

Senator

Smart network operator platform enabling shared, integrated and more sustainable urban freight logistics

**D6.7 Business Models Canvas and CBA
Analysis Report 2 (Public)**



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List of abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
BIDs	Business Development Districts
CONDOR	Customer order and Network Density OptimiseR
e.g.	Exempli gratia
ESG	Environmental and Social Governance
ETAs	Estimated Time of Arrival
GIS	Geographic Information System
HGV	Heavy Goods Vehicle
KER	Key Exploitable Result
ICT	Information and Communications Technology
i.e.	Id est
IT	Information Technology
KPI	Key Performance Indicator
LGV	Light Goods Vehicle
LEZ	Low Emission Zone
NTA	National Transport Authority
ORION	On-road Integrated Optimisation and Navigation
PM	Particulate matter
RTD	Research and Technological Development
SCOT	Supply Chain Optimisation Technologies
UCC	Urban Consolidation Centre
UFT	Urban Freight Transport
ULL	Urban Living Lab
UPS	United Parcel Service

Executive Summary

1 Introduction

This report is the third deliverable from Task 6.2 Emergent Business Models for the ‘on-demand’ economy and is the final version of the Business Plan for the SENATOR Platform.

This SENATOR Business Model describes the rationale for how an organisation that owns the SENATOR Platform can create, deliver and capture value based on quantified evidence based on the results from the Urban Living Labs. It also includes information on estimated costs and the profitability of running such a business – called “SENATOR Inc” for the purposes of this report.

2 The product: summary of the SENATOR Platform

Given the business-focussed nature of this report, the description of the SENATOR Platform - the ‘product’ that would be offered to the market - is summarised in terms of its Services Layer which provides the business functionality that would be perceived by users:

- On-demand Platform Manager
- Multimodal Fleet Manager
- Smart Routes Manager
- Diagnosis of Urban Infrastructure

The key sources of added value at a strategic level provided by the SENATOR Platform compared to in-house platforms operated by individual Transport Providers in urban areas is that the software allows collaboration between logistics operators to collectively optimise delivery routes and minimise their costs and environmental impacts. It also places more emphasis on the potential role of city authorities in facilitating sustainable urban logistics, including the ability to test the impact of potential regulatory interventions on the logistics efficiency of a city.

3 Value generated by the SENATOR Platform: Dublin Urban Living Lab

The results from the Dublin ULL suggest that the adoption of consolidation in the centre of Dublin would result in an increase in the transport costs incurred by the parcel operators of an average of €0.04 per parcel; this is due principally to the charge that would need to be made to cover the cost of operating the consolidation centre. However, the consolidation of the deliveries into a smaller number of vehicles carrying out ‘last mile’ deliveries in the city centre reduces the vehicle kilometres required and therefore results in a reduction in environmental emissions and traffic congestion. This can be translated into a quantified non-user benefit of €0.08 per parcel.

Overall, therefore, there is a net quantified benefit from consolidation of €0.04 per parcel with a €0.08 per parcel benefit to wider society but a €0.04 additional cost per parcel for the parcel operators.

4 Value generated by the SENATOR Platform: Zaragoza Urban Living Lab

Evidence from the Zaragoza ULL shows that implementation of the routing suggested by the Platform would lead to a 32% reduction in vehicle kilometres and a 6% reduction in the vehicle time required. This led to an estimated benefit (cost reduction) of €0.45 per parcel delivered.

In addition, testing of the SENATOR Platform in Bilbao shows that implementation of the routing suggested would lead to a 48% reduction in vehicle kilometres and a 26% reduction in the vehicle time required. This led to an estimated benefit (cost reduction) of €1.36 per parcel delivered.

5 SENATOR Business Model based on canvas methodology

The SENATOR Business Model adopts the business model canvas methodology, which is a strategic management template for documenting a new business model that was developed by Business Model Foundry AG in Austria.

The canvas summarises all the elements of a company’s business model, including its Value Proposition (its products and services and how they add value), along with its customers (Customer Segments), how the company relates to them and delivers the product/service

(Customer Relationships and Channels). It also highlights the Key Activities required to deliver the Value Proposition and the human, physical and digital resources (Key Resources), as well as the financial resources (Revenue and Costs) that would be required to run the company.

1 Introduction

1.1 Objective of Report

This report is the third deliverable from Task 6.2 Emergent Business Models for the ‘on-demand’ economy and is the final draft of the Business Plan for the emerging SENATOR Platform. This final SENATOR Business Model describes the rationale for how an organisation that owns the SENATOR Platform can create, deliver and capture value.

It sets out the physical/operational business models that are being tested within the SENATOR Urban Living Labs in Dublin and Zaragoza and how the emerging SENATOR Platform can add value to these physical/operational models by, in particular, reducing costs and generating environmental benefits in terms of lower emissions.

It then sets out how a quantitative assessment of value can be carried out, which provides the basis for the SENATOR Platform being developed as a commercial product and provides analysis of data on this value per parcel delivered that has been obtained from the Urban Living Labs.

The report then describes and summarises the potential business model for the SENATOR platform based on the Business Canvass methodology and, finally, the average value per parcel that has been calculated to-date from the ULLs is used to develop a quantified Business Plan for “SENATOR Inc”.

1.2 Working Definitions

Urban freight transport

SENATOR is principally concerned with developing an Information and Communications Technology (ICT) platform that seeks to optimise the physical operations of **urban freight transport (UFT)** and UFT can be defined as:

The movement of goods into, out of, within and through an urban area.

From the point of view of developing a business model for the platform, key considerations relate to the demand for and supply of urban freight transport services and how the demand can be met in a way that minimises costs and maximises benefits for businesses, their customers and for society.

Demand and supply

In economics, **demand** is the quantity of a good or service that consumers are willing and able to buy at a given price in a given time period. The level of demand for particular goods and services is influenced by a number of factors, including necessity, quality, convenience, purchasers income and tastes/fashions.

Urban freight transport is a **derived demand** as the demand for deliveries and collections of freight is the result of demand for goods (which subsequently needs to be transported into an urban area from distant locations) rather than demand for urban freight transport services in their own right. Similarly, demand for the SENATOR Platform is a derived demand, as users will want to use it to reduce their costs or improve the quality of service they receive from transport operators.

Supply, on the other hand, refers to the total amount of a specific good or service that producers are able and willing to make available to customers at a given price. In relation to urban freight transport this generally refers to the amount of freight transport capacity that can be made available to shippers by transport operators. The total supply of freight transport capacity will be defined by the number and size of vehicles such as HGVs, vans or cargo bikes and human resources that operators can make available to shippers at a given price in order to cover their costs and make a profit.

Key types of organisations involved

Shippers are the organisations which physically despatch goods into urban areas as a result of demand from businesses and residents.

The end-customers of the urban freight deliveries are the **receivers** of the goods, whether they are businesses receiving, for example, retail stock or individuals receiving deliveries of e-commerce parcels.

The process of transporting goods into urban areas is undertaken by **transport operators** either directly by shippers (using their own transport fleet) or by specialist logistics service providers on behalf of shippers.

In the market for urban freight deliveries and collections, which is competitive and therefore cost-focused, the main potential users of the SENATOR Platform are Shippers, Receivers and Transport Operators. However, a fourth user is the public sector (generally represented in the context of UFT by the city authorities) for reasons explained in the next section of the report.

1.3 Generic Stakeholder Analysis

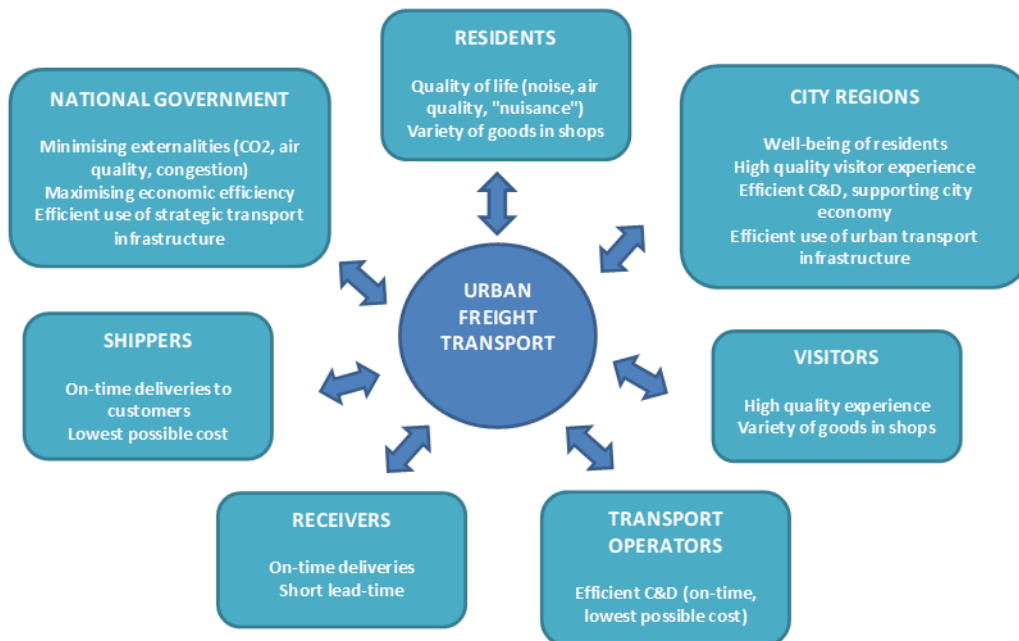
Urban freight transport involves the movement of vehicles in urban areas which generate economic externalities, such as greenhouse gas and pollutant emissions, congestion and noise, the latter being a particular issue if deliveries and collections are being made at night. These issues cause concern for residents in urban areas and for the city authorities that are responsible for environmental regulation and transport policy.

At the same time, however, residents want to have a wide range of goods available in the local shops, to visit bars and catering establishments and to receive e-commerce parcels at their homes or offices. They would also recognise that freight transport activity generates employment, as well as supporting city economies by providing an efficient low cost service. Taking these different perspectives into account, it is important that the regulatory/policy regime reflects the interests of local residents, as well as the private and commercial interests of the private sector freight transport industry.

The different expectations of the various actors in relation to urban freight transport can be described through stakeholder analysis, which categorises the different groups of people and organisations with an interest in the subject and highlights their different expectations.

The figure below shows the main stakeholder groups that are affected by freight transport in cities, with their main expectations. In very general terms, residents and visitors are seeking a high quality of life/experience ('quality of place'), while transport operators and their customers have a strong interest in achieving low cost, on-time deliveries. Having said that residents and visitors are also becoming increasingly aware of the impact of climate change and the impact they themselves have on carbon emissions as consumers; and many shippers are becoming increasingly conscious of their environmental and social responsibilities as well as the need to generate profits for their shareholders.

Figure 1.1: Urban Freight Transport – Key Stakeholders



These different stakeholder expectations can result in conflicts that need to be resolved through trade-offs between the private needs of the freight transport industry and its customers and public needs (improved air quality, lower congestion etc.) through the intervention in the market by city authorities. In economic terms, where the costs of private activities (so-called external costs) are not fully reflected in the user costs of the freight industry and their customers, there is market failure; the public sector therefore has a role in seeking to balance the needs of the private operators with the wider needs of society.

Where the SENATOR Platform facilitates a reduction in external costs (e.g. reduced carbon emissions or improved air quality through optimisation of the use of the logistics network capacity/resources and a reduction in vehicle kilometres within the urban area) or provides other more qualitative benefits such as enhancing the 'quality of place' on behalf of society, the relevant City Authority is a further potential beneficiary and therefore user of the Platform.

Split of costs and benefits

The above analysis of stakeholders highlights that any Business Model for the SENATOR Platform needs to take into account a number of different potential users which will be seeking to secure different benefits from the platform, while also potentially incurring

additional costs. The appropriate sharing of the costs and benefits between these different stakeholders to provide the required incentives will be crucial to the commercial success of the SENATOR Platform.

1.4 The theoretical value proposition for the SENATOR platform

The business model for the SENATOR Platform has to be based on the software creating value for a potential user by:

- Reducing the user's financial costs, which can usually be quantified and should be 'tangible' for the user because they are experienced through a reduction in financial costs. In the context of SENATOR and its functionality, these cost reductions would be most relevant to Transport Operators;
- Reducing the user's non-financial (or external) costs, which can usually be quantified and which are less tangible because they are not experienced in financial terms but only in the form of reductions in congestion for other road users and reductions in carbon emissions etc. In the context of SENATOR and its functionality, these cost reductions would be most relevant to City Authorities (or to an independent organisation that is operating on behalf of the public interest in a particular city);
- Improving the quality of service provided for the user, which may be quantifiable or may be relatively intangible (and therefore unquantifiable); this might help a Transport Operator to generate more demand and revenue compared to its competitors and therefore increase profitability. Quality of service benefits can be difficult to quantify for the Transport Operators, particularly because the Shippers or Receivers of the goods may not be able to willing to quantify their value in monetary terms.
- Providing wider economic benefits, particularly in terms of greater employment; the potential impact on employment is difficult to assess; where the SENATOR Platform increases the efficiency of urban logistics it may reduce the amount of resources required (including labour), while also potentially leading to some additional employment involved in using the SENATOR Platform.

A rational user will calculate the value generated as a direct result of using the software by comparing the WITHOUT SENATOR scenario with the WITH SENATOR scenario. This value generated is the theoretical maximum that the user should be prepared to pay for the SENATOR Platform, but normally the value would be shared between the user of the software and the provider. It is likely that SENATOR Inc would only be able to secure a small proportion of the total value because of the intangible nature of the link between the use of the software and being able to secure practical benefits.

The value generated for a particular user (in both quantitative and qualitative terms) is called the Value Proposition in the Business Model Canvas methodology that is being used by this project. For the reasons explained above, the analysis of the Value Proposition for the SENATOR Platform is focused on the user and non-user benefits from its use – rather than quality of service and wider economic benefits.

The following sections of the report will therefore set out the following:

- An outline of the SENATOR ‘product’: the SENATOR Platform itself (section 2);
- A description of the WITHOUT SENATOR scenario in each of Zaragoza and Dublin and then a comparison with the WITH SENATOR scenario to highlight the extent to which value is generated for potential users (sections 3 and 4);
- The results of the application of the Business Model Canvas methodology to SENATOR as a whole, based on the lessons learned from the Urban Living Labs in relation to the Value Proposition (sections 5) and then in terms of a quantified Business Plan for SENATOR Inc (section 6).

2 The product: summary of the SENATOR Platform

Given the business-focussed nature of this report, the description of the SENATOR Platform, which is the ‘product’ that would be offered to the market, is summarised in terms of its Services Layer. This layer provides the business functionality that would be perceived by users, without providing additional technical detail¹.

The four main services SENATOR has been designed to provide, and their functionality, are described below.

SENATOR service	Functional description	Main users
On-demand Platform Manager	- To integrate the demand for shipments coming from different sources (principally from Shippers and controlled by Transport Providers) - To match the demand from Shippers and Transport Providers with the offer made available by all Transport Providers available at that time on the SENATOR Platform	Shippers, Receivers & Transport Providers
Multimodal Fleet Manager	- Aggregates the information of logistics companies and transport agents that would participate in SENATOR as service providers (Transport Providers), such as the available vehicles, their characteristics and capacity/capability - Plans delivery routes taking into the demand and its features (e.g. level of service, user preferences, etc.), the fleet characteristics and available logistics services, as well as restrictions and preferences of authorities and managers. - Assists the operators of Urban Consolidation Centres (UCCs) in consolidating orders and preparing the departure of delivery routes	Transport Providers, including operators of the UCC

¹ Available in deliverable D3.6 SENATOR ICT platform integration and services implementation.

Smart Routes Manager	• The monitoring of delivery routes in real-time (e.g. location of vehicles, the status of consignments, etc.) • The monitoring of incidents that may affect the normal course of delivery routes • The load balancing of operators in cases of incidents that significantly affect the delivery of shipment • Monitoring of the status of the infrastructure in real-time (e.g. traffic, loading bays, etc.)	Transport Providers
Diagnosis of Urban Infrastructure	• Monitoring and management of urban infrastructure involved in last-mile logistics (e.g., traffic, low emission zones, loading bays, etc.); • Monitoring and management of incidents related to urban infrastructure	City Authorities

The services are designed to be provided to the different users via a web application, a mobile application and a web-based dashboard of KPIs, along with appropriate Application Profile Interfaces (APIs) to allow different ICT systems to communicate with each other. For example, while the manager of a Transport Operator is likely be using the web application to make capacity available in the Multimodal Fleet Manager, its delivery drivers are more likely to be using the mobile application to follow a route to make the deliveries and the City Authority is most likely to be using the Dashboard to view KPIs on estimated levels of carbon dioxide that are being generated.

The source of key added value at a strategic level provide by the SENATOR Platform compared to in-house platforms operated by individual Transport Providers in urban areas are likely to be as follows:

- The ability to collaborate by transferring information between different operators to reduce costs and environmental emissions;
- The ability for demand to be met in a multimodal manner, whether by electric LGV, e-cargo bike or by walking depending on the choice of the user; these choices could, for example, be to minimise costs or minimise carbon emissions.

The next section of the report considers the Value Proposition in a specific case, that of the Urban Living Lab in Dublin.

3 Potential value generated by the SENATOR Platform: Dublin Urban Living Lab

3.1 Introduction

Dublin is a major European capital city located on the east coast of Ireland. In 2018 it was designated as a global city by academics due to its status as a significant hub within the international economic and social system. The Greater Dublin Area, which encompasses the city of Dublin and its surrounding commuter hinterland, is estimated to have a population of 2.1 million. The city developed historically on the River Liffey at the mouth of which is the Port of Dublin, Ireland's largest port.

From the point of view of 'last mile' freight deliveries, most distribution centres are located close to the M50, the city's orbital motorway which circles around the city to its west. Goods are then transported into the city centre by all but the largest HGVs; the latter are banned to avoid freight to and from the port transiting the city centre rather than using the Port Tunnel, which is the start of the M50, linking the port under the city centre to the northern side of the city near Dublin Airport.

3.2 Stakeholder workshop

In May 2022 a stakeholder workshop was organised by Dublin City Council and AnPost to discuss the concept of a UCC for parcel deliveries in central Dublin. As well as some key public sector stakeholders, such as the Department of Transport and the National Transport Authority, a number of parcel operators and couriers attended.

The workshop allowed the key frustrations and pain points for deliveries in central Dublin to be highlighted by all stakeholders, which could act as an incentive to collaborate on 'last mile' distribution; these were defined as the amount of vehicle traffic and congestion which reduces operational efficiency and the difficulty in finding legal parking spaces in the city to make deliveries.

The workshop also highlighted the key barriers to collaboration in 'last mile' deliveries by means of consolidation, which were defined as:

- The cost: consolidation leads to additional costs in the door-to-door transport chain, which would need to be recovered or mitigated;

- Trust: the different operators compete with each other on price and service quality and the operators of the 'last mile' delivery service based on consolidation might gain a greater understanding of competitors' customer relationships; in addition, each of the operators would need to trust the 'last mile' operator to provide a high quality service for their customers.
- IT: each of the operators has its own IT system, which would require integration with that of the 'last mile' operator

Following the stakeholder workshop, a number of follow up meetings took place with logistics companies operating in Dublin to discuss collaboration for a trial of a UCC for central Dublin. Ultimately, the key barriers to collaboration could not be overcome and no agreement could be reached between the operators to co-operate within the SENATOR project. Instead, AN Post agreed to carry out theoretical simulations of what could be achieved if a greater level of collaboration was possible. The Dublin ULL also developed public policy scenarios to test by using the SENATOR Platform, so that a baseline counterfactual could be compared with these scenarios and the likely impact could be determined. This was, in essence, using the SENATOR platform as a strategic planning tool or an urban freight transport model.

In parallel, Dublin City Council has undertaken work to map the location of legal opportunities for freight vehicles to park in Dublin and this information can be provided as an input to a SENATOR Platform in Dublin to assist in planning routes.

3.3 Urban Consolidation Centre solution – WITHOUT SENATOR

One solution that was tested in Dublin using the SENATOR Platform was the development of a theoretical UCC with a 'last mile' delivery service operated by AnPost using electric vans and e-cargo bikes in central Dublin.

The theoretical consolidation concept would work as follows:

- HGVs belonging to multiple parcel operators would deliver consignments of parcels that are destined for central Dublin from their fulfilment centres near the M50 to the designated UCC on the outskirts of the city centre;
- The UCC operator would consolidate the consignments before loading them into electric vans or e-cargo bikes for onward delivery; and
- Electric vans or e-cargo bikes would be despatched into the city centre to complete the final deliveries.

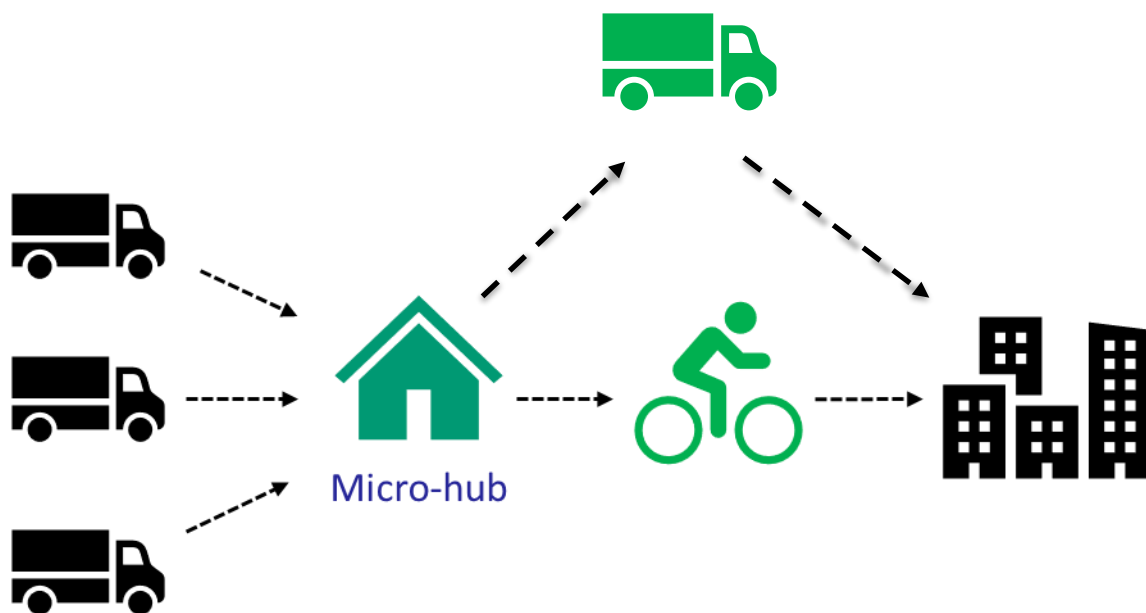


Figure 3.1: Potential logistics chain in Dublin

Without SENATOR (or a similar system) such an operation is unlikely to be possible because:

- The inbound parcel operators (Transport Providers) would want to have a digital record of when their consignments had been handed over to the ‘last mile’ operator at the UCC for reasons of security, insurance and liability claims.
- The inbound parcel operators (Transport Providers) would require a record of when the consignments had been delivered to the receivers; again, this would be to ensure the security of the consignments, to meet insurance requirements and to minimise issues over liability for the goods.
- The planning of the routing could be carried out ‘manually’, based on the knowledge of the staff of the ‘last mile’ Transport Provider in central Dublin, but it would be relatively inefficient as it would take time to carry out the planning exercise while the delivery vehicles would be stationary and therefore under-utilised.
- Receivers want to know when their parcels are going to be delivered and be able to track the delivery in order to plan for its arrival and avoid wasting time waiting for it

or missing the delivery. This is more difficult when the inbound Transport Provider is handing over responsibility for the final delivery to another operator.

- The inbound Transport Provider and the 'last mile' Transport Provider both want the Receiver to know when the delivery will take place to avoid a failed delivery, which increase their costs as a re-delivery has to be organised.

Overall, this suggests that for the WITHOUT SENATOR scenario, the 'last mile' delivery service might not be feasible without a suitable IT system. This conclusion is supported by the outputs of the workshop in Dublin in May 2022, when the issue of IT integration was raised as an issue that needed to be resolved.

3.4 Urban Consolidation Centre solution – WITH SENATOR

Introduction

The WITH SENATOR scenario would allow for the theoretical consolidation and 'last mile' delivery service to be feasible as described above by providing software to coordinate and plan deliveries that were originally sold by several different inbound Transport Providers but carried out in practice by a single 'last mile Transport Provider using electric vans or e-cargo bikes into central Dublin.

The UCC operations would incur some additional costs related to the operation of the UCC itself, which is required for the physical transfer of parcels between the inbound Transport Provider and the 'last mile' Transport Provider. The cost of the 'last mile' delivery would also need to be covered.

However, the benefits of the service would be as follows:

- Potential efficiencies would be available elsewhere in the supply chain (generating cost savings for the inbound Transport Provider), due in particular to the inbound Transport Provider being able to avoid its vehicles having to drive into the city centre and carry out the deliveries, so that they are available to carry out other work (or to potentially reduce overall fleet size);
- Continuing choice of providers for Receivers because all Transport Providers are able, indirectly, to offer a last mile delivery service into central Dublin;
- Environmental benefits would be secured for society through the zero emission last mile service (principally lower greenhouse gas emissions, improved air quality and

adding to the quality of place in the city centre); these benefits would be perceived by, in particular, City Authorities on behalf of their populations;

- Potential ESG (Environmental and Social Governance) benefits for Shippers and Transport Providers in terms of helping them to monitor and demonstrate that they are working towards meeting their carbon reduction targets and generally embedding sustainability more holistically into their corporate culture.

The inbound Transport Provider would be likely to secure cost efficiencies through:

- Not having vehicles and drivers tied up in central Dublin to make the deliveries (reduction in fixed costs); and
- The reduced distance travelled (a reduction in variable, distance-based, costs) for the vehicles. The vehicles are able to avoid central Dublin and carry out deliveries and collections in other areas of the city.

At the time of completion of this draft Business Plan, the analysis of the results of the scenarios was underway and so the final results were not available. The results will be incorporated into the final version of the SENATOR Business Plan once the quantified impacts are available.

3.5 Results from the Dublin simulation

Introduction

The simulations in Dublin were carried out using synthetic data for the deliveries by AN Post and other parcel operators of varying market shares in Dublin. Among the various scenarios developed and simulated using the SENATOR Platform in Dublin was the use of a consolidation centre, so that the operators in effect collaborated to make the last mile deliveries by passing their parcels to a single operator for final deliveries via a physical consolidation centre. For the purposes of calculating the value of the SENATOR Platform, the results of this scenario was compared with the baseline without SENATOR for an average or “medium” day in terms of the number of parcels, rather than a peak period.

The door-to-door transport costs (or user costs) for both the WITHOUT SENATOR scenario (i.e. direct delivery by each parcel operators to receivers in the city centre) and the WITH SENATOR scenario (including the transport of the parcels by each operator to the consolidation centre, the cost of cross-docking the parcels via the consolidation centre and then making the final deliveries in the city centre) were compared.

Similarly, the door-to-door distances were used to make an estimation of the quantified environmental impacts of the WITH versus WITHOUT SENATOR scenarios.

Estimated benefit from use of the SENATOR Platform in Dublin

	WITH SENATOR (consolidation)	WITHOUT SENATOR (direct delivery)
Number of parcels delivered	2,503	2,515
Total transport (user) costs	€8,263	€8,209
Average cost per parcel	€3.30	€3.26
Average user benefit per parcel	-€0.04	
Total km	698	1,008
Km per parcel	0.28	0.40
Average km saved per parcel	0.12	
Average non-user benefit per parcel	€0.08	

The results suggest that the adoption of consolidation in the centre of Dublin would result in an increase in the transport costs incurred by the parcel operators of an average of €0.04 per parcel; this is due principally to the charge that would need to be made to cover the cost of operating the consolidation centre. However, the consolidation of the deliveries into a smaller number of vehicles carrying out ‘last mile’ deliveries in the city centre reduces the vehicle kilometres required and therefore results in a reduction in environmental emissions and traffic congestion. This can be translated into a quantified non-user benefit of €0.08 per parcel.

Overall, therefore, there is a net quantified benefit from consolidation of €0.04 per parcel with a €0.08 per parcel benefit to wider society but a €0.04 additional cost per parcel for the parcel operators.

4 Potential value generated by the SENATOR Platform: Zaragoza Urban Living Lab

4.1 Introduction

Zaragoza is the capital of Aragon and is located in the North East of Spain. The city has a population of 0.7 million. The city developed historically on the banks of the River Ebro and was originally an Iberian tribal village and then a Roman town. Zaragoza is a heritage city, with some of the buildings forming part of the Mudéjar architectural style in Aragon, which has been recognized as a World Heritage Site by UNESCO.

From the point of view of ‘last mile’ freight deliveries, Zaragoza is an Urban Living Lab within the SENATOR project which tests two main concepts:

- Allowing two different parcels networks (Correos and Correos Express) with separate physicals networks and IT systems, to share capacity and then seek to minimise environmental emissions and costs when delivering parcels in the city. This allows, for example, the switching of parcels between vehicles at ‘virtual hubs’² to increase efficiency both in theory and, in practice, physically.
- Allowing market traders at Local Markets to jointly use a temperature controlled delivery service (provided by Correos, but branded as SENATOR) from the market to their customers. Subject to there being sufficient demand, the customers would be able to order their fresh produce using an e-commerce website (developed by the city council to facilitate e-commerce activity for stallholders at local markets) which could then be integrated with the SENATOR Platform, so that it receives data on the consignments that have been ordered for delivery.

² Where vehicles operated by two different Transport Providers transfer parcels between them in suitable locations ‘in the street’, rather than at a fixed location such as a warehouse.

4.2 Fresh produce delivery solution – WITHOUT & WITH SENATOR

WITHOUT SENATOR

At present the market stall holders selling fresh produce in the San Vicente de Paul local market in Zaragoza may have regular customers for whom they make deliveries using their own vans, which are likely to be parked adjacent to the market. Customers can order their deliveries on the telephone, but then the stall holder has to have a member of staff available to make the delivery with their van.

In practical terms, without the SENATOR platform the following physical operations would occur:

- The customer (the final Receiver) telephones the market stall holder (Shipper) to place an order;
- The market stall holder (Shipper) makes up the order and sends a member of staff to deliver it to the Receiver using their own van.

This means of operation is feasible, but may be sub-optimal for the stallholder (Shipper) and for wider society for a number of reasons:

- The stall holder has to have a van available and a member of staff has to be deployed to make the delivery;
- As all the stall holders may be offering the same service, many van journeys will be required to serve all their customers. The volume of movements generated leads to higher volumes of traffic and therefore greater traffic congestion and environmental emissions for the city.

WITH SENATOR

In order to offer a cost effective service to all the fresh produce stall holders, the SENATOR service needs to make maximum use of digital technology. This would involve:

- The customers (Receivers) placing their orders online using an e-commerce system provided by the city;
- The stall holders (Shippers) accepting the orders via the e-commerce system and making up the orders, with details of the orders being sent to the SENATOR Platform;
- The 'last mile' Transport Provider delivers all the fresh produce orders to the Receivers in a consolidated load and following a route which is optimised by the Platform.

The 'last mile' Transport Provider (or the city authority or market itself, depending on the circumstances at each market) would incur some additional costs related to the operation of the centralised cold storage at the local market and the operation of the refrigerated van deliveries.

The benefits of the service would be as follows:

- Potential efficiencies available for several different Shippers (fresh produce stallholders) in that they do not have to devote their vans and drivers to make 'last mile' deliveries; they can therefore focus on serving their immediate customers at the market.
- Potential increase in demand for the Shippers as a result of making their produce available on-line via an e-commerce system, with deliveries facilitated by the SENATOR 'last mile' service;
- Potential, in the longer term, for the Shippers to avoid having their own vans, as long as their inbound supplies can be delivered to them;
- Potential reduction in the number of loading/unloading bays because the fleet is common and optimised;
- The environmental benefits secured for society through the reduction in van movements and the use of zero emission vehicles for consolidated deliveries (principally lower greenhouse gas emissions, improved air quality and adding to the quality of place in the city centre).

At the time of completion of this draft Business Plan, not all of the results from the Zaragoza ULL were available and so only partial results were available for use in quantifying the value proposition for SENATOR. The final results will be incorporated into the final version of the SENATOR Business Plan once all the quantified impacts are available.

4.3 Results from the Zaragoza & Bilbao Pilot

Introduction

The first simulations carried out with the SENATOR platform were undertaken using Correos data for delivery routes in pilots which were carried out in Bilbao and Zaragoza. As well as Zaragoza, Bilbao was used as a case study because it allowed the technical team which was using the SENATOR Platform (Deusto in Bilbao) to more readily understand the geography of the baseline situation and the results from use of the Platform.

In Bilbao, data on deliveries carried out in two specific days were used. Each day contained three routes covering three areas or regions of Bilbao: one route in the city centre and one on each bank of the Nervión river estuary. In total, 147 shipments of refrigerated orders were

delivered along the three routes in Bilbao. In Zaragoza, data covering three routes in the city centre was also used for the delivery of 128 shipments in total.

The baseline routes were initially specified by the customer of Correos in both Bilbao and Zaragoza and then compared with the optimized routes using the SENATOR platform. The data outputs from the pilot were broken down by start and end times; total time spent; number of stops; number of parcels; total distance in kilometres; parcels delivered per hour; and parcel per kilometre. This allows for comparisons across metrics which influence transport costs.

This pilot quantified the potential benefits to be gained from using SENATOR as a route optimization tool and thus identified ways that transport operators can reduce kilometres and time spent delivering goods. In this way, their efficiency (number of parcels per kilometre travelled) and productivity (parcels delivered per hour) are improved. User benefits here are defined as reductions in transport operator's costs. Non-user benefits are reductions in negative impacts of freight transport which consist of environmental emissions, noise, and road accidents.

Results for Bilbao

In Bilbao in the baseline counterfactual, the three vehicles leave the Correos operating unit to collect the shipments from the customer's facilities and then begin delivery along their routes assigned by the customer.

Two scenarios were then modelled using SENATOR with differences in how morning and evening shifts are organized. Results from both scenarios showed reductions in kilometres travelled and overall time spent, with improvements in the parcel per kilometre and parcel per hour calculations. The optimal scenario tested led to a 48% reduction in vehicle kilometres and a 26% reduction in the vehicle time required. This led to a total user benefit to the Transport Operator for the three routes of almost €200, which represented an estimated benefit (cost reduction) of €1.36 per parcel delivered, as shown below.

Estimated benefit from use of the SENATOR Platform in Bilbao

	LGV distance (km)	LGV time (hours)
Original (BEFORE SENATOR)	347km	26.3 hours
Optimised (AFTER SENATOR)	181km	19.4 hours
Benefit from SENATOR (saving)	166km	6.9 hours
User benefit from SENATOR (€)	€0.18/km x 166km = €29.88	€24.59/hr x 6.9 hours = €169.67
Total user benefit from SENATOR	€199.55	
Average user benefit from SENATOR per parcel	€199.55/147 parcels = €1.36/parcel	

Results for Zaragoza

In Zaragoza, one scenario uses SENATOR to optimise the delivery routes, similar to that undertaken in the Bilbao pilot whereby three vehicles leave the Correos operating unit, arrive at the customer's facilities to load the orders and begin delivery along their respective routes.

The SENATOR Platform was then used to see if it was possible to optimize the routes, with the routes broken down into morning and afternoon shifts.

Two scenarios were also modelled whereby one vehicle picks up shipments from the customer, arrives to the San Vicente de Paul market where shipments are broken and consolidated to three vehicles which then begin the three routes of delivery. Both scenarios are similar with the only difference being the start time whereby the second scenario begins 30 minutes later than the first scenario.

The optimal scenario tested led to a 32% reduction in vehicle kilometres and a 6% reduction in the vehicle time required. This led to a total user benefit to the Transport Operator for the three routes of about €60 which represented an estimated benefit (cost reduction) of €0.45 per parcel delivered.

Estimated benefit from use of the SENATOR Platform in Zaragoza

	LGV distance (km)	LGV time (hours)
Original (BEFORE SENATOR)	313km	25.5 hours
Optimised (AFTER SENATOR)	212km	23.9 hours
Benefit from SENATOR (saving)	101km	1.6 hours
User benefit from SENATOR (€)	€0.18/km x 101km = €18.18	€24.59/hr x 1.6 hours = €39.34
Total user benefit from SENATOR	€57.52	
Average benefit from SENATOR per parcel	€57.52/128 parcels = €0.45/parcel	

5 Preliminary SENATOR Business Model based on canvas methodology

5.1 Introduction

Following on from the development of the understanding of the SENATOR Platform's value to its potential customers through analysis of the Urban Living Labs, this section of the report develops a Business Model for an entity (probably a company) which would seek to commercialise the platform in the future.

The Business Model adopts the business model canvas methodology, which is a strategic management template for documenting a new business model that was developed by Business Model Foundry AG in Austria. It summarises in a visual way all the elements of a company's business model, including its Value Proposition (its products and services and how they add value), along with its customers (called Customer Segments), how the company relates to them and delivers the product/service (Customer Relationships and Channels). It also highlights the Key Activities required to deliver the Value Proposition and the human, physical and digital resources (Key Resources), as well as the financial resources (Revenue and Costs) that would be required to run the company.

5.2 Competition

Introduction

Once commercialised, "SENATOR Inc" would be operating in a competitive market place where software is already available to allow the "last mile" deliveries of parcels to be carried out in an efficient manner. Some of the software that is available – starting with what the market leader has developed and uses - is described in outline below, along with a conclusion on where the prototype SENATOR Platform might have a competitive advantage.

Optimisation software used by Amazon

Amazon uses software called Supply Chain Optimisation Technologies (SCOT) to manage its demand forecasting, inventory placement and fulfilment for the efficient execution of its deliveries at scale, but then uses CONDOR (Customer order and Network Density Optimiser) to optimise delivery routes in real time by constantly reassessing orders to minimise travel distances at scale. The Amazon software uses AI and machine learning to analyse real-time

data such as traffic conditions, order clustering and customer proximity to plan optimal delivery routes for its delivery rivers.

The three main areas of optimisation for deliveries in order of priority are:

- Delivery reliability and speed, ensuring parcel delivery is on time;
- Distance and Transportation costs, minimising travel distances to reduce transport costs; and then
- Environmental impact, seeking to reduce carbon emissions by optimising routes and consolidating deliveries, supporting Amazon's Climate Pledge and its goal to achieve net- zero emissions by 2040.

The software was developed in house and is not available for external use or for sale to another entity. The software is effectively bespoke to the specific scale and logistical needs of Amazon's business. However, whilst the software is not available for purchase or use by another entity, Amazon's software is available for use by businesses for which Amazon sells and then carries out deliveries. It is also used by a large number of delivery operatives who are not directly employed by Amazon but are required to use the route optimisation software.

Other parcel operators

Federal Express (FedEx) relies on advanced route optimisation software which is also integrated with machine learning and real time data analysis. The FedEx software factors in traffic, weather and delivery density as well as package volume to create efficient routes.

UPS has software called ORION (On-road Integrated Optimisation and Navigation) which optimises delivery routes in real time. UPS offers their WorldShip windows based software which gives access to the complete portfolio of UPS small parcel and freight services. It has built in reporting and shipping profiles. Worldship also provides automation and integration features such as offline shipping as well as access to aggregation services such as UPS Trade Direct.

ROYAL MAIL has an internal system called delivery route optimiser and also owns a subsidiary called Storefeeder which has software that streamlines picking, packing, and dispatch of parcels with software that adapts to multiple warehouses and stock locations.

Third Party Platforms

There are also third party delivery software packages available for use, such as MyRouteOnline, EasyRoutes or Circuit. These platforms plan, optimise and assign routes whilst adapting to last minute changes with live tracking and route management. The software allows drivers to share proof of delivery and provide automatic recipient notification along with ETAs and tracking.

Circuit, for example, supports automatic importing of delivery data via Excel spreadsheets and can be integrated with an API, Shopify, Zapier. Circuit also provides delivery analytics.

Conclusion

In summary, most if not all of the large parcel operators use software which utilizes AI and machine learning, using real time data such as traffic conditions to plan and optimise routes for their delivery drivers. The software aims to achieve on time delivery success, minimise transport costs by finding the most efficient route and also reducing carbon emissions by bundling orders by proximity. These providers can offer their shipping services to businesses however do not offer the software they use for deliveries, which can be found through some third-party operators.

This means that there is significant competition in terms of software that is already available in the market place which is focused on optimisation of the routing of 'last mile' parcel deliveries. However, the major parcel operators have their own internal systems, which are designed for their own operations (even if they can receive data from shippers and can also communicate with receivers of parcels).

There are also third party software solutions available which can be purchased, although these appear to be focused solely on an individual logistics operator operations.

The unique selling points for the SENATOR platform would be its focus on:

The ability of the software to allow collaboration between logistics operators to collectively optimise delivery routes and minimise their costs and environmental impacts; and

The greater focus within the SENATOR Platform on the potential role of city authorities in facilitating sustainable urban logistics, including the ability to test the impact of potential regulatory interventions on the logistics efficiency of a city.

5.3 Value proposition

In the development of the Value Proposition for the SENATOR platform, based on the canvas model methodology, there is a focus on the specific jobs ('Customer Jobs') that the Platform can carry out for different 'Customer Segments'. Value is created where the Platform is able to provide benefits to one or more Customer Segments by 'Relieving a Pain' or 'Making a Gain' when a Customer Segment carries out a particular 'Customer Job'.

Customer Segments

As explained in sections 3-5 above the key relevant customer segments identified in the Urban Living Labs and Case Study and catered for by the SENATOR Platform are as follows:

- **Transport Providers**, who are providing a freight transport service to move goods between Shippers and Receivers; this includes the operators of Urban Consolidation Centres and specialist ‘last mile’ Transport Providers.
- **Shippers** of goods that have contracted the Transport Providers to deliver goods in urban areas.
- **Receivers** of goods: the businesses and residents receiving the deliveries in the city centre.
- **City Authorities** (or an independent third party working under contract to the City Authorities), which are concerned with securing wider benefits for society.

Customer Jobs

The SENATOR Platform would need to be able to perform the following required generic Customer Jobs to meet the key requirements of the Customer Segments in relation to deliveries of goods in urban areas. These Customer Jobs are irrespective of any data sharing or collaboration between Transport Operators that might be facilitated by the SENATOR Platform.

Customer Job	Customer Segment
Plan delivery route to minimise costs	Transport Providers
Plan delivery route to minimise carbon emissions	Transport Providers
Re-plan route following an incident (e.g. road traffic accident or vehicle breakdown)	Transport Providers
Inform receivers when delivery likely to be made	Transport Providers & Receivers
Inform shipper when delivery made	Transport Providers & Shippers
Inform shipper and receiver when delivery failed & rescheduled	Transport Providers, Shippers & Receivers
Record costs incurred in making deliveries	Transport Providers
Record environmental emissions in making deliveries	City Authorities, Transport Providers & Shippers

Customer pains & pain relievers

The SENATOR Platform is designed to allow different Transport Operators to collaborate and share data in order to secure benefits for both themselves and for society through operational concepts such as:

- Consolidation of consignments from different Transport Providers at an Urban Consolidation Centre into full loads for delivery by a single Transport Provider using zero emission modes of transport (e.g. Dublin);
- Consolidation of consignments from different Shippers into full loads for delivery by a single Transport Provider using zero emission modes of transport (e.g. Zaragoza local market);
- Transfer of consignments from different Transport Providers to a single or multiple Transport Providers for 'last mile' deliveries using another zero emission mode of transport to avoid regulatory restrictions (e.g. scenarios from the Dublin ULL).

As data sharing and collaboration between commercial operators is required, this creates additional potential 'customer pains' related to lack of information on the services provided by other Transport Providers and a potential lack of trust between Transport Providers which might normally compete with each other. This means these additional potential 'customer pains' need to be addressed, as well as addressing potential customer pains related to the key customer requirements set out under Customer Jobs.

In this context customer gains are usually the same as avoiding a customer pain and, for this reason, only customer pains are shown for each of the four Customer Segments.

Customer pains	SENATOR service	Value creation of SENATOR service
Transport Providers lack visibility of the availability of multimodal services offered by other Transport Providers	Multi-modal Fleet Manager	Transport Provider/Shipper is able to find alternative multimodal services and book the service.
Transport Providers lack visibility of the cost of alternative/multimodal services offered by other Transport Providers	Multi-modal Fleet Manager	Transport Provider/Shipper is able to see the cost of the service on the platform.
Lack of operational coordination between different Transport Providers so that transfers are not possible or lead to delays.	On-demand Platform Manager /Smart Routes Manager	Transport Providers share messages about estimated arrival times of vehicles at transfer points or UCCs.

Wrong goods transferred or incomplete transfer of consignments	On-demand Platform Manager/Smart Routes Manager	Transfer of each consignment recorded and communicated to both Transport Providers and Shipper.
Route planning carried out manually, leading to delays	Multimodal Fleet Manager/ Smart Routes Manager	Plans most efficient route based on delivery addresses for shipments.
Transport Provider carries out deliveries in an inefficient manner (more time and energy required)	Multimodal Fleet Manager & Smart Routes Manager	Plans most efficient route based on delivery addresses for shipments & feedback available on actual versus planned performance.
Transport Provider carries out deliveries in an inefficient manner due to an incident (e.g. road traffic accident, vehicle breakdown)	Smart Route Manager & Multimodal Fleet Manager	Re-plans most efficient route in real-time, including transfer between vehicles.
Receivers do not know when their deliveries are going to arrive	Smart Routes Manager	Provides shipment tracking so that Receivers know the location of their shipment with estimated delivery time.
Inbound Transport Provider and Shipper do not know whether their consignment has been delivered	Smart Routes Manager	Inbound Transport Provider & Shipper notified of successful delivery (or failed delivery).
Inbound Transport Provider & Shippers do not know what has happened to a consignment after a failed delivery.	On-demand Platform Manager	Inbound Transport Provider & Shipper notified of the location of the consignment and re-scheduled delivery time
Shippers & inbound transport Provider does not know whether the correct Receiver has received the shipment.	Smart Routes Manager	Secure identification of the ID of the Receiver during delivery.
City Authority lacks visibility of progress in reducing carbon emissions and other KPIs	Diagnosis of Urban Infrastructure	Data available via a web-based dashboard on KPIs such as estimated carbon & nitrogen dioxide emissions

Customer relationships

In order to market the SENATOR Platform in a particular city it is likely that **personal relationships** will be required with some key users in order to create sufficient critical mass of supply and demand for the Platform to make implementation cost effective. At this stage, the critical first relationship might be with the City Authority to demonstrate that the Platform can secure wider benefits to society by facilitating data sharing and collaboration between Transport Providers to provide a market-based service to Shippers and Receivers in cities. The City Authorities will have some regulatory role and powers, which could be used to encourage the Transport Providers and Shippers to develop a relationship of mutual trust to share data and collaborate to secure wider benefits for society and minimise costs for Transport Providers. The personal relationships could be developed by an in-house business development team or could be outsourced to a network of specialist software distributors.

Once the SENATOR Platform is implemented in a city, the customer relationships should be largely **automated** and it is through the automation that much of the value is created. The SENATOR Platform would facilitate the development of a community of users to secure benefits based on mutual trust, data sharing and collaboration and taking advantage of automated processes to minimise costs.

Channels

Developing **awareness** of the SENATOR Platform is likely to be via an initial approach to City Authorities, such as in Dublin and Zaragoza, to develop communities of potential users in each city and would need to be based on case studies of the practical benefits of implementation that can then be marketed via a website, social media and a press campaign.

In order to allow other potential customers to carry out an **evaluation** of the benefits of the Platform, these case studies would need to include quantified benefits from implementation, such as reductions in costs for identified users and enhanced quality of service KPIs. A simple financial evaluation model might need to be developed to quantify the potential benefits, based on assumed levels of demand in a particular city. The sales process could be carried out by an in-house business development team or could also be outsourced to a network of specialist software distributors.

Purchasing the Platform would probably be based on one or both of two types of charging:

- One-off charge to a City Authority for implementation, where the City Authority takes the demand-side risk and the user community is then developed by the City Authority – perhaps with the assistance of a third party independent contractor - with free access to the Platform based on authenticated logins; and/or

- A charge applied for each use of the Platform by Transport Providers, Shippers and Receivers, where the company that owns the SENATOR platform takes the demand-side risk but perhaps has the regulatory support of the City Authority to introduce a regime which encourages the introduction of collaborative operations facilitated by a Platform to share data and collaborate based on mutual trust to complete 'last mile' deliveries;
- Annual license for use of the SENATOR Platform where the user (whether a City Authority or a large Transport Operator) is able to make use of the SENATOR Platform for as long as the license is valid. This is the unit of demand which is assumed for the SENATOR Inc Business Plan (see section 6 below).

The services provided by the SENATOR Platform would be **delivered** digitally via web-based applications, applications on mobile phones, via web-based dashboards and with system integration provided by APIs.

After sales support would be provided by means of a centralised technical support team, which would respond to enquiries by web chat, email and, if necessary, on the telephone.

5.4 Operations and activities

Key partnerships

The key business partnership for a company operating the SENATOR Platform might be with a software distributor, which would have greater marketing reach than would be possible for a start-up software company and would be incentivised to develop businesses and make sales.

Another key partnership could be with associations and networks of city authorities around Europe and at a national level. For example, in the EU the CIVITAS network might offer opportunities to reach a wide range of city authorities.

Key activities

The key activities of a start-up company that could manage the SENATOR platform would be likely to be:

- Product development: continuing to develop/improve and maintain the SENATOR Platform.
- Business development: raising awareness of the SENATOR product and sales and marketing to potential users; even if this was mainly outsourced to a distributor, it is

likely that a business development director or manager would be required to manage the link between the product and its market.

- After-sales support: ensuring that users are fully supported in using the platform.

Other functions, such as human resources (principally to recruit and retain high quality staff), accounting (to ensure that users are charged correctly for their use of the Platform and costs are managed) and legal (to manage the company's intellectual property) could be out-sourced but would need to be managed effectively by the company's senior management.

Key resources

The key resources required for such a start-up would be as follows:

- Physical resources: minimal physical resources would be required, but it would probably be advisable to have an office to provide a 'home' where staff can physically meet to share ideas and foster creativity
- Digital resources: cloud-based server space and computers
- Intellectual property: legal advice would be required to protect and manage the intellectual property of the company and licensing of the software
- Human resources: likely to focus on technical IT staff and senior management to cover Operations, Business Development and Finance/Legal.
- Financial: initial seed funding would be required to fund technical development and business development activities.

5.5 Finances

Cost structure

A company that would commercialise and market the SENATOR platform itself would have an essentially fixed cost structure, with not only technical staff and senior management but also the fixed cost of a salesperson (who could also be given commission on sales as an element of their pay, which would therefore be variable).

Using a network of software distributors to market and sell the SENATOR Platform to City Authorities (on commission) would reduce the fixed costs of the company.

Revenue streams

Analysis to-date from the ULLs suggests that from a financial point of view the key beneficiaries from the SENATOR Platform would be Transport Providers, either traditional

Transport Providers that could reduce their costs or ‘last mile’ Transport Providers whose operations would be facilitated by the Platform.

In some circumstances, Receivers may benefit if the quality of service improves (perhaps because they can receive goods at more convenient times of the day) but these benefits may be more difficult to monetise as they may not be valued sufficiently by potential customer segments such as final consumers.

City authorities may also be prepared to facilitate the implementation of the SENATOR Platform, given the potential reductions in external costs and the more intangible benefits of improving the ‘quality of place’ and the difficulty in monetising the value of improved service quality received by Receivers. In addition, any reductions in user costs would, in the medium term, be competed through to consumers (given the competitive nature of the logistics market) and would therefore lead to lower costs in the economy as a whole.

The SENATOR Platform Business Model Canvas

The SENATOR Platform Business Model Canvas is summarised on the following page.

Key partners Software distributors for marketing and sales? Networks of City Authorities for awareness?	Key activities Product development & maintenance Business development & sales After-sales support	Value Propositions Reducing costs for ‘traditional’ Transport Providers Enabling operations of ‘last mile’ Transport Providers Enhancing the ESG credentials of Shippers Increasing service quality for Receivers Enabling a reduction in external costs and enhancing ‘quality of place’ for City Authorities	Customer Relationships Business development: personal relationships with City Authorities Focus on automated day-to-day operations	Customer Segments Transport Providers (‘traditional’) Transport providers (specialist ‘last mile’) Shippers Receivers City Authorities
	Key Resources Physical: office? Digital: cloud-based server space Human: technical & senior management Financial: start-up funding		Channels Awareness: promotion to networks of City Authorities? Evaluation of benefits: case studies & evaluation model Purchasing: one-off set-up costs & pay per use Delivery: digital After-sales support	
Cost structure More fixed cost structure if in-house salesforce More variable cost structure if sales made via software distributors		Revenue Streams Contribution to implementation by City Authorities? Pay per use by Transport Providers, Shippers & Receivers?		