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Towards Framework for a Collaborative Business Model for a Local Freight Consolidation Centre

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Executive Summary

Freight transport is responsible for urban congestion and 25% of EU road emissions. In this context, a local freight consolidation centre could offer benefits such as reduced emissions and congestion, and shorter delivery distances. One of the challenges related to urban freight consolidation is achieving collaboration between actors with conflicting interests. This study therefore proposes a collaborative business model framework for local freight consolidation centres. The framework was tested through a pilot project in Gothenburg. The study emphasises the importance of collaboration, co-creation, and institutionalisation among stakeholders in order to achieve collaboration for sustainable urban logistics solutions. The study also expands the knowledge on the challenges of using a combination of traditional and electric vehicles for the last mile delivery.

Keywords: Electric Vehicles, Hybrid Electric Vehicles, Business models for vehicle sales

1 Introduction

Today, freight transport has a significant impact on the climate, accounting for 25 per cent of road transport emissions in the EU [1]. While urban freight transport fosters the economic development of a city, it also has a significant impact on the city's environmental goals, climate impact, air quality, road safety; it also generates noise and congestion, which are considered negative transport externalities [2-5]. For example, about 17 per cent of the traffic on the Gothenburg's Event Route (Evenemangsstråket) comprises goods transport, including vans and light trucks, as well as some heavy trucks [6]. In addition to the approximately 27 million kilometres travelled by cars within the zone, freight transport accounts for 5.5 million vehicle kilometres [6].

In order to become climate-neutral cities by 2050, municipalities are adopting ambitious climate goals and developing zero-emission plans. At the same time, municipalities seek to reduce traffic and noise in order to make urban areas more liveable for citizens. The transition to a climate-neutral, sustainable city requires shifting to greener vehicles and implementing new logistics solutions that would help to mitigate the negative impacts of last mile urban freight transport. One possible solution is to establish a number of last-mile consolidation and distribution nodes in or near to urban neighbourhoods. These nodes could take the form of Urban Consolidation Centres (UCCs) [7], microhubs [2], or local freight consolidation centres and would require collaboration between freight operators.

However, the overall system of urban freight logistics in the last mile is very complicated due to the involvement of multiple actors with conflicting interests and complex operating models. In this context, the deployment of such consolidation and distribution nodes poses a number of challenges. One challenge is the need for coordination and collaboration between freight operators and the other actors involved in order to implement and use this service. Despite the obvious benefits of collaboration, which are improved operational planning, reduced running of empty vehicles, increased capacity utilisation, and improved

environmental conditions, achieving this can be difficult [4]. Another challenge is related to the need to combine both traditional and electrical vehicles for the last mile delivery, since logistic operators managing traditional and electric fleets have different costs and prices [3]. This makes it difficult to develop a commonly accepted business model and can lead to internal competition [3].

Previous research on the freight industry "has only limited experience of collaboration <…> due to a highly competitive market and low revenue streams" [4]. Furthermore, the literature focusing on business models used in urban freight transport is scarce, especially with a focus on the challenges posed by sustainability trends and electromobility [5, 8]. A different strategy to the business model is needed to promote collaboration between the involved actors and achieve sustainability goals, social and economic value [3]. Given these gaps in the literature, this study aims to propose a framework for a collaborative business model applicable to local freight consolidation centres. In this study, we address the following research questions:

RQ1) What opportunities and challenges does collaboration bring to stakeholders in the local freight consolidation centre ecosystem?

RQ2) How can the collaborative component be conceptualised and included in the business canvas?

To answer these research questions, we conceptualise collaborative business models as outcome-based partnerships, in which all parties are mutually invested in the success of the relationship [9]. We extend the business model canvas [10] with additional building blocks, such as Form/Models of collaboration, Price model, and Non-monetary revenue streams. We also incorporate the design principles of vested agreements [9] when discussing all the key components of the business model. The proposed collaborative business model was tested in a pilot project for a local freight consolidation centre, following the principles of engaged scholarship. We refine the proposed framework by addressing the need to further translate the benefits and value of collaboration into the business models of the actors involved. The findings presented in this paper are work in progress.

This study bridges the gap in the academic literature on urban freight logistics by proposing a framework for a collaborative business model for last mile consolidation and distribution nodes. This study also extends academic literature by providing knowledge about the challenges of using a mix of traditional and electric vehicles for last mile delivery. Furthermore, this study contributes by proposing further insights into how the benefits of the collaborative business model can be translated into the tactics of each collaborating organisation. The study provides important guidelines for practitioners developing urban last mile consolidation and distribution nodes. They can use the proposed collaborative business model framework as a practical tool.

In the next section, we provide a brief overview of the relevant academic literature, followed by a description of the methodology used. We then present and discuss our findings and draw conclusions.

2 Literature review

2.1 Forms of urban freight logistics and business models

The academic literature discusses a few forms of urban freight logistics. One form is UCCs, which can be defined as systems decoupling long-distance and last-mile transport, typically located within urban areas, and using vehicles designed for urban transport [7, 11]. UCCs can be operated by one or multiple companies and facilitate the collection of goods from multiple shippers, their transshipment, and consolidation for delivery to goods receivers [11, 12]. This requires significant effort in synchronising goods and establishing the necessary transportation infrastructure. However, UCCs face challenges such as unsustainable operations, low profitability, and dependence on government subsidies [2, 7].

Another form is microhubs, an evolution of UCCs, which are located closer to the delivery areas, serve a specific geographical area, and improve the efficiency of last-mile delivery by optimising load distribution and reducing the number of trips [2, 13]. Benefits include a reduced environmental footprint through the use of cleaner electric vehicles for last-mile delivery. [2,13] These vehicles include smaller electric vehicles, electric low-speed vehicles, and electric cargo bicycles [2,13]. Other benefits include fewer freight vehicles, less congestion and noise, and an improved quality of urban life [2]. Businesses receiving freight can benefit from fewer deliveries [14]. Logistics operators benefit from reduced time spent on congested roads or waiting at loading docks, use of microhubs for storage and transhipment, shorter distances travelled, and reduced driving of empty vehicles [2, 4, 14].

For the purposes of this study, we define a local freight consolidation centre as a system consolidating freight from local shippers (wholesales, producers, businesses) and distributing it within a specific geographic area of a city. This solution exhibits characteristics of both a UCC and a microhub.

It needs to be mentioned that academic research on urban freight transport, collaboration, and the business models used is rather limited, particularly due to the challenges posed by sustainability trends and electromobility [4, 5, 8]. A literature review helps to identify a gap in understanding of how traditional models can adapt to these challenges, emphasising the need for research to focus on sustainable and smart urban logistics solutions.

A number of researchers have analysed various aspects of business models for urban freight transport. Björklund and Gustafsson [7] identify seven critical factors for viable business models in urban consolidation centres, such as scalability, continuous development, and innovative service offerings. Vargas et al. [4] highlight the importance of collaboration and coordination in the freight industry for improving operational planning, and reducing operational expenditure, empty running vehicles, and environmental impact, while increasing capacity utilisation. However, due to high competition and low revenue, the industry "has only limited experience of collaboration" [4]. Vargas et al. [4] propose a framework for a freight collaborative business model, emphasising the importance of operational coordination and revenue sharing to improve efficiency and reduce environmental impact. The proposed framework incorporates critical aspects, such as revenue sharing, compliance with competition law, process synchronisation, organisational and systems interoperability, different forms of collaboration, mechanisms of coordination, and strategies for collaboration. Vargas et al. [15] propose a gain-sharing model for collaborating logistics operators in terms of operations, economics and benefits. Katsela et al. [16] have specifically examined the structure of costs and revenue streams in the business model for city logistics.

The role of actor collaboration is extensively discussed in the literature [2, 4, 7, 15]. Xu et al. [17] use a platform economy approach to redefine partnerships in collaborative logistic networks, focusing on achieving win-win situations, enhanced efficiency, and lower costs. de Bok et al. [13] explore the implementation of UCC and identify a key barrier: the unwillingness of involved participants (carriers, receivers and local authorities) to meet the financial costs of the UCC in return for the benefits that they receive. The research demonstrates that the largest reduction in vehicle kilometres can be achieved in scenarios involving full collaboration between the transport/logistic operators.

Sustainable solutions involve the integration of traditional and green transportation modes to address inefficiencies in the last mile delivery, which is an important research gap [3]. Perboli and Rosano [3] highlight the potential for potential price wars and the need for strategic collaboration to maintain service quality and efficiency in the coexistence between traditional vehicles and green alternatives such as electric vehicles, bikes and cargo bikes. Macário et al. [18] observe that logistics operators have no incentive to engage with sustainable solutions, because the costs they are responsible for are partly supported by the whole society, as externalities. The researchers suggest that public regulation could incentivise sustainable logistics.

The financial viability of last-mile urban logistics is another critical research area. Adaptable business models and the critical mass are necessary for long-term sustainability [7, 19]. Strategies for economic sustainability include value-added services and alternative revenue streams, suggesting strategies that include joint freight strategies, cost-efficient solutions, and value-based services, such as selling storage space, warehousing, as well as reverse logistics [2, 14].

2.2 The business model concept: a brief overview

A business model articulates how an organisation creates, delivers, and captures value from a service, product, or technology [20-25]. The concept of a business model was first introduced in the context of the boom in e-commerce and internet-based service boom [20, 26, 27]. Since then, the concept has been widely adopted in various fields and domains, including mobile services [28], the public sector [29], the transport and logistics industry [4].

There is no commonly agreed definition of the business model. For example, a business model can be described as follows: (i) a mediating device between technology and economic value [21]; (ii) a narrative explaining how the enterprise operates [23]; (iii) the logic of the firm [30]; (iv) a conceptual tool [31]; (v) an interrelated set of decision variables [32]; or (vi) a detailed conceptualisation of an enterprise's strategy [28].

Many researchers have attempted to define the main structural components of the business model. Most authors agree that the key components to consider are: (i) the value proposition, (ii) resources and capabilities, (iii) the market segment or target customers, (iv) the revenue model, (v) the cost structure, and (vi) the value network [21-23, 26, 27, 31-33].

One of the most widely used tools for business model development is the business model canvas [10], consisting of nine building blocks: key partners, key activities, key resources, value proposition, customer relationships, channels, customer segments, cost structure and revenue streams.

2.3 Collaborative business models

The literature on business models is mainly firm-centred. However, the emergence of innovative services often involves multiple actors within a business network. Zott and Amitt [34] argue that a business model is a combination of interdependent activities that go beyond the focal firm and embed it in its environment. From this perspective, there is a need for collaborative business models.

Collaborative business models can be conceptualised as outcome-based partnerships, where all parties become *mutually invested* in the success of the relationship [9]. Instead of prescribing detailed transactions, *vested agreements* articulate a limited set of shared, measurable outcomes and then grant the service

provider latitude to determine *how* those outcomes are achieved [9].

Effective co-creation among actors with different prerequisites and individual goals is required for collaborative business models to reach their overarching goal. Liao et al [35] highlight that effective coordination between vehicle manufacturers, financial and mobility service providers, public authorities and end users is critical for creating and capturing value. The broad constellation of actors involved is referred to as a 'value network' and is a fundamental element of the business model. These value networks are characterised by **mutual interdependencies** among actors in the industrial, service and governmental sectors. Key challenges include coordinating these heterogeneous interests and tailoring the business model to different consumer segments [35].

Effective co-creation requires a high degree of cooperation and institutionalisation between actors in both the overarching and individual business models. This process involves increasing the interdependence of resources, decision making, and risk sharing between public, private and civil society actors. Glasbergen's concept of **asset specificity** [36] suggests that greater joint investment in assets leads to greater interdependence (see Table 1).

Table 1: Asset specificity [36].

No.	Description
Step 4	**Institutionalisation – changing the political order.** Partnership is established as part of governance, creating new regulations, policies and norms, and securing long-term financing.
Step 3	**Implementation and learning**. Joint decisions are translated into action, results are measures, and the parties learn from the process. Developing a follow-up plan and sharing data openly for continuous improvement.
Step 2	**Organisation and Regulation**. Structures, roles, and rules are established, a neutral coordinator is appointed, and agreements are written to regulate responsibilities.
Step 1	**Partnership formation**. Transition from informal dialogue to formal partnerships with common goals, a shared vision, and clear mandates.

Five interlocking design principles underpin the collaborative business model. These are the following:

(i) *Focus on outcomes rather than transactions*. Traditional transaction-based agreements prioritise risk aversion and cost minimisation. In contrast, the *Vested model* encourages continuous improvement by rewarding actual outcomes, such as improved customer service, efficiency gains, and reduced CO_2 emissions [9]. Additionally, collaborative business models can facilitate co-creation and act as intermediaries between firms and broader socio-technical systems, enabling new technologies to disrupt existing regimes.

(ii) Governing the *what* instead of the *how*. A Statement of Objectives (SOO) replaces traditional prescriptive contracts [9]. This approach gives suppliers the freedom to optimise their processes and technologies, and encourages continuous innovation. Collaborative SOOs enable business model actors to pursue objectives that are more complex than those in traditional models. Furthermore, business actors gain the ability to adapt and reconfigure resources to secure a sustainable competitive advantage and innovate to achieve new competitive positions.

(iii) *Setting clear and measurable joint goals*. A few high-level Key Performance Indicators (KPIs), directly aligned with the shared vision, are monitored through an integrated performance management system [8]. Using formative KPIs instead of quantitative ones allows the business model actors to adapt to changes over time.

(iv) *Designing a pricing and incentive model that balances cost and service*. This model combines a baseline fee (e.g., per transaction) with outcome-based incentives (known as 'gain-share'), ensuring mutual benefits from efficiency gains and revenue growth [9]. This approach is labelled '*What's in it for We.*' The *Pricing* principle requires that the incentive model, cost and service are balanced fairly or equally. If these factors are unclear, it will be difficult to forecast the expected business model results.

(v) *Steering through insight rather than oversight*. A flexible governance architecture encompasses *relationship governance* (shared forums, culture and behavioural norms), *transformation governance* (continuous improvement and innovation), *exit governance* (a pre-emptive plan for potential disengagement), and compliance with regulatory or market-specific requirements [9].

3 Research approach

3.1 Methodology

The findings presented in this paper are work in progress and are the result of a qualitative approach based on the principles of engaged scholarship [37], spanning a year and a half. Engaged scholarship is defined

as “a participative form of research for obtaining the different perspectives of key stakeholders (researchers, users, clients, sponsors, and practitioners) in studying complex problems” [37:9]. Engaged scholarship can be applied in four different ways. For the purposes of this research, we have chosen collaborative research, which enables the co-production and co-creation of knowledge.

In order to obtain the perspectives of the key stakeholders involved in an urban freight micro-hub, we collaborated with two logistics operators, two goods receivers, a city municipality, and a science park organisation representing a neutral platform for collaboration and innovation in transport and logistics. Data was generated through:

(i) A series of three-hour workshops in which different aspects of the collaborative business model were discussed. These workshops were held on a monthly basis between April 2024 and January 2025.

(ii) An individual semi-structured interview with a science park representative involved in negotiating a pilot project agreement for a local freight consolidation centre. The interview questions were related to the details of the pilot contract agreements and conditions.

(iii) Shorter biweekly online project meetings to discuss project progress.

The authors have combined the knowledge gained through the engaged scholarship to develop and test a collaborative business model concept for a local freight consolidation centre.

3.2 Concept development

The business model canvas [10] is the most popular tool used for developing a business model. However, adjust it for the context of the local urban freight centre, we have extended the original nine blocks of the canvas to include a few additional elements.

Following the framework of a freight collaborative business model [4], we added a block called **Forms/Model of collaboration**. This block covers aspects such aa the forms of physical collaboration (e.g., horizontal, vertical or lateral) and collaboration strategies (e.g., backhauling, freight exchanges, consolidation centres, and joint optimisation) (see Figure 1). In our case, the collaboration strategy is a consolidation centre.

One of the key elements of a collaborative model is the **Price model**. It refers to the fourth success factor and involves setting a pricing and incentive model that is fair and balances cost and gain distribution [9].

As implementing a local urban freight centre creates different types of socio-ecological benefits and values, we separate revenue streams into monetary streams and non-monetary streams. **Monetary revenue streams** are related to earnings from the local urban freight centre’s business activities and increased efficiency (saved time, shorter distances travelled, and reduced empty vehicles trip). **Non-monetary revenue streams** include social benefits, such as a reduced CO2 footprint, reduced noise, and reduced congestion.

A number of studies [2, 4, 7, 14, 17] emphasise the importance of collaborative, sustainable and technologically advanced approaches for overcoming urban logistics challenges. For this reason, we incorporate design principles proposed by Vitasek and Manrodt [9] (see Section 2.3) in the discussion of all the key components of the business model.

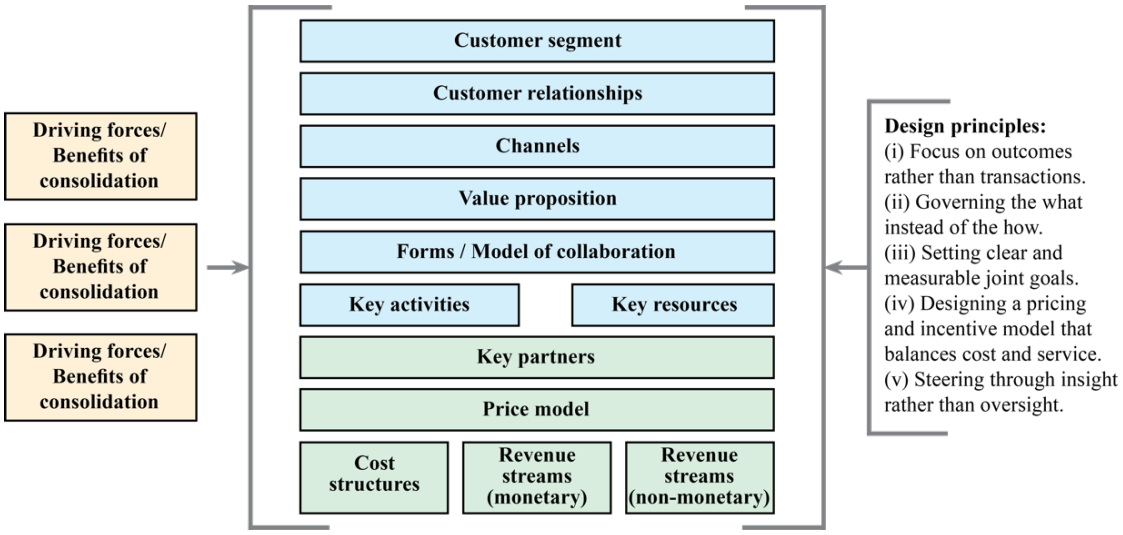

Figure 1: Conceptual framework of a collaborative business model.

Our working hypothesis was that the actors involved in the local urban freight centre project would realise the benefits of consolidated freight, which would then become forces driving collaboration.

4 Findings

4.1 The case of REDIG project

The REDIG project aims to create a demonstration system of the ecosystem required for a fossil-free open and scalable logistics system for a local freight consolidation centre focused on joint freight consolidation for receivers on the Event Route (Evenemangsstråket). This district in Gothenburg has a high concentration of event venues, museums, exhibition centres, and arenas. The number of businesses in the area is expected to increase in the future, due to new construction and an increase in business tenants, which will lead to consequences, such as increased transport needs, congestion, CO2 emissions, and noise.

To test such an urban logistics solution, a small-scale pilot of a local freight consolidation centre was implemented in the project with the start date on 2 April 2025. The core **collaborative strategy** of the local freight consolidation centre is to optimise logistics processes through freight consolidation. The pilot provides an opportunity to learn and share insights and experience that can be used to scale up and improve logistics in the future. Particular interest lies in understanding how different actors should collaborate around a local freight consolidation centre, the gains that can be achieved, and how these can be strengthened and extended to include more actors.

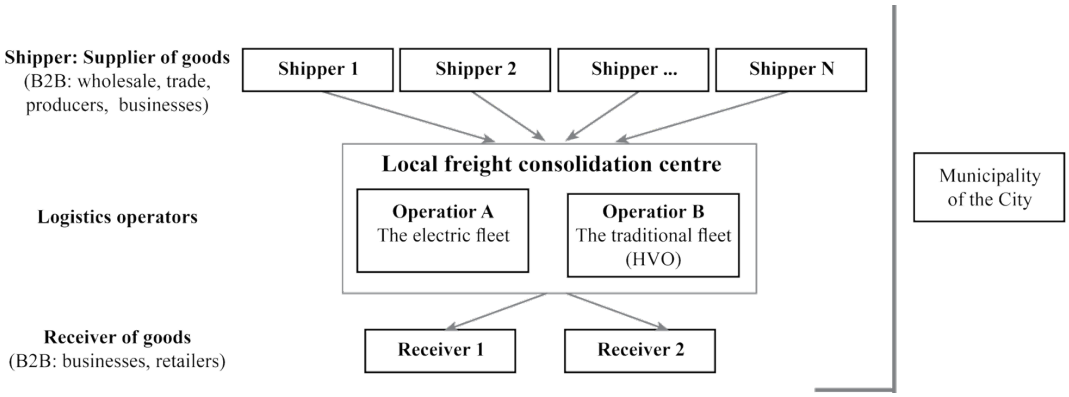

Figure 2: Business network of local freight consolidation centre in REDIG pilot.

The business network around the local freight consolidation centre pilot includes the following actors (see Figure 2):

- **Shippers:** Five to six suppliers of goods that are representing the business-to-business (B2B) and intra-business segments, who send goods to their customers.
- Two logistics operators:
    - **Logistics Operator A** manages an electric fleet and is responsible for transporting different types of goods on the last-mile segment. However, the electric vehicle fleet required a significant investment, resulting in higher operating costs and service prices compared to a traditional fleet operator.
    - **Logistics Operator B** is a traditional fleet manager. This actor generally provides transport and logistics services on the last-mile segment and can transport all goods except food. Its operating costs and service prices are lower than those of Logistics Operator A.
- Two receivers of goods are large Event Route actors representing the B2B and intra-business segments.
    - **Receiver 1** is an event organisation running many different activities including entertainment, hotels, and restaurants. At certain times of the year, this actor runs daily entertainment activities every day and requires a large supply of seasonal goods. At other times, the organisation is closed.
    - **Receiver 2** is also an event organisation that runs a many different activities, including entertainment, hotels, theatres, restaurants, and meeting facilities. The organisation requires the delivery of large quantities of event supplies/goods, but not on a daily basis.
- The **Municipality of the City of Gothenburg** is an important actor in this ecosystem. It aims to achieve zero environmental emissions and to make the city more attractive for its citizens. This actor is responsible for setting regulations and requirements for transport and logistics services in different parts of the city.

4.2 Pilot agreement, challenges, and benefits

Initially, the idea behind the pilot was that both logistics operators would be involved in the local freight

consolidation centre. Logistics Operator B would handle all event and consumer goods, while Logistics Operator A would handle all other goods. This collaboration was seen as essential for operating the local urban freight centre, enabling it to be further scaled up and opened to other logistics operators.

The expected benefits of the consolidated freight through the local freight consolidation centre, which were discussed during the project, are:

- Improved routines needed for collaboration and optimised logistics processes.
- Reduced number of routes and the use of more sustainable electric vehicles were discussed as a way to reduce the environmental impact in terms of both CO2 emissions, congestion, and noise.
- Increased load factor of vehicles was seen as a way to increase efficiency of logistics operators.
- Freight consolidation can offer receiving companies another type of cost saving in the form of consolidated CO2 emissions reports.
- There is a potential to reduce transport costs over time by consolidating transport and optimising logistics processes. However, the initial costs can be high, especially when considering investments in electric vehicles.
- The local freight consolidation centre can help to better structure deliveries and plan for more organised logistics flows, leading to time savings.
- By centralising deliveries at a local freight consolidation centre, more space can be freed up at receiving companies, which is particularly valuable for businesses that need the space for other purposes.

However, certain challenges have arose during the negotiation process of the temporary pilot agreement:

- Due to hygiene requirements, Logistics Operator B could not handle food. That is why Logistics Operator A's facilities were used for the consolidation of deliveries. This also resulted in the practical challenge to ensure that all deliveries were routed to the address of the new local freight consolidation centre. This required extensive dissemination of information and coordination with all parties to avoid misunderstandings and delays.
- A significant challenge was obtaining permission to consolidate transport with one of the largest wholesale shippers of goods. Discussions with this actor took time, and they eventually decided not to participate in the consolidation. This delayed the negotiation process and resulted in a significant change to the pilot, as this wholesale shipper was a large supplier that had initially been planned to participate in the pilot.
- An unexpected competitive situation arose when the same wholesale shipper of goods showed interest in taking on the function of a local freight consolidation centre, which challenged the existing distribution of role where Logistics Operator A and Logistics Operator B were intended to act as the main centres.
- There were some economic challenges, particularly with regards to the use of electric vehicles as part of the pilot. Logistics Operator A advocated the use of an electric vehicle to increase the environmental benefits. However, the cost of the transport service was higher than what Receiver 1 and Receiver 2 were initially willing to pay. Their financial situation, including ongoing restructuring and cost constraints, influenced their decision.
- For the pilot to work effectively, all actors involved had to adapt, adjust and change existing routines. This meant that everyone had to be willing to compromise and change their processes, which can be challenging in practice.

During the negotiation of the pilot agreement, additional services connected to consolidated freight were identified and discussed, such as the handling returns (i.e. empty crates, containers and returnable bottles). This could save costs, increase revenue, create a better working environment, and potentially contribute to lower emissions.

5 Discussion and conclusions

5.1 Opportunities and challenges of collaboration in the context of a local freight consolidation centre

Local freight consolidation centres are collaborative initiatives that aims to consolidate freight from local shippers and distribute it within a specific area of a city. We have used the experience of the REDIG project and the project pilot of a local freight consolidation centre, to explore the opportunities and challenges that collaboration around such a local freight consolidation centre brings to its stakeholders (addressing our RQ1).

Two logistics operators participated in the project: one managing a traditional fleet, and the other managing electric fleet. Both operators agreed on the expected benefits of collaboration, which are time savings, increased efficiency, shorter distances travelled, increased load factor of vehicles, which is in line with the findings of previous research [2, 4, 14]. The electrical fleet operator and the Municipality of the City of Gothenburg discussed a number of social effects and non-monetary effects, such as reduced CO2 emissions, noise, and congestion, as well as increased attractivity of the city, which support previous research [2, 13]. The urban freight receivers named the opportunity to reduce the numbers of deliveries as a benefit, which is consistent with previous research [14]. One of our findings is that such an added-value service of a local freight consolidation centre as storage could additionally help the urban freight receivers to free up space for other purposes. Furthermore, the manager of the local freight consolidation centre could generate a consolidated yearly CO2 emissions report based on the number of deliveries and routes, saving urban freight receivers time and money.

At the same time, we have identified several challenges related to collaboration within the context of a local freight consolidation centre. It is very challenging to combine and mix the services of traditional and electric fleets, because the operational costs and prices of the electric fleet operator are much higher, that those of the traditional fleet operator. There was a hesitation of logistic operators about considering their interests in a fair way, which challenged collaborative efforts. This way, including electric vehicles alongside traditional vehicles when developing a business model for a local freight consolidation centre therefore presents new challenges for collaboration. This issue was also discussed in the previous research [3].

The REDIG project focused entirely on collaboration questions. However, we have observed competition between actors in the pilot. In addition, it was challenging for participants in the pilot to agree and change or adapt existing work routines and processes. This behaviour can be explained by the fact that actors are locked into their existing business models, which can be difficult to change due to certain industry operating traditions, industry culture, conflicting interests, and different understandings of processes.

5.2 Proposal for further development of the framework of a collaborative business model for local freight consolidation centre

We have conceptualised a collaborative business model and included a collaboration component in the business canvas in Section 3.2. (addressing our RQ2). However, based on our findings, the challenges observed and lessons learnt, we conclude that in order for collaboration to happen in the context of a local freight consolidation centre, the proposed framework needs to be further elaborated (see Figure 3).

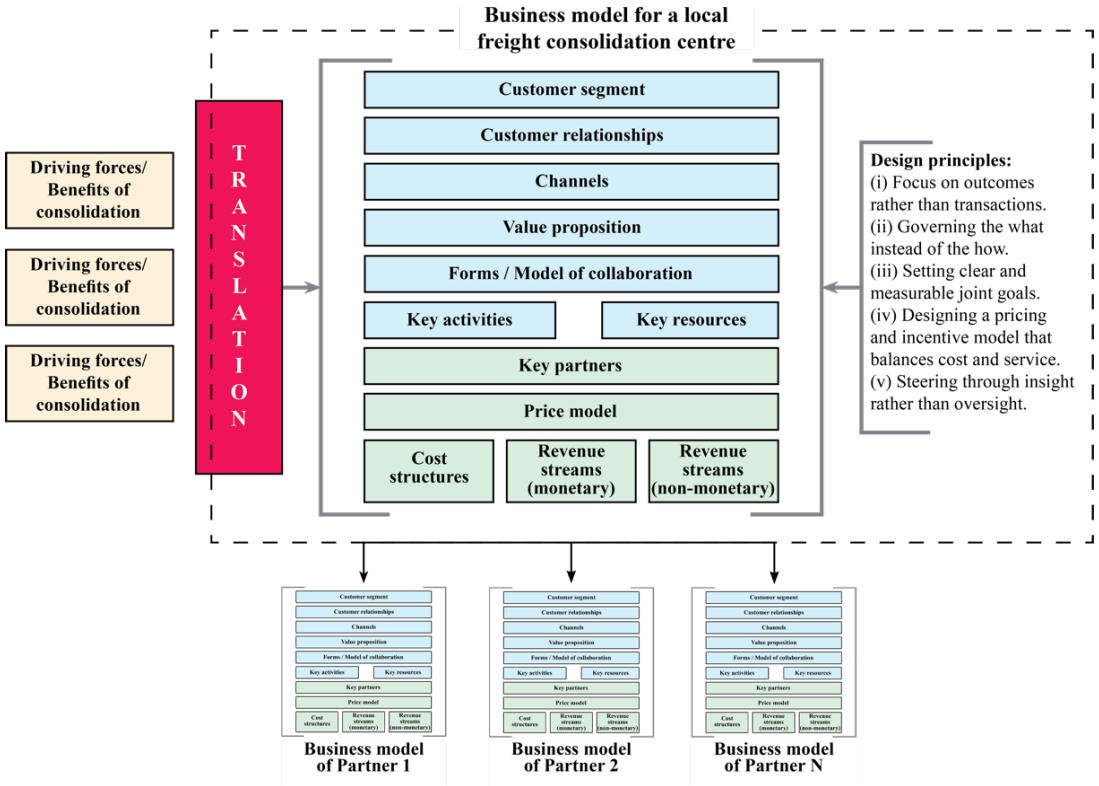

Figure 3: Elaborated framework of a collaborative business model for a local freight consolidation centre.

The collaborative business model for a local freight consolidation centre can be seen as an umbrella business model for a diverse constellation of actors collaborating to provide and receive services. At the

same time, all the partners involved have their own business models, diverse and sometimes conflicting interests, different industry operation traditions, norms, and routines. In order to reach true co-creation of a collaborative business model, an actor is needed to orchestrate and coordinate the collaboration of the different actors [35]. In addition, collaboration of these diverse actors requires not only clarifying each actor's roles, responsibilities, or actions, but also institutionalisation of routines and norms across both the collaborative business model of local freight consolidation centre and individual business models of the actors involved [36]. In order to move towards this level of collaboration, it is necessary to translate the monetary and non-monetary gains of the collaborative business model for a local freight consolidation centre into the business models of the individual actors.

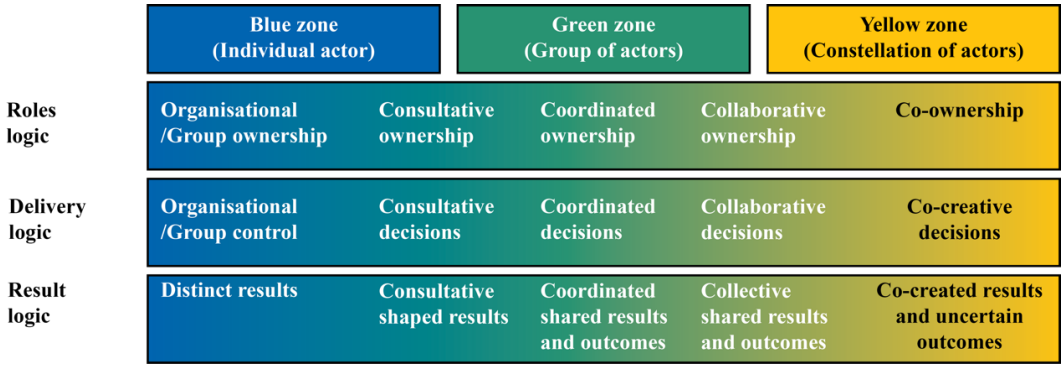

Figure 4: The FBL zone model [38].

We propose to make such a translation using Lund FBL model for innovation ecosystem portfolio tracking [38]. The FBL zone model (see Figure 4) illustrates these co-existing logics through three integrated processes: roles, delivery and results. The model describes a scale of collaboration ranging from an individual organisation to a constellation of actors. The tactics, results and outcomes will change as you moving along the scale. The ability to effectively translate the co-owned business model across different zones is crucial for ultimately achieving empowerment, agency, and implementation within the organisation. This process involves a structured progression from individual ownership and control to fully shared ownership and co-creative agency. A structured approach to translating results and effects is required to ensure that they are clearly articulated and aligned with the organisation's goals and strategy.

For this translation to be effective, it is essential that the translation of results and effects is conducted in a way that clearly explains both how and with what the collaborative business model contributes to the individual organisation's goals and strategy. This requires not only a clear articulation of the outcomes but also an understanding of the underlying mechanisms and contributions that drive these outcomes. A translation needs to take place when the collaborative business model is translated into tactics in each organisation. This means that the overarching purpose of the business model for results and outcomes needs to be granulated and linked to benefit results and outcomes in each organisation connected to the constellation of actors.

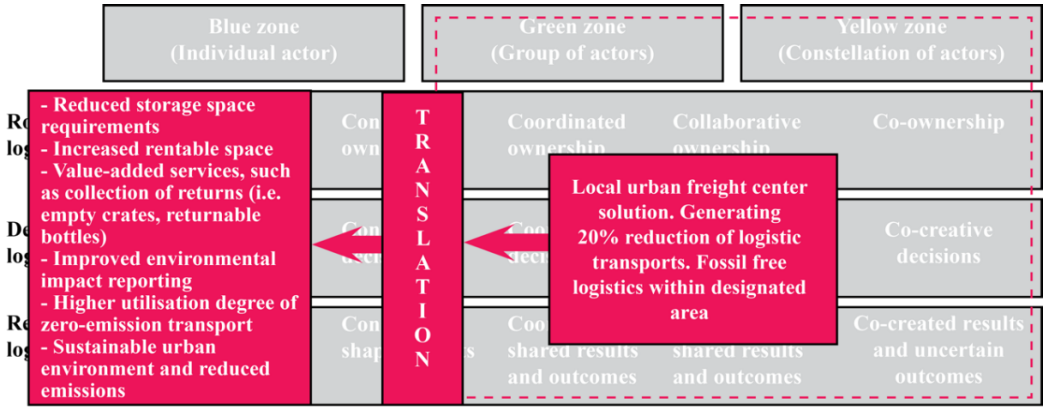

Figure 5: Example of translation explaining the REDIG local freight consolidation centre use case.

In Figure 5, we provide an example of such a translation between the Yellow and Green zones applied to the collaborative business model of the REDIG local freight consolidation centre. However, a more detailed translation is the subject of further research and conceptualisation.

5.3 Contribution, practical implications, limitations and further research

This study makes several theoretical contributions to existing research on last mile urban freight logistics. Firstly, it explores the challenges of collaboration among different actors of ecosystem of a local freight

consolidation centre, and how this collaboration could be strengthened by the overarching business model.

Secondly, we propose a conceptual framework for a collaborative business model for a local freight consolidation centre, which incorporated five design factors: (i) focus on outcomes rather than transactions; (ii) governing the what instead of the how; (iii) setting clear and measurable joint goals; (iv) designing a pricing and incentive model that balances cost and service; (v) steering through insight rather than oversight. This framework has been further refined based on the findings of this study. We also propose a further research direction into how the benefits of the overarching business model can be translated into the benefits for the individual business models of the involved actors and institutionalised within their organisations.

Thirdly, our research addresses the identified research gap concerning the coexistence of traditional and electric fleets by examining issues and challenges observed in the pilot project. Our findings suggest that a fair monetary and non-monetary gain sharing mechanism should be incorporated into the overarching business model and then further distributed amongst the involved actors.

This study has important practical implications for practitioners working in the last mile urban freight logistics. The proposed framework of collaborative business model can be used as a tool when developing business models for services requiring collaboration between actors representing different industries. One of the most important insights is that time is needed for collaboration to take off.

Another practical observation is that an electric fleet requires a substantial investment and has higher operational costs. Hence, from a broader perspective, when society aims to achieve zero environmental impact, the important discussion should focus on questions such as: who should take the cost of the transition to more environmentally friendly transport for last mile urban freight, given the low revenues in this sector? Another challenge to consider when talking about the broader adoption of electric vehicles for urban freight is the lack of technical charging infrastructure.

A major limitation of this paper is that it is only considers findings from a small-scale pilot. This could influence and bias the results of this study. Future work could examine collaboration trends and business model development in a wider array of urban freight consolidation centres.

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References

[1] ALICE. Urban freight. Research and innovation roadmap. https://www.etp-logistics.eu/wp-content/uploads/2022/08/Urban-Freight-Roadmap.pdf, accessed on 2025-04-26.

[2] Katsela, K., Günes, S., Fried, T., Goodchild, A., Browne, M. *Defining urban freight microhubs: a case study analysis*. Sustainability. 2022; 14 (532):1-27. https://doi.org/10.3390/su14010532.

[3] Perboli, G., Rosano M. *Parcel delivery in urban areas: Opportunities and threats for the mix of traditional and green business models*. Transportation Research Part C. 2019; 99:19-36.

[4] Vargas, A., Patel, S. Patel, D. *Towards a business model framework in increase collaboration in the freight industry*. Logistic. 2018; 1(22):1-32.

[5] Vluegel, J. *Modelling goods city distribution in the Netherlands*. European transport. 2004; 28:20-30.

[6] Eriksson, A., von Wieding, A., Gestrelius, S., Lyrberg M., Ranäng S., Carlén V., Hansson M. *REDIG – Regional goods hubs in Gothenburg*. RISE and CLOSER report, 2023. https://www.drivesweden.net/sites/default/files/2023-11/rise_slutrapport_redig.pdf.pdf, accessed on 2025-03-10.

[7] Björklund, M. Gustafsson, S. *Toward sustainability with the coordinated freight distribution of municipal goods*. Journal of Cleaner Production. 2015; 98:194-204.

[8] Alarcon, F.E., Mac Cawley, A., Sauma, E. *Electric mobility towards sustainable cities and road-freight logistics: A systematic review and future research directions*. Journal of Cleaner Production. 2023; 430: 138959.

[9] Vitasek, K. Manrodt, K. *Vested outsourcing: a flexible framework for collaborative outsourcing*. Strategic Outsourcing: An International Journal. 2012; 5(1): 4-14.

[10] Osterwalder, A., Pigneur, Y. *Business model generation: A handbook for visionaries, game changers, and challengers*. Hoboken, New Jersey: John Wiley & Sons, 2010

[11] Cleophas,C., Cottrill, C., Ehmke, J.F., Tierney, K. *Collaborative urban transportation: Recent advances in theory and practice*. European Journal of Operational Research. 2019; 237: 801-816.

[12] Egger, D.; Ruesch. *M. Best Urban Freight Solutions I*. 2001, https://trimis.ec.europa.eu/system/files?file=project/documents/20060821_161755_24060_BESTUFS%20Best%20Practice.pdf, accessed on 2025-04-18.

[13] de Bok, M., Giasoumi, S., Tavasszy, L., Thoen, S., Nadi, A., Streng, J. *A simulation study of the impact of micro-hub scenarios for city logistics in Rotterdam*. Research in Transportation Business & Management. 2024; 56:101186.

[14] Andruetto, C., Gillström H. *A system dynamics perspective on the willingness of freight receivers to pay for city hubs.* Cleaner Logistics and Supply Chain. 2025; 14:100202.

[15] Vargas, A., Fuster, C., Corne, D. *Towards sustainable collaborative logistics using special planning algorithms and a gain-sharing business model: A UK case study*. Sustainability. 2020; 12:6627. doi:10.3390/su12166627

[16] Katsela, K. et al., 2025. *Viable business models for city logistics: exploring the cost structure and revenue streams of fourteen European cases*. Transportation Research Procedia. 2025; 82:3889-3899.

[17] Xu, X., He, Y., Ji, Q. *Collaborative logistics network: a new business mode in the platform economy*. International Journal of Logistics Research and Applications. 2022; 25(4-5): 791-813.

[18] Macário, R., Galelo, A., Martins, P. M. *Business Models in Urban Logistics*. Engineering and Development, Universidad del Norte. 2008; 77-96.

[19] Gevaers, R., Van de Voorde, E., Vanelslander, T. *Characteristics and typology of last-mile logistics from an innovation perspective in an urban context*. In: City Distribution and Urban Freight Transport. Edward Elgar Publishing, Chapter 3. https://EconPapers.repec.org/RePEc:elg:eechap:14398_3, accessed on 2025-03-28.

[20] Amit, R., Zott, C. *Value creation in e-business*. Strategic Management Journal. 2001; 22(6–7): 493–520.

[21] Chesbrough H., Rosenbloom R.S. *Role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies*. Industrial and Corporate Change. 2002; 11(3):529–555.

[22] Johnson, M.W., Christensen, C.M., Kagermann, N. *Reinventing your business model*. Harvard Business Review. 2008; 86(12):50–59.

[23] Magretta, J. *Why business models matter*. Harvard Business Review. 2002; 80(5):86–92.

[24] Ranerup, A., Zinner Henriksen, H., Hedman, J. *An analysis of business models in Public Service Platforms*. Government Information Quarterly. 2016; 33:6-14.

[25] Teece, D.J. *Business models, business strategy and innovation*. Long Range Planning. 2010; 43(2-3): 172-194.

[26] Al-Debei, M.M., Avison, D. *Developing a unified framework of the business model concept*. European Journal of Information Systems. 2010; 19(3):359–376.

[27] Mason K. Spring M. *The sites and practices of business models*. Industrial Marketing Management. 2011; 40:1032–1041.

[28] Camponovo, G., Pigneur, Y. *Business model analysis applied to mobile business*. In: Proceedings of the Fifth International Conference on Enterprise Information Systems (ICEIS). Angers, France, 23 April 2003, 173-183.

[29] Micheli, P., Schoeman, M., Baxter, D., Goffin, K. *New business models for public-sector innovation: Successful technological innovation for government*, Research-Technology Management. 2012; 55(5):51-57.

[30] Casadeus-Masanell, R. Ricart, J.E. *From strategy to business models and onto tactics*. Long Range Planning. 2010; 43(2–3): 195–215.

[31] Osterwalder, A., Pigneur, Y., Tucci, C.L. *Clarifying business models: Origins, present, and future of the concept.* Communications of the Association of Information Systems. 2005; 16:1-25.

[32] Morris M., Schindehutte M., Allen J. *The entrepreneur's business model: toward a unified perspective.* Journal of Business Research. 2005; 58(6):726–735.

[33] Wirtz, B.W., Pistoia, A., Ullrich, S., Göttel, V. *Business models: Origin, development and future research perspectives.* Long Range Planning. 2016; 49(1): 36–54.

[34] Zott C., Amit R. *Business model design: an activity system perspective*. Long Range Planning. 2010; 43(2–3):16–226.

[35] Liao, F., Molin, E.J.E., Timmermans, H.J.P., van Wee, B. *The impact of business models on electric vehicle adoption: A latent transition analysis approach.* Transportation Research Part A: Policy and Practice. 2018; 116: 531–546. https://doi.org/10.1016/j.tra.2018.07.008

[36] Glasbergen, P. *Understanding Partnerships for Sustainable Development Analytically: The Ladder of Partnership Activity as a Methodological Tool*. Environmental Policy and Governance. 2011; 21(1): 1–15.

[37] Van de Ven, A.H. *Academic-practitioner engaged scholarship*. Information and Organization. 2018; 28: 37-43.

[38] Wise, E., Lorentz Hjorth, C., Scott, K. *Strengthening governance of place-based ecosystems – Lund model for innovation ecosystem portfolio tracking* (LIEPT). In: University Industry Innovation Network Congerence, Budapest, Hungary, May 2023.

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