In both the primary research carried out and in the literature, one almost common theme is the general lack of policy in the area of urban freight, particularly the concept of active city logistics[[3]](#footnote-3). As an example, research by Lindholm [2012] found that urban freight transport was not a priority in many Swedish cities, whilst Witkowski and Kiba-Janiak (2014) found for Polish cities only in a minority of cases (38%) was there any policy provisions that partly related to freight transport, and even here most were found to be problem focused. At best, freight has been described to be somewhat ‘uninteresting’ (Rodrigues, 2006) and at worst completely neglected (Sjostdet, 2007). This general outlook in public strategy is reflected in the structure of public administrations, with Ruesch and Glucker (2001) finding a significant percentage (25%) of cities in their study on the Netherlands had no responsible entity for goods transport issues, whilst Lindholm and Binge (2014) found this to be even more acute in Sweden (43%). The last point is particularly significant, as what it clearly shows is a lack of knowledge and expertise in public bodies with regards to urban freight issues, and the consequence of that is likely to be continuation of the status quo (problem focused, outdated) in the medium to longer term, and hence any measures are likely to be driven by the more general issue of the creation of improved (urban) public spaces.

## Discussion and Conclusions

This paper has outline the main economic principles surrounding the urban freight market that to date have generally operated against the establishment of last mile consolidation measures. To summaries, under supply side factors these include the cost structure of road hauliers, delivery as an intermediate good, economies of scope/counter consolidation, freight as a private good, and finally cost as a decisive factor. On the demand side the paradox of last mile consolidation and bottom up versus top down were identified.

It would appear to date, that the combined effect of the underlying economic principles surrounding urban freight have made it very difficult, if not near impossible, for any last mile consolidation measure to be commercially successful, although some examples do exist, although perhaps limited in scope.

As regards the policy framework, what it clearly shows is a lack of knowledge and expertise in public bodies with regards to urban freight issues, and the consequence of that is likely to be continuation of the status quo (problem focused, outdated) in the medium to longer term, and hence any measures are likely to be driven by the more general issue of the creation of improved (urban) public spaces.

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Appendix – Working Notes Etc

Fixed v variable costs – this are estimates of distances based on the national averages, taken from TSGB 2017.

The first ‘issue’ is to put the issue of the last mile delivery in the context of the wider issue of general deliveries. In order to do so, we take a very simplistic view, and at a very generally level estimate what proportion of operator costs does the last mile represent? Using national statistics for Great Britain in 2017, we get:

Tonnes Lifted (bn) 1.647

Tonne Kilometre (bn) 152

Average Haul 92.3

Non Last Mile 90.7 98.3%

Last Mile 1.6 1.7%

Fixed to variable costs 25%

Non Last Mile Costs 98.7%

Last Mile Costs 1.3%

Hence we have an average haul length of 92.3 km, which taking the ‘last mile’ at the literal sense, i.e. 1.6 km, then in terms of the overall delivery journey, this only represents 1.7% of the total distance travelled. Put another way, having driven 90.7 kilometres of the total delivery distance of 92.3km, the deliver will not continue on the last 1.6km but rather stop ‘short’ and unload the goods. A UCC operator will then consolidate this shipment with other consignments, before taking these out on delivery. Even if such a service were ‘free’, there has to be question marks over whether the added costs of loading, consolidating and re-loading would cover the 1.7% of costs saved by the haulier.

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3. Whilst there are many definitions in the literature of city logistics, these are probably best encapsulated by Cardenas et al (2017), who define city logistics as the inter-dependencies between citizens’ welfare, the logistics system and the public administration of urban logistics policies. [↑](#footnote-ref-3)