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Sustainable **U**rban **C**onsolidation **C**entr**ES** for con**S**truction

Business models for construction logistics optimisation and CCC introduction

Version 1.0

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Project Coordinator:

Luxembourg Institute of Science and Technology (LIST)

5, Avenue des Hauts-Fourneaux, L-4462 Esch-sur-Alzette, LUXEMBOURG

Contact Person:

FERRERO Francesco, +352 275 888 22 27, francesco.ferrero@list.lu

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Table of Contents

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

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1 Executive Summary

The main objective of the deliverable "*D3.3 Business Models Development and Analysis*" is to assess the different business models for the implementation of CCC's by analysing the cooperation and coordination of the Supply Chain stakeholders from three different perspectives: economic, commercial and organisational point of view.

Under this porpoise, the methodology followed to study and analyse the business models of UCC's and CCC's has been firstly to identify the different experiences that have been implemented and elaborate a state of the art of UCC's and CCC's with their most relevant information. Secondly, a preliminary analysis of the aforementioned experiences has been performed by making a SWOT Analysis of each type of Consolidation Centres: UCC's and CCC's. Thirdly, the general features of the of the business models for CCC's and UCC's and data requirements were identify, being selected the CANVAS Business Model as a structured methodology to describe the business models of the CCC's through a systematic description of nine basic building blocks.

Later on, the analysis and the methodology has been applied to the four pilots evaluated in the SUCCESS project: Paris, Luxemburg, Verona and Valencia. In this pilot approach, the methodology proposed to identify the scenarios and to define the best business model for each scenario in each of the pilots was composed by four main parts: introduction, were the main characteristics of the city and the pilots are explained, a specific SWOT for a CCC implementation in each city, the scenarios' definition step for a CCC implementation and finally the CANVAS Business Model for each of the scenarios proposed.

Finally, as conclusions, the different business models that have been identify considering the different needs and characteristics of the cities evaluated in the SUCCESS project pointed out that even though the cities face the similar problems regarding the urban logistics, the level of intensity of these problems vary in each city. Consequently, the business models to be applied to solve the problematic may also vary. However, in several cases, the solutions proposed matched and they can be easily replied and adapted to any city wanting to improve its urban logistics through the implementation of a Construction Consolidation Centre.

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2 Introduction

2.1 Background

The construction industry is one of the biggest consumers and producers of freight transport in the urban areas. In addition, this industry is normally very fragmented in a huge number of suppliers and distributors that deliver their products in different construction sites around the city. This fragmentation causes the raise of the transport and production costs and the increase of the problems caused by the urban freight transport (i.e. noise, pollution, congestion, etc.).

Under this framework, the project SUCCESS aims to reduce the negative impacts caused by the freight distribution in urban areas due to the activity of the construction industry and have a better understanding of its logistic supply chain. In order to do this, the SUCCESS project focuses on the improvement of the supply chain management (i.e. supplier's cooperation schemes) and the introduction of Construction Consolidation Centres (CCC) to reduce the logistics costs of the construction industry.

Regarding the Work Package3, the main objective pursued is to provide tools and methodologies to design innovative solutions for construction logistics in urban areas. In this regard, the deliverable "D3.3 Business Models Development and Analysis" will study new business models for the implementation of CCC. In the deliverable, the cooperation and coordination of the Supply Chain stakeholders is analysed from three different viewpoints:

- Economic
- Commercial
- Organisational

2.2 Objective of the report

The main objective of this report is to describe the work carried out in the "*Task 3.3: Business Models Development and Analysis*" included in Work Package 3. Thus, the main objectives of this deliverable are the following:

- Elaborate a state of the art of Urban Consolidation Centres (UCC) and CCC analysing the business models applied in different case studies.
- Select the most suitable business models taking into account its commercial, financial and organizational feasibility.

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2.3 Methodological Approach of T3.3

As previously mentioned, the "*Task 3.3: Business Models Development and Analysis*" focuses on the study and the analysis of the business models that have been applied in previous UCC's and CCC's experiences. This information will be useful in order to detect Business Models suitable for the implementation of CCC's by the construction industry. Under this framework, the process and the methodology to follow in this task is:

1. Identification of different experiences in UCC and CCC's
2. Elaborate a state of the art in UCC's and CCC's with their most relevant information.
3. Preliminary analysis of the aforementioned experiences in UCC's and CCC's (SWOT Analysis).
4. Definition of the general features of the business models for CCC's and UCC's and data requirements identification (*General Model Template*)
5. SWOT analysis for the implementation of CCC's in each of the local pilots
6. Definition of Business Models for each pilot site and for each scenario
7. Summary and conclusions

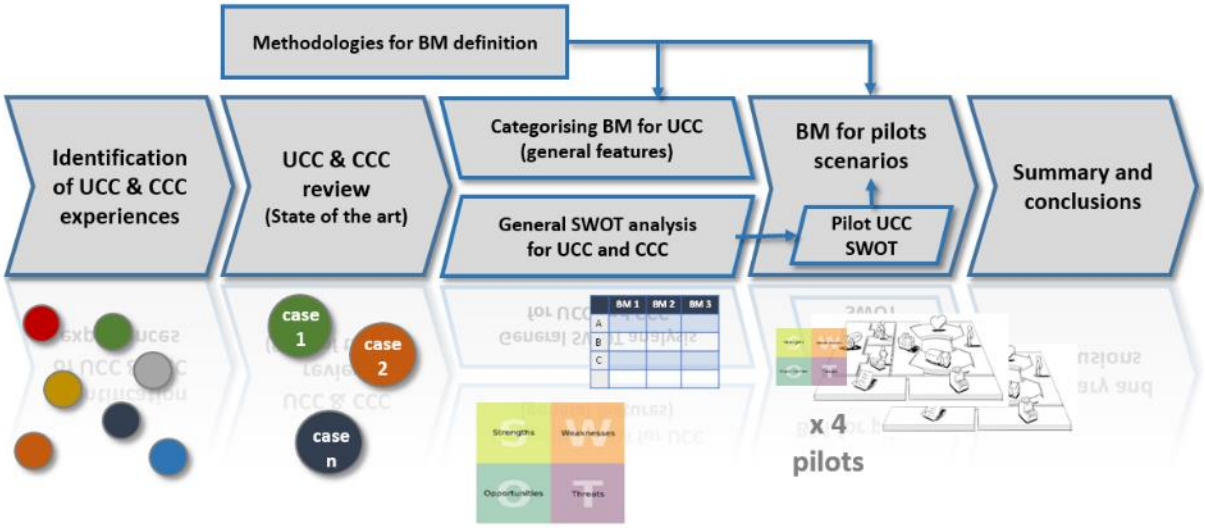

Figure 1. Illustration of the methodological approach of the task 3.3

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3 Identification of different experiences in UCC and CCC's

3.1 Overview of Consolidation Centres

3.1.1 Summary of Construction Consolidation Centres evaluated

Case Study	Location	Summary
Hammarby	Stockholm	UCC for construction materials (CCC) located in the largest ongoing urban development area in Sweden. The CCC was created to serve the development of a specific district and its main objective was to minimize the impact of the construction activity in the neighbourhood. The use of the CCC is compulsory for all the deliveries to the buildings inside the area. The deliveries are routed by the consolidation centre where they are also labelled and stored on short term basis. Only some bulk items such as steel and concrete are not routed by the CCC even though they are coordinated by it.
Old LCCC	London	The original London Construction Consolidation Centre was a facility located in South Bermondsey (south of London) and it had an area of 5000m^2 and a capacity of 200,000 pallets per year. The LCCC served four construction projects and worked for several contractors that placed the orders to their own suppliers but the delivery was made to the CCC instead of the construction site. The LCCC consolidated several contractors' orders onto one vehicle and send them to the different sites.
New LCCC	London	The new London Construction Consolidation Centre is a bigger facility (15,000m^2) compared with the old one, which had an original area of 5,000m^2. As in the old one, the new LCCC worked for several contractors that placed the orders to their own suppliers but the delivery was made to the CCC instead of the construction site. The LCCC consolidated several contractors' orders onto one vehicle and send them to the different sites. It is important to note that some materials such as steel or concrete are sent directly to the site rather than via CCC.
The Nine Elms	London	The Nine Elms CCC located in London is a 650 m^2 fully secure warehouse with an approximate capacity of 6,000 pallets. This is a single user facility that served for the support of the logistics activities for One Hyde Park project, a construction site of 86 luxury apartments located in central London where Laing O'Rourke is the main contractor.
Sainsbury's Park Royal	London	Sainsbury's consolidation centre in London is a facility with 6,000 m^2 of warehousing and 1,500m^2 mezzanine area with a capacity of 12,000 PEUs. In two years of operation, it has served more than 29 projects and the facility is share by Sainsbury and Fit Out (UK). The CCC is used for manufacture and delivery of fit out materials and also for refurbishment and store for returned equipment available for reuse.
London Construction Link	London (Port of Tilbury)	The London Construction Link (LCL) is a collaboration between the Port of Tilbury and S. Walsh & Sons. LCL builds upon the Tilbury's pedigree as the logistics and distribution hub for the 2012 Olympics and Paralympics and S. Walsh's success as the largest marine operator on the Thames. The partnership is seeking to relieve congestion on the capital's roads, with associated cycling safety and CO2 benefits, through promoting greater use of construction consolidation and the use of the river for construction projects on or near the Thames.

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Wembley CCC	Wembley (London)	Located in Wembley, the consolidation centre had 8000m² of internal and 3000m² of external storage space. It also provided short term secure storage for all materials used during the fit out phase of construction. The CCC support the construction of the One Hyde Park project, consisting of 86 apartments, spread over four pavilions overlooking Hyde Park and Knightsbridge. A penalty system, with a set fine per pallet, had been implemented for materials that were stored at the facility for longer than 28 days. This ensured that materials were not left on site beyond the agreed timescale. All specialist trade contractors were required (as a condition of their contract) to support and implement the plan and make full use of the facility. Operations at the CCC were outsourced to a third party contractor.
Premier Carriers CCCs	Bow and Barking (London)	In response to ongoing client demands Premier Carriers Ltd offers full warehousing and consolidation centre facilities in Bow and Barking (London), both open and covered. These developments enable its clients to store a variety of goods, in bulk, for final delivery into a range of destinations including all Crossrail construction sites. Goods can be held securely, picked as required and delivered on demand. These facilities also have the added benefit of 24Hr manned security offering additional peace of mind.
Lightwood CCC	Essex (London)	Lightwood operates a CCC in Essex, the North East of London and 60 minutes' drive time to central London. This facility has a storage capacity of near 7.000m2 and operates 24/7. The facility offers services such as commercial storage, cargo consolidation and specialised cargo loading & securing. Besides, they operate the goods distribution with their own vehicles.
DHL Barking	Barking (London)	In November 2008, DHL won the contract to run two of the Olympic Delivery Authority (ODA) logistics centres in Barking and Chigwell in Essex. The sites now manage inbound material deliveries for suppliers, manufacturers and contractors involved in the construction of the park. All inbound construction traffic is required to pass through these centres for marshalling, scheduling and security clearance. The Barking logistics centre is a 23-acre facility, accessed either from the A13 or the National Rail network. The site has capacity for 93 lorries per hour, 146,000ft2 of warehousing space and 40,000ft2 of secure office space. It has secure parking, high-speed internet access and an on-site canteen. It mainly deals with construction traffic coming from the South, East or from the ports at Tilbury, Felixstowe, Dover or Southampton. It can also offer a 'drop trailer' service where customers can deliver and/or collect the trailer from the site, increasing vehicle utilisation and ensuring compliance with drivers' hours regulations
Avondale CCC	London	Avondale Construction can arrange for the provision, management and maintenance of consolidation centres to enable managed, consolidated Trade Contractor deliveries for large projects in order to ensure delivery of Just - in - Time consolidated loads to meet planned productivity. Avondale CCC London is located in east London (40 minutes to central London) and Can operate 24 hours, seven days a week for inbound and outbound deliveries with no restrictions upon request. It is a 1.041m2 facility with a storage capacity of 1.400 pallets that offers services such as: Waste management, Recycling, Work pack creation, Tool storage and Pre-construction activity.
CSB Logistics CCC London	Charlton (London)	CSB specialises in material handling and logistics management for construction and related engineering industries to facilitate a sustainable JIT flow of materials. CSB operates at several levels within a particular trade's supply chain and for multiple trades on one project simultaneously. CSB logistics Charlton (London) is a consolidation centre that offers more than 10.000 m2 of warehouse facilities operating 24h and 7 days a week. The facility is located 45 minutes' drive to central London and has served for several projects within the city such as the University College London Hospital, One Hyde Park,

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		Queen Elizabeth Olympic Stadium and other Olympic venues and the Crossrail.
Wincanton Greenford CCC	**Middlesex (London)**	Wincanton is a market-leading construction company which is responsible for delivering 400,000 loads to construction and building sites across the UK every year. Wincanton has vast experience in the design, implementation and management of supply chain solutions for the construction and building sectors. They manage the UK's only national shared-user network with more than 60 clients of mechanical off-load vehicles and specialist equipment. The Wincanton Greenford CCC is shared facility located 40 minutes' drive time to central London and has served several projects for the 2012 Olympic and Paralympic games. It has 40,600m2 covered warehouse area and offers construction services such as: Kit building, Fabrication, Mock-ups, Off-site construction, Returns
Potsdamer Platz Consolidation Centre	**Berlin**	The reconstruction of the Potsdamer Platz area in Berlin during the '90 was the largest construction site in Europe. For that reason it was decided the implementation of a CCC with the aim to minimize the logistics problems related to the construction works in the city of Berlin. An agreement between the public bodies and the private companies was reached and the CCC (Baustellenlogistik Potsdamer Platz GmbH) was established in August 1993. The logistics consolidation centre was built adjacent to the Potsdamer Platz building sites due to the intensive construction works: an infrastructure of 5 km of rail facilities, 2.5 km of internal transport road, five bridges and other urban buildings. The Potsdamer Platz building site could only be accessed via the logistics centre which provided serviced such as: removal of all excavated material, concrete manufacture and delivery, deliveries management and waste management.

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3.1.2 Summary of Urban Consolidation Centres evaluated

Heathrow Airport Retail UCC	London	UCC for the retail operations of the Terminals 1, 2, 3 & 4 of Heathrow Airport. This UCC is in charge of all the deliveries of the airport except the newspapers and the high value items. Some of the additional activities included are: individual delivering, packaging and waste returns and warehouse.
La Petit Reine	Paris	UCC for parcels delivery in the City of Paris by using experimental tricycles in order to reduce the impacts of the urban freight transport. Some of the products delivered are: food, flowers, parcels and equipment.
Broadmead	Bristol	The Bristol Consolidation Centre is a UCC for the retail operations in the Broadmead district situated in the city centre of Bristol (UK). This UCC is mainly focused in medium-size and non-perishable goods with not high value. The BCC was 100% public funded when was launched due to the VIVALDI project (CIVITAS program). Later on it moved to a business model with higher degree of cost recovery and now is operated by DHL and supported by Bristol City Council.
Meadowhall	Sheffield	UCC for the retail operations in the Meadowhall shopping centre, which is located near to the M1 road in the edge of Sheffield (UK). It is an optional UCC, so it use is not compulsory for the retailers. It covers more than 3,100 m^2 and operates in just-in-time basis offering several value-added services.
Monaco	Monaco	Monaco Consolidation Centre (MoCC) is a public owned CC managed and operated by a private company on daily basis. It is located in the south west of Monaco with a surface of 1,300 m^2 in a land reclaimed from the sea. In Monaco, vehicles over 8.5 t are banned from entering the city and they have to deliver the goods through the MoCC platform, which unload the vehicles and manage the final distribution with vehicles with less than 8.5 t. In addition, these vehicles have time windows to do the deliveries inside the city. As a part of the MoCC, the Logistic Activity Park provides additional services such as storage, order picking, collection, etc.
Binnenstadservice	Nijmegen	Binnenstadservice (BSS) is a UCC located in Nijmegen, one of the oldest cities in the Netherlands. The main difference of BSS from other initiatives is that it is focused in receivers (small premises of the city centre) instead of carriers, trying to show the carriers the profits of UCC. In addition it offers added-value services to retailers such as storage, home deliveries, logistics activities and e-tailing. BSS-franchises recently started in other Dutch cities.
SMILE	Barcelona & Valencia	The SMILE project evaluated the implementation of UCC for parcels delivery in the cities of Barcelona and Valencia by using tricycles in order to reduce the impacts of the urban freight transport. The project focused on the study of different logistics supply chains that typically operate in the cities. Some of the products delivered during the evaluation period were: food, pharmaceutical products, newspapers and parcels

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La Rochelle	**La Rochelle**	The UCC of La Rochelle serves more than 1,300 business and was launched in 2001. It is managed by a private company (Transport Genty) and receives subsidies of the local government for the infrastructures and a fixed amount per package. The weight restrictions and the time windows applied in the city centre encourage the use of the UCC. The last mile distribution from the UCC is made using electric vehicles.
Kassel	**Kassel**	The UCC of Kassel was an initiative of 10 different private companies of the transport industry that decided to collaborate for improving their environmental friendly image and improve the urban deliveries in the city centre. During the first years of the UCC it was subsidised by the municipality of Kessel, but later on, it was paid only by the cooperating transportation companies. The stopped of the subsidy by the municipality of Kessel has produced a slowdown in the use of the UCC even though its goods results.
Leiden	**Leiden**	The municipality of Leiden lead a Public-Private-Partnership (PPP) initiative for the establishment of UCC and the use electric vehicles for the last mile distribution in the city. The UCC failed due to its low profitability and it stopped in 2000. It is explained by the reduced number of parcels handled in the consolidation centre and because of its non-appropriate location for electric vehicles.
Utrecht	**Utrecht**	Utrecht is a leading city in the urban logistics that has implemented an action plan where the city hall simulates, facilitates and regulates meanwhile the private companies invest and operate. The different UCCs are integrated in the normal operation and function in an open scheme: there is no concession and everyone who meets requirements can become Urban Distribution Centre (UDC). Nowadays there are two companies operating large UCCs (DHL and GLS) and their vehicles are exempt from the time restrictions of the city imposed to other goods vehicles. The vehicles have specific benefits such as a special time windows and the allowance to use the bus lane. The private companies run the UCC with support of the public authorities in terms of operating exemptions (i.e. the use of the bus lane) but they don't receive any public subsidy.
Cityporto	**Padova**	Cityporto is consolidation centre for freight distribution in the city of Padova, located in the freight village area of Interporto Padova and served by methane and electric vehicles. The project aims to improve the quality of city life, by fostering eco-friendly transport, intermodal system and reduction of traffic congestion.
Luccaport	**Lucca**	Luccaport is a consolidation centre located in a service area outside the city of Lucca, which implements freight distribution activities using zero-emissions vehicles. Luccaport aims to provide eco-friendly logistics service for transport operators, citizens and tourists, in order to reduce negative effect of logistics operations on environment and promote a smart urban mobility.

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4 State of the art in UCC and CCC

4.1 Construction Consolidation Centres

4.1.1 Hammarby Consolidation Centre (Sweden)

Name	Hammarby Waterfront Logistic Centre
Location	Construction sites in Hammarby Sjöstad district, Stockholm (Sweden). CCC adjacent to the construction site area.
Project/s	CIVITAS Project –The CCC was used in several construction sites located in Hammarby district
Operating period	2001-2004 (Construction works ended in 2010)
Sector	Construction – Temporary CCC adjacent to the urban development served
Objective of the CCC	Minimize the impact of the construction in Hammarby, one of the most important urban developments in Stockholm, Sweden, with 8,000 new apartments as well as other facilities (e.g. schools, commercial premises). The use of the CCC was mandatory for all the deliveries to the buildings inside the Hammarby area.
Scheme	**Mandatory scheme** for the deliveries inside the area except for exempted materials
Type of CCC	Multi-User and Multi-Site CCC
Policies & Regulations	Support of the public authorities for the CCC implementation and operations (funding support)
Description	▪ Exempted materials co-ordinated via internet based scheduling ▪ Construction materials deliveries routed via the CCC ▪ Prior deliveries in Just in Time basis ▪ Deliveries made in "work packs" as requested by the contractors ▪ 10 people working ▪ Area of approximately 7,500 m^2 ▪ 8 Vehicles (Euro IV class) ▪ Operator responsibilities: fleet purchase and operation, employment of drivers and other staff, warehouse and office management and web supervision ▪ Materials were consolidated for 22 different delivery areas within the site. ▪ Web calendar where contractors schedule the arrival time of the deliveries ▪ Charges after 5 days for stored materials
Operator	Subcontractor
Stakeholders involved	Contractors working on the site (10), Investors in the urban development & the City of Stockholm
Service provided	Deliveries, Warehousing, packing, deliveries co-ordination, labelling,
Financial issues	▪ Operation part founded by the EU: 280,000 EUR ▪ Initially, 95% of the project's funding came from the City of Stockholm (including the EU funds through CIVITAS programme) with the intention of withdrawing the subsidy ▪ Total budget of approximately 2 million EUR ▪ Low transport charge to companies that delivery goods ▪ Charges mainly related to material storage and value-added activities ▪ Charges to prevent long term storage ▪ Reduction of 40% of the public share funding by the end of the project ▪ Important support of private sector that was crucial for the viability of the CCC ▪ Operational Cost: 40% public / 60% private

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Results (operational & environmental benefits)	▪ Important reduction in theft materials ▪ Demonstrable reduction in damage materials due to less material movements ▪ Pollution reduction: reduction in CO_2, PM and NO_x emissions up to 90% ▪ Safety improvement ▪ Increase in labour productivity ▪ Less traffic congestion ▪ 700 deliveries per day ▪ Reduction in energy consumptions ▪ 80% reduction in small volume direct deliveries ▪ Reduction on average vehicle distances from 64 km per day to 24 km per day. ▪ Increase in the load factor from 50% to 85% ▪ Vehicle delivery time reduced from 60m to 6min

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4.1.2 Old London Consolidation Centre (United Kingdom)

Name	London Construction Consolidation Centre (LCCC)
Location	South Bermondsey, London, outside the congestion charging zone, at three miles from the City of London and just four miles from the West End, good links to both the A2 and M25. Determination of the site based rather on site availability.
Project/s	Local funding – It serve to projects such as the head offices of Unilever PLC, 35 Basinghall Street, the global headquarters of Legal & General and Bow Bells House. ▪ LCCC for four construction sites: ○ Unilever House (2005 - 2007).is the head office of Unilever Plc, 250,000 sq. ft. (i.e. 23,000 m2) of office space ○ 35 Basinghall Street (2005 – 2007) is being developed into the global headquarters for Standard Chartered Bank, providing 200,000 sq. ft. (i.e. 18,000 m2). ○ One Coleman Street (2005 - 2007) will be the global headquarters of Legal & General, with 10 storeys and 180,000 sq. ft. (i.e. 17,000 m2) of office space. ○ Bow Bells House (2005 – 2007) is likely to be of mixed use with 140,000 sq. ft. (i.e. 13,000 m2) of offices and 14,500 sq. ft. (i.e. 1,300 m2) of retail space.
Operating period	2005 – 2007 (trial)
Sector	Construction
Objective of the CCC	The LCCC was a pilot demonstration which key aim was to understand and demonstrate the potential benefits and impact reductions that it could provide for the supply of construction materials. The mission statement of the LCCC was “Deliver in the safest and most efficient manner possible the right materials to the right site at the required time in active partnership with trade contractors and project managers”
Scheme	Trial Test (Voluntary)
Type of CCC	Multi-User and Multi-Site CCC
Policies & Regulations	No information available
Description	▪ Size: 5,000 m2 ▪ Storage capacity: 200,000 pallets per year throughput ▪ Vehicle fleet information: Total vehicle fleet of 5 vehicles (Euro III) + 3 forklifts ○ 1 x 26 tonne flatbed rigid (Euro 3); ○ 2 x 26 tonne flatbed rigid with crane (Euro 3); ○ 1 x 18 tonne flatbed rigid (Euro 3); ○ 1 x 7.5 tonne curtain-sided rigid (Euro 3); ○ 1 x 3.5 tonne van (LGP fuelled); ○ 1 x 4 tonne counter balance forklift; ○ 1 x 3.5 tonne telehandler forklift; ○ 1 x 2 tonne reach and tier forklift; ○ 2 x 2.5 tonne electric hand pump trolleys. ○ The majority have GPS tracking4 and telematics system installed. ○ The vehicles are adapted to the nature of the goods: goods which needed to be kept dry (electronic equipment, insulation material), flatbed vehicles for bulky or awkward shape. ▪ Drive time to/from central London: 40 minutes ▪ Dwell time in the LCCC: 7 days ▪ The maximum storage time was 10 days. ▪ Opening hours: between 7:30 and 17:30 Monday to Thursday and 7:30 to 16:00 on Friday

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	▪ Employment: 16 staff ○ 1 site/project manager: general running of the project, liaising with trade contractors. ○ 1 depot manager: time is split between the office and warehouse. ○ 1 depot supervisor: of warehouse staff. ○ 2 supply controllers: deal with the suppliers and the construction sites and organise both inbound and outbound transport. ○ 1 admin clerk: general administration for the operation. ○ 4 full time HGV drivers driving to and from construction sites + helping to load vehicles. ○ 4 fork-lift truck drivers: loading and unloading of vehicles, put-away of products. ○ 2 warehouse operatives: general warehouse duties, also involved in driving vehicles to undertake deliveries when there is pressure to increase deliveries. ▪ Potential for serving 10 projects, 6 construction sites are required in order for the operation to be financially self-sustaining.
Operator	Wilson James
Stakeholders involved	Operator: Wilson James (owner of the equipment) Promotor: Transport for London Major contractor: Bovis Lend Lease Site development: Stanhope PLC Others: Constructing Excellence, University of Westminster
Service provided	24 hour operation available if required Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading, Training for staff
Financial issues	▪ The LCCC project costs £3.2 million: ○ Transport for London funded £1.85 million, ○ Stanhope and Bovis Lend Lease : £1.35 million
Results (operational & environmental benefits)	▪ 97% improvement in delivering reliability (right materials, right place, right time) ▪ Increase in the labour force productivity in 25min per day and person ▪ 60-70% reduction of vehicles traveling to the four sites evaluated ▪ 40% of reduction in vehicles deliveries from suppliers ▪ 20% reduction in driver's working day ▪ 25% savings of the pallets cost due to recovering efforts ▪ 70-80% reduction in CO2 emissions ▪ 2 hour average reduction in supplier journey times ▪ Increase in the order lead time up to six days ▪ Reduction of approximately 3000 goods vehicles entering in the city of London

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4.1.3 New London Consolidation Centre (United Kingdom)

Name	LCCC Wilson James
Location	Silvertown, East London (UK). 40 min drive to central London
Project/s	Quadrant III, Bloomberg, St Bart's Hospital, University College London, Central St Giles, Café Royale, Grosvenor House Apartments and Willis Tower
Operating period	2008 – still in operation
Sector	Construction
Objective of the CCC	The main purpose of the CCC is to promote the efficient flow of construction materials through the supply chain to the actual points of use on the projects.
Scheme	Voluntary
Type of CCC	Multi-User and Multi-Site CCC
Policies & Regulations	Gold FORS accreditation CLOCS Champion

Description	▪ Size:15,000 m2
	  ○ Covered warehouse area: 13,000 m2
	  ○ Uncovered warehouse area: 2,000 m2
	▪ Storage capacity: 15,000 m2 (250,000 pallets per year throughput)
	▪ Vehicle fleet information: Total vehicle fleet of eight vehicles. All delivery vehicles are Low Emission Zone (LEZ) compliant
	▪ Drive time to/from central London: 40 minutes
	▪ The centre does not store goods in the conventional sense, with an aim of a turnaround time of 10 - 15 days
	▪ Staff:
	  ○ 8 skilled employees kept at their work stations doing what they do best;
	  ○ 1 site manager;
	  ○ 1 administrator;
	  ○ 42 people from WJ on site, of which 7 are waste operators and 7 materials handling operators including supervisors.
	▪ Equipment:
	  ○ 1x26 tonne flatbed with crane;
	  ○ 2x18 tonne flatbed;
	  ○ 1x18 tonne curtain sided with tail lift;
	  ○ 1x LWB Transit;
	  ○ 4x forklift trucks;
	  ○ 8 dedicated fleet of Euro 5/6 vehicles.
	  ○ The vehicles are bio-diesel powered and have GPS tracking, cyclist proximity sensors and side bars to improve safety. Warning signs for cyclists are displayed on the rear of all vehicles. Drivers have completed Crossrail.
	▪ Designated areas for assembling deliveries and loading.
	▪ Opening hours: between 7:30 and 17:30 Monday to Thursday and 7:30 to 16:00 on Friday.
	▪ Awarded FORS gold standard of the Transport for London accreditation scheme

Operator	Wilson James
Stakeholders involved	Transport for London, Wilson James, St Bart's Hospital, University College

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Service provided	Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading Site operations include: ▪ Security; ▪ Traffic management; ▪ Welfare/cloakroom; ▪ Forklift driver; ▪ Slinger; ▪ Site management. ▪ Storage activities free for the first 30 days. ▪ Quality control: WJ doesn't have the responsibility for the results. ▪ Work area used by contractors which leads to a faster job, less waste generated and any material is carried to site, speeding up installation on site (done by contractors) ▪ The LCCC has 24 hour security, which is important for large quantities of extremely high value goods (vulnerable to damage and theft). ▪ A limited amount of pre-assembly, for example on goods such as glazing windows and the preparation of lift trucks for lift rails. ▪ Waste operators and recycling: Timber, MDF and metal are strapped and palletised. Cardboard and polythene are baled. Plaster is carried in one-tonne bags. Pallets and cable drums are also returned to the LCCC for reuse. ▪ Packaging: LCCC encourages suppliers to use pallets, cages or stillages that allow mechanical handling so that manual lifting can be avoided. This means they are not too heavy and can easily be handled on site with hand truck. ▪ 24/7 hour operation available if required.
Financial issues	No information available
Results (operational & environmental benefits)	Waste arises from • over-ordering 5-10%; • damage 3-25%; • packaging 5-20%; • off-cuts 1-5%; • design changes 1-5%; • planning & programme amendments 1-10%. The cost for storage is based on the occupied warehouse surface rather than on PEU's number. Improvements: – Reduction in the number of construction vehicles entering the City of London by 68% (Over a period of 12 months 2000 commercial vehicles did not enter the Congestion Zone). – Improvement in certainty of supply (100% availability within 24 hours). – Increase of on-site productivity thanks to less labour downtime (e.g. searching for material) by 47%. – Reduction of materials waste of 15% resulting from less damage and reduced shrinkage. – 25% reduction in accidents/injuries thanks to a more secure work environment by the arrival and on-site storage of only those materials intended for immediate incorporation. – Achievement of delivery performance of 95% of goods delivered right material-right place-right time (less than 50% in the overall industry). – Reduction in supply journey time, by going directly to the LCCC rather than driving into the City of London (including loading/unloading time), of an average of two hours (average of 40 min in enter and 40 min in exit the city centre). – Tracking the vehicles allows visibility and real-time control and lead to the reduction in local distribution journey times, from the LCCC to the sites, of up to10%. – Reduction of CO2 emissions run up at 80%. – Reduction of congestion in the served area. – Better fuel efficiency achieved.

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	– Reduction of unloading time to 40 min instead of hours. – Reduction in the over-ordering of materials of 14%, saving 25 min per day thanks to better management of materials on site. – Greater delivery flexibility since companies can order smaller quantities for each site while suppliers can send full loads. Several key performance indicators (KPI) were studied to estimate the previously illustrated benefits: – Reduction in freight journeys by 70% (the target was 40%). – Reduction in journey time of supplier of 2h delivering at the CCC (the target was 30-60 minutes). – Delivery reliability 97% (industry standard is 39%). Without CCC: No of vehicles = 4099 in one year Cost of congestion charges (at £8 per vehicle per day) = £32,792 With CCC: No of vehicles= 1,461 in one year Cost of congestion charges (at £8 per vehicle per day) = £11,68 → Minimum saving = £21,10 One case. CIVITAS-VIVALDI project for Central St Giles ▪ Reduction in truck journeys: 956 fewer delivery vehicle journeys into central London between January 2009 and July 2009, leading to a 75% reduction in carbon emissions. ▪ A delivery accuracy averaging over 97% measured as vehicles arriving within ±15 minutes of required time and with the correct load. Studies have shown that typically in the industry only 40% of deliveries arrive within ±30 min of the scheduled slot. ▪ Plasterboard waste running at 6.4% again the industry average of 22.5% and exceeds by a wide margin the 15% target set. ▪ Consolidation factor: 4.1 ▪ Reduction in Carbon emissions: 7.7 t

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4.1.4 Nine Elms Consolidation Centre (London, United Kingdom)

Name	The Nine Elms CCC
Location	London (Nine Elms)
Project/s	One Hyde Park Project (CCC Supporting the construction site of 86 apartments)
Operating period	2007-2010
Sector	Construction – One Hyde Park Project (Temporary CCC specific for the project)
Objective of the CCC	Minimize the urban impact of the construction works
Scheme	Mandatory Scheme for deliveries (one hour delivery time window)
Type of CCC	Single User and Single Site
Policies & Regulations	No information available
Description	▪ One hour delivery slot to site allowed per day ▪ Warehouse area: 650m2 ▪ Capacity: 6.000 PEUs ▪ 4.000 bins with 660 litre capacity for reverse logistics operations ▪ 9 Employees ▪ Vehicle fleet characteristics: o 2 lorries o 1 forklift o 1 van It was used by only one contractors in order to serve one specific project.
Operator	MLogic (Site owned by DHL)
Stakeholders involved	Operator: MLogic (part of Mace) Owner: DHL Contractor: Laing O'Rourke
Service provided	
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.5 Wembley Consolidation Centre (London, United Kingdom)

Name	Wembley Consolidation Centre
Location	Wembley
Project/s	One Hyde Park (OHP) in Central London. Construction of 86 apartments in four pavilions in Hyde Park and Knightsbridge.
Operating period	2006 - 2010
Sector	Construction – One Hyde Park Project
Objective of the CCC	Implementation of best practices to improve material handling, recycling and efficiency
Scheme	**Mandatory scheme** except for some specific materials
Type of CCC	Single User and Single Site
Policies & Regulations	No information available
Description	The CCC serve for the construction of 86 apartments where the suppliers deliver the materials in a **mandatory scheme** except for some specific materials. Some features: ▪ Warehouse internal area: 8.000m2 ▪ Warehouse external area: 3.000m2 ▪ Maximum storage: 28 days (fine per pallet if exceeds) ▪ External operator managing the CCC ▪ Material inspection in the CCC before their delivery in OHP project ▪ Online delivery management system ▪ Reverse logistic managed using the CCC ▪ Specialist trade contractors required (as a condition of their contract) to support and implement the plan and make full use of the CCC
Operator	Select Plant (Part of Laing O'Rourke group of companies)
Stakeholders involved	Laing O'Rourke (Construction Manager), Client (Project Grande Guernsey Limited),
Service provided	Delivery management, safe storage, ensure material received in good condition, secure are for high value materials, returning management and revers logistics, recycling.
Financial issues	No information available
Results (operational & environmental benefits)	▪ 66% reduction in vehicle trips to the One Hyde Park development. ▪ Reduction in CO^2 emissions. ▪ 93% of materials arrive at the Construction Consolidation Centre on time. ▪ 100% of materials arrive at the construction site on time. ▪ 100% of materials arrive in the right quantity and in the right condition. ▪ 97% of on-site waste recycled. ▪ Reverse logistics employed using the CCC

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4.1.6 Sainsbury's Park Royal Consolidation Centre (London, United Kingdom)

Name	Park Royal CCC
Location	London area (West London)
Project/s	Several refurbishment projects for Sainsbury in London
Operating period	2007 - Ongoing
Sector	Construction – Refurbishment projects
Objective of the CCC	Consolidation Centres managing the delivery of construction materials into London refurbishment projects for Sainsbury's supermarkets
Scheme	Voluntary Scheme
Type of CCC	Single User and Multi-Site
Policies & Regulations	No information available
Description	This CCC is used exclusively by the company Sainsbury for its refurbishment projects inside the London area. It is a **private initiative** implemented with the aim to improve the logistics and increase the control of the construction operations in London. ▪ 6000m2 of warehouse space ▪ 1500m2 for mezzanine area ▪ Yard area with capacity for 12.000 PEUs ▪ 7 Employees ▪ 24/7 operation ▪ Vehicles: 1 own lorry, 1 own forklift and hired lorries when required (freelance)
Operator	Fit Out UK
Stakeholders involved	Sainsbury's (more than 29 nine projects in 2 years) and Fit Out UK (Operator)
Service provided	Waste management, recycling, storage of returned equipment, work pack creation, tool storage, security,
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.7 London Construction Link (Port of Tilbury, United Kingdom)

Name	London Construction Link
Location	Port of Tilbury, London. Located at 75min drive to central London, 6 miles outside the M25 and 22 nautical miles from Tower Bridge with dedicated barge facilities and three rail freight heads.
Project/s	Logistics and distribution hub for the 2012 Olympic and Paralympic Games, Blackfriars Bridge, Crossrail and Battersea Power Station
Operating period	2007 - Ongoing
Sector	Port Industry and construction
Objective of the CCC	London Construction Link is an alliance between the Port of Tilbury and S Walsh offering construction solutions for sites near or beside the Thames. Based at the seaport, LCL is a versatile consolidation and distribution facility combining river access with excellent road, rail and IT-driven storage management infrastructure to create a facility that can store and move all kinds of construction-related materials.
Scheme	Voluntary Scheme
Type of CCC	Multi-User and Multi-Site
Policies & Regulations	Gold FORS accreditation CLOCS Champion
Description	The London Construction Link is a collaboration between construction solutions provider S Walsh and the Port of Tilbury and provides efficient and versatile consolidation and distribution on the Thames. The use of the **CCC was not mandatory**. ▪ Size: From 5,905m2 to 23,226m2 of short and long-term containerised and open cast storage, plus vehicle holding area ▪ Covered warehouse area: 1,858m2 ▪ Uncovered warehouse area: 4,057m2 ▪ Storage capacity: flexible, can be scaled up if required from the minimum outlined above ▪ Operating hours: 24 hours, seven days a week ▪ Other services ○ Stevedoring ○ River transport ○ Rail transport ▪ Total vehicle fleet of 45 vehicles. All delivery vehicles are Low Emission Zone (LEZ) compliant Vehicles include: ○ Four standard tugs ○ Nine barges and access to more than 80 barges ○ One pontoon ○ 67 HGVs of various tonnage and type
Operator	S Walsh & Port of Tilbury
Stakeholders involved	Logistics and distribution hub for the 2012 Olympic and Paralympic Games
Service provided	Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading, temperature controlled storage, container handling
Financial issues	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.8 Premier Carriers Bow (Bow, United Kingdom)

Name	Premier Carriers Barking
Location	Bow, East London. Located 35min drive to central London (Inside M25 ring).
Project/s	Involved in London Crossrail projects
Operating period	Ongoing
Sector	Construction
Objective of the CCC	Support for the construction logistics of the London Crossrail
Scheme	Voluntary Use
Type of CCC	Single-User and Multi-Site
Policies & Regulations	Night Exemption Certificate Oversize Vehicles allowed Silver FORS accreditation CLOCS Champion
Description	Premier Carriers Bow CCC is located in London, 35 minutes' drive to central London and it serves as a CCC for the London Crossrail projects. It has London Night Exemption Certificate and can accommodate oversized movements of up to 60 tonnes. ▪ Size: 279 m2 ▪ Covered warehouse area 93 m2 ▪ Uncovered warehouse area: 186 m2 ▪ Storage capacity: 279 m2 ▪ 24/7 Operations ▪ Total vehicle fleet of 44 vehicles (all delivery vehicles are Low Emission Zone LEZ) that include: o 44 tonne articulated vehicles; flat bed and curtain side o 18 tonne flatbed vehicles o 18 tonne vehicles; box, curtain side and tail lift o 7.5 tonne vehicles; box, curtain side and tail lift o 1.5 tonne payload Transit long wheel base vans o One tonne payload Transit vans o 300 kilogram payload small vans o HIAB FASSI 310 crane
Operator	Premier Carriers
Stakeholders involved	Crossrail London
Service provided	Security, pre-construction activity, on-site/off-site loading, vehicle marshalling
Financial issues	No information available
Results (operational & environmental benefits)	No information available

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4.1.9 Premier Carriers Barking (Barking, United Kingdom)

Name	Premier Carriers Barking
Location	Barking, East London. Located 45min drive to central London (Inside M25 ring).
Project/s	Involved in London Crossrail projects
Operating period	Ongoing
Sector	Construction
Objective of the CCC	Support for the construction logistics of the London Crossrail
Scheme	Voluntary Scheme
Type of CCC	Single-User and Multi-Site
Policies & Regulations	Night Exemption Certificate Oversize Vehicles allowed Silver FORS accreditation CLOCS Champion
Description	Premier Carriers Bow CCC is located in London, 45 minutes' drive to central London and it serves as a CCC for the London Crossrail projects. It has London Night Exemption Certificate and can accommodate oversized movements of up to 60 tonnes. ▪ Size: 2.044m2 ▪ Covered warehouse area 186m2 ▪ Uncovered warehouse area: 1,858m2 ▪ Storage capacity: 2.044m2 ▪ 24/7 Operations ▪ Total vehicle fleet of 45 vehicles that include: o 7.5 tonnes rigid vehicles o 44 tonnes articulated vehicles o 18 tonnes vehicles o 1.5 tonnes vans o Fork lift trucks
Operator	Premier Carriers
Stakeholders involved	Crossrail London
Service provided	Security, pre-construction activity, on-site/off-site loading, vehicle marshalling
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.10 Lightwood Logistics CCC (Essex, United Kingdom)

Name	Lightwood Logistics CCC
Location	Essex, North-East London. Located 60min drive to central London.
Project/s	Shell Centre and Victoria and Albert Museum
Operating period	Ongoing
Sector	Construction
Objective of the CCC	Support for the construction logistics of the Shell Centre and Victoria and Albert Museum
Scheme	Voluntary scheme
Type of CCC	Multi-User and Multi-site
Policies & Regulations	FORS Silver accreditation CLOCS champion Sub-contractors in accordance with ISO 9000.1
Description	Lightwood Logistics CCC is located in Essex, 60 minutes' drive to central London and it has served as a CCC for projects such as the Shell Centre and Victoria and Albert Museum. ▪ Size: 6.968m2 ▪ Covered warehouse area 6.968m2 ▪ Storage capacity: 6.968m2 ▪ 24/7 Operations ▪ outwards and inwards deliveries ▪ available by pre-booking ▪ Total vehicle fleet of 4 vehicles of 18 tonnes and other agreements with independent hauliers who used vehicles with approved sub-contractors
Operator	Lightwood PLC
Stakeholders involved	No information available
Service provided	Tool storage, Security, Container handling (warehouse only), Crane facilities
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.11 DHL Barking Logistic Centre (Essex, United Kingdom)

Name	DHL Barking Logistics Centre
Location	Essex, East London. Located 40min drive to central London (inside M25 ring).
Project/s	London 2012 Olympic Park and venues, London 2012 Athletes Village, Crossrail C510 package and construction projects across London for building materials suppliers
Operating period	2008 - Ongoing
Sector	Construction
Objective of the CCC	Support for construction logistics in several construction for London 2012 Olympic and Paralympic games
Scheme	Voluntary Scheme
Type of CCC	Multi-User and Multi-Site
Policies & Regulations	Bronze FORS accreditation CLOCS Champion
Description	▪ Size: 17.000m2 ▪ Covered warehouse area13.000m2 ▪ Uncovered warehouse area: 4,000m2 ▪ Storage capacity: flexible space to accommodate materials ▪ Other services o Plant and equipment maintenance o Off-site assembling o Trailer shunting o Fit out mock-ups o Security screening ▪ Total vehicle fleet of 25 vehicles that include: o 7.5 tonnes rigid vehicles o 44 tonnes articulated vehicles
Operator	DB Schenker & DHL Supply Chain
Stakeholders involved	London 2012 Olympic Park and venues, London 2012 Athletes Village, Crossrail C510 package and construction projects across London for building materials suppliers
Service provided	Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading,
Financial issues	No information available
Results (operational & environmental benefits)	No information available

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4.1.12 Avondale Construction (London, United Kingdom)

Name	Avondale: The Assertive Centre
Location	London, 40 minutes to central London
Project/s	Ministry of Defence Whitehall
Operating period	Ongoing
Sector	Construction
Objective of the CCC	Support for construction logistics. Construction logistics advice and pre-construction services i.e. swept-path analysis
Scheme	No information Available
Type of CCC	Single-User and Multi-Site
Policies & Regulations	Bronze FORS accreditation
Description	▪ Size: 1.040m2 ▪ Covered warehouse area 650m2 ▪ Uncovered warehouse area: 260m2 ▪ Storage capacity: 910m2 (1400 Pallets) ▪ Construction logistics advice and pre-construction services ▪ Vehicle fleet that include: ○ 18 tonnes rigid vehicles ○ 17 tonnes rigid curtain trailer ○ Independent hauliers
Operator	Avondale / Assertive Transport
Stakeholders involved	Ministry of Defence Whitehall, Avondale Construction, Assertive Transport
Service provided	Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading, vehicle marshalling, container handling
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.13 CSB Logistics (Charlton (London), United Kingdom)

Name	CSB Logistics
Location	Charlton, London. 45 minutes to central London (inside M25 ring)
Project/s	Canary Wharf, 30 St. Mary Axe, University College London Hospital, 125 Old Broadstreet (Bankside), One Hyde Park, St. Bart's and Royal London Hospitals, 1 Threadneedle Street, King's Cross Station, More London, Heron Tower, The Shard, Queen Elizabeth Olympic Stadium and other Olympic venues, 20 Fenchurch Street, 122 Leadenhall Street, 1 Embankment Place, 5 Broadgate, Crossrail, Canada House, 184 Shepherds Bush Road, East Village and Africa House
Operating period	Ongoing
Sector	Construction
Objective of the CCC	
Scheme	Voluntary Scheme
Type of CCC	Multi-User and Multi-Site
Policies & Regulations	Bronze FORS accreditation
Description	Services offered: ▪ Specialist protection ▪ Transit packing services Features: ▪ Size: 10.000m2 ▪ Covered warehouse area 7.000m2 ▪ Storage capacity: 1.000 m2 ▪ A third party logistics (3PL) manages a vehicle fleet for the CCC Operates with hauliers with minimum bronze standards (FORS)
Operator	CSB Logistics Limited
Stakeholders involved	CSB Logistics, Crossrail, University College
Service provided	Waste management, recycling, work pack creation, tool storage, security, pre-construction activity, on-site/off-site loading, and vehicle marshalling and crane facilities.
Financial issues	No information available
Results (operational & environmental benefits)	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.14 Wincanton Greenford Consolidation Centre (Middlesex, United Kingdom)

Name	Wincanton Greenford Consolidation Centre
Location	Greenford, Middlesex (West London). Drive time to central London: 40 minutes (inside M25 ring)
Project/s	London 2012 Games and Paralympic Games, Milton Court, Sir Robert McAlpine and two central London developments for Lend Lease
Operating period	Ongoing
Sector	Construction
Objective of the CCC	
Scheme	Voluntary Scheme
Type of CCC	Multi-User and Multi-Site
Policies & Regulations	Bronze FORS accreditation

Description	▪ Shared multiuser site with about 60 clients.
	▪ Size: 440.600m2
	▪ Covered warehouse area 40.600m2
	▪ Storage capacity: 33.000 Pallets spaces
	▪ Other services
	  ○ Kit Building
	  ○ Fabrication
	  ○ Mock-ups
	  ○ Off-site construction
	  ○ Returns
	▪ Total vehicle fleet of 4.000 vehicles that include:
	  ○ 45 delivery vehicles
	  ○ 44 tonnes articulated vehicles

Operator	Wincanton PLC
Stakeholders involved	London 2012 Games and Paralympic Games, Milton Court, Sir Robert McAlpine and two central London developments for Lend Lease
Service provided	Waste management, recycling, bulk waste, work pack creation, tool storage, security, crane facilities, pre-construction activity, on-site/off-site loading, vehicle marshalling, container handling, crane facilities, and temperature controlled storage.
Financial issues	No information available

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

Results (operational & environmental benefits)	▪ 35,452 vehicle km saved in nine months ▪ 80% fewer deliveries to site in nine months ▪ 32,820 litres of fuel saved in nine months ▪ 53% reduction in CO2 emissions in nine months ▪ 86,330 kg of CO2 saved in nine months

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.1.15 Postdamer Platz Consolidation Centre

Name	Postdamer Platz Consolidation Centre
Location	Central Berlin. CCC adjacent to Postdamer Platz construction site
Project/s	Offices, commercial and residential buildings, theatre, hotels stores, other buildings and transport facilities in Postdamer Platz
Operating period	1992-2002 (Temporary CCC)
Sector	Construction
Objective of the CCC	Reduce the potential effects (noise, congestion, etc.) of the reconstruction of the Postdamer Platz area in Berlin.
Scheme	Mandatory Scheme
Type of CCC	Multi-User and Multi-Site CCC
Policies & Regulations	No information available
Description	For the reconstruction of the Postdamer Platz area in Berlin, that was the largest construction site in Europe, the private and public sectors decided to implement a CCC in order to solve the logistics problems and established Baustellenlogistik Potsdamer Platz GmbH (referred to as baulog) in August 1993. A logistics consolidation centre was built which was adjacent to the Potsdamer Platz building sites. An infrastructure of 5 km of rail facilities, 2.5 km of internal transport road, and 5 bridges had to be built. The Potsdamer Platz building site could only be accessed via the logistics centre. The logistics consolidation centre provided the following services: • Removal of all excavated material from the site by rail or water • Manufacture and delivery of ready mixed concrete to the site (cement and aggregates delivered to the concrete factory by rail) • Organisation of the delivery of general cargo by rail, transfer and transport to the building sites by lorry • Collection of sorted building refuse, transfer and rail transport out • Acceptance and discharge of all ground water from the excavation pits on the site
Operator	
Stakeholders involved	Several private companies and public organisations including Daimler-Benz InterServices GmbH, Sony Berlin GmbH, Asea Brown Boveri, Deutsche Bahn AG and the federal state of Berlin.
Service provided	Waste material management, concrete logistics solutions, delivery management, transport management, reverse logistics,
Financial issues	No information available
Results (operational & environmental benefits)	The Potsdamer Platz construction consolidation centre resulted in the avoidance of 50,000 lorry's kilometres per day (through the use of other modes) and the completion of the building work six months ahead of schedule.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

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4.2 Other Urban Consolidation Centres

4.2.1 Heathrow Airport Retail Consolidation Centre (London, United Kingdom)

Name	London Heathrow CC
Project	Construction project of the Terminals 1 and 4
Operating period	2000 - Ongoing
Sector	Retail and Construction
Objective of the CCC	
Description	**Retail:** A retail operation supplying all shops at Terminals 1, 2, 3 & 4. All deliveries (except newspapers and high value / high insurance items) are made to a consolidation centre outside the airport perimeter where inbound deliveries are security checked (scanned) and sorted by delivery address into sealed roll cages and then delivered to a regular schedule. Some low value items e.g. soft drinks are delivered on pallets. **Initially voluntary** however it is **compulsory since 2004** for all the retailers in the terminal. 24/7 day operation. **Construction:** 20,000 sq. ft. building (a former aircraft hangar) at Hatton Cross. Goods for use on projects at Terminals 1-4 were delivered to the centre checked for quantity and quality, and held ideally for a maximum of 7 days. **Compulsory except for exempted items**: bulk items such as concrete and steel frames are not routed via the centre. Contractors call off materials in "work packs" for JIT delivery to the "workface". Deliveries often made at night, but intake only during the day. This CCC was based in the Hammarby Scheme in Stockholm.
Operator	Retail :A partnership between British Airports Authority (landlord) and a logistics provider (Exel) Construction : Wilson James Ltd., Mace Ltd., British Airports Authority (BAA)
Stakeholders involved	
Service provided	The service includes: delivering to individual premises by a dedicated "delivery team" located within each terminal and the return of packaging / waste to the depot.
Financial issues	No information available
Results (operational & environmental benefits)	**Retail:** A successful example of a consolidation centre. Considered essential by BAA who claim that the concept means that the new Terminal 5 will need far fewer than the originally planned 64 delivery bays. Charges to retailers are not fully transparent as an element of the rent is likely to be assigned to the operation by BAA as their contribution to operating costs. **Construction:** ▪ Greatest benefits seen as predictability and certainty. ▪ Improvements in productivity (+5% claimed through having materials on time), safety and environmental matters. Reduction in waste. ▪ Reduction in number of deliveries "airside" – not quantified – with attendant reductions in congestion, pollution and carbon dioxide emissions. ▪ The centre provides a "buffer stock" for materials with long or complex supply chains

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.2 La Petit Reine Consolidation Centre (Paris, France)

Name	Le Petit Reine
Project	
Operating period	2003 - Ongoing
Sector	Goods deliveries
Objective of the UCC	Reduce the impacts of the freight transport testing an alternative to motorised vehicles for final delivery of goods.
Description	▪ Electrically assisted vehicles for deliveries ▪ Maximum payload of the vehicles 100kg ▪ Maximum volume of the vehicles 450l ▪ Three types of delivery service have been tested by la Petit Reine: o Ad hoc deliveries from businesses to customer's homes o Driver and tricycle dedicated to a business for deliveries to customers (dedicated shop-based service) o Consolidation and final delivery of goods entering Paris (using a consolidation centre located in the centre of Paris offered by the Mairie de Paris at low rent). ▪ **Voluntary use** ▪ Products: food, flowers, parcels, equipment and parts.
Operator	La Petite Reine Company
Stakeholders involved	The City of Paris, ADEME (French Agency of Environment Management), parcel carriers, transport operators, retailers and other Paris-based business
Service provided	Deliveries, Consolidation.
Financial issues	This experiment has been also supported by the ADEME (Agence De l'Environnement et de la Maîtrise de l'Énergie / French Agency of Environment Management) providing financial aid representing 50% of the feasibility study and evaluation reports, and 15% of the investment in tricycles.
Results (operational & environmental benefits)	Use of the delivery services has been increasing during the trial. The number of trips in the 24th month (14 631) is 18 times higher than in the 1st month (796). Parcel freight has become the most important type of freight during the course of the trial. It has increased from 51% of all items handled at the beginning of the experiment to 97% after 2 years. 156 248 km of diesel van activity have been avoided as a result of the trial. This has saved 43.3 toe (tonnes oil equivalent) of energy consumption, and helped to avoid 112 tonnes of CO_2, 1.43 tonnes of CO, and 280 kg of NOx.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.3 Broadmead Consolidation Centre (Bristol, United Kingdom)

Name	Broadmead CC
Project	Vivaldi Project
Operating period	May 2004 - Ongoing
Sector	Urban distribution of medium size and non-perishable goods
Objective of the CCC	Reduce congestion and related emissions
Description	▪ **Voluntary Scheme** for deliveries inside the affected area ▪ Voluntary UCC for the Cities of Bristol and Bath ▪ Area of the UCC: 5,000m^2 ▪ Value added services in the UCC ▪ UCC located near to strategic road network with a 25min distance to the Broadmead ▪ Benefits to suppliers and retailers: no vehicle restrictions ▪ Time windows previously agreed
Operator	Private Company
Stakeholders involved	Bristol City Council, The Broadmead Board, The Galleries Shopping Centre, Business West (formerly Chamber of Commerce), Exel, Retailers in the Broadmead Shopping Centre
Service provided	
Financial issues	▪ Operating cost in 2007/8 - £459,000 ▪ Operating costs - 62% public : 38% private
Results (operational & environmental benefits)	▪ Near 70% reduction of vehicle trips ▪ Better vehicle utilisation ▪ Retailers satisfaction: 75% would choose the scheme and 94% recommends it ▪ 50% of delivery time improved ▪ 100% on-time deliveries ▪ No reports of losses or damage to stock ▪ Retailers typically saving more than 20 minutes per delivery ▪ 38% of retailers can spend more time with customers ▪ 45% of retailers say improved staff morale ▪ Savings of: 20,3 tonnes of CO2 , 660 kg of NOx, 19.7 kg of PM10 and 12.9 tonnes of cardboard and plastic collected and recycled

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.4 Meadowhall Consolidation Centre (Sheffield, United Kingdom)

Name	Meadowhall Consolidation Centre (ASR)
Project	
Operating period	2006 - Ongoing
Sector	Retail – Serves Meadowhall Shopping Centre
Objective of the CCC	Reduce operating costs, improve sales and reduce loss/theft

Description	The Meadowhall Consolidation Centre (MCC) is situated on the perimeter of the retail park, and provides 30,000 square feet of storage space.
	
	• privately operated – **Recommended for Retailers but not mandatory**
	• Capabilities:
	  ○ pre-retail
	  ○ cross-dock, storage
	  ○ stock returns
	  ○ inter-branch transfers
	  ○ on-demand replenishment service
	
	Open 7 days a week
	
	6 staff plus extra staff at peaks as needed

Operator	Clipper Group
Stakeholders involved	Retailers and shops of the Meadowhall Consolidation Centre
Service provided	Consolidation, delivery when required plus value added services: 3PL, Distribution, Transportation, Warehousing
Financial issues	Capital and operating costs - 100% private
Results (operational & environmental benefits)	▪ Reduced the number of vehicles delivering to shopping centre but not quantified ▪ Reported that consolidation centre reduces vehicle movements to store thereby helping to reduce pollution in surrounding area ▪ Up to 10% increases in sales turnover reported by retailers ▪ Reduced staffing costs ▪ One retailer reduced store refit time by two days and reduced impact of lost sales

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.5 Monaco Consolidation Centre (Monaco)

Name	MoCC – Monaco Consolidation Centre
Project	
Operating period	1989 - Ongoing
Sector	City goods distribution, retail and construction
Objective of the CCC	Reduce the impacts of the city goods distribution
Description	▪ **Compulsory scheme** for heavy vehicles with more than 8.5t weight ▪ Time windows for light vehicles inside the city centre ▪ Loading/unloading operations forbidden when the circulation is prohibited ▪ Private logistics company management with a concession from the Principality ▪ Staff level: 8 workers
Operator	Monaco Logistique
Stakeholders involved	
Service provided	City goods distribution
Financial issues	Operating costs were 20% public: 80% private.

Results (operational & environmental benefits)	▪ 38% reduction in traffic congestion
	▪ 42% reduction in space used by vehicles for deliveries
	▪ Reductions for deliveries from consolidation centre to site of:
	  ▪ 26% in fuel consumption
	  ▪ 25% in NOX
	  ▪ 35% in CO
	  ▪ 26% in SO2
	  ▪ 26% in CO2
	  ▪ 30% in local atmospheric pollution
	  ▪ 30% in vehicle noise pollution

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.6 Binnenstadservice Consolidation Centre (Nijmegen, Netherlands)

Name	Binnenstadservice - BSS
Project	
Operating period	2008 - Ongoing
Sector	Retail
Objective of the CCC	Provide logistical services to local inner city stores, regional consumers, carriers and local government as well as reduce the impact of the urban deliveries focusing on receivers rather than on carriers
Description	Binnenstadservice manages an Urban Consolidation Centre (logistics depot and distribution service) on behalf of retailers and other organizations located in the city centre. Goods destined for these retailers are delivered to this consolidation centre by freight operators. The concept is : • **Voluntary and open scheme for the deliveries** (possibility to join the initiative) • Cooperation of retailers to create a critical mass needed to set up such a service • Start-up subsidy from local authorities • Retailers pay for value-added services • Ultimately it leads to cost reduction for retailers, transport companies and shippers In the five years since the launch of Binnenstadservice in Nijmegen, it has been rolled out to 13 other cities in the Netherlands. The approach should be transferable to other cities across Europe
Operator	Binnenstadservice
Stakeholders involved	Main actors involved : Retailers, Transport companies, City authorities
Service provided	• Storage (so that retailers no longer have to use their shop to store goods or rent storage space elsewhere), • Home-deliveries (for example for large goods, such as fridges and computers), • Value-added logistics including retour logistics (of for example clean waste) • Possibilities for e-tailing in the city of Nijmegen.
Financial issues	▪ Binnenstadservice started with a public subsidy to allow time to encourage the shopkeepers to participate ▪ Binnenstadservice needs a lot of retailers to join to create the critical mass to make it successful. In many cities
Results (operational & environmental benefits)	▪ Financial: reduced stockholding at expensive shop spaces, reduced time needed to receive/ship goods, reduced time loss for last mile delivery, thus about 10% cost reduction ▪ Benefits in the field of services: shop keeper pay a small fee for time consuming activities such as the collection of packaging material, empties, paper ▪ Benefits for society: less congestion, fewer delivery journeys, more liveable city centre, about 40% reduced CO2 and pollutants emission

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.7 SMILE (Barcelona & Valencia, Spain)

Name	SMILE Project
Project	SMILE Project (MED programme)
Operating period	Barcelona in 2013 and Valencia in 2014
Sector	Parcel distribution in the city centre of Barcelona and Valencia
Objective of the CCC	New sustainable solution for last mile distribution in congested areas
Description	The SMILE Project was an initiative that aimed to reduce the impact of the urban deliveries in congested areas such as the city centres of Valencia and Barcelona. Under this framework, two pilots were implemented in both cities in order to estimate the impact of the urban deliveries by using a consolidation centre and environmentally friendly vehicles for last mile distribution. Barcelona: ▪ 2 e-tricycles ▪ 40 parcels per trip and tricycle ▪ UCC: 33m2(Covered) + 40m2 Valencia: ▪ 2 e-tricycles ▪ 40 parcels per trip and tricycle ▪ UCC: 2x15m2 (Two 20 feet containers) The project was a trial were some of the most important carriers of the cities involved collaborated in a **voluntary scheme.**
Operator	Vanapedal (Valencia and Barcelona)
Stakeholders involved	DHL, SEUR, TNT, Fundacion Valenciaport, InnDEA, City Hall of Valencia and Barcelona, Vanapedal (operator), ITL, AFT, CENIT
Service provided	Last mile distribution, consolidation and storage.
Financial issues	Barcelona: ▪ Investment costs: 82.542€ ▪ Operating costs: 104.929€ Valencia: ▪ Investment costs: 40.808€ ▪ Operating costs: 57.600€
Results (operational & environmental benefits)	Barcelona: ▪ Km saved per parcel (annually): 1.81km per delivery ▪ Fuel (litres) saved per parcel (annually): 0.54l per delivery ▪ CO2 (kg) saved per parcel (annually): 0.21CO2 kg per delivery ▪ Hours saved (annually): 533h per year ▪ 120 daily operations with 16.8 km done by tricycle ▪ 5.3% saving per trip (i.e. 225 km of savings per truck) Valencia: ▪ Km saved per parcel (annually): 0.71km per delivery ▪ Fuel (litres) saved per parcel (annually): 0.21l per delivery ▪ CO2 (kg) saved per parcel (annually): 0.14 CO2 kg per delivery ▪ Hours saved (annually): 341h per year

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

4.2.8 La Rochelle (France)

Name	La Rochelle
Project	ELCIDIS project
Operating period	2001 - Ongoing
Sector	Goods distribution
Objective of the CCC	Assess the efficiency of electrical vehicles for urban goods distribution
Description	• **Voluntary service** with restrictions • Heavy delivery vehicles (>3.5 t) banned from the city • UCC with electric vehicles for last mile distribution • Possible logistics services in the UCC • Surface area of the UCC: 800m^2
Operator	Veolia Transport – Proxiway (filial)
Stakeholders involved	Communaute D'Agglomeration de la Rochelle (promoter and coordinator), Chamber of commerce, Craft Associations, shopkeepers, local premises and logistics companies.
Service provided	Parcels delivery inside the assessed area in la Rochelle
Financial issues	• Delivery from the UCC to the inner city costs 3.75 euro/parcel • Fixed subside provided by the local government for the infrastructure • Fixed subside per package • 600 parcels per day needed for the break even
Results (operational & environmental benefits)	• 450 parcels per day • Between 5-10 pallets per day • 30% of the deliveries done through the UCC • Better traffic and parking conditions • 61% less vehicle kilometres with conventional trucks in the city centre • Carriers avoid wasting time in delivering in the city • Important time savings for carriers • Good participation

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4.2.9 Leiden (Germany)

Name	Leiden UCC
Project	
Operating period	1989 (trial) and 1994 operational - 2000
Sector	Urban freight delivery
Objective of the CCC	Decrease congestion and distribution costs
Description	Public-private-partnership (PPP) with the municipality, a consultancy company, a real estate company, a transport company and a reemployment organisation. ▪ **Voluntary UCC** ▪ Deliveries with environmentally friendly vehicles
Operator	Coopers & Lybrand
Stakeholders involved	
Service provided	Consolidation, distribution and other logistics services
Financial issues	The UCC in Leiden failed because of low profitability due to the disappointing number of parcels handled in the distribution centre. The objective was to deliver 500 shipments per week to the city centre. This objective was not met by a long way ▪ Break even considered at 600 parcels per day ▪ Beak even without subside at 2,000 parcels per day
Results (operational & environmental benefits)	▪ Strong opposition from business community ▪ Loss of competitive edge of the major retailers in terms of their own logistics arrangements ▪ Best achievement: 394 shipments per week

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4.2.10 Kassel (Germany)

Name	Kassel
Project	Private initiative
Operating period	1994 – 2005
Sector	City Goods
Objective of the CCC	Co-operation of several transport companies to consolidate their retail supplies and deliveries in Kassel
Description	The UCC of Kessel was born as an initiative of private transport companies in 1994. Ten transport companies responsible of the 3% of the retail deliveries to the city centre of Kassel decided to cooperate using a UCC where their cargo is consolidated and delivered by a single 'neutral' carrier. As it is a co-operation between companies, this UCC works in a **voluntary scheme**.
Operator	Neutral Carrier into Kassel cbd.
Stakeholders involved	Chamber of Commerce and Industry, retail business organisation, City Council, University of Kassel and the ten forwarders and neutral carrier involved in the agreement.
Service provided	City goods distribution
Financial issues	UCC not subsidised
Results (operational & environmental benefits)	Load factor of the vehicles increased in 100% (volume) Load factor of the vehicles increased in 140% (weight) 60% decrease in the total of kilometres inside the city 40% decrease in the total of kilometres outside the city Number of deliveries per retailer per year reduced by 13% Delivery weight per drop increased by 15% Transport cost savings do not cover the additional handling cost Improvement of their brand image

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4.2.11 Utrecht Case (Netherlands)

Name	Utrecht UCCs
Project	
Operating period	Four UCC that started in 1994 - Ongoing
Sector	Goods distribution
Objective of the CCC	Reduce the urban freight distribution impacts and protect the city's arched basement
Description	The UCCs of Utrecht can be divided into two groups. First, there are those run by large service providers like GLS and DHL that operate a CDC from a commercial point of view in the urban distribution market: ▪ Run by the private sector – **Voluntary Scheme** ▪ Support of the local authorities in terms of operating exemptions ▪ Makes use of the existing freight transport and logistics operations and infrastructure ▪ Vehicles with less than 2 t weight ▪ Minimum of 25 deliveries per journey and 100 deliveries per day to get the permit ▪ Allowance to use the bus lane by the city distribution vehicles ▪ Special time windows for the city distribution vehicles
Operator	TNT, Hoek Transport (Smal UCC) and DHL and GLS (Large UCC)
Stakeholders involved	Premises in the urban area, local authorities and all the carriers that wanted to join the initiative
Service provided	Urban freight distribution (parcels and goods)
Financial issues	▪ Without any subside
Results (operational & environmental benefits)	

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4.2.12 City Porto (Padua, Italy)

Name	Cityporto, Padua (Italy)
Project	SUGAR
Operating period	Since April 2004 - Ongoing
Sector	Freight urban distribution
Objective of the UCC	Cityporto is the goods transit point for the city, located in the freight village area of Interporto Padova, using methane and electric vehicles which Interporto Padova offers to all the haulage companies to provide an efficient service to cover the "last mile" into the city. Cityporto optimizes and consolidates the urban freight distribution, to contribute to the reduction of traffic in city centre and foster the use of low-polluting vehicles.
Description	▪ A terminal for consolidation, 2 miles outsides the city centre and close to the major highways ▪ Management software (tracking and tracing of deliveries) ▪ Vehicles running on CNG ▪ One operation manager directly employed by Cityporto ▪ Terminal operators with experiences in logistics management ▪ Goods' handling and distribution entrusted to a third party ▪ Enforcement scheme: limited time windows to access to the LTZ, implementation of electronically monitored gates to access to the LTZ ▪ Monitoring procedures: monthly monitoring statistics of the number of deliveries, time windows for access and loading/unloading, tariffs per delivery agreed with third party operators
Operator	Interporto of Padova S.p.A.
Stakeholders involved	▪ Interporto of Padova: project leader and service management operator ▪ Municipality of Padua: co-leader of the project and regulator ▪ Commercial Chamber of Padua: provides funding and regulation advice ▪ A.P.S. Mobilità, the local public transport company: provides funding and regulation advice ▪ More than 55 freight transport operators: users of the system
Service provided	Freight transport operators deliver their goods to the logistics platform in Interporto Padova, where eco-friendly methane and electric vehicles are loaded, then distribute goods to the city centre. IT system supports the managing of the daily delivery plans: Cityporto eco-friendly vehicles cover the last mile distribution, having maximized their loading capacity, in order to reduce the number of delivery trips. The vehicles have preferential lanes, free access to the city centre and parking in the LTZ at any time of the day. The service is dedicated to the subcontracted and direct goods hauliers working in the city, it will also be extended shortly to perishable goods delivery.
Financial issues	▪ Grants attribution from public administrations: 360,000 € ▪ Decreasing amounts granted with the increasing success of the UCC: ○ 2004: 85% grants on total inflow ○ 2005: 50% ○ 2006: 24% ○ 2007: 22% ○ No public funding as of 2007

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Results (operational & environmental benefits)	▪ Environmental benefits in terms of reduction of pollutant emissions (period analysed 24 months, 2008-2010): ○ CO_2: 219.65 tonnes ○ NOx: 369 kg ○ SOx:72.8 kg ○ VOC: 210.4 kg ○ PM10: 51.4 kg ▪ Operational results (period analysed 24 months, 2008-2010): ○ Reduction of kilometres covered: 561400 km ○ Daily average reduction: 1216 km/day ○ Reduction of gas consumption: 58200 litres ○ Natural gas consumption of Cityporto CNG vehicles: 3904 kg ○ Number of delivery performed: 122,170 (94,000 deliveries in 2014) ○ Operative days: 485 ○ Delivery trips (registered by tracking and tracing IT system): 6,306 ▪ Qualitative results: the consolidation of goods distribution in the city centre gives space to different mobility policies for citizens (pedestrian zones, bike lines, etc.)

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4.2.13 Luccaport (Lucca, Italy)

Name	Luccaport, Lucca (Italy)
Project	MEROPE (Interreg IIIB), CEDM (Life Environment), LUSLIN (Ministry of the Environment)
Operating period	Since 2003 - Ongoing
Sector	Freight urban distribution
Objective of the UCC	Optimise the urban distribution, by using an urban consolidation centre, as main structure to support rationalised – eco and business- efficient city distribution schemes.
Description	▪ A consolidation centre for freight transhipment and freight collection, located in a strategic position, near the city centre and the major highways ▪ An ICT platform: e-service system, which supports the planning and management of the freight distribution and allows to link all main stakeholders in the city logistics system ▪ 1 operations manager ▪ 1 planner of trips ▪ 1 administrative manager ▪ Warehouse operators ▪ 6 electric vehicles for freight distribution in the city centre ▪ **Enforcement scheme**: voluntary UCC scheme with time windows and promotion of electric vehicles for list mile distribution
Operator	Municipality of Lucca
Stakeholders involved	▪ Municipality of Lucca: financing body ▪ Tuscany region: financing body ▪ European Commission: financing body ▪ Shopkeepers: users ▪ Operators: users
Service provided	Organisation of the urban freight distribution and collection in the city centre of Lucca. Cooperation with freight operators to cover last kilometres, using electric vehicles. The service is also oriented to citizens and tourists, for goods delivery in different points. Different services supplied: pallets and parcels delivery, pick up, delivery to hotels, reverse logistics.
Financial issues	

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Results (operational & environmental benefits)	▪ Operational results:
	  ○ Reduction of congestion by reducing the total number of vehicles in the historical city centre
	  ○ Optimisation of loading capacity and delivery routes
	▪ Environmental benefits, in terms of reduction of pollutant emissions (period analysed 2007 – 2012)
	  ○ CO2: 270 tonnes
	  ○ CO: 1.2 tonnes
	  ○ NOx: 160 kg
	  ○ PM10: 100 kg
	▪ Negative externalities: Reduction of noise pollution and risk for historical buildings
	▪ Qualitative results: improvement of the quality of life in the city centre for residents, visitors and tourists

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5 SWOT analysis:

5.1 General SWOT analysis for UCC and CCC:

Strengths:

- **Increment of the transport efficiency**. The use of UCC:
  - Increases the load factor and volume utilisation of the vehicles,
  - Reduces the total amount of kilometres travelled
  - Reduces the number of urban trips
  - Reduces the number of vehicles in urban areas
  - Improves the vehicle and energy usage.
  - Fewer but larger deliveries, so less time losses in entrance and receiving operations.
- **Increases the level of performance.** The use of UCC facilitates the implementation of just-in-time delivery systems with all its benefits, such as:
  - Minimization of inventory cost.
  - Reduction of stocks.
  - Better customer satisfaction.
  - Better supply chain management.
- **Positive environmental effects associated to the higher transport efficiency:**
  - Reduction in fossil fuel consumption
  - Less noise
  - Less pollution and emissions and better air quality
  - Favours the use of green vehicles
- **Positive effects on the city traffic**
  - Less congestion
  - Less traffic accidents
  - Less occupation of parking space
- **Clear customer-approach:**
  - More flexibility to choose the delivery hours.
  - Remote storage that makes possible to increase the commercial surface in the shop.
  - Potential returns management and reverse logistics
  - Improve the punctuality of the deliveries
  - Improve the reliability of the deliveries.
  - Simplification of the processes due to the fact that there is only one actor involved for the delivery management.
- **Possibility to implement economies of scale in the UCC with all its benefits.**
- **Higher potential to develop and implement innovative solutions (R&D)**

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Weaknesses:

- **Loss of the brand image.** The presence of a new intermediary in the logistics chain (the UCC) makes more difficult the communication between the customer and the supplier of the service and this situation may lead to a loss of the brand's reputation.
- **Lack of contact between the supplier and the final customer.** As previously mentioned, the presence of a UCC introduces a new element in the logistics chain that makes more difficult the communication between the offer and the demand of the service. This lack of contact makes more difficult to build loyalty between the companies or shippers and the customers.
- **Need of support of the public authorities.** Most of the experiences in UCC need the support of the public authorities in terms of subsides in at least the initial part of its implementation. In other cases, the public assistance is needed not only for the implementation of the UCC but even for daily operations.
- **High implementation cost.** The initial investment required for the implementation of UCC is high while the benefits that they provide are obtained in the long term. In addition, in several cases is difficult to translate into profits (euros) the benefits of the UCC.
- **Additional handling in supply chain and associated costs.** The implementation of a UCC adds transport and handling costs due to the presence of a new element in the supply chain. The introduction of additional handling may produce other problems regarding security, liability or customer service issues. Besides, a new element implies new costs and communication issues to the global process.
- **Difficult allocation of costs and benefits.** It is difficult to estimate the full impact of a UCC scheme, besides the parties involved are normally only concerned about the costs and benefits that directly affect to themselves. There are several benefits and costs that are easy to measure (i.e. establishing cost and operational benefits). However, there are other hidden cost and benefits difficult to quantify and express in monetary terms. It is important to remark that the calculation of the benefits and profits is more complex than the costs calculation, situation that makes more difficult the implementation of UCC schemes.
- **Multiple procedures and IT systems may be required** for the UCC and last mile delivery (lack of interoperability of systems)
- **Possible increment of the vehicles trips near the UCC area** that may affect the traffic congestion surrounding the UCC (if JIT scheme).
- **Other weaknesses:**

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- Difficult to replicate in some cases because the UCC are local solutions for specific problems.
- Higher risk due to the concentration of the business regarding the deliveries. An unforeseen event in the UCC would affect the whole logistic chain.
- Difficult to find an optimum location for the UCC that accomplish with the requirements needed for the UCC in terms of cost and space

Opportunities:

- **New increasingly traffic legislations in urban environments.** These restrictions traditionally affected to the presence of heavy trucks in the city centre but now, the restrictions are also affecting light vehicles used for the transport of goods and also light private vehicles in some restricted areas (e.g. London).
- **New environmental legislations for the cities.** Currently, the global awareness about environmental issues is continuously increasing, and the local authorities are now more implicated in the introduction of policies to improve the way of life of citizens. In this way, several cities worldwide are developing and implementing environmental measures, specially related to the carbon footprint and with the emission's control.
- **Rebirth of the historical city centres inside the cities**. Large urban developments in the outskirts of the cities took place in the last decades at the same time than were built big commercial centres near these areas. Even though the development of new urban areas is still happening at a moderate rate, the historical city centres are living a rebirth due to the increase of their level of activity. This activity is mainly related to the development of small commercial premises located in the city centre that require an efficient logistics activity due to the narrow streets that form the historical centres. Because of this, the support of the local authorities to boost the central areas is remarkable.
- **Development of the urban logistics.** Urban logistics is a relatively new science that addresses problems related to mobility, environment, energy consumption and economics in urban areas. Urban logistics is a discipline that is becoming more important year by year due to the increase awareness of the public authorities and the new urban trends.
- **Change of business paradigm: from a competitive framework to a collaborative one.** The business paradigm is changing rapidly in the last years, especially due to the availability of new communication systems. Now, the willingness of the companies to collaborate between them in order to achieve a common objective or solution is higher than years ago, where the competitiveness between companies was the typical framework.

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- **Advantages derived from the use of green vehicles (bikes, electric vehicles, etc.)**
- **Other relevant opportunities:**
  - New more efficient and less pollutant vehicles
  - Increment of the congestion in the cities
  - Opportunity to develop added value activities in the UCC

Threats:

- **Weak economic growth.** The main economies in Europe and in the OECD have not recovered the economic growth previous to the economic crisis and this situation affects the current investments. In addition, it is important to mention that most of the UCC or CCC count with the support of the public authorities and their financial status is not as strong as it was before the crisis.
- **Lack of knowledge about the benefits of the UCC.** Most of the companies are not aware of the potential benefits of the UCC because for them it is difficult to translate into financial flows the benefits of a UCC (e.g. traffic congestion or environmental benefits are difficult to translate into euros). This situation hinders the implementation of the consolidation centres that, in contrast, can bring remarkable benefits to the whole logistics chain, to the cities and also to the citizens.
- **Possibility to develop a logistics monopoly.** The possible generation of a logistic monopoly or oligopoly is real if the logistics activities are centralized through a UCC. In this scenario the different actors of the logistic chain lose their direct contact and distribute theirs goods through an intermediary and, if its activity is not regulated properly, this fact can become counterproductive.
- **Unwillingness to collaborate.** Carriers, shippers and logistics companies do not trust completely into the potential benefits of the UCC because of the loss of contact with their clients after its implementation. They identify the UCC as a threat that may produce a loss in part of their business or clients' portfolio.

5.2 Specific SWOT analysis for CCC:

In this point, only the Consolidation Centres for the construction industry are being analysed. The CCC is a specific case of UCC and because of this, in addition to the general advantages and disadvantages of the UCC, they have their own specific benefits and drawbacks. Some of the additional positive and negative points are:

Strengths:

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- Large number of materials required for the construction sites that can be routed through the CCC. An example of this is the CCC in Hammarby, Sweden.
- Better reliability of the deliveries that improves the planning of the constructions sites.
- Reduction of the congestion problems near the construction site produced by the huge number of delivery trucks coming and leaving the site daily.
- Less number of damaged materials.
- Less number of stolen materials.
- Less storage capacity required in the pilot site and inventory management.
- More flexibility and punctuality of the deliveries.
- Possibility to add new added value activities in the CCC (e.g. the London and Hammarby experiences).
- Possibility to involve several construction sites in the same CCC (i.e. London).
- Increase of the Safety due to the reduction in the handled materials and the higher safety measures of the CCC than in the construction site.

Weaknesses:

- One of the most important materials of the construction cannot be routed by the CCC because it has a specific logistics (concrete). The concrete uses a full loaded specific truck and it cannot be storage (if fresh concrete), so no added value to go through the CCC.
- Static solution for a dynamic problem. The CCC is placed in a fixed location but the construction sites vary in time. The possible logistic benefits related to the transport efficiency can be reduced if the construction activity is slowed or if the construction sites are too far from the CCC.
- The materials used along the different project phases vary and this situation modifies the logistics of the CCC time because it does not handle the same materials in each step of the project.
- Difficulty for the users of the CCC to obtain short term direct profits.
- Most of the benefits of the CCC are related with the planning improvement, environmental issues and traffic. However, it is not easy to compensate the high initial investment with the cost savings obtained due to the normal operation.
- Most of the cases, the support of public authorities is needed

Opportunities:

- **Take advantage of previous UCC experiences for other industries.** The development of CCC is still in its firsts steps, nevertheless, there are

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several successful UCC experiences related to other industries (parcels, retail, goods, etc.) that can be used to accelerate the development and implementation of CCC.

- **Development of new ICT tools for the construction industry.** The construction industry is typically reluctant to change, and the possibility to develop new ICT tools for its logistics and processes is high. This has especial impact in the CCC, where new ICT systems could be more easily implemented than in several companies.
- **Rebirth of the construction in the city centres** due to the new urban trends such as the creation of big pedestrian zones and the limitation of the traffic in the historical city centres. This new situation makes necessary the use of efficient logistics for the construction and new regulations where the CCC can be a realistic and feasible solution. Besides, local authorities are implementing new policies to promote the small and medium size premises in the historical centres.
- **Possibility to work in just is time basis.** The construction industry has been a sector with a lack of innovation, however, the implementation of CCC enables the possibility of introducing just in time operation systems and its potential benefits for the construction industry. This will also help the construction industry to become more innovative and efficient. (i.e. CCC in Hammarby)

Threats:

- **Lack of big urban developments in the cities.** Even though the city centres of the cities are being recovered with the support of the public authorities, the lack of big urban projects or developments, mainly because of the crisis, difficult the implementation of CCC and UCC due to the need of coordinate several construction sites with different contractors involved.
- **Construction industry debilitated after the economic crisis**. The construction sector has been one of the most affected by the economic crisis and it is still recovering. Several construction companies went bankrupt during the crisis and the ones that are still functioning are reluctant to get engaged in risky operations.

6 Business Models in City Logistics

6.1 Definition of Business Models

The concept of business model became popular in the 1990s in the IT sector, mainly used by dotcom companies during its search of investors. Currently, the concept has become widespread to practically all sectors in the industry and has focused more attention from the academic world. Many authors have

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provided alternative definitions of what a business model is. For example, Shafer et al mention 12 authors that have offered alternative definitions, and also propose their own based on the definition of the words included in the term (business and model). These authors define a business model as "*a representation of a firm underlying core logic and strategic choices for creating and capturing value within value network*". From this definition and considering that a business has become a management tool, it is also possible to define a business model as a conceptual instrument containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm (Osterwalder, Pigneur & Tucci, 2005). The organization has to consider concepts and relationships for a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences.

Different methods can be found in the literature to either identify the existing business model of an already created company (mainly for software development purposes) or as an assistant tool to identify the most convenient structure to be adopted by a starting company. In their work, Montilva and Barrios identify several methodologies of the former, i.e. methods that include the definition of the business model of a company as one of the steps that should be taken during the development of specific management software. Montilva and Barrios mentioned among the most significant methodologies, the Rational Unified Process (RUP), the Unified Modeling Language (UML), Business Engineering, Watch, MERISE, EKD, Mainstream Objects and the Information Engineering. Finally they propose their own one called Business Modelling Method (BMM). The purpose of these techniques is the visualisation of the processes that take place in a business and they mainly differ in the methods and tools used to accomplish this goal[1]. The simplest approach would be the use of a whiteboard or PowerPoint, while more complexes ones involve the use of sophisticated standards.

Currently, there are no obvious standards for business modelling notation; there are, however, efforts underway to align several common practices. Standardization initiatives are driven by BPMI (Business Process Management Initiative, www.bpmi.org) in collaboration with the OMG (Object Management Group, www.omg.org). The review of the main characteristics of some of them can give a better idea of the fundamentals of these group of techniques.

6.1.1 The RUP

The RUP method is two-dimensional, using as the first dimension the phases (inception, elaboration, construction and transition) and the disciplines (business modelling, requirements, analysis & design, implementation, test,

[1] http://www.ibm.com/developerworks/rational/library/content/RationalEdge/aug04/5634.html

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deployment, configuration & change management, project management and environment). Business modelling is the starting point of the whole process and it is present in three out of the four phases. The workflow diagram using RUP notation of this phase is shown in the following Figure 2. RUP workflow diagram of the Business Modelling stage Figure 2. As can be seen, the process identifies processes, realisations and roles and responsibilities of the business in order to detect improvement opportunities.

Another methodology, UML, has been traditionally used for analysing and designing computer programs. In fact, UML is the de facto standard for modelling software. However, there are several aspects of a business that favours the use of such this technique. The most important one is that both software and businesses can be divided into processes and their relations, so the use of a technique that has been proved to be convenient for one field can be of direct application to the other. However, business systems have many concepts that are no present in a program and, consequently, the use of UML requires the use of some extensions to the standard language.

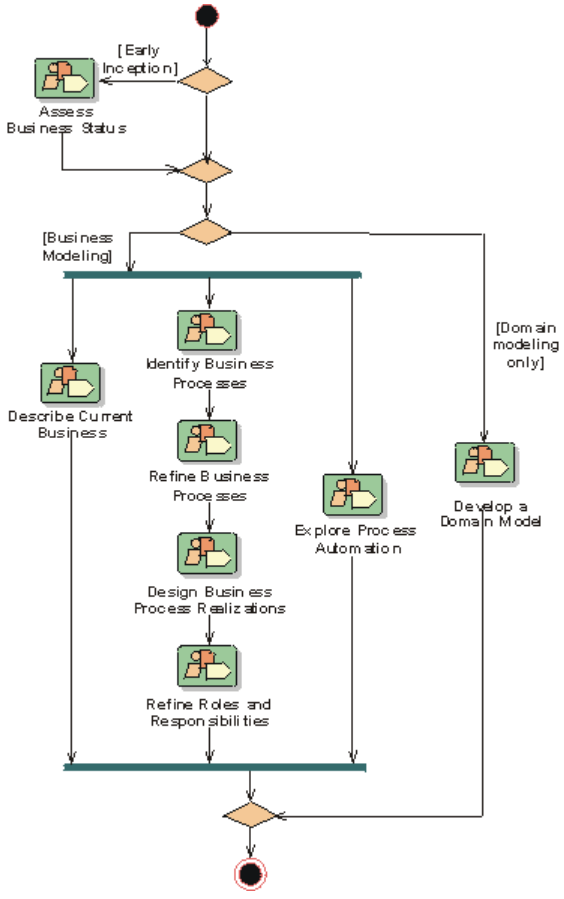

Figure 2. RUP workflow diagram of the Business Modelling stage

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6.1.2 The UML

The UML consists of nine different diagram types, and each diagram shows a specific static or dynamic aspect of a system. The basics of UML are easy to learn, and very powerful constructs, such as stereotypes or powertypes, are available for the more advanced modeller. When applied to business modelling, the approach taken is the definition of the whole business architecture through the use of 4 views, each containing a number of diagrams. The concepts that are used in the diagrams are the following: process, events, resources, goals, business rules and general mechanisms. Therefore, the whole model will consist on a group of diagrams, such as a goal model, a conceptual model, order statechart, resource model, organisation model, action workflow pattern, etc. As an example, the following figure shows the description of the workflow of a business through the use of the activity diagram.

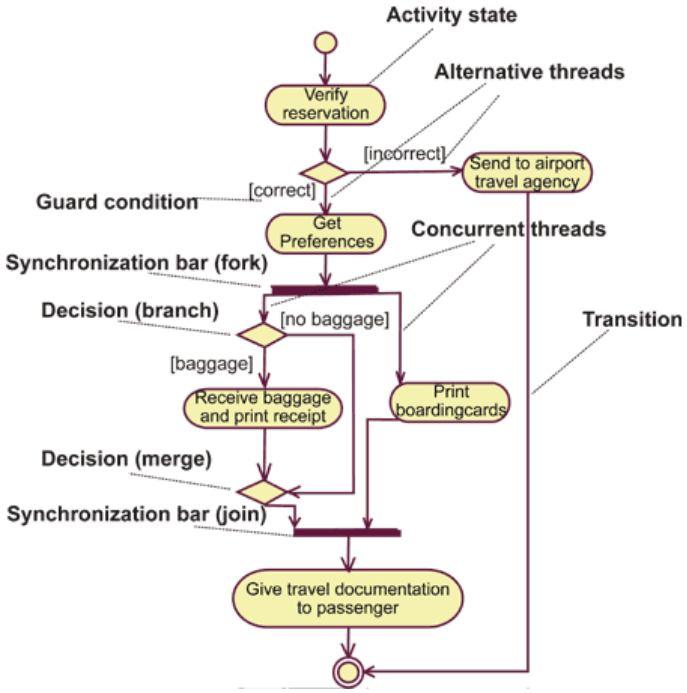

Figure 3 .UML Activity Diagram Depicting Workflow Structure

6.1.3 The BMM

Another methodology, BMM was designed based on principles, processes and concepts borrowed from Method Engineering, Enterprise modelling and Object Oriented Software Engineering. Similarly to UML business modelling, it consist on a series of submodels (also called meta-models), each of them being represented by one or more diagrams. The submodels are categorized into three different groups: product, process and team models. The following figure shows, as an example, the structure of the business model meta structure.

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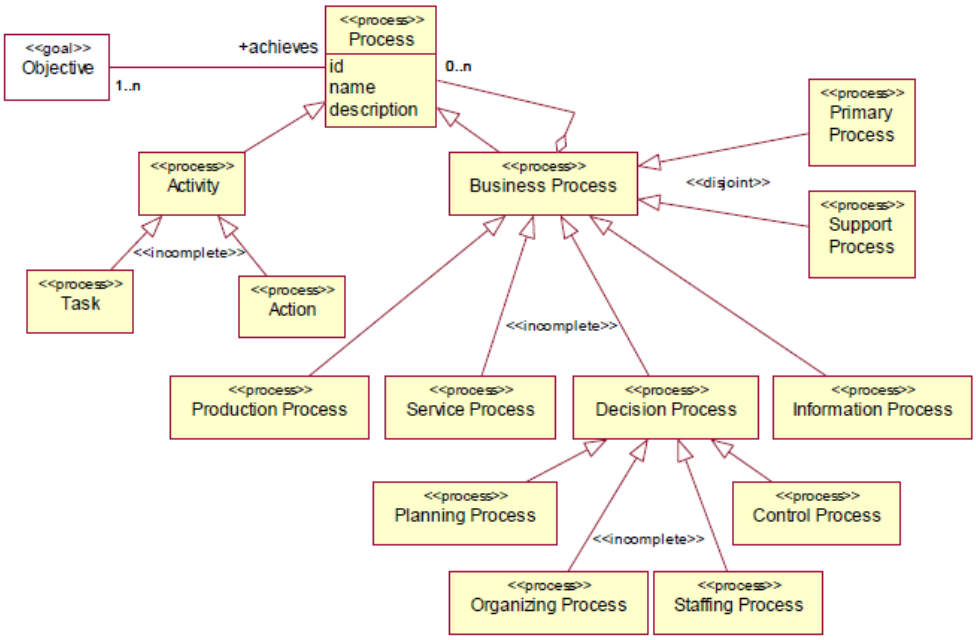

Figure 4.UML Activity Diagram Depicting Workflow Structure

Even though these methods provide a quite comprehensive view of the complete structure and operative of a business and could be used during the stage of definition of the business (before the actual start of activities), the degree of detail involved in their development makes its use more appropriate for latter uses. Much simpler approaches are required for the conceptual design of a future activity, which is actually the definition of the fundamental structure that will define the future activity of the company. In this sense, a relatively new developed methodology dominates most of the dedicated literature: the Business Model Canvas. The method and its derivatives propose a series of blocks that should be defined and that cover all the main aspects of a business. The differences of between methods rely on the blocks defined by each of the authors, even though in all cases their contents are identified as a result of a collaborative work carried out by the team in charge of defining the business model. All methods propose an interactive process in which the initial empty canvas is filled by the ideas proposed by the team and its discussion.

6.2 Theoretical Framework of CANVAS Business Models

The goal of any Business Model is to describe the rationale of how an organization creates, delivers and captures value (Osterwalder, 2010). The Business Model Canvas (BMC) consists on a strategic management and entrepreneurial tool that uses a visual chart/template to describe the structure of a business plan. Importantly, it describes a business' value proposition, infrastructure, customers, partners and finances, which, when combined, provide a coherent view of a business' key drivers. It has three main advantages over the traditional business plan (Cowan, 2014):

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- Focus: Traditional business plans are bulky with important information getting lost in translation, the BMC offers clarity and conciseness in what is driving the business.
- Flexibility: It is simpler to tweak the business model using the BMC (from a planning perspective) on a single page rather than 40+ pages of text.
- Transparency: Users and viewers of the BMC will understand the business model easier and much more likely to buy into an idea that is explained easily.

The BMC can be printed out onto a large surface so that groups of people can formulate ideas and discuss business model elements together, using pens and post-it notes amongst other implementing tools. Its hands-on approach makes it ideal for business model understanding, discussion, creativity and analysis.

BMC has a structured methodology to describe any business through the systematic description of nine basic building blocks that show the logic of how a company intends to make money. The nine blocks cover the four main areas of a business: customers, offer, infrastructure, and financial viability. The contents of the nine blocks are identified from a series of questions which should be answered by the promoters of the business, and they are graphically represented using a predefined template. The following Figure shows the main structure of the original business canvas

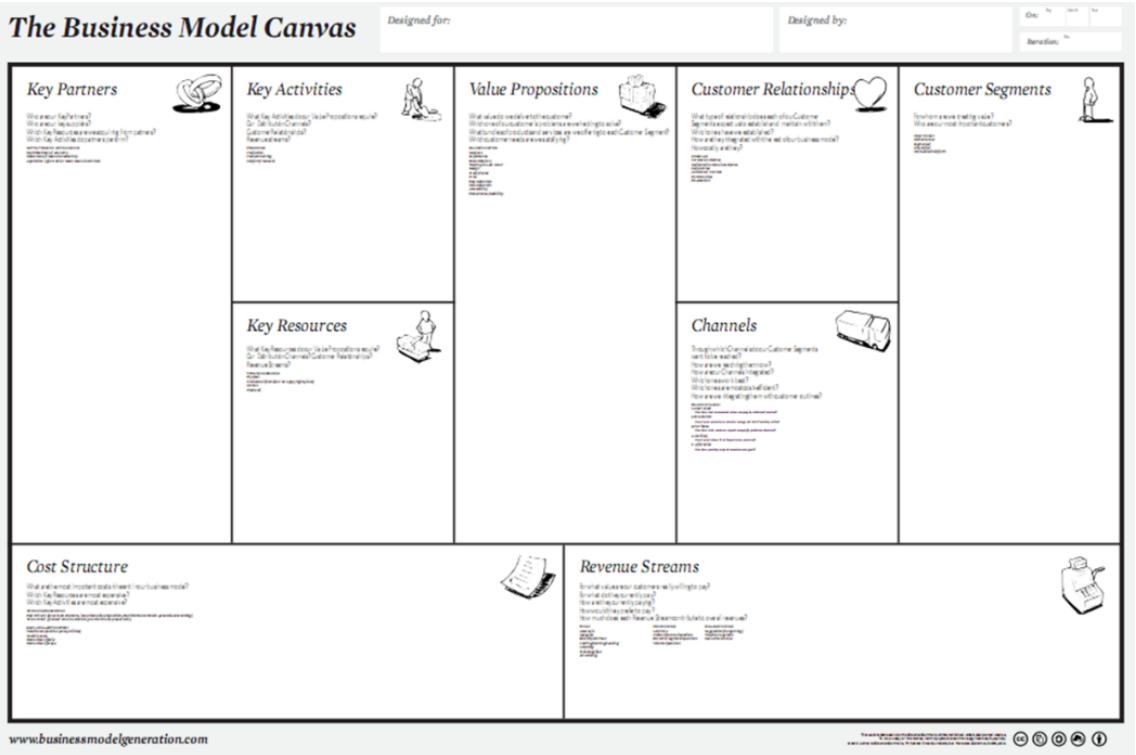

Figure 5.Template used in the methodology Business Model Canvas

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Based on the original philosophy, the Innovation Canvas [2] includes four quadrants of Explore, Ideate, Design, and Market surrounding the core themes of creating value. As the main advantages of this approach, the author of this approach highlights the following:

- encourages both sequential and simultaneous thinking,
- encourages repetitive testing and refinement of the themes and basic building blocks critical to the development of the business model and product or service offering
- promotes a team-based approach, where team members populate the canvas according to their particular perspectives and needs
- inspires innovation by making visible the connections, interactions, and alignments among themes across the canvas
- approximates the reality and complexities of developing a successful business venture through its lack of start points and end points.

The main advantages of this approach is that it analyses more deeply the product or service offering. The following figure shows the main structure of the Innovation Canvas.

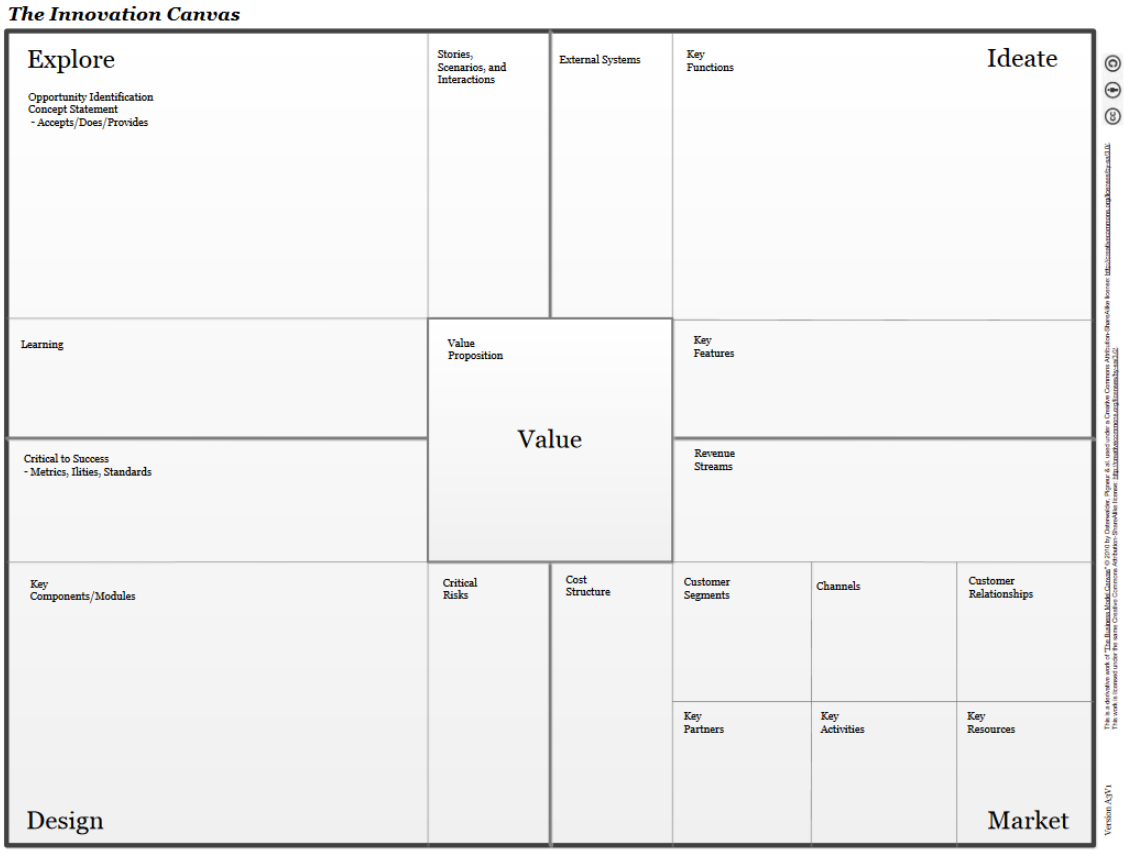

Figure 6.Template used in the methodology Innovation Canvas

[2] http://www.rose-hulman.edu/offices-and-services/office-of-innovation/innovation-canvas.aspx

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Another adaptation of the original Canvas method aimed to be used for web apps business companies and was proposed by Rob Fitzpatrick. This proposal adapt the concept to the '4 steps of Epiphany' concept[3] developed by Steven G. Blank especially focused on new product development. The following figure shows the main structure of this type of Canvas.

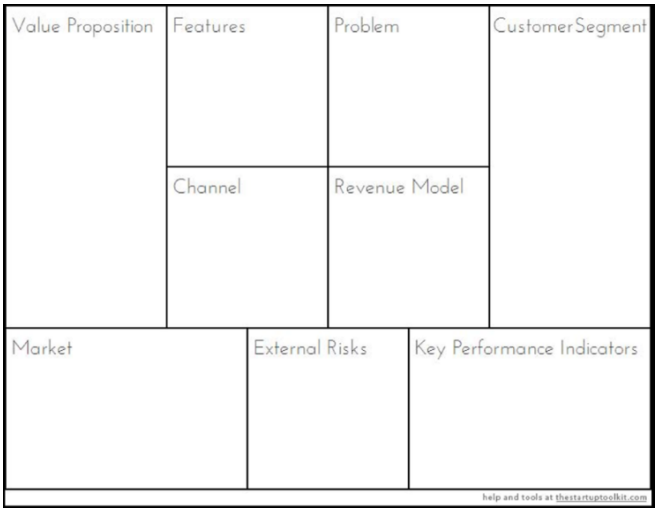
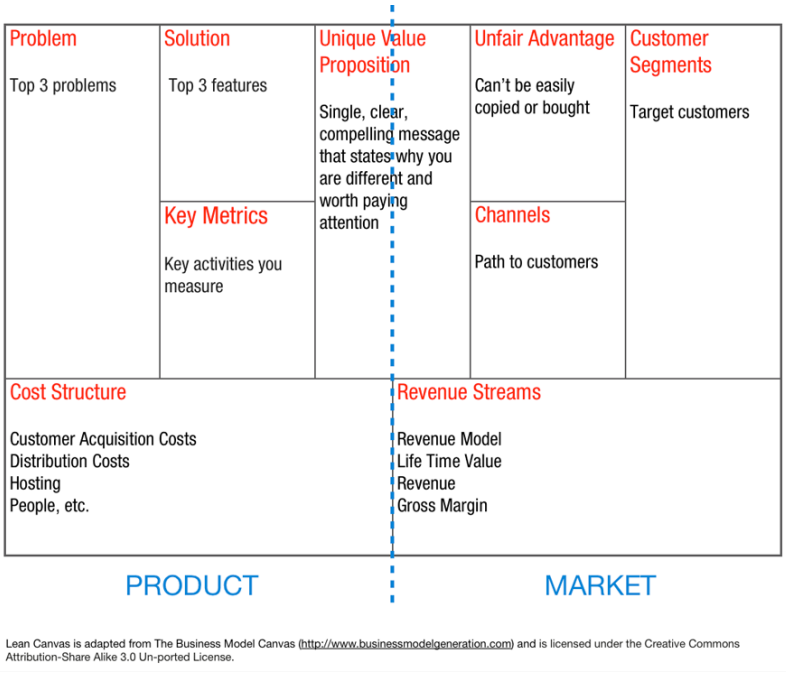


Figure 7.Template used in the Canvas methodology proposed by Fitzpatrick

From the previous work, Ash Maurya[4] introduces Lean Canvas methodology, an alternative proposal intended to be as actionable as possible while staying entrepreneur-focused. As in the previous case, it includes 9 blocks, even though the contents differ from that of the original method.



[3] http://web.stanford.edu/group/e145/cgi-bin/winter/drupal/upload/handouts/Four_Steps.pdf
[4] https://leanstack.com/why-lean-canvas/

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Figure 8.Template used in the Canvas methodology proposed by Maurya.

As can be extracted from the above, the use of a Canvas methodology is really powerful and can be adapted to particular uses. Even though the derivatives Canvas models have their own specific applications, the original method adapts perfectly to the case of urban logistics. It has been the selected methodology for such problems by several authors, such as Quak et al or Abrahamsson and Björklund. Canvas was also chosen as the selected methodology to propose Business Models for several past European project focused on City Logistics, such as TURBLOG[5], SMILE[6] or CITYLOG[7]. For all the above mentioned, it was decided to also use the original BMC in this project.

[5] http://www.turblog.eu/
[6] http://smile-urbanlogistics.eu/
[7] http://cordis.europa.eu/publication/rcn/16579_en.html

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7 Definition of general models and data requirements identification: CANVAS for UCC and CCC

In this section, the main characteristics of the UCC and CCC are going to be listed with the aim to establish a general classification for the UCC, and more specifically for the CCC, based on the literature review and the experiences that have been identified previously. This general classification for the CCC will provide the possibility to establish a general framework in which the SUCCESS partners will have to identify and select which possible CCC organizational scheme fits better according to the pilot and city characteristics and objectives.

7.1 Objective of the CCC

The objectives of a specific consolidation centre can vary depending on several factors such as who is the owner and the operator of the CCC, the users of the CCC, the area, the projects served, etc. The main objectives could vary in the following ways:

- Based on economic efficiency and profitability or, in contrast, mainly focused in environmental/social factors (or both). In this way it is important to establish if the CCC is implemented as a profit centre or a cost centre.
- Based on achieving supply chain-wide improvements or improvements in a localised area (or both). This can be apply for a single company that pursues improvements in its own logistics in a specific area but also to a group of companies that also want to improve the logistics in a specific area.
- Focused on greater consolidation of goods destined for the urban area or to tranship these goods onto smaller, lighter, cleaner goods vehicles for final delivery (or both)

7.2 Type of CCC

After the literature review and identification of several UCC and CCC schemes carried out as well as the SWOT analysis performed for their characteristics, it is possible classify the UCC and CCC into a system where all the experiences can fit. According to Browne et al. 2007[8] the UCC and CCC can be classify into three main different categories of UCC:

1. **Special project UCCs**: Usually these UCC are used for non-retail purposes and they are very common for the construction industry and the delivery of construction materials (i.e. Heathrow and Stockholm). This type of UCC may well serve a single site (Heathrow) or several sites in a single area (Hammarby). Another feature is that this type of UCC commonly operates

[8] http://www.wctrs-society.com/conferences/archive-of-world-conferences/proceedings-from-berkeley-conference/

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for a given period of time while the specific activity linked to the UCC takes place. However, there is not restriction for the geographical coverage and they could potentially operate over any scale of the urban area.

2. **UCCs on single sites with one landlord**: This type of UCC has the following characteristics:

   - These sites are built as a single development so the UCC can potentially be designed into the planning of the site.
   - The landlord has the potential to insist that tenants use the UCC.
   - The unloading points tend to be located off-street in a specially designed delivery area with access via a single route.
   - The UCC operation can potentially be made self-financing through rent structures and handling charges.

Some examples of this type of UCC include Heathrow retail UCC, and Meadowhall shopping centre.

3. **UCCs serving a town/city:** This type of UCC are implemented in La Rochelle in France, Monaco and Broadmead (in Bristol) and their schemes can vary in terms of:

   - **The geographical area they serve** because they can either be large or small and can serve a small district (historic centre of an urban area), a specific retail area or an entire town/city.
   - **The number of companies operating the UCC scheme:** which can be a single company (e.g. La Rochelle), or several companies (e.g. LCCC in London).

It is important to remark that these three types of UCC can vary also in the logistics activities carried out in the UCC, offering basic consolidation services or offering a wider range of value-added logistics activities such as stockholding facilities, ticketing and pricing, goods return and waste collection services.

7.3 Checking List for the CCC

Based on BESTUFS[9], there are some relevant questions to be addressed in order to meet with the main objective of the UCC and to select the most suitable type of UCC to be implemented. In the scope of the SUCCESS project, this methodology has been adapted for the case of the Construction Industry and the use of CCC in the construction supply chain. Under this framework, and specifically for the use of CCC, some of the questions that must be considered are:

Is the CCC intended to be temporary or permanent?

[9] http://www.bestufs.net/download/BESTUFS_II/good_practice/English_BESTUFS_Guide.pdf

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- Temporary
- Permanent

Where will the CCC make deliveries?

- Single site with one landlord (One single construction company)
- Multiple sites with one landlord (One single construction company)
- Multiple sites with many landlords (several sites and several construction companies)

How many CCC will be? Identify possible locations

- One single CCC
- Several CCC

How close will the CCC be located to the target delivery area?

- Maximum distance from the CCC to the area:

How much of the urban area will the CCC serve?

- Single site in urban area
- Part of urban area
- Entire urban area

What services will the CCC offer?

- Delivery services
- Collection services: waste, recycling, packaging and returns
- Storage
- Work Pack creation
- Others

Will the use of the CCC be voluntary or compulsory for the construction companies receiving materials inside the target delivery area?

- Voluntary
- Compulsory

Which Materials are going to be routed by the CCC? And which ones not?

- Materials routed by the CCC:
- Materials not routed by the CCC

Will the CCC be operated by one or several logistics companies?

- One single company
- Several companies

Will the CCC initiative be led by the private sector, the public sector or is it a joint initiative?

- Public sector
- Private sector

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- Joint initiative

Is there sufficient interest and intent to use the CCC among all relevant stakeholders?

Are they any other companies interested in a shared use of a CCC? How many companies?

Will the CCC be supported by the Public Authorities?

Will the introduction of the CCC be accompanied by any other transport measures in the target area?

- New access and/or loading time regulations
- New vehicle weight regulations
- Road pricing
- Environmental zone
- Benefits for the companies using the CCC
- Other…

In the case of a public initiative, are the public authorities ready to participate in the funding of the CCC operation?

- Yes, to help the implementation of the project
- Yes, on a permanent basis if necessary
- No, the project has to be financially autonomous since the beginning

7.4 CANVAS for CCC

The Business Model Canvas (BMC) has been demonstrated for several European project focused such as TURBLOG, SMILE and CITYLOG as a really powerful tool that can be adapted to the case of urban logistics and because of this, BMC has chosen as the selected methodology in this project.

As previously mentioned, BMC is a structured methodology that describes any business model through nine basic building blocks showing schematically how a company intends to make money. This nine blocks are graphically represented using a predefined template divided into the four main areas of a business:

- Customers (Demand)
- Offer
- Infrastructure
- Financial viability

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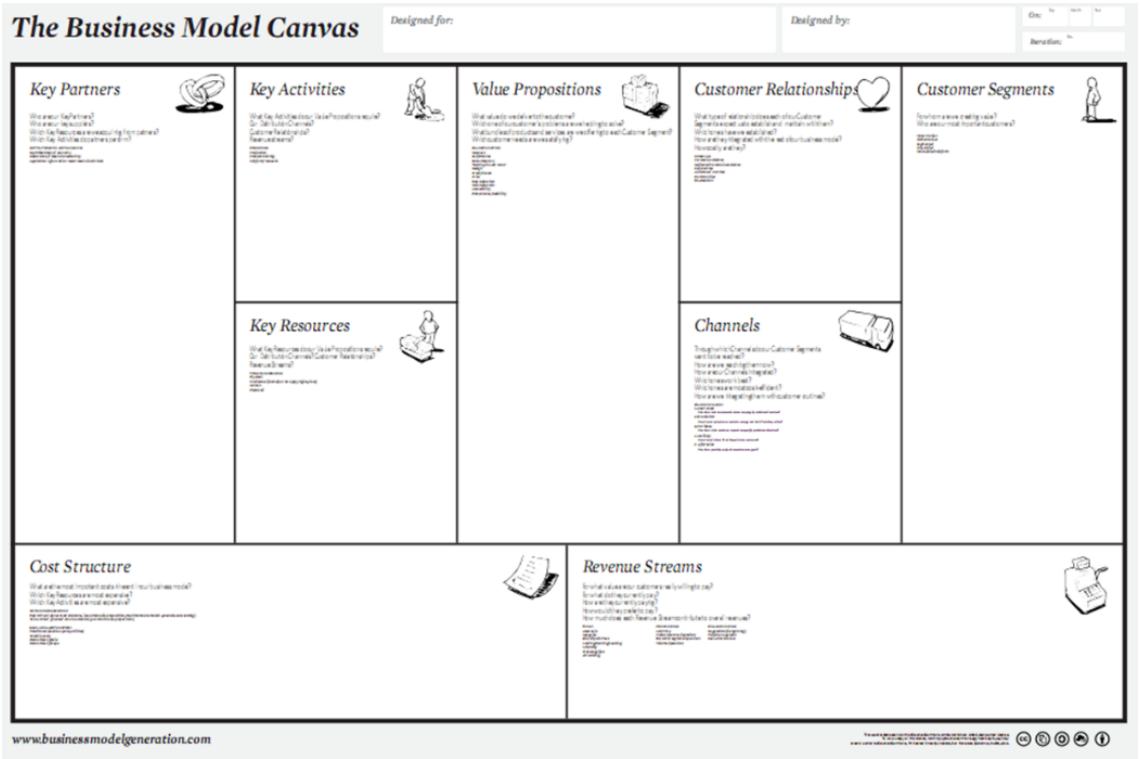

Figure 9.Template used in the methodology Business Model Canvas

The contents of each of the nine blocks of the BMC are the result of a series of questions which should be answered by the promoters of the business. Concerning the urban logistics and, more specifically the CCC implementation, the questions shown in the previous section 6.3 can help to fulfil the BMC.

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8 Definition of Business Models for each pilot site and for each scenario

In this section, the SUCCESS partners have contributed to the deliverable by providing a pilot analysis of the different scenarios to be assessed. Each of the scenarios proposed by the pilots has a particular business model analysed depending on the CCC and city characteristics with the aim to provide a specific solution to the existing problematic of the city and challenges of the construction industry.

The pilots assessed in the SUCCESS project have their own problematic concerning the construction supply chain due to the different city characteristics. Besides, each region participating in SUCCESS project has its own main objectives and because of this, different scenarios have to be proposed in order to find those solutions that fit the better to the features and objectives of each pilot of the SUCCESS project. Once the scenarios have been defined, it is necessary to analyse the corresponding business model to be implemented according to the main scenarios' characteristics. The methodology proposed to identify the scenarios to be analysed and to define the best business model for each of the pilots is divided in four main parts:

1. **Introduction:** in this part, the main city characteristics that have an influence on the urban and construction logistics are identified providing an overview of the city and pilot characteristics.
2. **Specific SWOT**: The construction logistics and the construction supply chain share common problems that affect the majority of the constructions sites, such as lack of space on site, urban congestion in the cities, etc. However, each construction site is different and they have specific problems that vary depending on the time, location, etc. In this section, the different city pilots carried out **a specific SWOT analysis for its own city that identifies** the most relevant problems and the opportunities for a CCC implementation.
3. **Scenarios**: Once the problems affecting each city are identified, the next step is to analyse possible improvements to the construction logistics that can come by the introduction of CCCs. Thus, at least two different scenarios are proposed by the each of the city pilots in order to be assessed even though **more scenarios are recommended**.
4. **CANVAS**: The last step is the selection of the most suitable business model for each of the scenarios defined by using the CANVAS methodology. **Business Model CANVAS** is a structured methodology that describes any business model through nine basic building blocks (See annex 1) showing schematically how a company intends to make money. This nine blocks are graphically represented using a predefined template (see annex 2) divided into the four main areas of a business: Customers (Demand), Offer, Infrastructure and Financial viability.

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8.1 Luxemburg

8.1.1 Introduction

Topography

Luxembourg City, capital of the Grand Duchy of Luxembourg, is located in the central southern part of the country. The city has a varied topography as it is set on several levels. The city is composed of the upper city and lower city which is developed around the narrow valleys of the Alzette and Pétrusse rivers.

Access

Various bridges including the Adolphe Bridge, the Grand Duchess Charlotte Bridge, and the Passerelle allows to connect the different parts of the city. Four international motorways (A3 and A4 from France, A6 from Brussels in Belgium and A1 from Trier in Germany) as well as a national motorway (A7 from North of the country) connect to the ring-road around Luxembourg City.

Figure 10. Main access to Luxembourg City

Source: realcorp.lu

Congestion issues

In 2016, as per the TomTom European Congestion Index, Luxembourg City ranks 39th and drivers need 29% longer during rush hour compared to normal traffic.

Access restrictions

Delivery windows in the pedestrian area of the city centre limit access from 6.00 to 10.00 am and sometimes from 6.00 to 10.00 pm.

The few weight, width and height restrictions are mainly due to the characteristics of some streets (bridge, tunnel or street next to an industrial area).

Specific to construction sector

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The traffic law requires construction sites which are closed to the public space to put relevant signs when a potential risk on traffic safety exists.

When moving or renovating, companies and individuals can submit an online-request to rent temporary public space and to change temporary traffic regulation (e.g. forbidden parking) to the city of Luxembourg via an online-request.

The rental price depends on the geographic sector, the use of the rental space, the surface area and the duration. The prices are detailed in the table 1 and the sectors on the image 1.

Tariff	Not fenced Scaffolding	Fenced scaffolding, fenced site, material storage	Work machines (concrete pump mobile crane platform)		Container Lift
Sector	*By month*	*By m² and by month**	*<= 1 lane*	*< 1 lane or road closure*	*For 5 days*
I	24 €	12 €	60 €	120 €	50 €
II	24 €	6 €	30 €	60 €	30 €
III	24 €	3 €	30 €	60 €	30 €
IV	24 €	1,5 €	30 €	60 €	30 €
Min tax: 30 €					

Table 1. Rental price for public spaces

If the duration expires, the prices are multiplied by three during the extended period and the extension is limited to 3 months.

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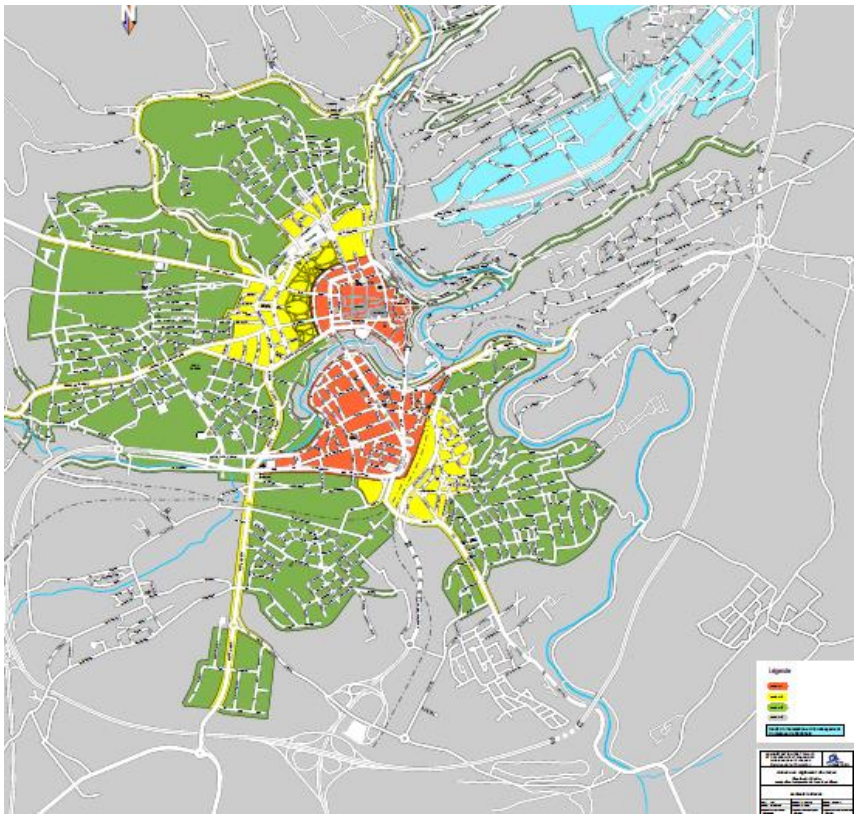

Figure 11. Map of sectors

8.1.2 SWOT analysis

Strengths:

- Better reliability of the deliveries that improves the planning of the constructions sites.
- Reduction of the congestion problems near the construction site produced by the huge number of delivery trucks coming and leaving the site daily.
- Less storage capacity required in the pilot site and inventory management.
- Possibility to involve several construction sites in the same CCC (i.e. London) - 2nd scenario.
- Improve safety due to the reduction in the handled materials and the higher safety measures of the CCC than in the construction site.

Weaknesses:

- Static solution for a dynamic problem. The CCC is placed in a fixed location but the construction sites vary in time. The possible logistic benefits related to the transport efficiency can be reduced if the construction activity is slowed or if the construction sites are too far from the CCC.
- Packaging and equipment vary along the different project phases.

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- Most of the cases, the support of public authorities is needed.

Opportunities:

- **Development of new ICT tools for the construction industry.** The construction industry is typically reluctant to change, and the possibility to develop new ICT tools for its logistics and processes is high. This has especial impact in the CCC, where new ICT systems could be more easily implemented than in several companies.
- **Rebirth of the construction in the city centres** due to the new urban trends such as the creation of big pedestrian zones and the limitation of the traffic in the historical city centres. This new situation makes necessary the use of efficient logistics for the construction and new regulations where the CCC can be a realistic and feasible solution. Besides, local authorities are implementing new policies to promote the small and medium size premises in the historical centres.
- **Possibility to work in just is time basis.** The construction industry has been a sector with a lack of innovation, however, the implementation of CCC enables the possibility of introducing just in time operation systems and its potential benefits for the construction industry. This will also help the construction industry to become more innovative and efficient. (i.e. CCC in Hammarby)
- **Big urban developments in the cities.** Luxembourg is developing a lot of urban projects or developments. Critical mass should be easy to reach for running a CCC.

Threats: None

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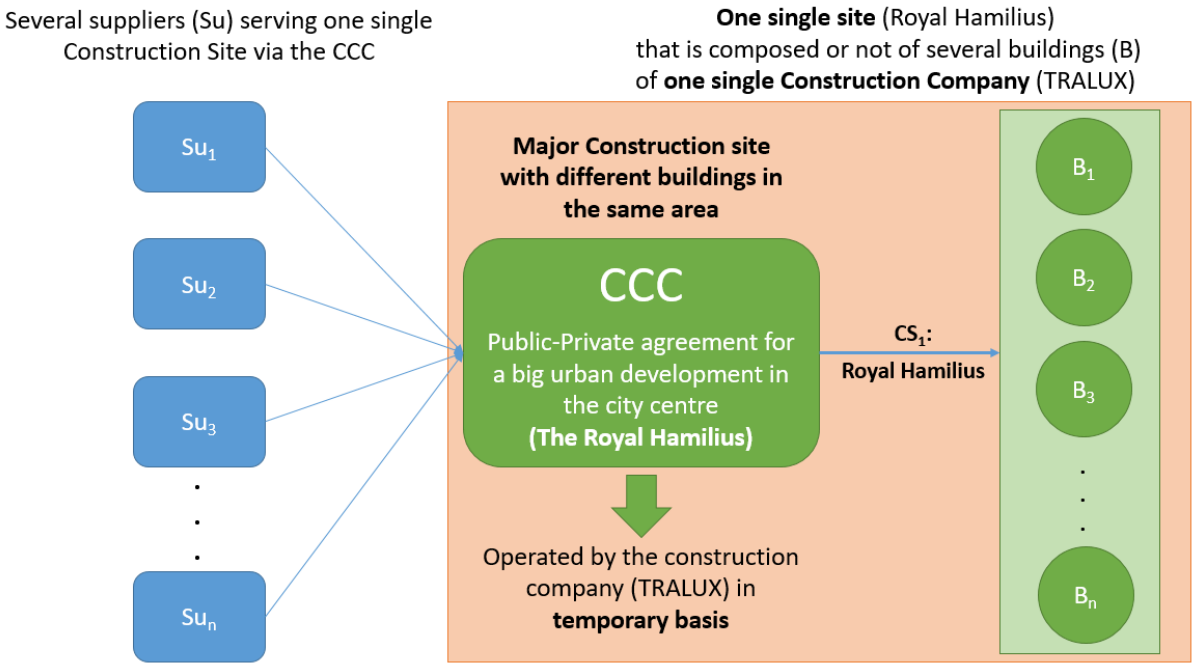
8.1.3 Scenarios

8.1.3.1 Scenario 1

Definition of the Scenario

In this scenario, TRALUX with the City of Luxembourg decide to use a basic CCC that serves a major construction site in the city centre (e.g. The Royal Hamilius composed of one big building or a project of several buildings). The CCC will increase storage capacity, reduce construction costs and reduce access issues in the congested city centre. The construction company operates itself the logistics activities.

Similar case: Hammarby in Stockholm



Main characteristics of the Scenario

- The CCC runs on a temporary basis
- The CCC delivers a major construction site coordinated by TRALUX
- The CCC offers the following services:
    - Deliver materials from the CCC to the construction sites
    - Deliver handling and structural works equipment such as scaffolding and formwork to the construction site. The handling equipment are backhoe loader, telescopic forklift, pallet truck, trolley.
    - Store materials in the warehouse
    - Manage loading and unloading operations on site

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    - Repack materials for small work units (paid service)
    - Remove returnable pallets and other packaging, unused materials and unused equipment back to the CCC (paid service)
    - Off-site assembling (paid service)
    - 24 hours operation (paid service). The suppliers delivers the materials to the CCC in the morning but can deliver on request the afternoon or in the night
- All the sub-contractors have to use the CCC. Direct deliveries to the site will be allowed on request and agreed at the beginning of the project.
- The main contractor (TRALUX) operates itself the CCC and ensures the delivery service
- The CCC could be a joint initiative between the main contractor and operator of the CCC (TRALUX) and the landowner (City of Luxembourg)
- The CCC runs as a cost centre supporting mainly operations on site, but could generate incomes even though it doesn't intend to be fully paid for its services.
- The local authorities encourage the initiative. They could extend the access restriction to capture larger volume if contracts don't include a clause on CCC.

TRALUX expressed its interest for this scenario but it has not been validated yet by the city of Luxembourg neither the sub-contractors at this stage.

Other contractors around the construction site could maybe join the initiative.

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CANVAS Business Model

Key Partners 8

- Sub-contractors
- City of Luxembourg
- Suppliers

Undefined roles:
- Real estate developer (Codic)

Key Activities 7

- Transport materials + equipment
- Store materials + equipment
- Reverse logistics
- Repack materials for JIT deliveries
- Manage reception on site

Key Resources 6

- Warehouse
- Equipment
- Vehicles
- Labour force
- *A software for the call-off*
- Contract or local regulation to force sub-contractors to use the CCC

Value Propositions 2

- Do things better
- Reduce construction costs)
- Flexible delivery time
- Save time in traffic jam and at the site gate
- Store materials and equipment in a safe place
- Better liveable city

Customer Relationships 4

- Personal assistance
- Self-service
- Personal assistance
- Personal assistance

Channels 3

- Face-to-face discussion
- Phone calls

Customer Segments 1

Multi-sided market:
- Construction companies
- Suppliers
- City of Luxembourg

Cost Structure 9

- Labour and training costs
- Vehicles and equipment costs
- Software (optional)
- Facility rental (ideally a facility that the City of Luxembourg proposes)

Revenue Streams 5

- Surface occupied on the floor after a storage time period in the warehouse
- Number of units collected from the site
- Commission for urgent deliveries (for the same day)
- Space for Off-site assembling
- Surface occupied on the floor after a storage time period in the warehouse
- Commission for delivering outside opening hours
- Provide the facility

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1. Customer segments

Construction companies

Main contractor - The main contractor wants to improve logistics efficiency on site to reduce the risk to put the project behind schedule or over budget.

Sub-contractors (trade contractors) are interested in a secured storage area to reduce any theft, damage or loss to the materials and equipment.

Sub-contractors can be interested in a storage area to get volume discount (at least reduce transport price).

Suppliers

Suppliers (shipper or carrier) who prefer not entering the city during the peak hours and dropping off material at the CCC at their convenience.

Suppliers who don't have a warehouse to store temporary equipment can use the CCC as storage.

City of Luxembourg

The City of Luxembourg is interested in getting a liveable city where the construction site impacts as less as possible the attractiveness the city centre.

2. Value propositions

Construction companies

- Do things better (main contractor)
  To improve logistics efficiency on site and thus reduce the risk to put the project behind schedule or over budget, the main contractor decides to use a CCC.
- Reduce construction costs
  The construction companies would like to prevent materials from damage, theft and losses, order small deliveries without extra-costs, dispose of the material on the point of use and maybe for some of them get urgent deliveries or realise cost savings (economies of scale for large volume and order in advance).

Suppliers

- Flexible delivery time
  The suppliers not located closely to the construction site might not want to enter the city in the peak hour in the morning and prefer delivering some days before at their convenience.
- Save time in traffic jam and at the site gate
  The suppliers can waste a lot of time waiting at the entrance gate before delivering materials. When the waiting time is too long, some suppliers organised in roundtrip decide to unload themselves the

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materials with their own equipment otherwise they are late in their delivery schedule.

- Store materials and equipment in a safe place
  Some suppliers located far from the construction site might want to store equipment temporarily when it is not rented instead of bringing back equipment to their warehouse.

City of Luxembourg

- Better liveable city
  The City of Luxembourg would like to reduce as much as possible the negative impacts of a large construction site. The impacts are various: congestion, noise, pollution, attractiveness (premises), safety.

3. Channels

Face-to-face discussions: Because some contracts are already signed off, the main contractor can't oblige the sub-contractors to pay for using the CCC. The main contractor will explain to sub-contractors the paid and unpaid services.

The team at the CCC will get in contact directly with sub-contractors' suppliers to propose to them additional services.

4. Customer relationships

The CCC will operate to generate some revenues to pay its activity, some commercial activities has to be put in place to sell additional services to the identified customers.

- Personal assistance and self-service for construction companies
  Since the CCC operates on a temporary and compulsory basis, the CCC operator will interact with the sub-contractors to sell paid services (personal services) but will just provide the basic means to use the unpaid services (self-services).
- Personal assistance for suppliers
  The CCC operator will present paid services to the suppliers after asking contact at the reception of materials and equipment.
- Personal assistance for the City of Luxembourg
  The CCC operator gave regular feedback on the experience to validate the added-value of a CCC.

5. Revenue streams

Construction companies

- Surface occupied on the floor after a storage time period in the warehouse
- Number of units collected from the site pallets, big bags…)
- Commission for urgent deliveries (for the same day)
- Space rental for Off-site assembling

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Suppliers

- Surface occupied on the floor after a storage time period in the warehouse
- Commission for delivering outside opening hours

City of Luxembourg

- Provide the facility

6. Key resources

- Warehouse: Logistics facility relatively close to the construction site and to road access. The City of Luxembourg could be offered to use one of its facilities in which it stores construction material for its own purpose (warehouse and open-air area) or provide a facility a with low rental price.
- Handling equipment: Handling equipment to handle material at the warehouse and construction site. Equipment shared on the site.
- Delivery vehicles: The fleet should be composed of unused vehicles of the construction company and rented vehicles depending on the needs.
- Labour force: The construction company appoints some employees to manage the CCC. The staff should receive a basic training to get the main rules to run a warehouse. With a background in construction, it will be easier for the staff to identify materials and trade's needs.
- Contract or local regulation: To make the CCC compulsory, the contract or a local regulation should mention the CCC.
- Software (optional): The logistics team will work with a predefined email to start and evolve then a web-based application. Suppliers will mail or telephone if they need.

7. Key activities

The CCC offers the following services:

- Deliver materials from the CCC to the construction sites
- Provide handling and structural works equipment such as scaffolding and formwork to the construction site
- Store materials in the warehouse before being used and equipment when not needed on site.
- Manage loading and unloading operations on site
- Repack materials in small work units (paid service)
- Remove returnable pallets and other packaging, unused materials and unused equipment back to the CCC (paid service)
- Off-site assembling (paid service)
  This activity should interest one sub-contractor so far (scrap) because most of the sub-contractors are not used to work with prefabricated materials.

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- 24 hours operation (paid service). The suppliers delivers the materials to the CCC in the morning but can deliver on request the afternoon or in the night

8. Key partnerships

The main contractor has a buyer-supplier relationship with the sub-contractors and the suppliers.

The main contractor develops a strategic alliance with the City of Luxembourg who supports the experience before researching in policies related to the construction logistics.

9. Cost structure

Labour and training costs: fixed cost for the TRALUX staff that follows training on warehouse training.

Vehicles and equipment costs: purchase handling equipment, rent vehicles in addition to the TRALUX ones.

Software: nice to have tool but would be in a first step very manual activities.

Facility rental: fixed cost. Due to the high prices, the City of Luxembourg decides to subsidize facility rent. The City of Luxembourg could use the CCC for the works in the adjacent streets.

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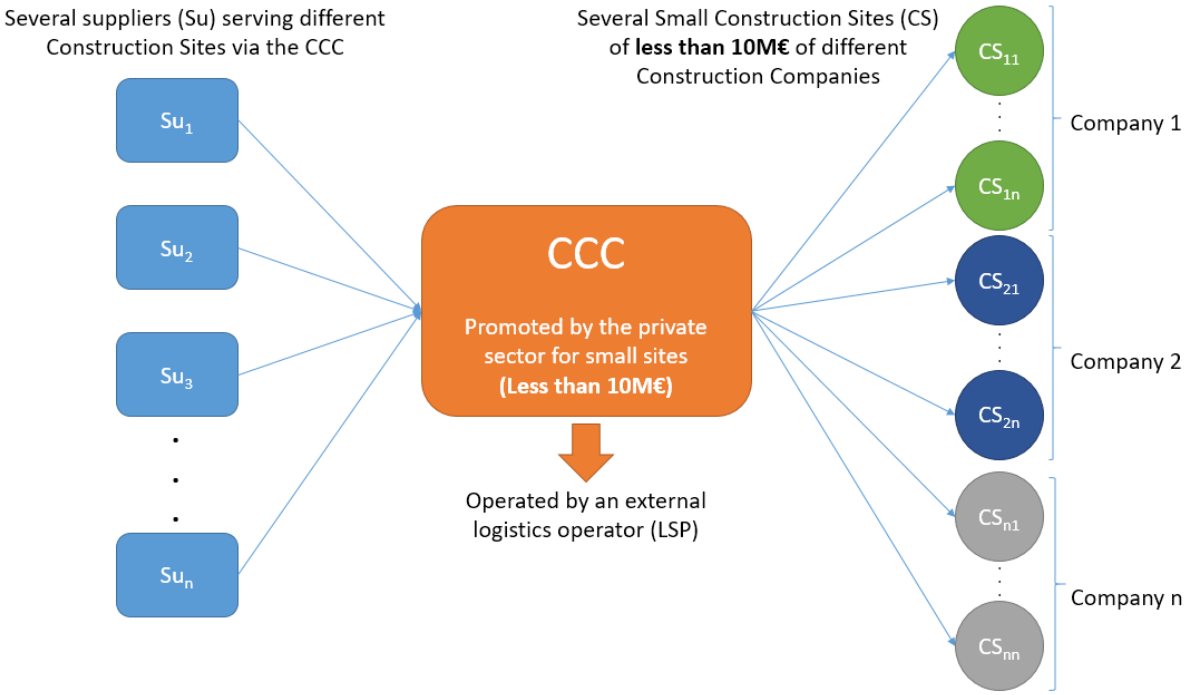
8.1.3.2 Scenario 2

Definition of the Scenario

In this scenario, a CCC that serves small construction sites (<10 M€) in the city and neighboured cities offers services to both construction companies and suppliers. A logistics service provider (LSP) operates this CCC.

Similar case: LBCC in London



Main characteristics of the Scenario

Similar case: LBCC in London

- The CCC runs on a permanent basis
- The CCC delivers several construction sites
- The CCC offers services to several construction companies and suppliers
- The CCC offers the following services:
    - Deliver materials from the CCC to the construction sites
    - Rent equipment (handling equipment and standard structural work equipment) they have on their own
    - Store materials in the warehouse (price for multiple sites of the same construction company)
    - Manage loading and unloading operations on site
      Note that on small construction sites, it is difficult to get resources on site for these activities.
    - Repack materials for small work units

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Smaller the site there is, the bigger the interest for repacking materials
    - Remove returnable pallets and other packaging, unused materials and unused equipment back to the CCC
    - Off-site assembling
    - Open upon request with an extra cost outside normal time hours. The suppliers delivers the materials to the CCC in the morning but can deliver on request the afternoon or during the night
- The CCC is used on a voluntary basis
- A logistics service provider operates the CCC
- The CCC is a private initiative
- The CCC runs as a profit centre
- The construction companies are the main customers
- The local authorities are not included in the initiative

TRALUX expressed its interest for this scenario but it should be validated by other construction companies and suppliers.

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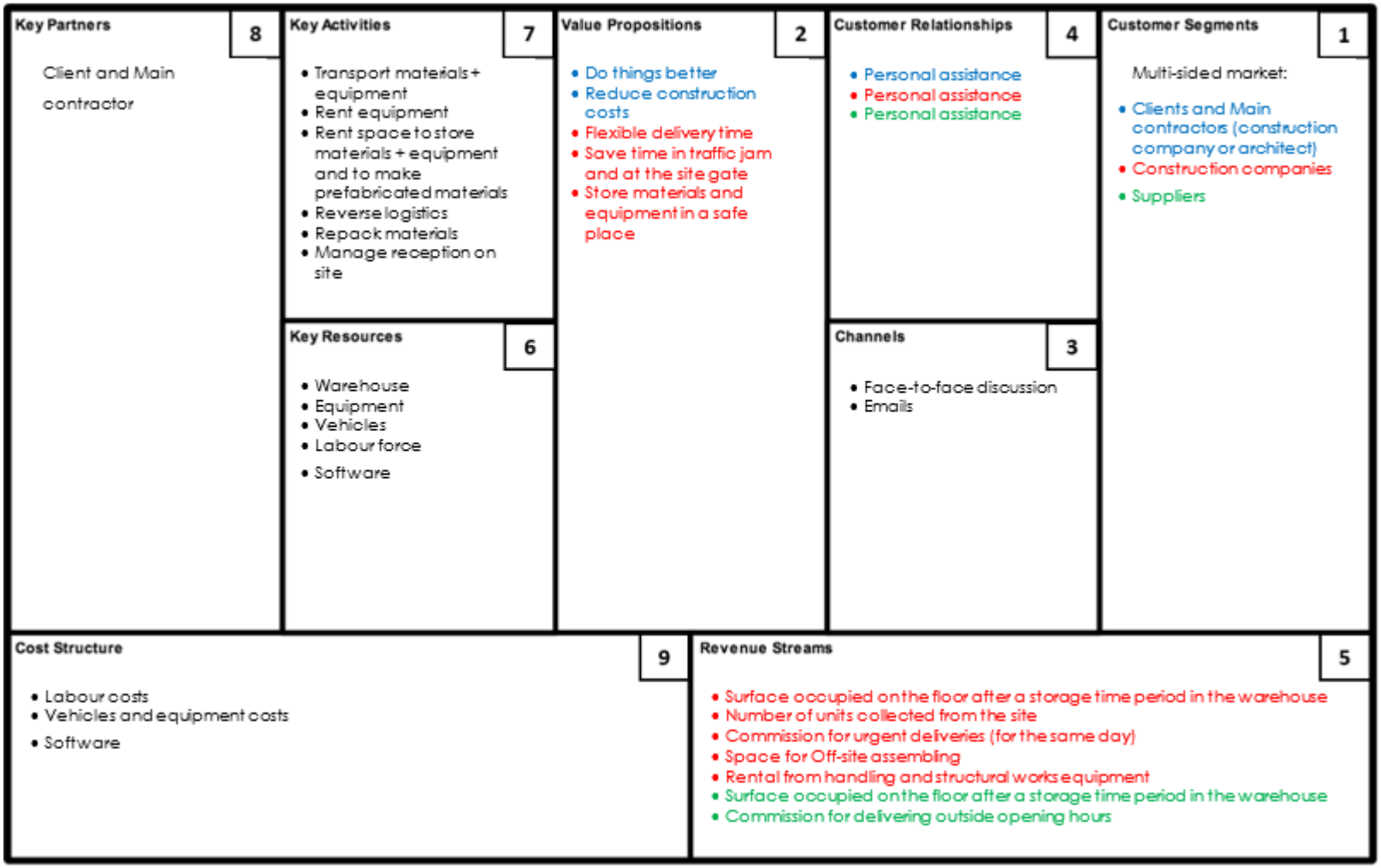
CANVAS Business Model



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1. Customer segments

Client and Main contractor - Prescribers

Clients are organisations which regularly develop real estate projects. They are cities, ministries or properties developers. They promote the CCC to reduce the risk to put the project behind schedule. Public authorities also promote the CCC to comply with environmental issues and safety issues (school, pedestrian area).

Main contractor could be construction companies and architects. Lack of space has a bigger impact on medium and small construction sites. They promote the CCC to reduce the risk to put the project behind schedule and over budget. During the planning phase, they include a clause in the contract making mandatory the delivery via the CCC.

Both clients and main contractors are prescribers.

Construction companies – Users and prescribers

The construction companies ask their suppliers to deliver the materials to the CCC as requested by the main contractor/client or on a voluntary basis.

The LSP benefits to get in contact with the suppliers to sell a global solution to the suppliers.

Suppliers – Users and prescribers

Suppliers can be either the shipper or the carrier.

Some suppliers use the CCC because they receive the address of the CCC to deliver the goods.

Some suppliers who prefer not entering the city during the peak hours drop off materials at the CCC at their convenience (e.g. suppliers far from the construction site)

Some suppliers delivering several points during the day use the CCC and reduce waiting time at the entrance of the construction site and driving time.

Some suppliers who don't have a warehouse to store temporary equipment can use the CCC as storage.

2. Value propositions

Client and Main contractor

- Do things better (main contractor)
  To improve logistics efficiency on site and thus reduce the risk to put the project behind schedule or over budget, the main contractor decides to use a CCC.
- Better liveable city (only for public authorities)

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The public authorities would like to reduce as much as possible the negative impacts of construction sites they develop. The impacts are various: congestion, noise, pollution, attractiveness (shops), safety.

Construction companies

- Reduce construction costs
  The construction companies would like to prevent materials from damage, theft and losses, order small deliveries without extra-costs, dispose of the material on the point of use and for some of them get urgent deliveries or realise cost savings (economies of scale for large volume and order in advance).

Suppliers

- Flexible delivery time
  The suppliers not located closely to the construction site might not want to enter the city in the peak hour in the morning and prefer delivering some days before at their convenience.
- Save time in traffic jam and at the site gate
  The suppliers can waste a lot of time waiting at the entrance gate before delivering materials. When the waiting time is too long, some suppliers organised in roundtrip decide to unload themselves the materials with their own equipment otherwise they are late in their delivery schedule.
- Store materials and equipment in a safe place
  Some suppliers located far from the construction site might want to store equipment temporarily when it is not rented instead of bringing back equipment to their warehouse.

3. Channels

Client and Main contractor

The LSP will promote the CCC via face to face discussion and convince them to include the CCC in the contract.

Construction companies

The LSP will sell directly its services to construction companies via emails and face-to-face discussions. It will also sell its service through clients and main contractors.

Suppliers

The LSP will sell a global and permanent solution to suppliers who are already delivering goods to the CCC.

4. Customer relationships

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To launch this new service in Luxembourg, the LSP needs salespeople to get a direct link to this niche market and sell the services to the different customer segments.

5. Revenue streams

Construction companies

- Surface occupied on the floor after a storage time period in the warehouse
- Number of units collected from the site
- Commission for urgent deliveries (for the same day)
- Space for Off-site assembling
- Rental from handling and structural works equipment

Suppliers

- Surface occupied on the floor after a storage time period in the warehouse
- Commission for delivering outside opening hours

6. Key resources

Warehouse: Logistics facility relatively close to the city and to road access that the LSP already uses.

Handling equipment: The LSP invests in additional handling equipment to handle material at the warehouse and rent them to construction companies.

Structural works equipment (optional): The LSP can rent standard structural works equipment it invested in.

Delivery vehicles: The fleet is composed of existing vehicles of the LSP and rented vehicles depending on the needs. Depending on the type of material, the LSP who extends its activities could combine in the same vehicle construction materials with other goods.

Labour force: The LSP may hire additional staff (warehouse order pickers and couriers) to extend their activity to the construction market.

Software: The LSP uses a WMS and a TMS to manage operations. The software should be the one that the LPS uses.

7. Key activities

The CCC offers the following paid services:

- Deliver materials from the CCC to the construction sites
- Rent equipment (handling equipment and standard structural work equipment) they have on their own
- Store materials in the warehouse (price for multiple sites of the same construction company)

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- Manage loading and unloading operations on site
  Note that on small construction sites, it is difficult to get resources on site for these activities.
- Repack materials for small work units
  Smaller the site there is, the bigger the interest for repacking materials
- Remove returnable pallets and other packaging, unused materials and unused equipment back to the CCC
- Off-site assembling
- Open upon request with an extra cost outside standard time hours. The suppliers delivers the materials to the CCC in the morning but can deliver on request the afternoon or during the night

8. Key partnerships

Client and Main contractor

The LSP promotes the benefits of the services to the architects and property developers and incite them to include the use of the CCC in the contract (specially the public authorities).

Construction companies and Suppliers

The LSP has a *buyer-seller relationship* with the construction companies and the suppliers.

9. Cost structure

Labour costs: fixed cost for the LSP.

Vehicles and equipment costs: purchase handling equipment, rent perhaps additional vehicles.

Software: adapt maybe from the existing software.

Facility rental: minor, since the LSP exploits an existing facility.

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8.2 Paris

8.2.1 Introduction

Geography

Paris, the capital of France, has an area of 105 km². Its population was of 2,229,621 inhabitants within its administrative limits in 2013. The city is both a commune and department, and forms the centre of the Île-de-France region. Paris is located in northern central France, in the north-bending arc of the Seine River, and includes two islands, the *Île Saint-Louis* and the *Île de la Cité*, which form the oldest part of the city. The city is divided into 20 arrondissements, which are municipal boroughs, numbered clockwise (see figure below).

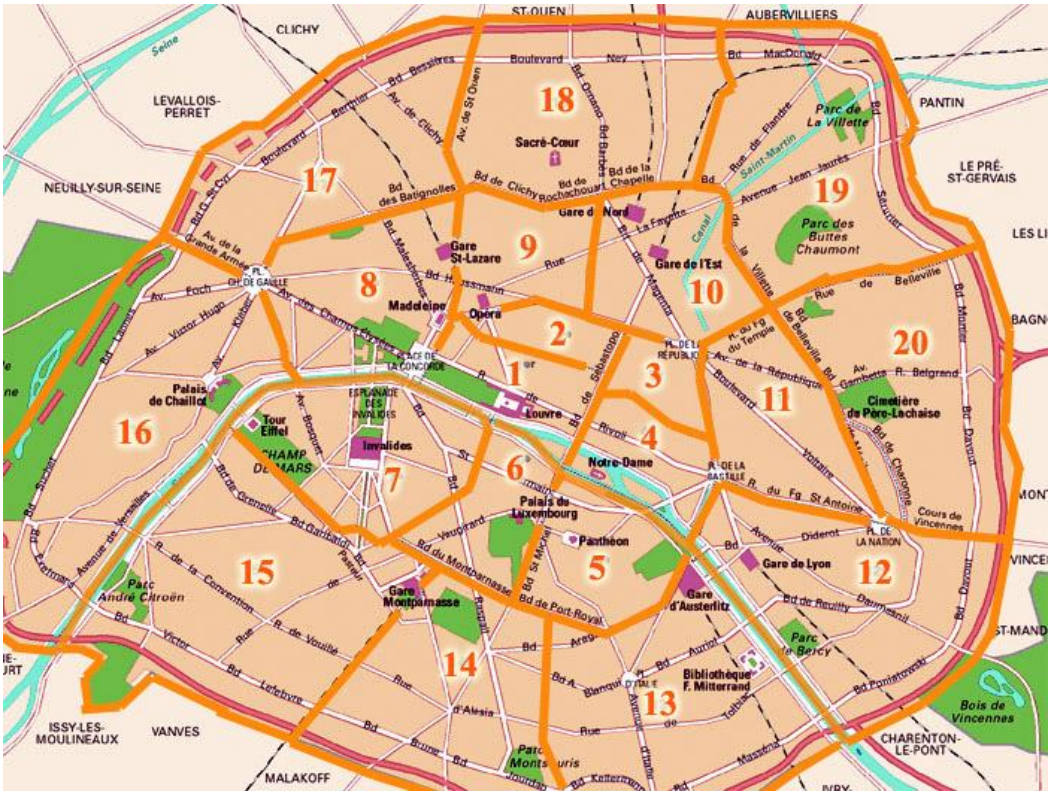

Figure 12. Parisian arrondissements

Transport

As the French capital, Paris is the national railway network hub. There are several options:

- At the national level, the high speed train (TGV), which serves most of the principal French cities from 1 hours for a Paris-Lille trip, to 3 hours for a Paris-Marseille trip ; the interregional trains serves the medium cities
- In the Île-de-France region, the suburban train (RER)
- Within Paris, the subway network, the Metro, which is the second busiest metro system in Europe (5.23 million passengers a day).

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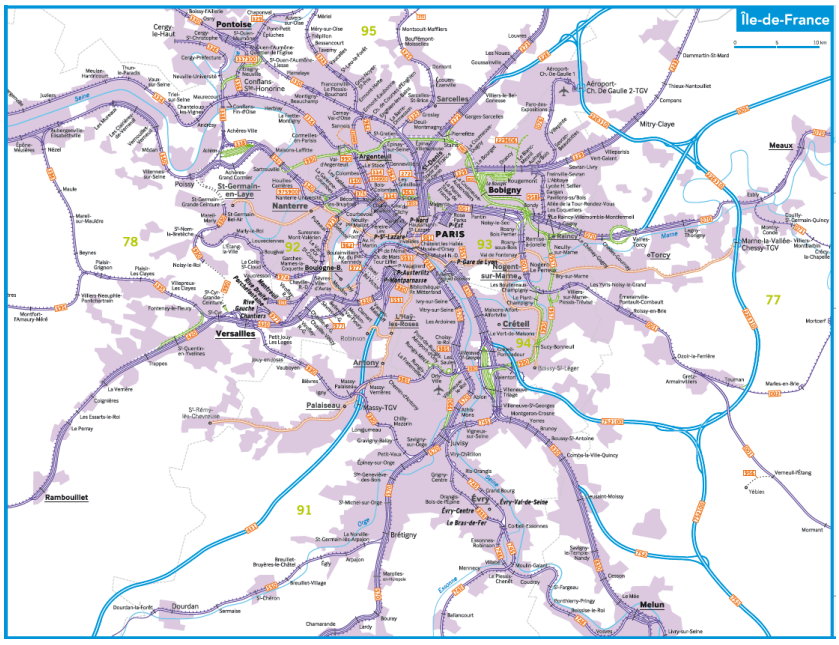

Figure 13. Rail network in the region of Paris

Paris is the hub of the national road network and is enclosed by three roads: the Périphérique, the A86 motorway, and the Francilienne motorway.

Figure 14. Road network in the region of Paris

The Parisian Metro network will soon be completed by a major railway project, the Grand Paris Express. Created in 2016, the Metropole of Grand Paris combines the commune of Paris and its nearest suburbs into a single area for economic and environmental cooperation. Grand Paris covers 814 km² and has a population of 6,945 million persons. The central project lies in the creation of an automatic subway, the Grand Paris Express, which implies 200 km of railway and 75 railway stations with a budget about 32.5 billion euros. The Grand Paris also forecast the creation of a technologic cluster, Paris-Saclay, at 20 km in the South of Paris.

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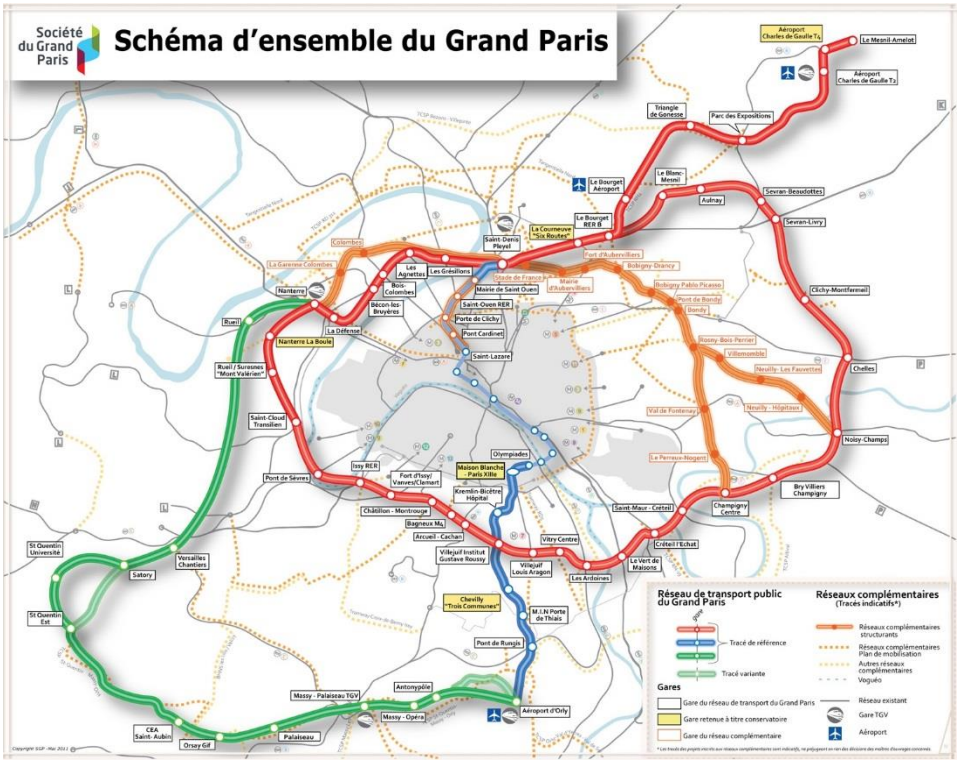

Figure 15. The Grand Paris Express map

Traffic issues

In Paris, especially in the city hyper centre, traffic congestion is a major issue. Parking is also a huge topic of concern, for delivery vehicles as well as private vehicles. In this field, since 2007, special regulations have been set for deliveries in Paris, gathered in the *Charter of good practices for transport and deliveries of goods in Paris*. This document, updated in 2013, aims at optimizing the entrance into the city and simplify deliveries while controlling negative impacts such as air or noise pollution. The charter is simple and basically based on the organization of deliveries in two main circulation periods:

- from 22:00 to 05:00, vehicles with a surface smaller than 29 m² are allowed to enter Paris
- from 22:00 to 07:00, vehicles with a surface smaller than or equal to 43 m² are allowed enter the city
- "clean" vehicles (electric, gas or hybrid) with a surface smaller than 29 m² are allowed to deliver 24h/24h.

1. The pace of deliveries has been validated by the road authorities and the construction company has to guarantee the good circulation of vehicles and pedestrians. The company has to use traffic workers, who regulate the traffic when there is a delivery, to take care of the work signalization. These dispositions are validated by the road authorities.

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8.2.2 SWOT analysis

A SWOT analysis related to the development of a CCC in the city of Paris is performed in the following section.

Strengths

- **Reduction of traffic congestion** in the city, thanks the diminution of the number of delivery trucks
- **Positive environmental impacts**, with a decrease in greenhouse gases and pollutants emissions and **reduction of noise pollution**
- **Better reliability of the deliveries** and reduction of thefts and damaged materials on sites
- **Better respect of the construction planning**, thanks to just-in-time deliveries
- **Paris commitment in sustainable development issues**, through its very ambitious *Climate Plan*, or some initiatives such as a call for proposals made in July 2016, dedicated to urban logistics, where the City make available five sites to create small logistic centres from 400 to 2500 m² [10]

Weaknesses

- **Heavy initial investments induced by the CCC installation**, to rent or purchase a land, the equipment, and operate the facility
- **The positive impacts, and the related profits,** have to be observed in the long-term profits
- **A tense real estate market in Paris**, which leads to investigate strategic locations, (reasonably) remote from the city centre, that are less attractive for other applications: highly noise exposed areas, industrial wastelands, etc.
- **The impossibility to deal with the main construction material**: concrete. Because it cannot be stored, it has its own logistics, and is out of the scope of the CCC.
- **The CCC position is static**, whereas the worksites locations will vary along the time.

Opportunities

- **The developments expected within the large-scale urban development program *Grand Paris***, many, such as buildings construction and refurbishment, but above all public works activities: 200 km of underground and 75 railway stations will be created from now until 2030.
- **Rehabilitation of the industrial wastelands;** in this case, the CCC is an opportunity to re-develop an economic activity.

[10] http://www.actu-transport-logistique.fr/supply-chain/logistique-urbaine-la-ville-de-paris-propose-5-espaces-180886.php

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- **The development of ICT tools use in the construction field**, such as BIM, or dedicated logistics tools, which is currently rising in a sector traditionally not very familiar to this kind of tools
- **The rising ecological awareness** in line with the COP21 held in 2015 in France. The French law, *Loi de Transition Énergétique pour la Croissance Verte,* which is the French Intended Nationally Determined Contribution (INDC), oblige the construction industry to achieve ambitious targets regarding the **circular economy**.
- **The growing importance of companies' social responsibility objectives**. In this perspective, the CCC can be a relevant tool to treat the reverse logistics, to deal with construction material waste.

Threats

- **The economic context of crisis, which leads many companies to focus on their core business**, and to externalize the other activities. This trend makes companies reluctant to invest huge amounts of money into their own infrastructure for a CCC.

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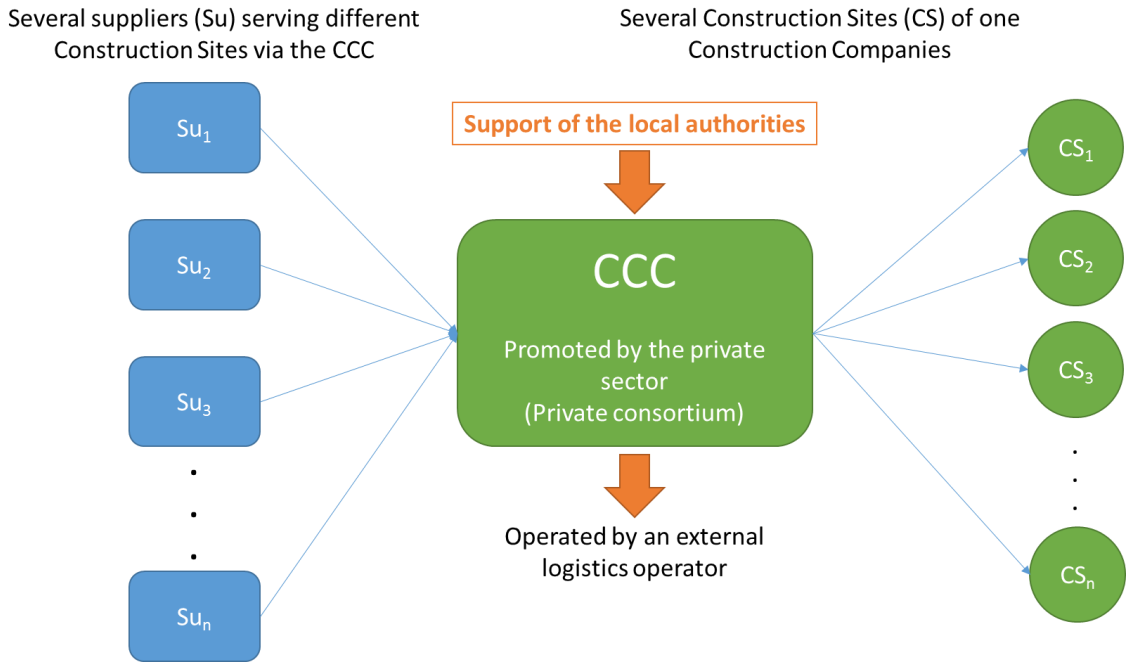
8.2.3 Scenarios

8.2.3.1 Scenario 1:

***Definition of the Scenario**: 100% private – CCC operated by the construction company*

The first scenario to be assessed implies one CCC owned, operated and used by a single construction company, here VINCI Construction France. The construction company has decided to invest in a CCC in a long-term purpose, with the aim to improve its own logistics organization for all its worksites and be more efficient in its core activity business, i.e. construction. In fact, this decision corresponds to an activity evolution for one of its branch, today called "Equipment centre", which is originally responsible for the machines and equipment stock management for all the construction worksites (cranes, forklifts, etc.). There is thus an activity shift from only stock management to a specialization in full construction logistics management.



Main characteristics of the Scenario

1. One single CCC serves several constructions sites, held by the same construction company.
2. The owner and operator of the CCC is a private construction company
3. The business model of this scenario will be assessed from the operating company point of view.
4. The CCC is designed to be permanent, following a long-term business plan.
5. The CCC is operated as a profit centre

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6. The CCC provides the main following services :
    - Management of the suppliers' deliveries (1st echelon): the CCC is in charge of the pick-up of the materials needed for the construction sites on the suppliers' storage sites. The suppliers can also deliver themselves the materials to the CCC, is the route optimization and/or cost analysis proves more advantageous.
    - Storage of the materials within the CCC warehouse, plus extra services within the CCC such as material handling, picking, merchandise quality check, crossdocking, work pack creation...
    - Management of the transport towards the different works sites (2nd echelon)
    - Reverse logistics management: waste sorting, transport to repurposing centres, transport to other construction sites after re-characterization of the material, introduction into the recycling industry, etc.
7. The CCC is a 100% private initiative, without any public funding for implementation or operation.
8. There may be a support from the public authorities through traffic regulations, land rental at a preferential rate, or extended access authorizations for the CCC vehicles of the CCC vehicles.

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CANVAS Business Model

Key Partners 8

- Construction company
- Material suppliers
- Transport companies
- Waste management contractor
- Public authorities
- Industrial security professional
- Software developer

Key Activities 7

- Route and load factor optimization
- 1st and 2nd echelon delivery management
- Material handling, picking, merchandise quality check, crossdocking, work pack creation
- Reverse logistics management

Key Resources 6

- Human resources
- Land for warehouse and delivery gate
- Handling equipment
- Software application

Value Propositions 2

- More efficiency thanks to valuable logistics services
- Reduction of material damages, thefts and losses on site
- Construction costs optimization/reduction
- Higher reliability on deliveries, traceability of the delivery notes
- Congestion reduction on worksites
- Positive environmental impacts : CO_2 emissions, circular economy

Customer Relationships 4

- Personal assistance
- Co-creation relationship

Channels 3

Awareness

Internal communication campaign

Monitoring

Oral communications, periodic reports, notification e-mails, etc.

Customer Segments 1

Construction company which owns and operates the CCC

Cost Structure 9

- Tax collected by the public authority
- Cost due the classified facility status (security, environmental protection....)
- Land rental or purchase
- Handling equipment rental or purchase
- Software development or purchase

Revenue Streams 5

- Contribution due by each company subsidiaries
- Resale of the material waste as resources
- Zero worksite surveillance costs
- Operational saving thanks to logistics optimization

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1. Customer Segments

The CCC only serves the single construction company which owns and operates the CCC. This company has several worksites in the CCC area.

2. Value Propositions

- Improve the worksites efficiency thanks to a better logistics organization; the worksite can thus focus on their core activity. Using the CCC helps the worksites to be more reactive, since it permits just-in-time production, like any actual industrial activity, and prevent the risk of delay in the planning.
- Prevent the risk of material damages, thefts and losses on site, thus reducing, even eliminating, the surveillance costs on the worksite
- Optimize / reduce the construction costs: there is room for economies of scale, thanks to large volume and long-term anticipated orders
- Permit a higher reliability on deliveries, through processes like quality checks, traceability of the delivery notes by automatization, etc.
- Reduce congestion on worksites, by providing material storage services and consequently, there is no need for storage areas on sites.
- Generate positive environmental impacts: the use of the CCC helps to decrease CO_2 emissions and contributes to more efficient circular economy, through a better management of the material returning from the sites (waste or unused materials).

3. Channels

The CCC offer is promoted through an internal communication campaign, which aims at informing all the company subsidiaries (the clients) that a corporate CCC is created. During the CCC operation, there is a constant communication between the CCC team and the worksite manager through oral communications, periodic reports on KPI evolution, deliveries notification e-mails, etc.

4. Customer relationships

- Personal assistance: human interaction is essential, especially when the CCC is an internal service for the company worksites. Before, during and after the CCC operation, there is dedicated responsible to refer to.
- Co-creation: customers, i.e. the company worksites, are regularly invited to collect information to improve the model continuously, through a collaborative scheme. This feature is very important where the CCC is a corporate service, because it is involved in a continuous improvement process.

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5. Revenue Streams

The CCC funding comes from the contributions due by each company subsidiaries, as a percentage of the won bids. It generates revenues thanks to the:

- Resale of the material waste as resources
- Zero worksite surveillance costs
- Operational savings thanks to logistics optimization.

6. Key Resources

- Human resources for the CCC staff
- Land with easy access by road, non-liable to flooding, to build a warehouse, and a delivery gate. The whole facility size is defined basing on the worksites demand.
- Handling equipment (crane, forklift, scales…)
- Software application, to manage and optimize all the CCC inputs and outputs (supply, transport, reverse logistics, etc.).

7. Key Activities

- Route and load factor optimization: optimizing the route permits to reduce the number of kilometres made by the delivery vehicle; optimizing the trucks load factors helps to decrease the total flow of trucks circulating in town and entering the worksite. These two means are essential activities for the CCC, since they have great potentials for CO_2 and financial savings.
- 1st and 2nd echelon delivery management: the CCC is in charge of the material from the supplier and organize the transport to the construction sites.
- Logistics services: material handling, warehousing, merchandise quality check, crossdocking, work pack creation.
- Reverse logistics management: the CCC helps the company to achieve its goals regarding circular economy, by managing the material returning from the construction sites (unused materials or waste).

8. Key Partnerships

- Construction Company, as the CCC owner and operator. Are especially involved the subsidiaries technical Departments (methods), which define

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the construction schedules, the worksites managers, the environment managers in charge of the waste management on site. The company purchasing department has also a key role to play since the CCC warehouse can stand for a "bank" of referenced materials and equipment.

- Material suppliers, which must have a constant and efficient relationships with the CCC staff, in order to reach high level of performance regarding the whole logistics system. The material suppliers can also retrieve the unused material at the CCC.
- Transport companies, to provide the delivery vehicles, which are preferentially low carbon vehicles to reduce the overall carbon footprint.
- Waste management contractors, which must have a tight cooperation with the CCC operator, in order to maximize the proportion of waste sorted and collected for treatment and repurposing.
- Industrial security professional: to manage the security on site. Storing such construction materials of different nature involve security measures to separate them regarding fire safety, environmental regulations, etc. The advice of a qualified professional is helpful in this case.
- Public authorities: even when the CCC emerges from a private initiative, the city / the region where the CCC is installed can bring its support by land rental at preferential rate, traffic regulations, extended access to the CCC vehicles…
- Software developer, to provide and set up the digital tools to operate the CCC efficiently, and to enhance the application in case of need.

9. Cost Structure

The cost drivers are:

- Human resources
- Tax collected by the public authority, because the CCC is a classified facility. On this point, the public authority can spare the CCC operator of this tax, or reduce its value, to encourage this positive initiative.
- Land rental or purchase: once again, the public authority can be helpful on this point, by granting a preferential rate.
- Costs due the classified facility status, in terms of security measures, environmental protection….
- Handling equipment rental or purchase
- Software development or purchase.

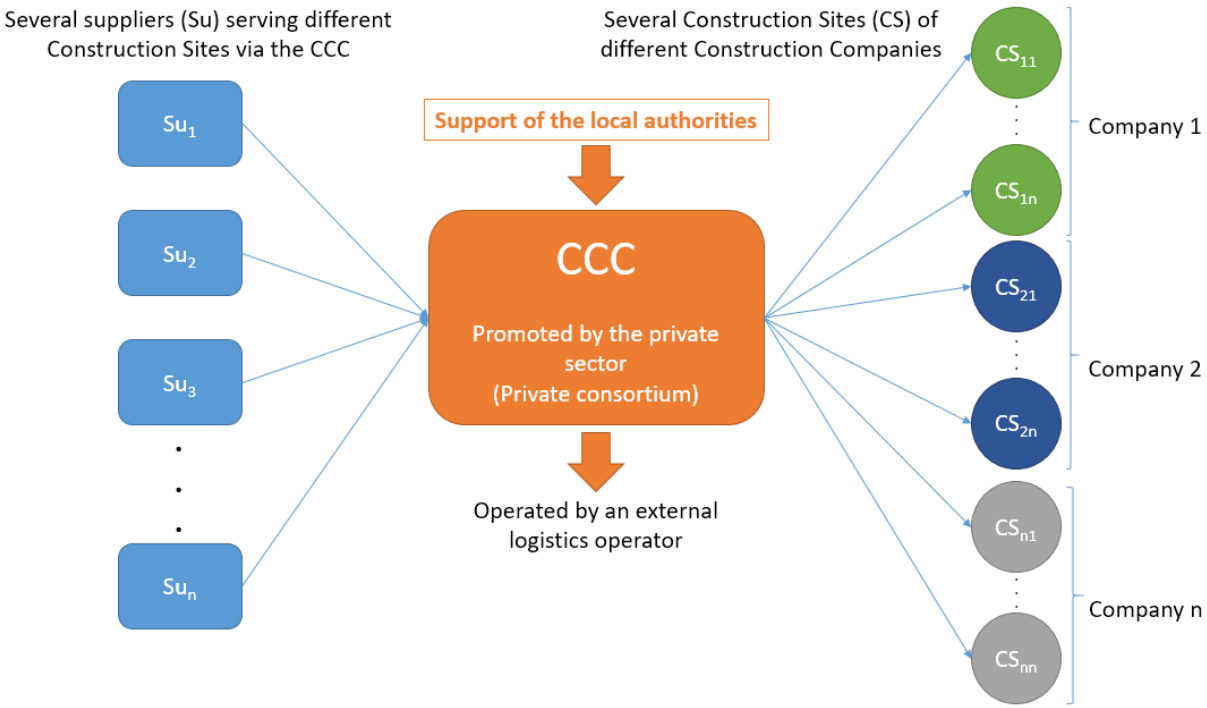
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

8.2.3.2 *Scenario 2:*

Definition of the Scenario: 100% private consortium – *CCC managed by an external logistics operator*

The second scenario to be assessed implies one CCC initiated by a consortium of private actors. This companies, which come from the construction, the logistics or another sector, have invested in the CCC and contracted with an operator to manage the consolidation centre. The CCC is considered as "permanent", since its activity is recognized as a lasting business.

This external logistics operator provides services to several construction sites, those sites being managed by several construction companies. In this scheme, the main purpose of the private consortium, owner of the CCC, is to make profits by optimizing the logistics chain. Positive effects from environmental and social point of views are lower ranking objectives.



Main characteristics of the Scenario

1. One single CCC serves several constructions sites, which are held by different construction companies.
2. The owner of the CCC is a private consortium.
3. The operator is a company specialized in logistics, chosen by the private consortium.
4. The business model of this scenario will be assessed a two levels: from the owner point of view and from the logistics company point of view that operates the CCC.

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5. The CCC intends to be permanent, following a long-term business plan.
6. The CCC is operated as a profit centre.
7. The CCC provides the main following services :
    - Management of the suppliers' deliveries (1st echelon): the CCC is in charge of the pick-up of the materials needed for the construction sites on the suppliers' storage sites. The suppliers can also deliver themselves the materials to the CCC, is the route optimization and/or cost analysis proves more advantageous.
    - Storage of the materials within the CCC warehouse, plus extra services within the CCC such as material handling, picking, merchandise quality check, crossdocking, work pack creation...
    - Management of the transport towards the different works sites (2nd echelon)
    - Reverse logistics management: waste sorting, transport to repurposing centres, transport to other construction sites after re-characterization of the material, introduction into the recycling industry, etc.
8. The CCC is a private initiative, but is supported by the public authorities through traffic regulations.
9. The CCC use is voluntary, but an incentive system is carried out by the public authority to encourage the construction companies in this way, according to sustainable policy purposes.

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CANVAS Business Model

Key Partners 8

- Logistics operator
- Construction companies
- Materials suppliers
- Transport companies
- Waste management contractors
- Public authorities
- Industrial security professional
- Software developer

Key Activities 7

- Route and load factor optimization
- 1st and 2nd echelon delivery management
- Material handling, picking, merchandise quality check, crossdocking, work pack creation
- Reverse logistics management…

Key Resources 6

- Human resources
- Land for warehouse and delivery gate
- Handling equipment
- Software application

Value Propositions 2

- Improve the worksites efficiency thanks to a better logistics organization
- Higher reliability on deliveries and offer a guarantee covering the defective pieces
- Reduction of material damage, theft and losses on site
- Congestion reduction on worksites
- Positive environmental impacts : CO_2 emissions, circular economy.

Customer Relationships 4

- Personal assistance

Channels 3

Awareness

Communication campaign : press release, trade shows, internet

Monitoring

oral communications, periodic reports, notification e-mails, etc.

Customer Segments 1

Construction companies

Cost Structure 9

- Tax collected by the public authority
- Cost due the classified facility status (security, environmental protection….)
- Land rental or purchase
- Handling equipment rental or purchase
- Software development or purchase

Revenue Streams 5

- Basic services package against a user monthly subscription
- Extra added value services as an option
- Resale of the material waste as resources
- Operational saving thanks to logistics optimization

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

1. Customer Segments

The CCC only serves construction companies, which have several construction sites in the same area.

2. Value Propositions

- Improve the worksites efficiency thanks to a better logistics organization; the worksite can thus focus on their core activity. Using the CCC helps the worksites to be more reactive, since it permits just-in-time production, like any actual industrial activity, and prevent the risk of delay in the planning.
- Permit a higher reliability on deliveries and offer a guarantee covering the defective pieces, through processes like quality checks, traceability of the delivery notes by automatization, etc.
- Prevent the risk of material damages, thefts and losses on site, thus reducing, even eliminating, the surveillance costs on the worksite
- Reduce congestion reduction on worksites, by providing material storage services. Consequently, there is no need for storage areas on sites.
- Generate positive environmental impacts: the use of the CCC helps to decrease CO_2 emissions and contributes to more efficient circular economy, through a better management of the material returning from the sites (waste or unused materials).

3. Channels

The CCC offer is promoted through a communication campaign, through press release, participation in trade shows, or internet announcement.

During the CCC operation, all the process is monitored thanks to constant communication between the CCC team and the worksite manager through oral communications, periodic reports on KPI evolution, deliveries notification e-mails, web application, etc.

4. Customer relationships

Personal assistance, with a dedicated service based on human interaction. Before, during and after the CCC operation, there is a special responsible to refer to.

5. Revenue Streams

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

The CCC provides a basic services package, against a user monthly subscription. Its revenues come from:

- the range of extra added value services which are sold as options
- the resale of the material waste as resources
- operational savings due to logistics optimization, such as zero worksite surveillance costs.

6. Key Resources

- Human resources for the CCC staff
- Land with easy access by road, non-liable to flooding, to build a warehouse and a delivery gate. The whole facility size is defined basing on the worksites demand.
- Handling equipment (crane, forklift, scales…)
- Software application, to manage and optimize all the CCC inputs and outputs (supply, transport, reverse logistics, etc.).

7. Key Activities

- Route and load factor optimization: optimizing the route permits to reduce the number of kilometres made by the delivery vehicle; optimizing the trucks load factors helps to decrease the total flow of trucks circulating in town and entering the worksite. These two means are essential activities for the CCC, since they have great potentials for CO_2 and financial savings.
- 1st and 2nd echelon delivery management: the CCC is in charge of the material from the supplier and organize the transport to the construction sites.
- Logistics services: material handling, warehousing, merchandise quality check, crossdocking, work pack creation.
- Reverse logistics management: the CCC helps the company to achieve its goals regarding circular economy, by managing the material returning from the construction sites (unused materials or waste).

8. Key Partnerships

- Logistics operator, which is the central stakeholder responsible for the CCC management.
- Construction companies, which are the main CCC customers.
- Material suppliers, which must have a constant and efficient relationships with the CCC staff, in order to reach high level of performance

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regarding the whole logistics system. The material suppliers can also retrieve the unused material at the CCC.

- Transport companies, to provide the delivery vehicles, which are preferentially low carbon vehicles to reduce the overall carbon footprint.
- Waste management contractors, which must have a tight cooperation with the CCC operator, in order to maximize the proportion of waste sorted and collected for treatment and repurposing.
- Public authorities: even when the CCC emerges from a private initiative, the city / the region where the CCC is installed can bring its support by land rental at preferential rate, traffic regulations, extended access to the CCC vehicles…
- Industrial security professional: to manage the security on site. Storing such construction materials of different nature involve security measures to separate them regarding fire safety, environmental regulations, etc. The advice of a qualified professional is helpful in this case.
- Software developer, to provide and set up the digital tools to operate the CCC efficiently, and to enhance the application in case of need.

9. Cost Structure

The cost drivers are:

- Human resources
- Tax collected by the public authority, because the CCC is a classified facility. On this point, the public authority can spare the CCC operator of this tax, or reduce its value, to encourage this positive initiative.
- Costs due the classified facility status, in terms of security measures, environmental protection….
- Land rental or purchase: once again, the public authority can be helpful on this point, by granting a preferential rate.
- Handling equipment rental or purchase
- Software development or purchase.

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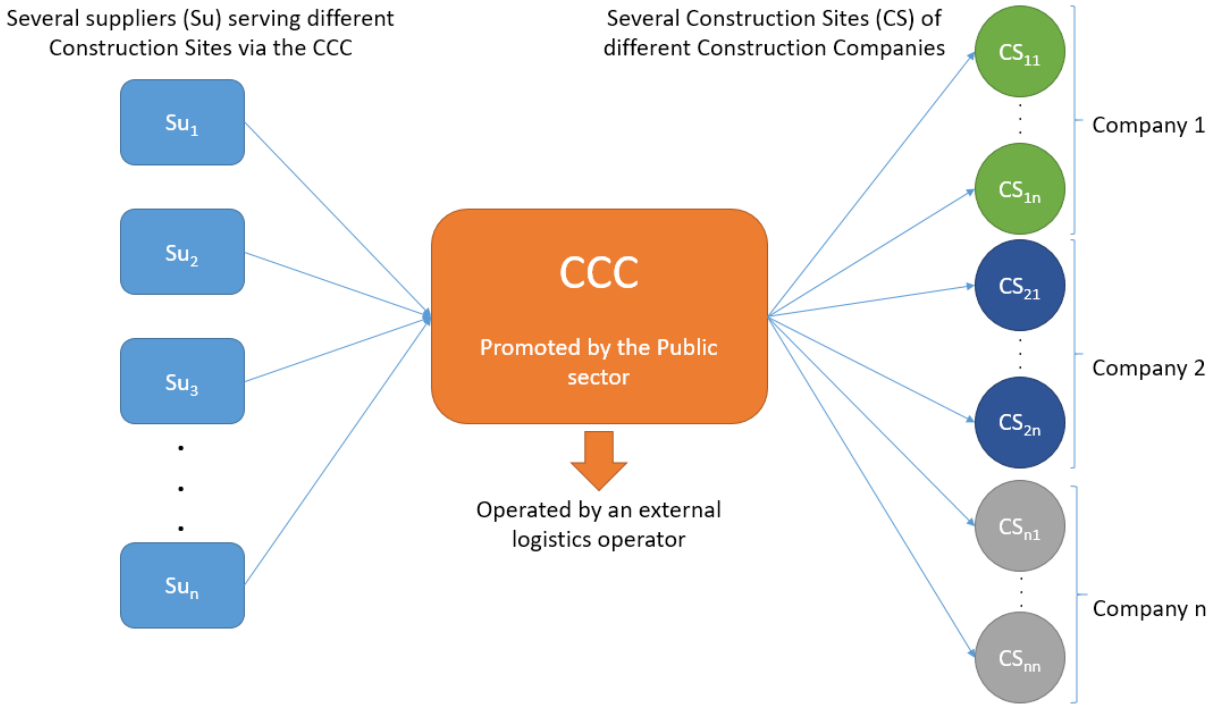
8.2.3.3 *Scenario 3:*

Definition of the Scenario: public / private partnership

The first scenario to be assessed consists in one single CCC that emerges from a public initiative, i.e. a city, an intercommunal gathering, or a public development authority. This public authority has contracted an external logistics company to operate permanently, i.e. over larger time scale than one single worksite lifetime, his own CCC. This external logistics operator provides services to several construction sites, those sites being managed by several construction companies that agreed to the CCC terms and conditions.

In this scheme, the public authority purpose is mainly to improve the whole logistics chain and to maximize the positive effects from environmental and social point of views. The CCC is managed as a profit centre, but this purpose is secondary.



Main characteristics of the Scenario

1. One single CCC serves several constructions sites, which can be held by different construction companies.
2. The owner of the CCC is a public authority
3. The operator is an external logistics company, which is the tender winner for the management of the CCC.
4. The business model of this scenario will be assessed from the owner point of view (the public authority).

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5. The CCC intends to be "permanent", i.e. beyond the life of one construction site. As a comparison, the economic cycle of the building sector is about 30 years.
6. The CCC is not a profit centre.
7. The main services offered by the CCC are :
    - Management of the suppliers' deliveries (1st echelon): the CCC is in charge of the pick-up of the materials needed for the construction sites on the suppliers' storage sites.
    - Storage of the materials within the CCC warehouse, plus extra services within the CCC such as material handling, picking, merchandise quality control, crossdocking, work pack creation...
    - Management of the transport towards the different works sites (2nd echelon)
    - Reverse logistics management: waste sorting, transport to repurposing centres, transport to other construction sites after re-characterization of the material, introduction into the recycling industry, etc.
8. Public initiative, implying public funding for the CCC implementation and operation.
9. Support of the public authorities in terms of traffic regulations.

The public authority makes the CCC use compulsory for the construction companies through its calls for tenders for the projects where it is the client, or through the construction permit procedure for the private developments.

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CANVAS Business Model

Key Partners 8

- Public authority
- Logistics operator
- Construction companies
- Materials suppliers
- Transport companies
- Waste management contractors
- Industrial security professional
- Software developer
- Citizens and associations

Key Activities 7

- Route and load factor optimization
- 1st and 2nd echelon delivery management
- Material handling, picking, merchandise quality check, crossdocking, work pack creation
- Reverse logistics management

Key Resources 6

- Human resources
- Land for warehouse and delivery gate
- Handling equipment
- Software application

Value Propositions 2

- Outsourcing of the logistics issues and improve the worksites efficiency thanks to a better logistics organization
- Higher reliability on deliveries and offer a guarantee covering the defective pieces
- Reduction of material damages, theft and losses on site
- Congestion reduction on worksites
- Positive environmental impacts : CO_2 emissions, circular economy
- Positive social impacts : reduced traffic congestion, limited noise and air pollution

Customer Relationships 4

- The CCC use is mandatory
- Personal assistance, based on human interaction

Channels 3

Awareness

Calls for tender, local regulations

Communication campaign : press release, trade shows, internet

Monitoring

Digital communication : web application with e-mail notifications

Customer Segments 1

Construction companies

Cost Structure 9

- Cost due the classified facility status (security, environmental protection....)
- Handling equipment rental or purchase
- Human resources
- Software development or purchase

Revenue Streams 5

- Users monthly subscription to pay for the operating costs (the CCC is not a business unit)
- Operational savings thanks to logistics optimization

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

1. **Customer Segments**

The CCC only serves construction companies, which have several construction sites in the same area.

2. **Value Propositions**

- Outsource the logistics issues and improve the worksites efficiency thanks to a better logistics organization; the worksite can thus focus on their core activity. Using the CCC helps the worksites to be more reactive, since it permits just-in-time production, like any actual industrial activity, and prevent the risk of delay in the planning.
- Permit a higher reliability on deliveries and offer a guarantee covering the defective pieces, through processes like quality checks, traceability of the delivery notes by automatization, etc.
- Prevent the risk of material damages, thefts and losses on site, thus reducing, even eliminating, the surveillance costs on the worksite
- Reduce congestion on worksites, by providing material storage services. Consequently, there is no need for storage areas on sites.
- Generate positive environmental impacts: the use of the CCC helps to decrease CO_2 emissions and contributes to more efficient circular economy, through a better management of the material returning from the sites (waste or unused materials).
- Generate positive social impacts for the surrounding citizens, such as reduced traffic congestion, limited noise and air pollution, etc. These are key aspects for the City, as they stands for true motivations for investments in CCC, effective means to achieve their sustainable program objectives, and potential electoral arguments.

3. **Channels**

The construction companies are made aware of the CCC creation by the public authority through the calls for tender, and/or announcements of a change in the local regulations, that made the CCC use mandatory. The CCC creation is then promoted through a communication campaign, via press release, participation in trade shows, or internet announcement.

During the CCC operation, all the process is monitored thanks to constant communication between the CCC staff and the worksite managers from all the companies through oral communications, periodic reports on KPI evolution, deliveries notification e-mails, web application, etc.

4. **Customer relationships**

Personal assistance, with a dedicated service based on human interaction. Before, during and after the CCC operation, there is a special responsible to refer to.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

5. **Revenue Streams**

As the CCC is mainly a public service, and not aims at making profit, the users' monthly subscription fees aim only at paying the operating costs of the CCC. However, the construction companies will benefit from substantial savings related to logistics optimizations, like zero worksite surveillance costs, decrease of the damaged materials on site, etc.

6. **Key Resources**

- Human resources for the CCC staff
- Land with easy access by road, non-liable to flooding, to build a warehouse and a delivery gate. The whole facility size is defined basing on the worksites demand.
- Handling equipment (crane, forklift, scales…)
- Software application, to manage and optimize all the CCC inputs and outputs (supply, transport, reverse logistics, etc.).

7. **Key Activities**

- Route and load factor optimization: optimizing the route permits to reduce the number of kilometres made by the delivery vehicle; optimizing the trucks load factors helps to decrease the total flow of trucks circulating in town and entering the worksite. These two means are essential activities for the CCC, since they have great potentials for CO_2 and financial savings.
- 1st and 2nd echelon delivery management: the CCC is in charge of the material from the supplier and organize the transport to the construction sites.
- Logistics services: material handling, warehousing, merchandise quality check, crossdocking, work pack creation.
- Reverse logistics management: the CCC helps the company to achieve its goals regarding circular economy, by managing the material returning from the construction sites (unused materials or waste).

8. **Key Partnerships**

- Public authority, as the CCC initiator.
- Logistics operator, which is the central stakeholder responsible for the CCC management.
- Construction companies, which are the main CCC customers.
- Material suppliers, which must have a constant and efficient relationships with the CCC staff, in order to reach high level of performance regarding the whole logistics system. The material suppliers can also retrieve the unused material at the CCC.

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- Transport companies, to provide the delivery vehicles, which are preferentially low carbon vehicles to reduce the overall carbon footprint.
- Waste management contractors, which must have a tight cooperation with the CCC operator, in order to maximize the proportion of waste sorted and collected for treatment and repurposing.
- Industrial security professional: to manage the security on site. Storing such construction materials of different nature involve security measures to separate them regarding fire safety, environmental regulations, etc.
- Software developer, to provide and set up the digital tools to operate the CCC efficiently, and to enhance the application in case of need.
- Citizens and neighbourhood associations, which are key actors in the scheme. The public authority and the CCC operator will have to give constant information about the sustainable and social impacts improvements made thanks to the whole process.

9. Cost Structure

The cost drivers are:

- Human resources
- Costs due the classified facility status, in terms of security measures, environmental protection….
- Handling equipment rental or purchase
- Software development or purchase.

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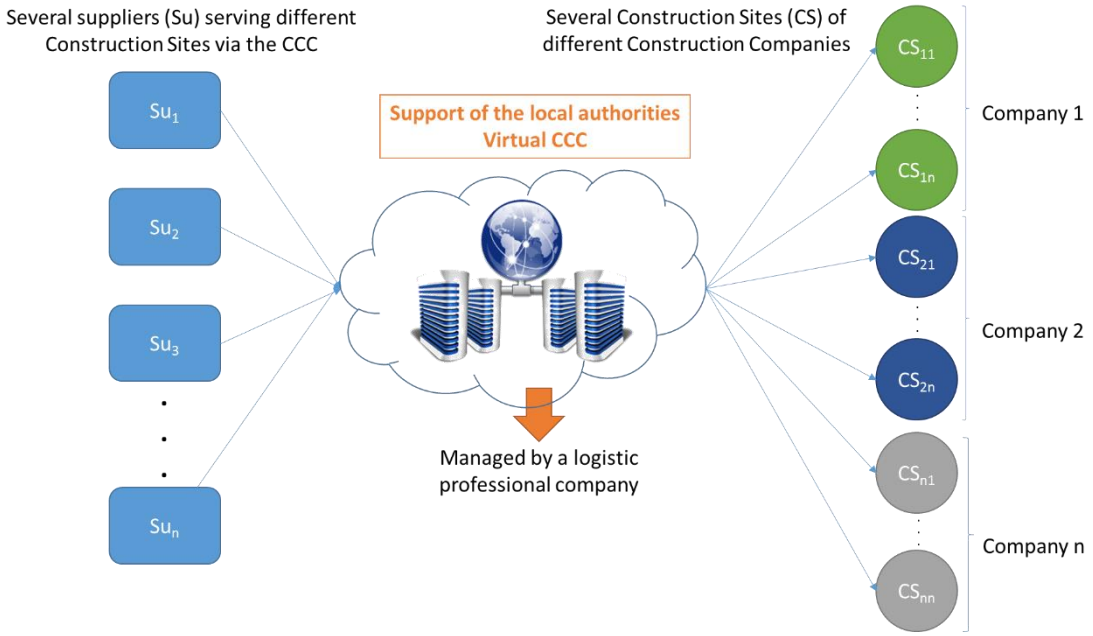
8.2.3.4 Scenario 4:

Definition of the Scenario: the virtual / digital CCC

Despite the consistence of the first three scenarios may be for the French present context, building a physical CCC in town implies several kinds of barriers:

- This approach may involve **heavy financial investments**, especially for land, equipment and human resources. Moreover, warehousing and handling construction materials requires a facility, which generates additional costs.
- The physical CCC basically has a non-negligible **environmental footprint** since the facility occupies a land.
- The construction sector is evolving towards more use of **ICT tools**, more **automatization** of its processes, and more **industrialization** of the building components. Building a physical CCC seems to be against the flow of this trend.
- The CCC, by introducing a new step in the distribution chain, can trouble the current chain value. Indeed, it is a potential competitor with the existing distributions networks actors, which are quite powerful, and not really willing to lose their dominant position.



Based on this observation, the fourth scenario to be investigated is the **virtual/digital CCC**. This kind of CCC is operated through a digital platform, accessible via a web application, which permit to optimize the materials supply flows with a **just-in-time approach**, with **zero stocks**. There is no physical site attached with it: the materials or equipment are manufactured, and their transport is optimized by the virtual CCC service to reduce costs and

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environmental impacts. The goods are gathered in the trucks, with optimized load factors, to fit the different worksites construction planning. This scenario, which reduce the intermediaries in the supply chain, is absolutely relevant in a context in which the carbon will be taxed: to run an economically viable project, it will be crucial to give priority to local distribution channels and considering overall cost. The virtual CCC scenario intends to be a win-win scheme for every stakeholder.

Main characteristics of the Scenario

1. One single CCC serves several constructions sites, which can be held by different construction companies.
2. The CCC is under a public-private-partnership (PPP) involving the City, and specialized private companies (logistics, consultancy, transport, construction, real estate…)
3. The virtual CCC platform is operated by a logistics professional.
4. The business model of this scenario will be assessed the public authority point of view, that delegates the CCC operation.
5. The CCC intends to be "permanent", i.e. beyond the life of one construction site. As a comparison, the economic cycle of the building sector is about 30 years.
6. The CCC is a profit centre.
7. The main services offered by the CCC are :
    - Management of the suppliers' deliveries (1st echelon): the CCC is in charge of the pick-up of the materials needed for the construction sites on the suppliers' storage sites.
    - Storage of the materials within the CCC warehouse, plus extra services within the CCC such as material handling, picking, merchandise quality control, crossdocking, work pack creation...
    - Management of the transport towards the different works sites (2nd echelon)
    - Reverse logistics management: waste sorting, transport to repurposing centres, transport to other construction sites after re-characterization of the material, introduction into the recycling industry, etc.
8. The use of the CCC is at first on a voluntary scheme, with an incentive system put in place by the public authority, in terms of traffic regulations, extended delivery time slots, or other advantageous conditions.
9. Once the service has proved to be efficient, it can become compulsory by the public authorities for construction companies, through contractual clauses included in the public calls for tenders, or in the planning permission procedure for the private developments.

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CANVAS Business Model

Key Partners 8

- Public authorities
- Private companies involved in the PPP
- Logistics operator
- Software developer
- Construction companies
- Materials suppliers
- Transport companies (to provide the delivery vehicles)
- Waste management contractor
- Citizens and associations

Key Activities 7

- Route and load factor optimization
- 1st and 2nd echelon delivery management
- Reverse logistics management…

Key Resources 6

- Software application
- Human resources

Value Propositions 2

- Outsourcing of the logistics issues
- Just-in-time deliveries, with higher reliability, and flexibility
- No stock : reduction of material damage, theft and losses on site
- Congestion reduction on worksites
- Positive environmental impacts : CO2 emissions, circular economy
- Positive social impacts : reduced traffic congestion, limited noise and air pollution

Customer Relationships 4

- The CCC use is on a voluntary basis
- Personal assistance

Channels 3

Awareness

Communication campaign : press release, trade shows, internet

Monitoring

Digital communication : web application with e-mail notifications

Customer Segments 1

Construction companies

Cost Structure 9

- Software development
- Human resources

Revenue Streams 5

- Low monthly fees (public funding)
- Resale of the material waste as resources
- Zero worksite surveillance costs
- Operational saving thanks to logistics optimization

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

1. **Customer Segments**

The CCC only serves construction companies, which have several construction sites in the same area.

2. **Value Propositions**

- Outsource the logistics issues and improve the worksites efficiency thanks to a better logistics organization; the worksite can thus focus on their core activity. Using the CCC helps the worksites to be more reactive, since it permits just-in-time production, like any actual industrial activity, and prevent the risk of delay in the planning.
- Just-in-time deliveries, with higher reliability, and flexibility
- Zero stock process : reduction of material damage, theft and losses on site, thus reducing, even eliminating, the surveillance costs on the worksite
- Reduce congestion on worksites, by providing material storage services. Consequently, there is no need for storage areas on sites.
- Generate positive environmental impacts: the use of the CCC helps to decrease CO_2 emissions and contributes to more efficient circular economy, through a better management of the material returning from the sites (waste or unused materials).
- Generate positive social impacts for the surrounding citizens, such as reduced traffic congestion, limited noise and air pollution, etc. These are key aspects for the City, as they stands for true motivations for investments in CCC, effective means to achieve their sustainable program objectives, and potential electoral arguments.

3. **Channels**

The CCC creation is then promoted through a communication campaign, via press release, participation in trade shows, or internet announcement.

During the CCC operation, all the process is monitored thanks to constant communication between the CCC staff and the worksite managers from all the companies through oral communications, periodic reports on KPI evolution, deliveries notification e-mails, web application, etc.

4. **Customer relationships**

Personal assistance, with a dedicated service based on human interaction. Before, during and after the CCC operation, there is a special responsible to refer to.

5. **Revenue Streams**

The CCC provides a basic services package, against a user monthly subscription. The fees are voluntarily low, in order to be attractive. These low fees are possible thanks to public funding.

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The CCC revenues come from:

- the range of extra added value services which are sold as options
- the resale of the material waste as resources
- operational savings due to logistics optimization, such as zero worksite surveillance costs.

6. Key Resources

The only resources needed are:

- The software application, to manage and optimize all the CCC inputs and outputs (supply, transport, reverse logistics, etc.)
- The human resources, to run the application and monitor the CCC.

7. Key Activities

- Route and load factor optimization: optimizing the route permits to reduce the number of kilometres made by the delivery vehicle; optimizing the trucks load factors helps to decrease the total flow of trucks circulating in town and entering the worksite. These two means are essential activities for the CCC, since they have great potentials for CO_2 and financial savings.
- 1st and 2nd echelon delivery management: the CCC is in charge of the material from the supplier and organize the transport to the construction sites.
- Reverse logistics management: the CCC helps the company to achieve its goals regarding circular economy, by managing the material returning from the construction sites (unused materials or waste).

8. Key Partnerships

- Public authority, as the CCC initiator.
- Private companies involved in the PPP consortium
- Logistics operator, which is the central stakeholder responsible for the CCC management.
- Software developer, to create, set up and continuously improve the digital platform at the heart of the virtual CCC.
- Construction companies, which are the main CCC customers.
- Material suppliers, which must have a constant and efficient relationships with the CCC staff, in order to reach high level of performance regarding the whole logistics system. The material suppliers can also retrieve the unused material at the CCC.
- Transport companies, to provide the delivery vehicles, which are preferentially low carbon vehicles to reduce the overall carbon footprint.

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- Waste management contractors, which must have a tight cooperation with the CCC operator, in order to maximize the proportion of waste sorted and collected for treatment and repurposing.
- Citizens and neighbourhood associations; those partners will have to be constantly informed about the sustainable and social impacts improvements made thanks to the whole process.

9. Cost Structure

The cost drivers are:

- Human resources.
- Software development or purchase.

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8.3 Verona

8.3.1 Introduction

Urban configuration and main entrance axis to access the city

Verona is an Italian city of 258,274 inhabitants. It is the Capital of the homonym Province and the second largest city by population in the Veneto Region, after its capital, Venice.

The urban setting of Verona bases its origins in the Roman city, of which today retains much of the urban fabric. In particular, the historic centre is a characterizing element of the urban fabric, it has high historical and cultural value and it is developed within one of the Adige river bends.

Peripheral districts are more modern: they developed at the end of the Nineteenth Century and are characterized by a strong industrial, craft and agricultural vocation. The metropolitan area of the city reaches a population of almost 500,000 inhabitants.

Roads

Verona represents a highway junction at the intersection of the A4 motorway (Milan-Venice), exit Verona East and Verona South, and the A22 Brenner motorway, exit at Verona Nord.

Verona is also reached by State Road 434 "Transpolesana", which connects it with the town of Rovigo; by State Road 11 "Padana Superiore" (Turin – Venice), by State Road 12 "Abetone", by "Brennero" State Road, that connects Pisa to the Brennero Pass in the Alps, and by State Road 62 "Cisa" connecting Verona to the town of Sarzana. The city is served by a tangential road system.

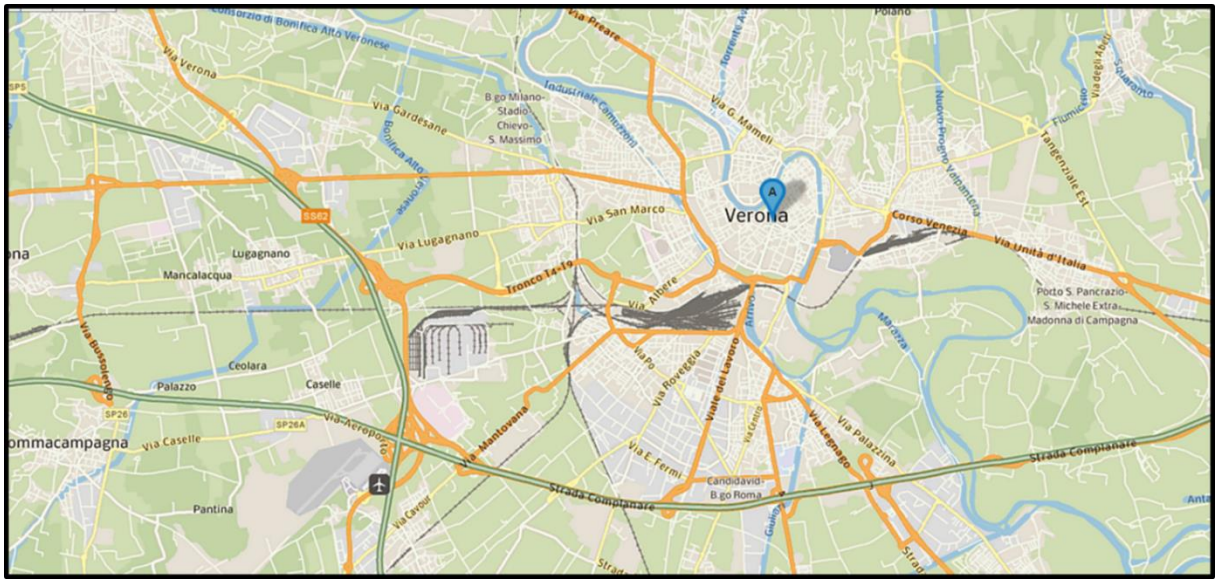

Figure 16 An overview of the city of Verona

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Rail system

Even from the point of view of the rail system, Verona is an important hub, where the Brennero railway, the Verona-Bologna railway and the Milan-Venice railway arrive. Freight trains are mainly directed to the "Quadrante Europa" area, which is a production area of Verona where an intermodal hub - which is currently considered the most important of Europe - was realized. The "Quadrante Europa" area is the ideal meeting point for freight transport via road, rail and air. Here, freight traffic from and to northern Europe, France, Spain and Eastern Europe arrives through the Brennero Pass.

Figure 17 The Verona railway system and the Interporto Quadrante Europa

The Borgo Trento urban context

The Major Civil Hospital of Borgo Trento is located in a residential area with high population density, close to the Adige River and to the historical centre. The hospital was built in the early twentieth century and it is embedded in the fabric of the neighbourhood who was not, at the time of its construction, densely built. The hospital perimeter is defined to the north by Via Goffredo Mameli and to the south by Lungadige Attiraglio. While the first road axis is characterized by a considerable traffic, the Lungadige Attiraglio is configured as an infrastructure with a low load of users, having characteristics of a fast sliding axis.

The Borgo Trento pilot site is equipped with 2 entry driveways on Via Mameli, which is the only useful road for arrivals and departures of building materials needed for the construction site. In facts, the morphology of the territory surrounding the Borgo Trento site, shows us how the construction site is surrounded by a number of urban and natural barriers that stop only on the west side; to the southern side there is the Adige river, to the eastern side there is a densely built neighbourhood and to the northern side we find the

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promontory on which the sanctuary of Our Lady of Lourdes stands. Via Mameli, racing on the East - West direction, is therefore characterized as the more functional road axis, able to provide communications from the pilot to the west side of the city and with the other main roads, including the Brennero motorway.

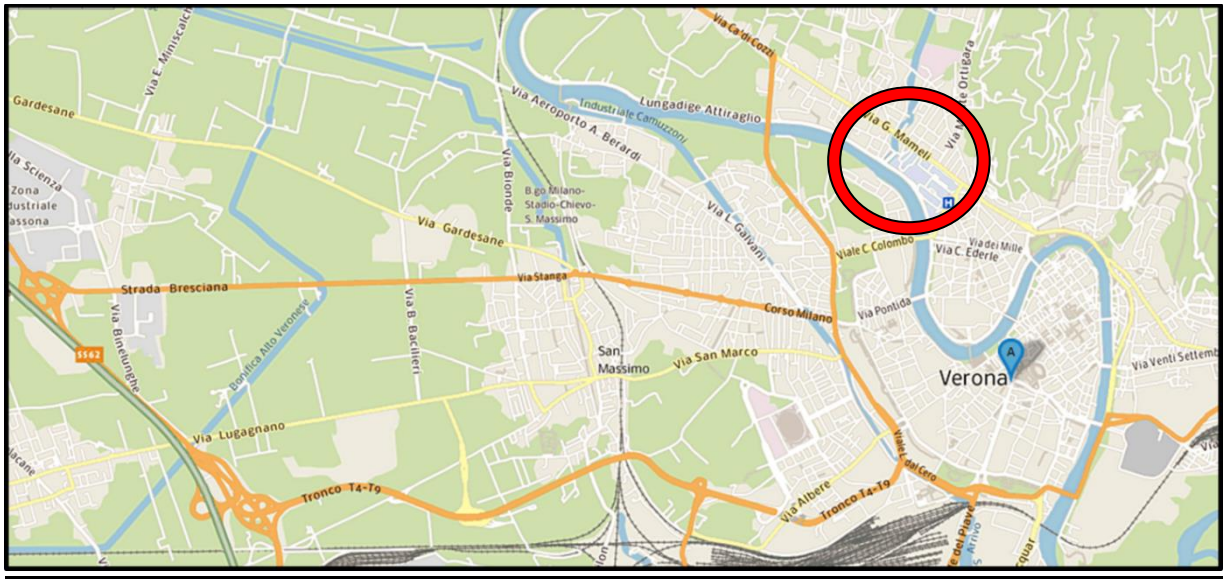

Figure 18 The Borgo Trento Location in Verona

Figure 19 A highlight of the Borgo Trento location

The Borgo Trento urban context influence on the pilot site

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This urban context has definitely influenced many choices related to the organization of the internal and external logistics of the construction site. It is clear that there are no adjacent areas that could be exploited to create a large logistics area on site where to store incoming materials from suppliers and to distribute them on the construction site. For this reason, storage areas for input materials have been identified within the site itself, in a distributed manner in order to take full advantage of all the spaces and trying to concentrate them close to the points where the same materials were used in manufacture. Often, building materials were stored along the internal paths of the construction site. For the waste material, the same rule applies: containers for their collection have been positioned in proximity of the exit, to facilitate their removal. In order to be effective, this type of organization cannot happen without a proper management of incoming material: it has to be studied in advance, being sure the right amount of material arrives only when it is necessary, that is in time with their put in place.

Another factor that certainly has affected the logistics choices of the pilot site is the densely built fabric of the Borgo Trento neighbourhood. This implies high traffic that, during peak hours, congestion occurs in Via Goffredo Mameli, the main road on which construction site material can run. Although there are no specific restrictions to traffic, the constraints arising by the dynamics of the daily traffic have been identified soon. Therefore, two types of remedies have been identified. The first was to organize arrivals in the hours with less traffic congestion (in the early morning, for instance); the second was to equip the pilot exit passage with a dedicated traffic light system, able to stop the traffic on both directions of via Mameli, in order to allow the exiting material to proceed in both directions, in particular in the west side.

8.3.2 SWOT analysis

Strengths

- **Simplification of the planning of the logistics organization of the construction site.** Being aware of the efficiency of a CCC on the territory, this could result in cost savings, as the company saves costs of renting an area adjacent to the site for the storage of materials. This implies a simpler logistics organisation within the construction site, in its planning phase.
- **Simplification of the management of the supply chain of the construction site.** The office in charge of programming the supply chain of building materials will not have to interact daily with a large number of suppliers throughout the area but will have a single point of contact well identified and qualified to give its support in the organization of transport. This can result in a time saving for the person in charge of the process, and in a simplification since he/she interacts with an entity specializing in logistics. This line of reasoning extends also to the reverse logistics.

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- **Preliminary check of the quantity and quality of materials**. The CCC can give its added value by acting as first filter in the verification that the delivery of materials meets the quantity and quality required by the production site. In addition, the CCC could provide support in the recovery of that certification documentation which, by law, must accompany the building materials and that sometimes is lost, or arrives incomplete
- **Increased reliability of compliance with the program and the delivery times.** The presence of a CCC with respect of a production site can be considered as a "tank". The tank, by its nature, creates a "reserve" that allows to take care of any shortcomings at the source, and that would be reflected directly on the end user. Even the "psychological" appearance is not negligible for a site manager who, facing a critical phase of the construction with a very tight timetable, is aware that the materials they need are already in a warehouse near the city and which, if necessary, may be checked by himself with a few minutes' journey.
- **Appreciation by transport companies**. It is possible to suggest an appreciation by the company that usually carries building materials from production sites to construction sites. Assuming the delivery to a CCC rather than to a site such as that of Borgo Trento, it means delivering on site probably located in the outskirts of the city without having to enter the city's urban fabric and, in certain moments of the day, addressing the congested traffic. The benefits to the carrier may then be: greatly reduced lead times, lower probability of road accidents, delivery throughout the whole day and even in peak hours, to avoid possible delays in the construction site for unloading.
- **Having already a logistics hub (specific SWOT).** The city of Verona has in its DNA a vocation for the management of freight logistics. In the close suburbs, surrounded by the Brennero motorway (A22) and the Milan–Venice motorway, it is located the "Quadrante Europa", which is considered the most important intermodal hub of Europe (see, e.g., Figure 17). Therefore, the creation of a UCC or CCC may draw from the model of the "Quadrante Europa" and their geographical location could lead to integrate these structures to the existing ones.
- **Objectives and strategic plan of the Municipality of Verona (specific SWOT).** The City of Verona is among the first municipalities of Veneto Region that adopted the "P.A.T." (*Piano Assetto del Territorio*, that is Operational Territorial Plan), according to the new planning law no. 11/2004. From the general report of the Operational Territorial Plan (chapter 2.2 and 2.3) you can extract the following passages that constitute the plan objectives:

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- *Increase of pedestrian areas, addition of Limited Traffic Zones in the historical centre and of "30 zones" in neighbourhoods;*
- *Re-organisation of urban freight logistics with more sustainability*
- *Development and implementation of "Quadrante Europa" as main hub for infrastructures and logistics and interchange activities for good and services of metropolitan and interregional scale.*

What has been described above represents a good soil for the potential implementation of a UCC or a CCC.

- **Historic urban fabric (specific SWOT).** The presence of a highly urbanized territory and, in particular, of an historic centre of great artistic and cultural value, that preserves an architecture characterized by roads not passable to heavy vehicles, could be an interesting lever to review the distribution system of building materials for all those sites that are located in the central area of the city.

Weaknesses

- **Cost-benefit analysis**. Lack of examples throughout the national territory that demonstrate a real economic benefit to the construction site that decides to adopt a CCC.
- **Centralization of the service**. In one side interacting with a single subject can lead to organizational optimization of the production site (see strengths), but on the other side concentrating supplies of building materials in a single entity exposes to the risk of total paralysis of the site in case of problems of the CCC.
- **Supply of fresh concrete**. By the nature of the material, the CCC cannot enter the concrete distribution chain. This is a strong point of weakness because the concrete is the most widely used material in the construction industry.
- **Previous experience (specific SWOT)**. During the local event (held in Verona the 26/10/2016), in which the SUCCESS project was presented to public and private actors, it emerged from the city of Verona the past experience of an embryonic CCC project which has not led to a positive outcome, as unable to function without the support of public administration.
- **Impacts on the Public Administration**. The birth of a CCC is probably linked to very heavy and very impactful measures in the sector of construction companies and logistics operators. The establishment of a fee to access the city canter could be a very strong leverage to support the idea of the implementation of a CCC, on the other hand those decisions could have a repercussion on the political agreement by the association of builders.

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Opportunities

- **Objectives of P.A.T**. Investing resources, by the Public Administration of the city of Verona, in the realization of a CCC project, would certainly be in line with the objectives of the Operational Territorial Plan (P.A.T.).
- **Replicable example**. Given the great success of the "Quadrante Europa" area that ranks as the most important intermodal logistics hub of Europe the creation of an integrated CCC to this structure could be a model that the Public Administration of the city of Verona may export in other major Italian cities.
- **Opportunity for the territory.** The implementation of a CCC could bring some opportunities for the territory:
  - *Creating a centre of excellence as part of "Quadrante Europa", which aims at research and development of urban mobility systems and freight logistics. The collaboration with leading universities could give rise to a sort of incubator for start-ups, specific to the issues mentioned above.*
  - *impact in terms of green policies such as the possibility to use means of transport with ecological fuels for the supply of building materials.*
  - *repercussions in terms of employment.*

Threats

- **Passivity of the construction sector.** High passivity of the construction industry to change their traditional organizational models and to invest resources in testing new models that may not bring them short-term profits.
- **Investment in research.** Scarcity of funds invested in research and development both in universities and particularly in private companies.
- **Financial Statements of Public Administrations.** With respect of commitments by P.A. for the development of policies on urban mobility and environmental policies, there is a general lack of economic resources.
- **Economic crisis**. Economic crisis of the entire productive sector that primarily affects the leading sector of the construction.

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8.3.3 Scenarios

8.3.3.1 Scenario 1

Definition of the Scenario

In the first scenario there is considered the realization of a CCC starting from a collaboration between public and private sector; The CCC has a permanent character and it appeals to most construction companies each of which has more construction sites.

- The Municipality of Verona, within the objectives of the P.A.T., introduces measures related to road traffic for delivery of goods in urban areas, in addition to the establishment of tax area for access to the main areas of the city.
- At the same time, it promotes initiatives for private entities that wish to develop projects in the field of logistics of goods and building materials.
- The City of Verona is part of the ZAI Consortium, an institutional public body on a territorial basis (composed by Verona Council, Verona Province and Verona Chamber of Commerce) whose tasks are town planning and propulsion towards the overall development of the area and its economy; it is also the body that manages the "Quadrante Europa" area. The City proposes to the other members of the consortium to issue a public call for tenders for the construction and management (project financing) of a CCC, identifying a lot of land, to give it free of charge for 50 years.
- The ZAI Consortium, having verified that the creation of a CCC is akin to the objectives of "Quadrante Europa" Area Plan (P.A.Q.E.), decides to issue a public call for tenders to build and manage a CCC in the Quadrante Europa identified area.
- As a possible hypothesis, the Association of Construction Manufacturers of Verona creates a company named ACEVR-LOG that wins the call for tenders and builds the CCC.
- The CCC management is entrusted by ACEVR-LOG to a specialized logistics operator.

Benefits for ACEVR-LOG: it is a for-profit company

Benefits for the Municipality of Verona: infrastructure costs for the construction of the CCC are saved and ACEVR-LOG is obliged to use only ecological fuels means for the distribution between CCC and construction sites.

- The CCC is addressed to many Construction Companies, which, in turn, have many construction sites within the city
- The CCC is permanent
- Construction Companies may use the CCC on a voluntary basis.

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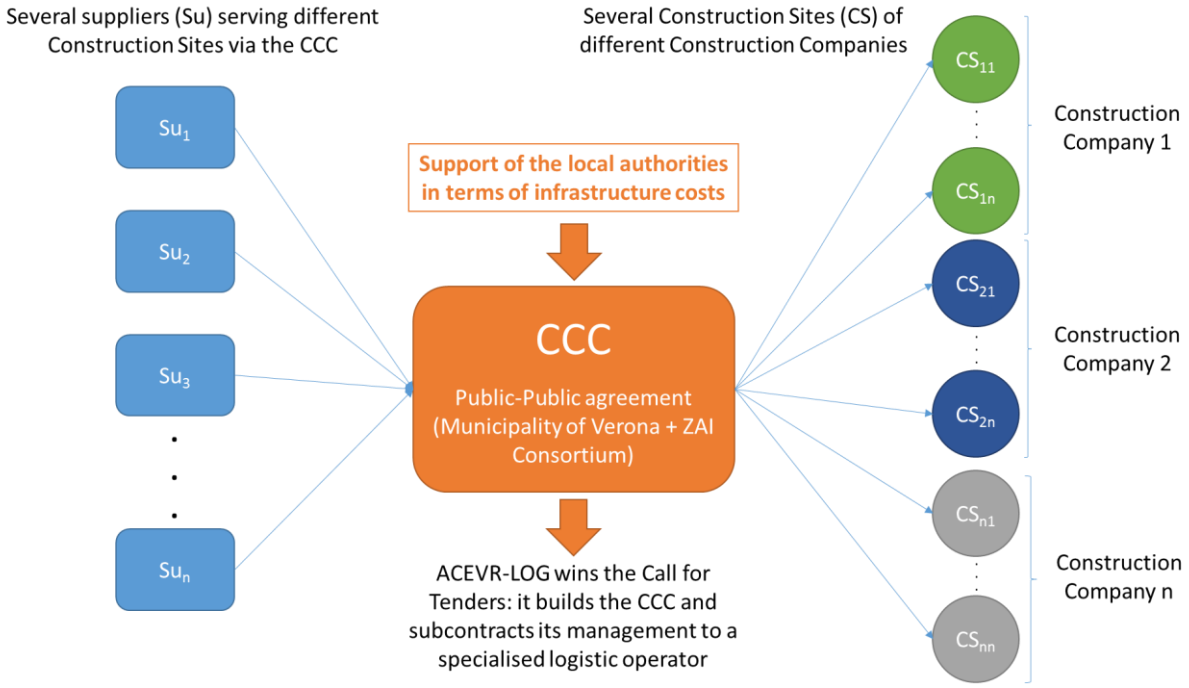
SERVICE OFFERED BY THE CCC:

- *Pick-up and delivery service to 1st level suppliers: the CCC organises the pick-up of materials that the construction site needs by suppliers warehouses*
- *Transport and delivery to the construction site (2nd level suppliers): the CCC organises the delivery of material from the CCC to the construction site.*
- *Logistic services within the CCC: storage, movement of materials, assisting the logistic personnel*
- *Reverse Logistics service: waste material do not run within the CCC, but they are directly sent to the garbage dump.*



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CANVAS Business Model

Key Partners 8	Key Activities 7	Value Propositions 2	Customer Relationships 4	Customer Segments 1
• Transport Companies • Vehicles Rental Agencies • Suppliers of fuels • Public authorities	• Meeting customers' expectations • Management of contingencies and singularities	• Reduction of logistics costs • Last minute deliveries • Less human resources costs for logistic activities • 24H service	• Specialised logistic operator • WEB application for the management of logistic processes	• Construction companies
	Key Resources 6 • Logistic operator • Position of the CCC • CCC dimensions • Technologies • Flexibility		**Channels 3** • Call for Tenders • ZAI Consortium website • ACEVR-LOG website • Face-to-face contacts • Advertising • Mailing-lists	

Cost Structure 9		Revenue Streams 5
Direct costs: • Labour costs • Vehicles costs • Equipment costs • Waste disposal	Indirect costs: • Amortization of CCC construction costs • Management costs for CCC • Consulting costs	• Transport of materials in txKM or m3xKM • Consulting services • Renting warehouse spaces

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1. **Customer Segment**
   - Services offered by the CCC are addressed to construction companies: in this scenario, there is more than one company, each company having construction sites in the city of Verona.
2. **Value Proposition**
   - Reduction of logistics costs: the construction company externalises logistic operations of all its construction sites in the area of the CCC. The costs reduction comes from the optimisation of operations, thanks to the centralised management performed by a logistics expert.
   - Last minute deliveries: the CCC can offer a last-minute delivery service to those companies which ask for it, meaning that, in case a construction site unexpectedly requires material, it can have it with a maximum delivery time of 2 hours.
   - Less human resources costs for logistic activities: construction companies will reduce time related to the management of supply chain. They would relate only with the CCC, instead of dealing with each supplier, thus implying more economic savings.
   - 24H service: If necessary, the CCC will be able to offer its services also during night and holidays. As construction companies are asked to reduce their timings, this means that the working activity shall continue above normal working hours
3. **Channels**
   - ZAI Consortium publishes a Public Call for tenders, to decide the entity who will manage and build the CCC.
   - The Call is published in the ZAI Consortium website, section "Amministrazione Trasparente" ("Transparent Administration"). The winner (in this case ACEVR-LOG), subcontracts the management to a specialised logistic operator, through a public call on its website.
   - Single construction companies receive communication of the possibility to use the CCC thanks to advertising, personal contacts and mailing lists. Communication via e-mail will include a detailed study on potential gains and improvements for the entire construction supply chain due to the CCC, in order to convince construction companies of the benefits of the use of a CCC.
4. **Customer relationship**
   - Specialised logistic operator: the contact point between the CCC and the construction company will be a dedicated and qualified logistic operator. In this way the CCC will establish a direct relationship with its customer who, in turn, will be able to interact with the logistic operator he has been assigned. This will allow the logistic operator to understand the dynamics of each construction site and to contribute to the management of the delivery plan and, more in general, in the management of the supply chain.

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- WEB application for the management of logistic processes: the CCC will adopt an IT system through which it will share with clients all management activities of the logistic process.

5. **Revenue Stream**
   - Transport of materials in t x Km or m^3 x Km: the main source of revenue for the CCC logistics operator comes from a calculation of metric tons or cubic meters (the most restrictive) transported from the warehouse of a supplier to the CCC and from the CCC to the construction site
   - Consulting services: consulting services will be offered to those construction companies that wish to implement a CCC.
   - Renting warehouse spaces for any entity which needs a storage area for non-perishable materials
6. **Key resources**
   - Logistic operator: the experience of a logistic operator will be one of the main success factor for the CCC.
   - Position of the CCC: the choice of the location of the CCC plays a major role; its location in relation to the city and the connection with the main axes that fit into the urban fabric are important for everyday operations of the CCC.
   - CCC dimensions: calibrating the size of the CCC is definitely an important factor; it must be equipped with the correct spaces for the storage of building materials both in covered areas and uncovered depending on the type.
   - Technologies: the CCC must be equipped with software systems for both inventory management and for the management of the vehicle fleet. The first will allow an optimized management of the warehouse, avoiding losses or confusing materials. The software for fleet management will maximize the movement of trucks, driving hours and rest periods for drivers and fuel consumption which are the first voice of expense for companies operating in the transport sector.
   - Flexibility: the organization of the CCC must be properly calibrated to average operations. To cover any peak periods of activity it will have to rely to sub-assignment of a share of the goods movement to external transportation companies, rentals of equipment rather than relying to the use of temporary labour force.
7. **Key activities**
   - Meeting the customer's expectations: dedicated logistics operators enter into the dynamics of the single construction sites and give their contribution in the organization of the supply chain.
   - Management of contingencies and singularities: the CCC must be flexible and adaptable to the needs of construction companies and single construction sites. Each delivery must be preliminarily investigated

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and verified and strategies must be put in place having, if necessary, different features from site to site.

8. **Key partners**
   - Transport Companies: the CCC, if necessary, will need to have a very large and diverse fleet and therefore a frequent activity will be the sub-assignment of part of the transport to other companies in the industry.
   - Vehicle Rental Agencies: construction sites with specific requirements will have the need to be served by particular means of transport, thus requiring rental agencies.
     Suppliers of fuels: considered that the first item of expenditure, for the transport companies, is the consumption of fuel, assumes that we upstream contracts with one or more fuel suppliers from which to obtain the best market prices.
   - Public authorities: the CCC, may enter specific agreements with the public administrations to enjoy special rates for access to the tax area of urban centres or to can use preferential lanes

9. **Cost - Structure**

Direct costs:

- Labour costs: employees' salary;
- Vehicles costs: purchase, fuel, maintenance, rental, insurance;
- Equipment costs: purchase, maintenance, rental;
- Waste disposal: in case of reverse logistics.

Indirect costs:

- Amortization of CCC construction costs;
- Management costs for CCC: phone/internet costs, heating, electric energy, local administration taxes, etc.
- Consulting costs: personalised study for new logistic models and cost reductions.

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8.3.3.2 Scenario 2

Definition of the Scenario

In the second scenario the construction company implements directly the CCC for its own use

- The Municipality of Verona, within the objectives of the P.A.T., introduces measures related to road traffic for delivery of goods in urban areas, in addition to the establishment of a tax area for access to the main areas of the city.
- At the same time, it promotes an agreement to reduce the tax area to those companies which want to create a CCC and that commit to adopt and respect a plan to optimise the supply chain of construction materials, including the reverse logistics.
- A single construction company creates the CCC
- The CCC is directly run by the construction company

Benefits for the construction company: optimisation of costs and of the supply chain.

Benefits for the Municipality of Verona: getting closer to the objectives of the plan for a sustainable re-organisation of urban freight logistics.

- The CCC is dedicated to the construction sites of the construction company.
- The CCC is temporary.
- The construction company adopts a CCC on a voluntary basis.
- The CCC is managed by the construction company.

SERVICE OFFERED BY THE CCC:

- *Pick-up and delivery service to 1st level suppliers: the CCC organises the pick-up of materials that the construction site needs by suppliers warehouses*
- *Transport and delivery to the construction site (2nd level suppliers): the CCC organises the delivery of material from the CCC to the construction site.*
- *Logistic services within the CCC: storage, movement of materials, assisting the logistic personnel*
- *Reverse Logistics service: waste material don run within the CCC, but they are directly sent to the garbage dump.*

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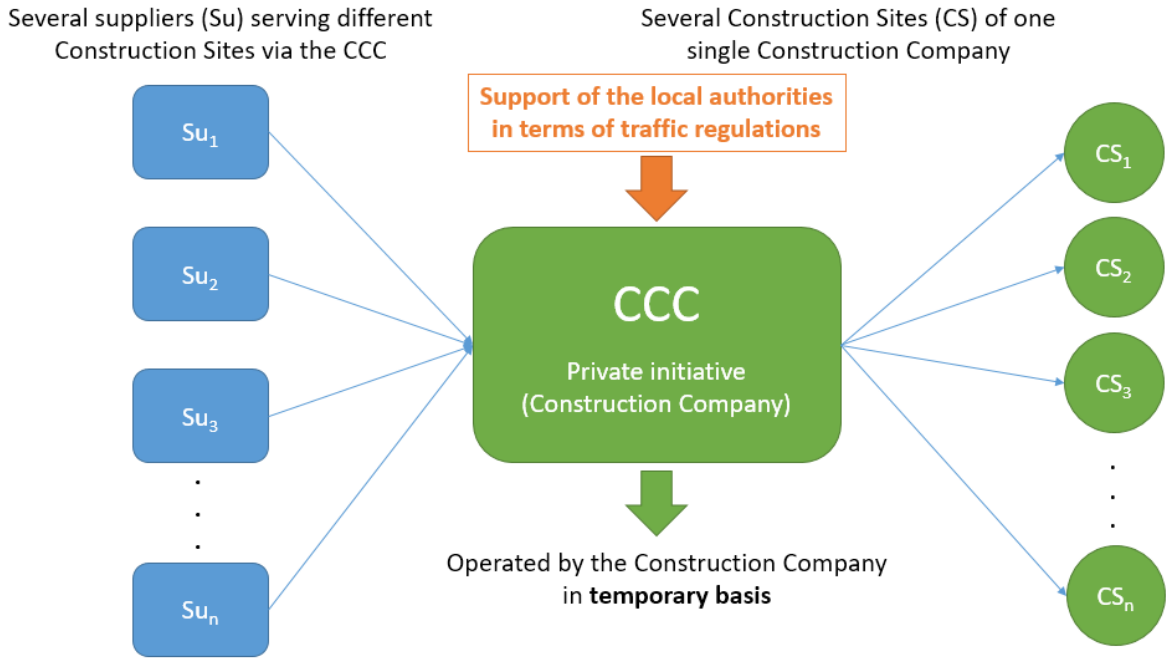

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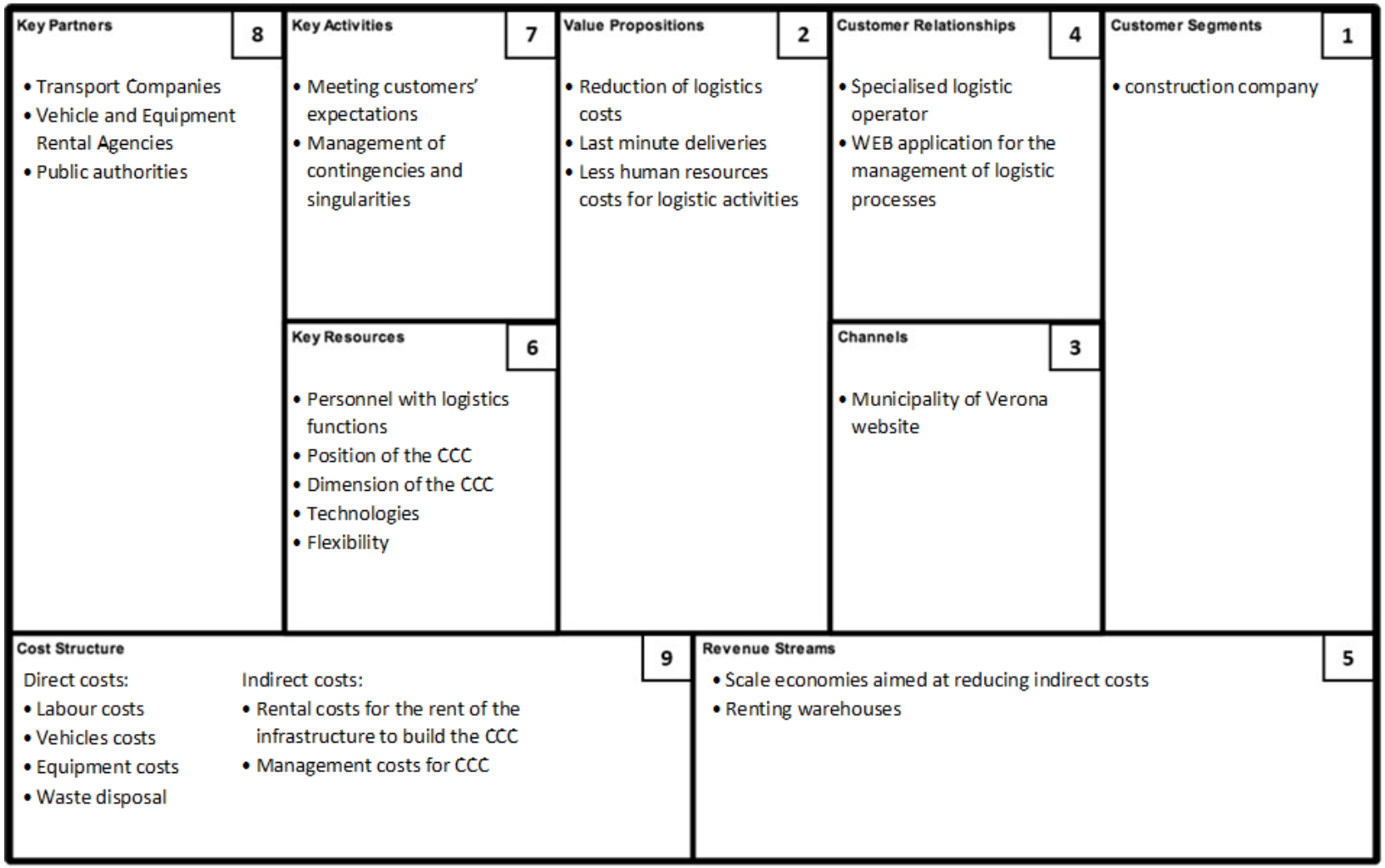
CANVAS Business Model



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This scenario differs from the other as the single construction company organises itself autonomously to create a CCC and it centralises the construction material supply chain, to get scale economies. In this scenario, the CCC is smaller and the construction company will aim to minimise the initial investment costs and to have a return of this investment within the life of the CCC. The management of the CCC is in the hands of internal personnel while external companies will be involved to rent equipment and for road transport.

1. **Customer segment**
   - Services offered by the CCC are addressed only to construction companies: in this specific scenario, one construction company which has more construction sites in the city of Verona.
2. **Value proposition**
   - Reduction of logistics costs: the construction company gets a reduction of costs by centralising the logistic management and optimising the supply chain management of all the construction sites within the city. The activation of a CCC aims to get scale economies in the management of personnel committed to construction site logistics.
   - "Last minute" deliveries: the CCC will organise a "last minute" delivery service in order to make small deliveries with a short time notice from the construction site.
   - Less human resources needed for logistics activities: the construction company saves time for the management of supply chain programmes. Instead of dealing with all material's suppliers it deals only with the CCC operator, implying a further saving in human resources.
3. **Channels**
   - The Municipality of Verona communicates through its website about the tax discount companies would have if they provide themselves with a CCC and of an optimisation plan. Moreover, a detailed study on potential gains and improvements for the entire construction supply chain due to the CCC is also published in the Municipality's website, explaining the benefits of the adoption of a CCC.
4. **Customer Relationship**
   - Dedicated logistic operator: the contact point between the CCC and the construction company will be one or more construction company employee(s), trained in logistic processes. Thus, the CCC will be able to have a direct relation with the construction site that, in turn, can interact with the operator. In this way, with a short time, the operator will get to know each construction site and will be able to contribute more to the management of delivery plans and, more in general, with the supply chain.
   - WEB Application to manage logistic processes: the CCC will use an IT system through which it can share with clients all supply chain management activities.

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5. **Revenue Stream**
   - In this scenario there is not a direct stream of revenues, the goal is reaching scale economies aimed at reducing indirect costs linked to logistics and supply chain management.
   - Renting warehouses to any entity that needs a storage area for non-perishable materials.
6. **Key resources**
   - Personnel with logistics functions: the operators' experience will be one of the main success factor for the CCC.
   - Position of the CCC: the choice of the position of the CCC has a primary role; the location with respect to the city and its connection with main urban axis must be analysed.
   - Dimension of the CCC: the dimension of the CCC is important; it should be equipped of correct spaces for construction material storage, both internal and external spaces, depending of the type of material to be stored.
   - Technologies: the CCC must be equipped with software systems for optimised inventory management, avoiding losses or confusion of materials.
   - Flexibility: the CCC organisation should be based on an average functioning mechanism both for equipment and personnel needs. To face peak activity periods, it will rely on renting equipment and hiring interim personnel.
7. **Key activities**
   - Meeting the construction sites' expectations: dedicated logistics operators enter the dynamics of the single construction sites and give their contribution in the organization of the supply chain.
   - Management of contingencies and singularities: the CCC must be flexible and adaptable to the needs of single construction sites. Each delivery must be preliminarily investigated and verified and strategies must be put in place having, if necessary, different features from site to site.
8. **Key partners**
   - Transport Companies: this second scenario reports the CCC working almost exclusively with not owned vehicles; then, to provide its service to construction sites, it will enter into sub-contracting with shippers' companies having means and authorizations for the transport of goods by road.
   - Vehicle and Equipment Rental Agencies: most equipment and vehicles used by the CCC will be rented.

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- Public authorities: the CCC, may sign specific agreements with the public administrations to enjoy special rates for access to the tax area of urban centres.

9. Cost Structure

Direct costs:

- Labour costs: employees' salary;
- Vehicles costs: rental contracts with transport companies;
- Equipment costs: purchase, maintenance, rental;
- Waste disposal: in case of reverse logistics.

Indirect costs:

- Rental costs for the rent of the infrastructure to build the CCC;
- Management costs for CCC: phone/internet costs, heating, electric energy, local administration taxes, etc.

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8.4 Valencia

8.4.1 Introduction

The city of Valencia is located in the East coast of Spain, at the banks of the river Turia, which crosses the city from West to East. It is the capital of the Comunidad Valenciana, one of the 19 main administrative divisions of Spain. Valencia is the third largest city of Spain after Madrid and Barcelona with a population near to 800.000 inhabitants inside its city limits and more than 1.500.000 considering its metropolitan area. The extension of the city of Valencia reaches 98.827km^2 and its population density is on average 7.966 inhabitants/km^2 (see Figure 20).

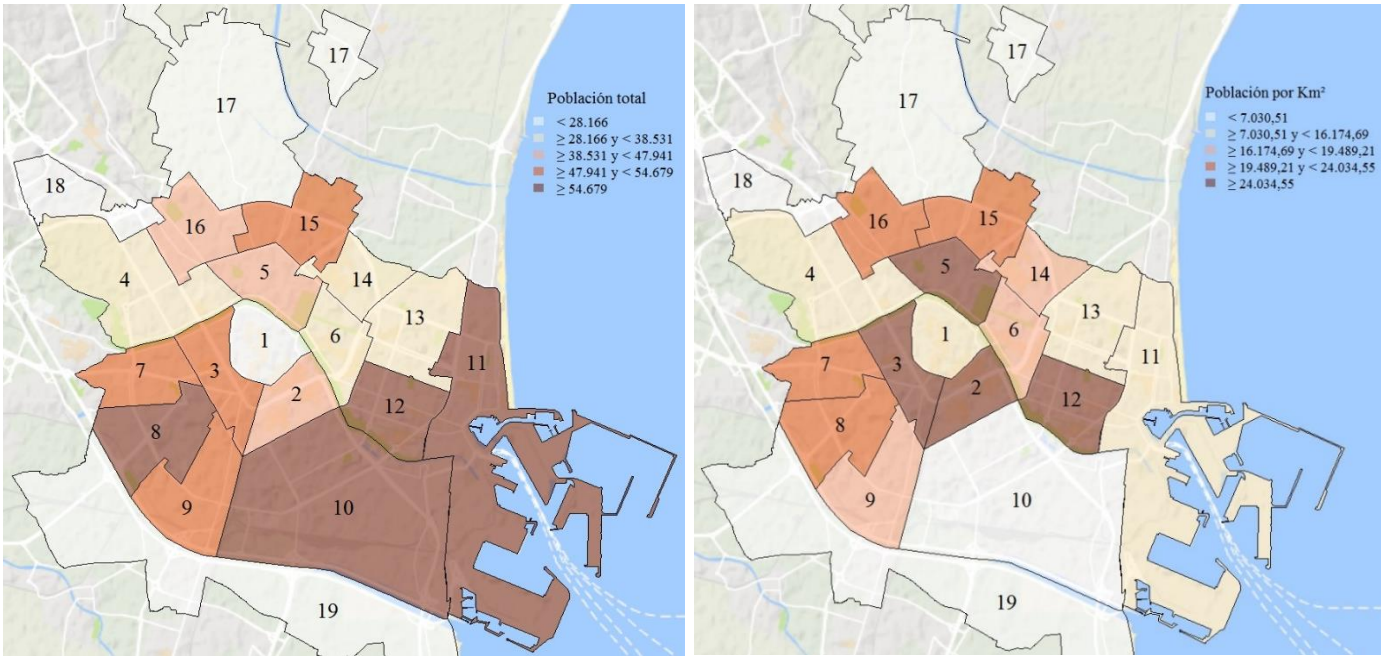

Figure 20. Population (left) and density of population (right) of the city of Valencia

Transport infrastructure

The city of Valencia has a strategic position inside Spain due to both its location and the infrastructure network that connects Valencia to the most important economic nodes. For instance, Valencia is connected by inland transport to the regions that concentrate the 27% of the Spanish population in less than two hours and to the regions that produce with more than 50% of the Spanish GPD in less than three.

A free motorway connects Valencia and Madrid allowing the movement of freight and people in approximately 4 hours. Northwards, Barcelona and Valencia are connected by a motorway where the travel time is less than four hours (AP-7). Besides, a free motorway (A-7) connects Valencia and Castellón, one of the most important cities of the region of Valencia located 70km in north

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direction. Southwards, the city of Valencia is connected by two motorways: The AP-7 which runs parallel alongside the coast of the Mediterranean Sea, and the A-7, which connects the inland villages of the region of Valencia. The complete road network of the region of Valencia can be seen in Figure 21.

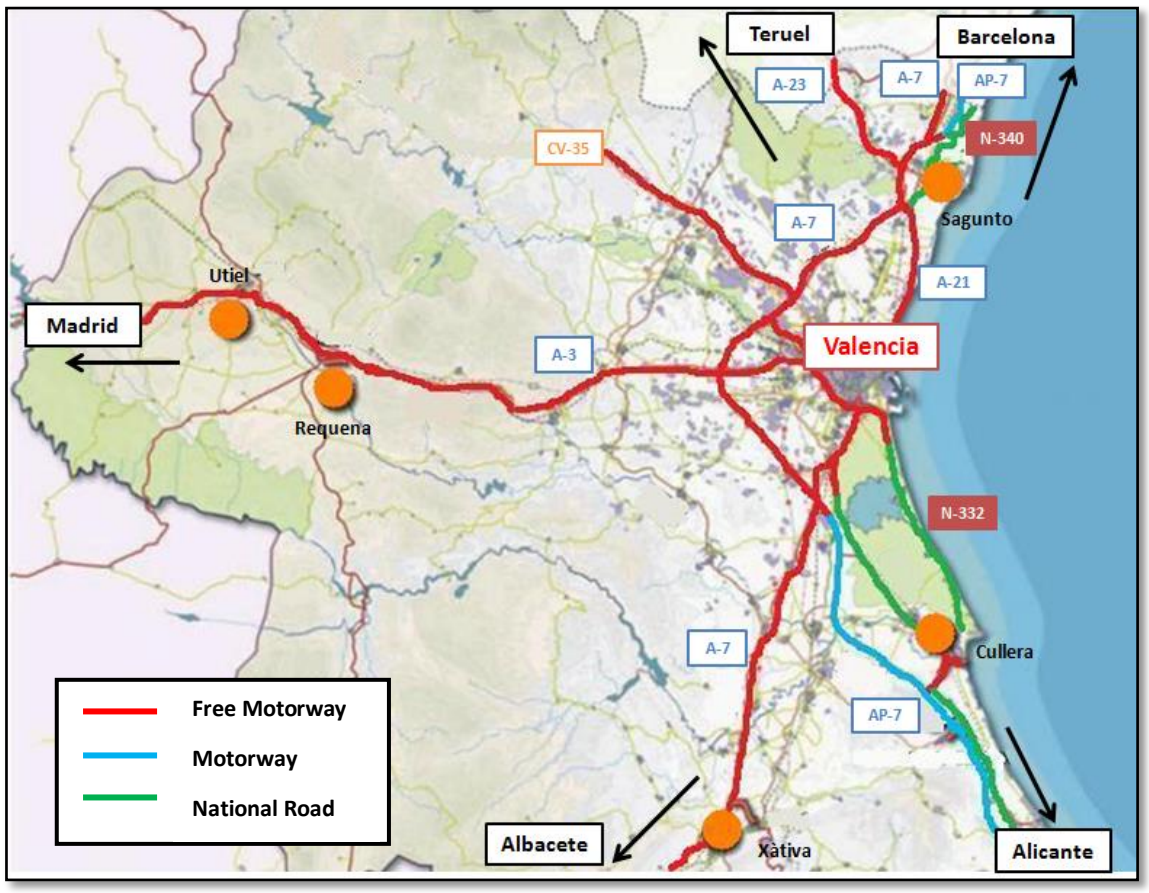

Figure 21. Road network of the region of Valencia

Urban Characteristics

The urban structure of the city of Valencia presents a radial layout pattern that reflects an outward expansion of urban development from the city centre induced by the construction of new circumferential and radial roads. The radial structure is composed by three main concentric rings that surround involving the historic city centre as can be seen in Figure 22. The old riverbed of the Turia River crosses the city from West to East until it flows into the Mediterranean Sea. The relocation of the course of the river allowed the creation of a green zone that crosses the city from West to East. In addition, of the old riverbed represents an important artery in the urban network that helps to flow and redistribute the traffic through the city avoiding congestions.

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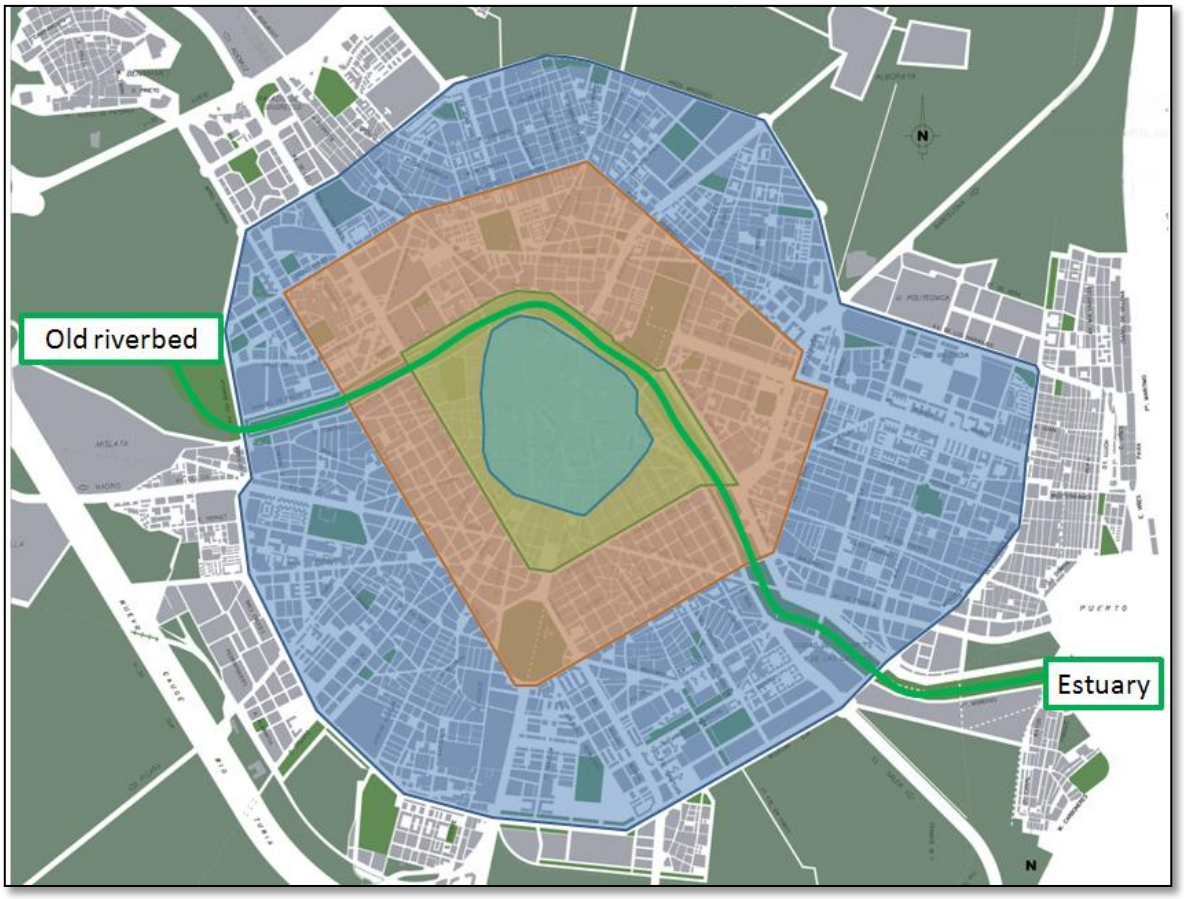

Figure 22. Layout of the urban structure of the city of Valencia

The city centre of Valencia is characterized by the presence of many pedestrian zones and narrow streets. Most of the streets are one-way and, in some cases, access control measures are applied. The urban freight distribution causes severe traffic problems and during the peak hours the congestion and the lack of space for loading/unloading activities lead to the use of unauthorized areas for parking and to the pass of vehicles pass through pedestrian streets for the delivery of goods. There is a weight limit from 7-22h in the city for transport vehicles up to 9Tn, however, the construction vehicles have a special exemption and can access the city at any time.

As a complement to the above mentioned transport policies in the city of Valencia, it should be added that the number of bicycle lanes is increasing considerably, transforming a vehicle lane into a two-way bike lane. The goal of this action is to reduce the space for the car by giving it to the pedestrian and the cyclist. So that, the variation of traffic flows and changes in the capacity of the streets will also modify the routes of the industrial and construction vehicles, limiting their passage through the city centre and areas with a limited speed of 30 km/h.

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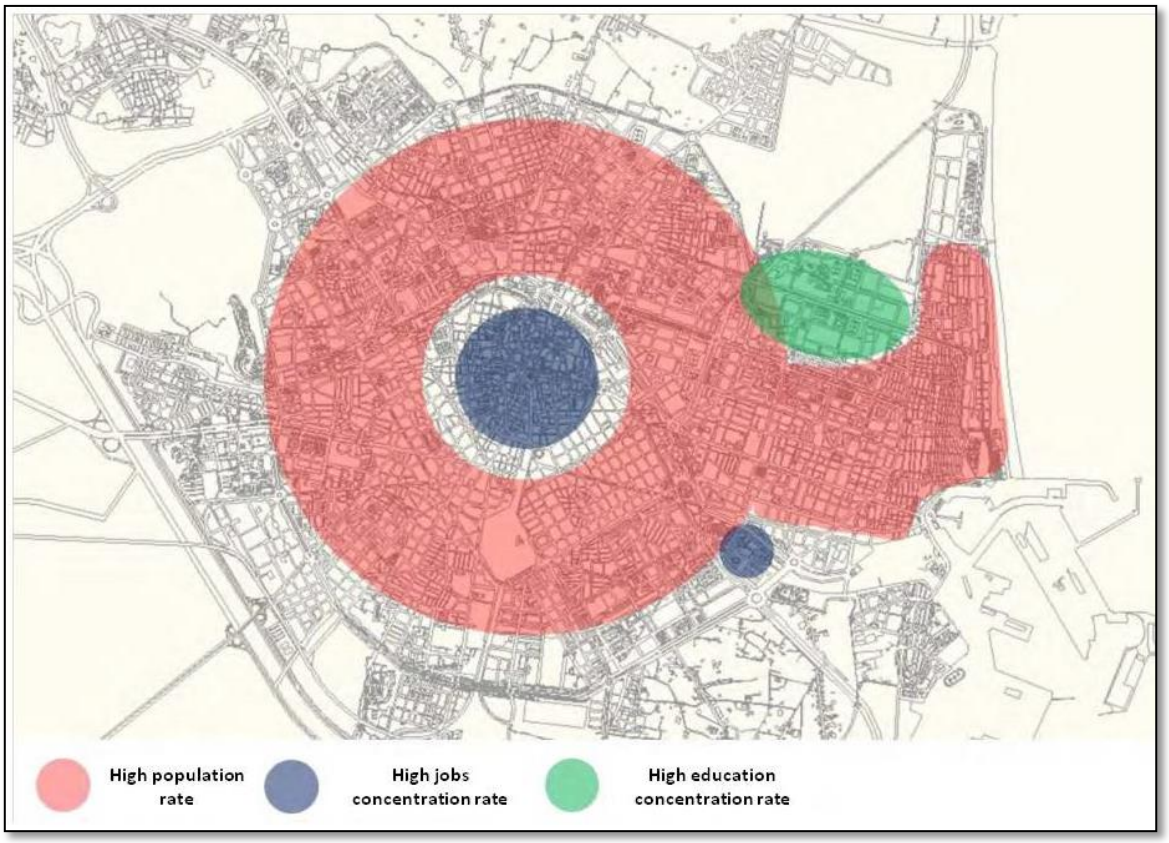

Figure 23 Distribution of population, jobs and education centres in the city of Valencia (PMUS of Valencia)

The Figure 23 illustrates clearly the existence of a strong concentration of jobs in the city centre that produces important transport flows from the outskirts, which are more densely populated. As mentioned previously, the problem of the congestion in the centre of the city increases during the mornings. To this end, the public authorities have continuously proposed measures and regulation to mitigate the adverse effects of the urban freight deliveries such us pollutant, noise, congestion and the occupation of the pedestrian areas and sidewalks by the transport operators.

The local legislation of the city of Valencia currently in force includes a regulation that addresses the loading and unloading operations. However, it only affects partial aspects such as maximum load of the vehicles and traffic timetabling. There is not a specific law that integrates the problem of urban distribution and the construction logistics in all their dimensions: economical, urban and environmental.

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Construction Sector

The construction industry was a driver sector in the Valencia region and more specifically in the city of Valencia with large urban developments in the outskirts of the city and with important restorations of historical buildings of the city centre. However, when the economic crisis started in 2008 the number of constructions slowed down drastically and it hasn't recovered yet the pre-crisis levels.

Following Figure 24 shows the total number of construction licenses given by the city hall of Valencia segregated by districts between 2003 and 2012. As can be seen, there is a high concentration of construction licenses in the city perimeter and the city centre.

In addition, Figure 25 shows the density of construction licenses per squared kilometre given by the city hall of Valencia between 2003 and 2013. In the same manner, the figure shows an important concentration of constructions in the city centre (*Ciutat Vella*) and in the districts located at the outskirts (*Poblats Maritims* and *Pobles de l'Oest*).

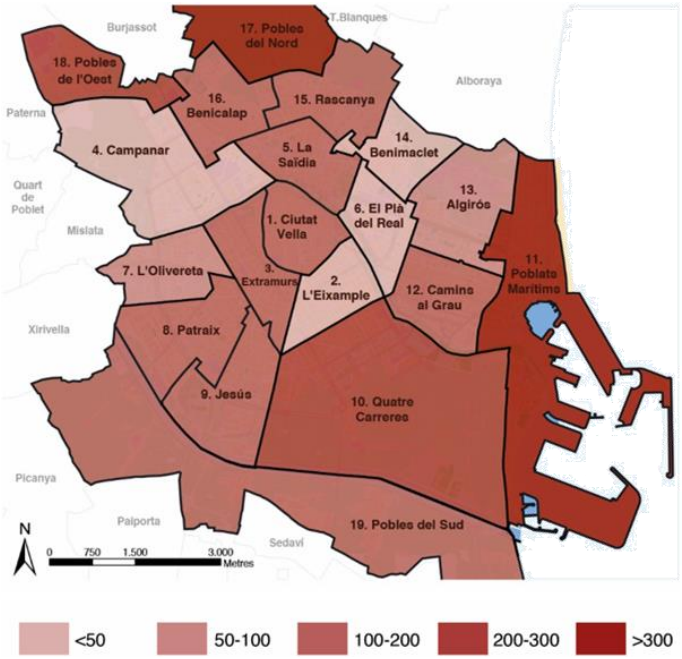

Figure 24. Total number of construction licenses given between 2003 and 2012

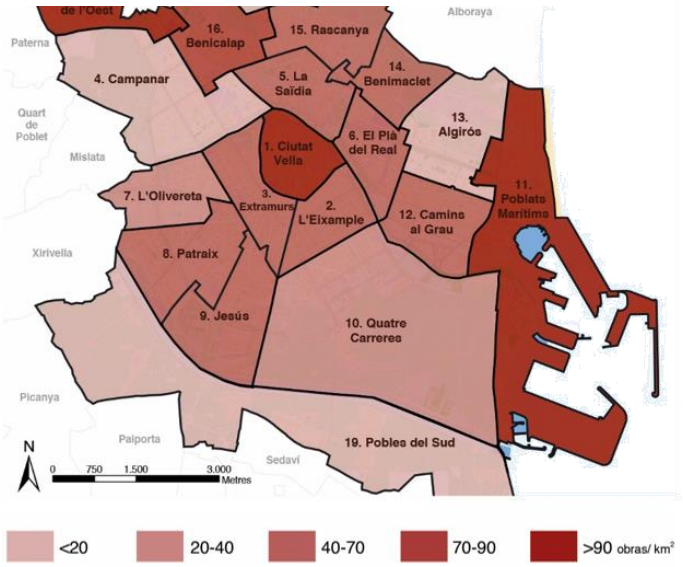

Figure 25. Density of construction licenses per km2 given between 2003 and 2012 in the city of Valencia

8.4.2 SWOT analysis

A SWOT analysis for the development of a CCC in the city of Valencia is done below:

Strengths:

Despite the generally accepted advantages of the UCC and CCC presented in the section 4 regarding the increment of the transport efficiency (e.g.

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increment of the load factor, reduction of total kilometres covered, etc.), the increment of the level of performance due to JIT deliveries, stock reduction, etc. and other positive effects in the urban environment regarding the CO_2 and NO_x emissions, the congestion or the noise, the main strengths for the implementation of a CCC in the city or Valencia are:

- Possibility to add **new business models and added value activities** in the CCC in a sector weakened as a consequence of.
- Possibility to involve several construction companies collaborating in the same CCC to reach economies of scale.
- **Increases Safety** in the construction sector due to the reduction of the handling of materials and the higher safety measures of the CCC compared to the construction site.
- Higher potential to develop and **implement innovative solutions** (R&D)

Weaknesses:

Concerning the main weaknesses for the implementation of a CCC in Valencia, the most significant are:

- **Lack of successful UCC and CCC experiences** previously implemented in Spain and in Valencia. The involved actors for the CCC implementation will be newcomers in an industry reluctant to change.
- **High implementation cost.** The initial investment required for the implementation of CCC is high while the benefits that they provide are obtained in the long term. In addition, in several cases is difficult to translate into profits (euros) the benefits of the UCC.
- **Lack of huge congestion** problems in the city of Valencia that may difficult the justification of a new actor in the construction supply chain due to the CCC implementation.
- **Debilitated industry due to the economic crisis.** The construction industry has been hugely affected by the crisis and is a sector that is still recovering the activity levels previous to the crisis. Besides, the CCC implementation represents a high risk that could not be difficulty accepted by the construction companies in this context.

Opportunities:

The most remarkable opportunities for the development and implementation of CCC in the city of Valencia are:

- **New urban policies and traffic legislations in Valencia.** The municipality of Valencia is empowering sustainable solutions for urban mobility and the CCC implementation fits with the objectives pursued by the local authorities.
- **New mobility paradigm** in the city of Valencia due to the increment of the number of bicycle lanes, transforming a vehicle lane into a two-way

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bike lane, with the aim to reduce the space for the car by giving it to the pedestrian and the cyclist.

- **Rebirth of the historical neighbourhoods in the city centre of Valencia**. During the last years several neighbourhoods of the city centre of Valencia have been renewed with important investments by the local authorities. The new local government wants to increase the investments in these neighbourhoods and promote the central areas of Valencia where traffic regulations and conditions are stricter due to the characteristics of the urban structure (e.g. narrow streets).
- Possible **development of huge urban projects** promoted by the local and regional authorities such as the following phases of "*Parc Central*" including the new high speed railway station, the new regional underground rail network, and the new real-estate developments on the surroundings.
- **Promotion of the urban logistics.** The city hall of Valencia is promoting the urban logistics and other areas related to the "Smart City" concept such as mobility, environmental quality, TIC solutions, and energy efficiency in urban areas.
- Possible **new business models transformation for construction material warehouses and distributors** for small and medium projects located in the city of Valencia. This specific case is one of the scenarios that is going to be assessed.
- **Introduction of the BIM to the construction sector.** The BIM will change the way that the construction sector works and could be an ice breaker for other business models and solutions to a traditional industry such as the construction sector.

Threats:

- **Lack of support and use of the CCC** by the construction companies that can make fail it.
- **Unappropriated design and dimensioning of the** CCC according the future constructions developments of the city.

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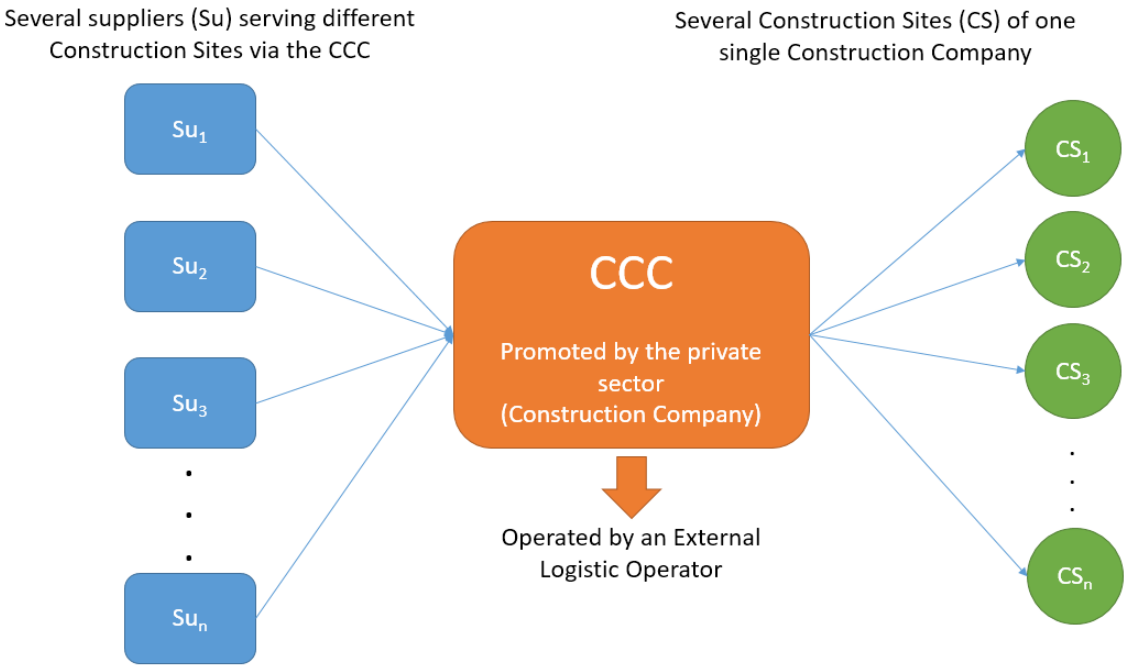
8.4.3 Scenarios

8.4.3.1 Scenario 1

***Definition of the Scenario**: Outsource CCC for a single Company*

The scenario to be assessed consists on one single CCC operated for an external logistics operator that serves to several construction sites that are managed by one single construction company. The construction company has contracted an external logistics company to operate temporarily (long time period) his own CCC with the aim of improving the construction logistics of the different sites that the construction company has and will have in the city of Valencia.



Main characteristics of the Scenario

1. One single CCC operated by an external logistics company/operator
2. One single construction company
3. The logistics operator is the selected bidder for the management of the CCC where the construction company is the main contractor.
4. The business model of this scenario is going to be assessed from the point of view of the logistics company that operates the CCC
5. CCC Serving several constructions sites in one single city (Valencia)
6. Temporary basis (long time period)
7. The CCC is operated as a profit centre
8. Main Services offer by the CCC:

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- Suppliers' delivery and pick-up services (1st echelon): the CCC manager organises the pick-up of materials needed for the construction sites coming from the suppliers' storages to the CCC. With this service, the construction company control the transport allowing to improve its associated cost. In other cases, the suppliers can deliver themselves the materials in the CCC (the decision is taken based on the route optimization and cost evaluation).
- Transport to site delivery services (2nd echelon): the CCC organizes the delivery services from the CCC to the different construction sites.
- Logistics services in the CCC: storage, material handling, picking, crossdocking, work pack creation, pre-assembling, urgent deliveries, etc.

9. Private initiative without public funding for the implementation neither for operation.
10. Possible support of the public authorities in terms of traffic regulations.

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CANVAS Business Model

Key Partners

- Company Suppliers
- Transport Companies
- Public Authorities
- Construction Company
- Software provider
- Equipment provider

Key Activities

- Route optimization
- Load factor optimization
- Cargo consolidation
- Coordination with construction company
- Material planning
- Stock Management
- Storage

Key Resources

- Warehousing
- Handling equipment
- Transport vehicles
- Labour force
- Optimization and management software

Value Propositions

- Logistics cost reduction
- Congestion on site reduction
- Higher delivery reliability
- Less Human resources for logistics activities
- More bargaining power with suppliers

Customer Relationships

- Collaborative and dedicated personal assistance

Channels

- Personal Interviews
- Tailored study of new logistics model and client cost reduction
- Control reports (periodical evaluation)

Customer Segments

- Niche Market (construction Companies)

Cost Structure

- Transport Cost (fuel, vehicles, insurances, etc)
- Labour force
- Facility rental/acquisition
- Equipment rental/acquisition
- Software acquisition

Revenue Streams

- Material transport: T×Km or m^3×Km
- Special picking services: workpack creation

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1. **Customer Segments**

The customer segment of the CCC is a Niche Market because it only serves construction companies, and specifically for this scenario, one single construction company with several construction sites in Valencia.

2. **Value Propositions**

Logistics cost reduction: The construction company outsources the logistics operations of all its construction sites in the area served by the CCC. The cost reduction comes from the optimization of the operations due to a centralized management by a logistics expert.

Congestion reduction on site: The outsourcing of the logistics operations allows a better traffic management on site due to a centralized planning managed by a logistic expert.

Higher delivery reliability: The deliveries on the different sites are centralized and routed via the CCC which allows a better reliability and more flexibility in the deliveries.

Less Human resources for logistics activities: The CCC operator is in charge of the logistic operations for all the construction sites, which allows to obtain important savings in human resources for the main contractor of the CCC (Construction Company)

More bargaining power with suppliers: The logistic company in charge of the CCC is the responsible of the pick-up and the delivery of the materials needed in the construction sites. With this system, the construction company can save the transport cost to the site, centralize the purchase and increase the bargain power with its material suppliers.

3. **Channels**

Personal Interviews: direct contact between the logistic operator and the main contractor offering the logistics services for the entire construction supply chain.

Tailored study of new the logistics model and client cost reduction: a detailed study of the potential savings and the benefits for the entire construction supply chain that the CCC can produce for the main contractor (Construction Company) will be the initial channel of communication that will work as a key factor for convincing the company of the benefits of the use of a CCC.

Control reports (periodical evaluation): during the CCC operations, the logistics operator of the CCC reports to the main contractor the KPIs and benefits of its operations.

4. **Customer Relationships**

Collaborative and dedicated personal assistance: the relationship between the main contractor and the logistic operator of the CCC has to be very close and fluent. Both have to work closely in order to achieve the higher performance of

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the logistics operations and to reach the maximum potential benefits that can be produced in the construction process in the different sites.

5. Revenue Streams

Material transport in *t* × *Km* or m^3 × *Km*: the main income for the logistic operator of the CCC comes from the calculation of the tonnes or the cubic meters (the most restrictive) transported from the suppliers' warehouses to the CCC and then from the CCC to the construction sites. Special tariffs can be applied for dangerous and hazardous material. This calculations in *t* × *Km* or m^3 × *Km* is also applied for the reverse logistics with different tariffs.

Special picking services: work pack creation and other value added services. The logistic operator of the CCC offers other added value services to the construction company that facilitate the construction process and improves the efficiency of the different construction sites.

6. Key Resources

Warehousing: Warehouse facility to perform the required logistics operations needed for the supply to the different construction sites served through the CCC. The facility has to be planed and sized according to the construction sites' requirements during the lifespan of the project.

Handling equipment: in the same manner than the warehousing, the handling equipment needed for the logistics operations has to be sized according to the demand requirements.

Transport vehicles: the vehicles' fleet is essential for the transport operations. The fleet has to be optimized according to the transport needs and characteristics. However, the fleet can be composed by a mix of owned vehicles, rented vehicles and subcontracted vehicles that help to meet with the peaks of transport demand.

Labour force: as with the transport vehicles, the labour force needed for the CCC operations has to be sized and optimized according to the demand. During working peaks the staff can be completed with personnel from temporary employment agencies.

Optimization and management software: The optimization software for the route calculation and the materials consolidations is a key element for the operations of the CCC. This software allows the CCC to optimize the transport operations and achieve the required potential savings.

7. Key Activities

Route and Load factor optimization and Cargo consolidation: these are the key activities to be performed by the CCC operator because they can potentially optimise the total transport flows. The reduction of the total tonnes and cubic meters transported per kilometre produces the main revenue for the CCC operations. The CCC operator charges to the main contractor

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(Construction Company) the transport cost from the suppliers' storages to the CCC and then from the CCC to the site. However, the reduction of the number of empty trips, the non-fully loaded vehicles, the achievement of higher load factor rates and the route optimization allows the CCC operator to save the total distance covered in tonnes or cubic meters per kilometre.

Coordination with the Construction Company and the construction sites: the optimization of the logistics operations in the CCC and the transport flows requires a higher degree of coordination between the site managers and the CCC operator. This coordination is essential to match the demand of materials from the construction sites with the flow of materials from the suppliers.

Material planning and Inventory management: in the same manner than in the previous point, it is necessary to manage the materials' inventory of the CCC with the suppliers in order to meet with the demand from the construction sites.

8. Key Partnerships

Construction Company Suppliers: a fluent relationship between the CCC operator and the suppliers is needed to achieve a higher level of performance of the transport flows and inventory management.

Transport Companies: transport companies are important actors for the transport operations of the CCC due to the support that they provide to meet with peak demands in the transport flows.

Public Authorities: they support in terms of transport exemptions in urban areas can be relevant for the achievement of the targets set.

Construction Company: its cooperation is a key element for the success of the CCC initiative. The relation between the construction company and the CCC operator is a key element for the economic and operational feasibility of the CCC.

Software and equipment providers: a close relationship between the CCC operator and the software and equipment providers is important for the maximization of the efficiency in the CCC operations.

9. Cost Structure

Transport Cost (fuel, vehicles, insurances, etc.): variable cost that has to be minimized due to the reduction of the total kilometres covered.

Labour force: fixed cost for the permanent staff plus a variable cost for temporary workers during working peaks.

Facility rental/acquisition: fixed cost that must be optimized by correct sized of the facility during the project lifespan.

Equipment rental/acquisition and Software: fixed cost incurred during the implementation of the CCC plus a maintenance cost for the equipment and the software update.

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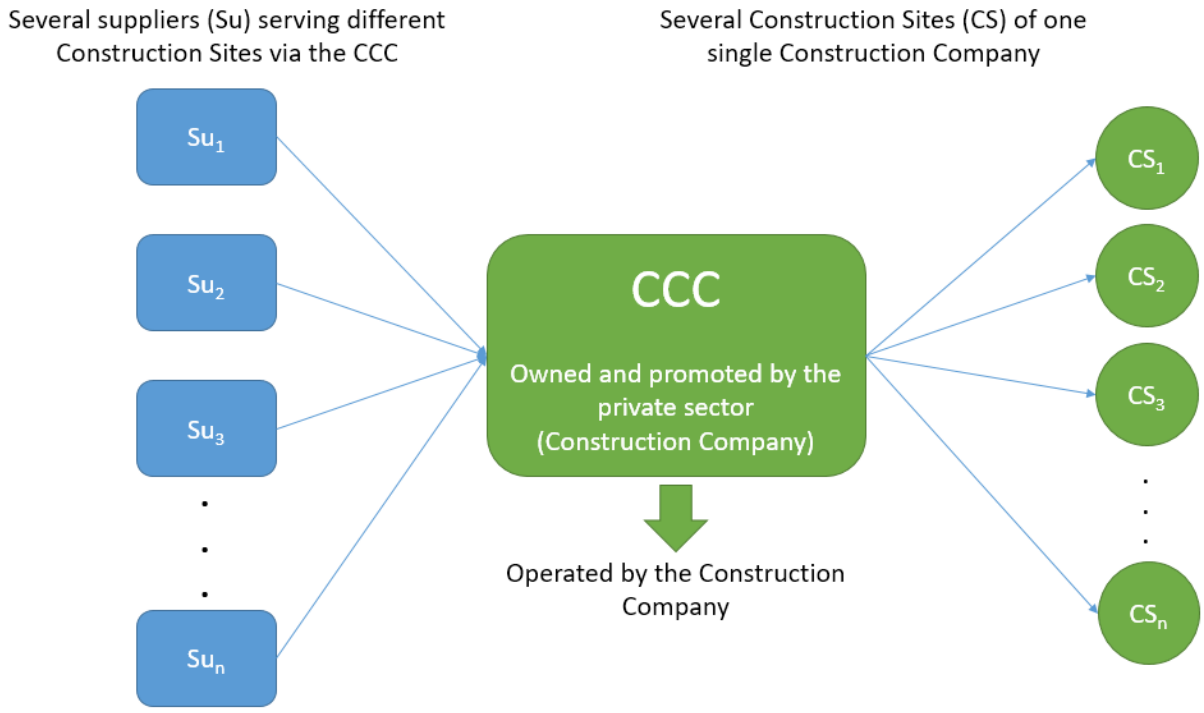
8.4.3.2 *Scenario 2*

Definition of the Scenario

The scenario to be assessed consists on one single CCC operated by a construction company that manages several construction sites. The construction company is the owner of the permanent CCC with the aim of improving its own supply and logistic chain in its construction sites located in the city of Valencia.



Main characteristics of the Scenario

1. One single CCC operated and owned by a construction company that build several construction sites in Valencia.
2. One single construction company and Multi-site
3. CCC serving several construction sites in one single city (Valencia)
4. Permanent basis
5. The CCC is operated as a cost centre. The main objective of the company is to improve the global supply chain of the construction using the CCC but it isn't intended to generate revenues for the logistic activity.
6. Main services offer by the CCC:
    - Suppliers' delivery and pick-up services (1st echelon): the CCC manager organises the pick-up of materials needed for the construction sites coming from the suppliers' storages to the CCC. With this service, the construction company control the transport

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allowing to improve its associated cost. In other cases, the suppliers can deliver themselves the materials in the CCC (the decision is taken based on the route optimization and cost evaluation).

- Transport to site delivery services (2nd echelon): the CCC organises the delivery services from the CCC to the different construction site under request.
- Logistics services in the CCC: warehousing and storage, handling operations, picking, cross docking, work pack creation, pre-assembling, urgent deliveries, etc.

7. Private initiative without public funding for the implementation and for operations.
8. Possible support of the public authorities in terms of traffic regulations, land concessions or extended access restrictions for the vehicles of the CCC.

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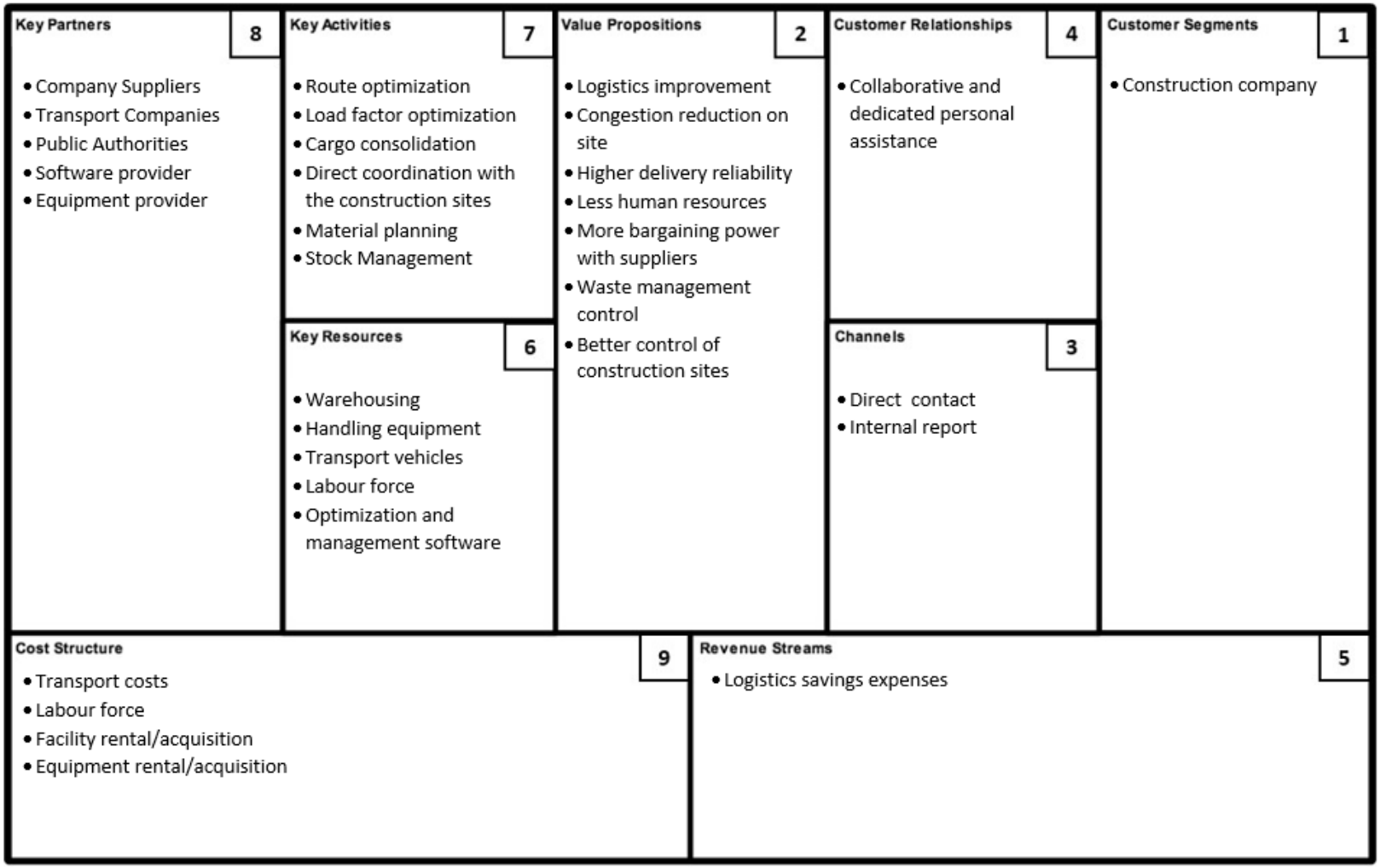
CANVAS Business Model



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1. Customer Segments

The customer segment of only one Construction Company including all the sites that this company manages in a specific area (city of Valencia).

2. Value Propositions

To improve its own logistics and supply: the own management of the CCC by the construction company allows it to increase the level of control of its supply chain and its logistics operations, which translate in better performance and level of service for the construction sites.

Congestion reduction on site: The outsourcing of the logistics operations allows a better traffic management on site due to a centralized planning managed by a logistic expert.

Higher delivery reliability: The deliveries on the different sites are centralized and routed via the CCC which allows a better reliability and more flexibility in the deliveries.

Less Human resources for logistics activities: The CCC is in charge of the logistic operations for all the construction sites, which allows obtaining important savings in human resources for the Construction Company.

More bargaining power with suppliers: The Construction Company that owns the CCC is the responsible of the pick-up and the delivery of the materials needed in the construction sites. With this system, the Construction Company have more control and can organize in a better way the transport cost to the site, centralize the purchase and increase the bargain power with its material suppliers.

Waste management control: The construction Company can organize and manage the waste on a more precise manner.

Better control of its construction site: Double checking control by the CCC manager and also the site Manager.

3. Channels

Direct contact between CCC staff and site Manager of each construction site (e.g. telephone, mail, meetings, etc.).

Internal control report: during the CCC operations the CCC staff reports to the Construction Company Manager about the KPIs and benefits of its operations.

4. Customer relationships

Collaborative and dedicated personal assistance: The relation between the construction company and the CCC staff has to be close and fluent.

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5. Revenue Streams

Logistics saving expenses: Reduction of vehicles fleet, transporters, etc.

6. Key Resources

Warehousing: Warehouse facility to perform the required logistics operations needed for the supply to the different construction sites served through the CCC. The facility has to be planed and sized according to the construction sites' requirements.

Handling equipment: in the same manner than the warehousing, the handling equipment needed for the logistics operations has to be sized according to the demand requirements.

Transport vehicles: the vehicles' fleet is essential for the transport operations. The fleet has to be optimized according to the transport needs and characteristics. However, the fleet can be composed by a mix of owned vehicles, rented vehicles and subcontracted vehicles that help to meet with the peaks of transport demand.

Labour force: as with the transport vehicles, the labour force needed for the CCC operations has to be sized and optimized according to the demand. During working peaks the staff can be completed with personnel from temporary employment agencies or staff of the Construction Company.

Optimization and management software: The optimization software for the route calculation and the materials consolidations is a key element for the operations of the CCC. This software allows the CCC to optimize the transport operations and achieve the required potential savings.

7. Key Activities

Route and load factor optimisation and cargo consolidation: these are the key activities to be performed by the Construction Company (CCC operator) because they can potentially optimise the total transport flows. The reduction of the total tonnes and cubic meters transported per kilometre produces the main revenue for the CCC operations. The CCC operator is the main contractor, for this, the construction company must not pay the transport cost from the suppliers´ storages to the CCC and then from CCC to the site. It´s a very important saving expense. However, the reduction of the empty trips, the non-fully loaded vehicles, the achievement of higher load factor rates and the route optimization allows the CCC operator to save the total distance covered in tonnes or cubic meters per kilometre.

Direct coordination between Construction Company and constructions sites: There are not intermediaries

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Material planning and stock management: It is necessary to manage the materials´ stock of the CCC with the suppliers in order to meet with the demand from the construction sites.

8. Key Partnerships

Construction Company Suppliers: a fluent relationship between the CCC operator and the suppliers is needed to achieve a higher level of performance of the transport flows and inventory management.

Transport Companies: Transport companies are important actors for the transport operations of the CCC due to the support that they provide to meet with peak demands in the transport flows.

Public Authorities: They support in terms of transport exemptions in urban areas can be relevant for the achievement of the targets set.

Software and equipment providers. This is very important for the maximization of the efficiency in the CCC operations.

9. Cost Structure

Transport Cost (fuel, vehicles, insurances, etc.): variable cost that has to be minimized due to the reduction of the total kilometres covered.

Labour force: fixed cost for the permanent staff plus a variable cost for temporary workers during working peaks.

Facility rental/acquisition: fixed cost that must be optimized by correct sized of the facility during the project lifespan.

Equipment/rental acquisition and Software: fixed cost incurred during the implementation of CCC plus a maintenance cost for the equipment and the software update.

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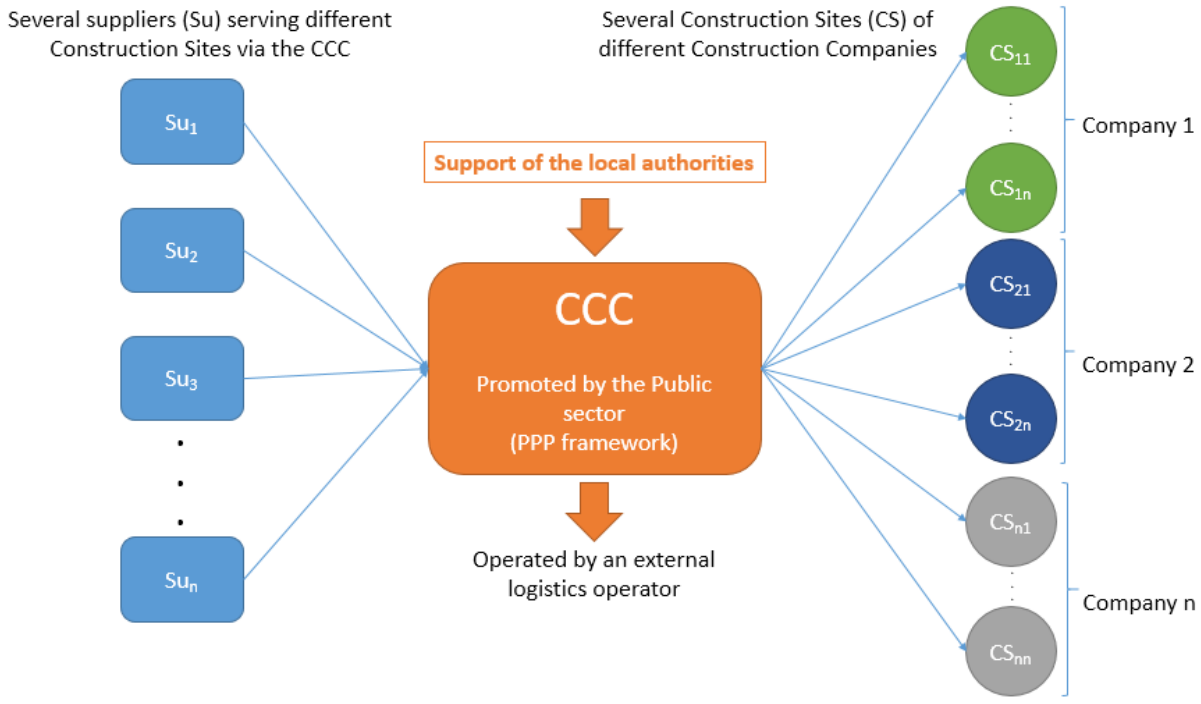
8.4.3.3 *Scenario 3*

Definition of the Scenario: *Private-Public Partnership CCC*

The Valencia City Council and its innovation agency, InnDEA Valencia, are looking for some possible alternatives for Private Public Partnership (PPP) and other different measures in order to promote new initiatives for the improvement of the urban logistics. In this concern, regarding the construction supply chain and the CCC implementation, some measures to be taken by the City Council may be new traffic ordinances, public promotion campaigns, special permissions, load/unload exemptions or public land concession. These group measures represent a pool of resources to test a new logistic model with some interesting details such as: avoiding illegal landfill, promote the circular economy, improve recycling process and coordinate construction logistic in the city. More precisely, in this scenario for a CCC implementation, the CCC is owned by a PPP composed by the Public Authority and several Construction Companies that have several construction sites in Valencia.



Main characteristics of the Scenario

1. One single facility with one landlord (City council with PPP) in order to provide the logistics services.
2. One single CCC operated by an external 3rd party logistic company through a tendering process.
3. Shared CCC with many Construction Companies, several sites and supplier companies (multi-site CCC).

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4. The logistics operator is the tender selected for the management of the CCC where the City Council and pool of Construction Companies are the main contractor.
5. This scenario takes into consideration the support of public authorities for the implementation of the CCC in terms of the concession of public space for the CCC.
6. The business model of this scenario is going to be assessed from the point of view of the city council.
7. CCC Serving several constructions sites in one single city (Valencia)
8. Temporary basis (long time period and possibility to become permanent based on the results)
9. The use of the CCC is voluntary and it will have some advantages as it will be easy to organise transit and freight, improve situation and coordinate efforts between agents.
10. The CCC is operated as a non-profit centre, it will analyse direct and indirect costs and benefits for the city.
11. Main Services offer by the CCC:
    - Suppliers' delivery and pick-up services (1st echelon): The CCC manager organises the pick-up of materials needed for the construction sites coming from the suppliers' storages to the CCC. With this service, the CCC controls the transport allowing to improve its associated cost. In other cases, the suppliers can deliver themselves the materials in the CCC (the decision is taken based on the route optimization and cost evaluation).
    - Transport to site delivery services (2nd echelon): the CCC organises the delivery services from the CCC to the different construction sites.
    - Logistics services in the CCC: storage, rental of equipment, material handling, picking, crossdocking, work pack creation, pre-assembling, urgent deliveries, etc.
    - Reverse logistics and recycling services: CCC will be used as main storage point for reverse logistics and it also will be a recycling point and it will prevent illegal landfills and promote recycling selection process allowing the circular economy in some cases and reducing the quantity of wasted materials.
12. Support of the Public Authorities combining set of instruments, such as: public land concession, promotion campaigns, traffic regulations to promote the use of CCC and reduce traffic jam (e.g. vehicle restrictions, time windows, bus lane use, etc.), and reduction of CO_2 and NO_x emissions.

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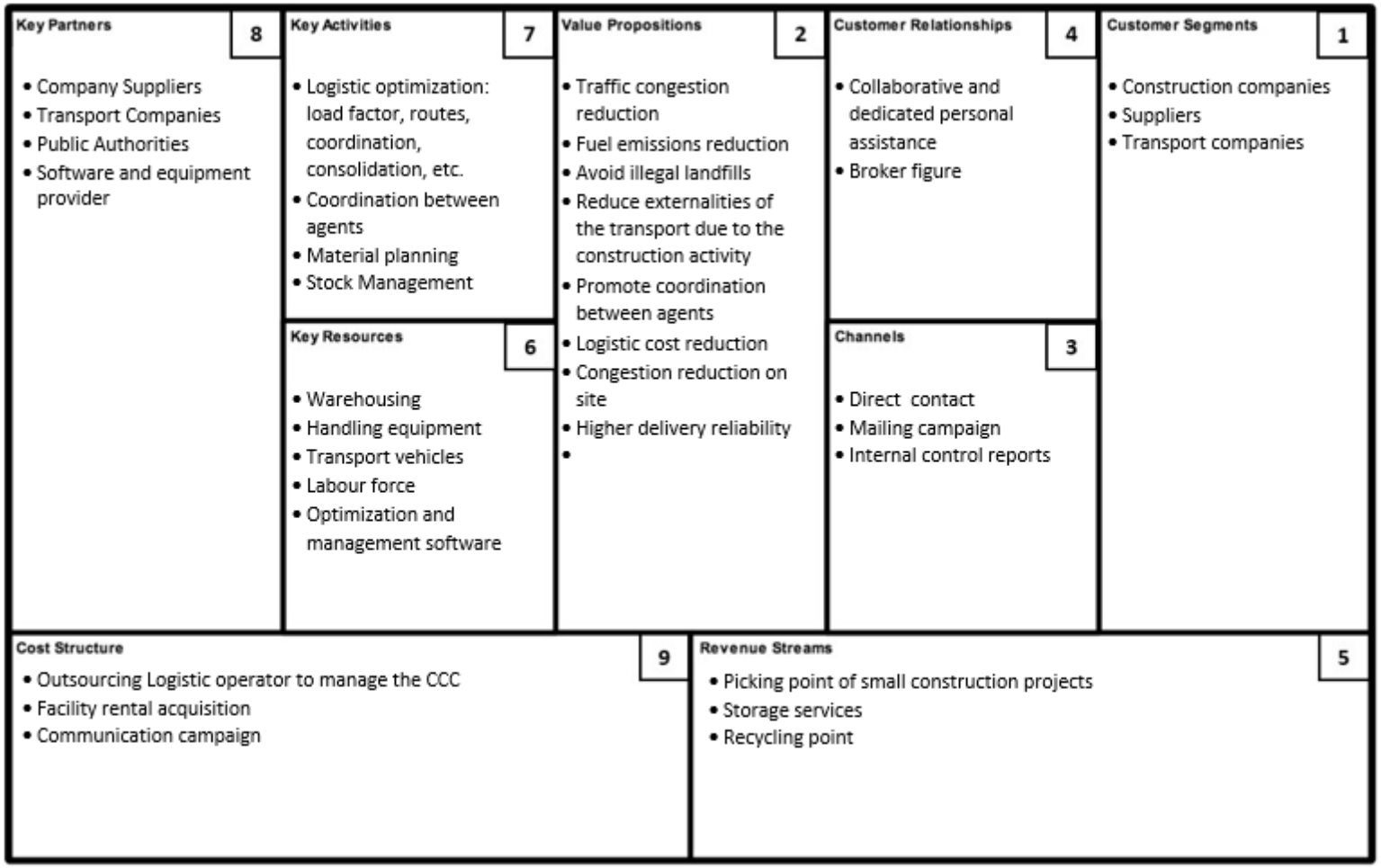
CANVAS Business Model



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1. **Customer Segments**

The customer segment of the CCC is a Niche Market because it only serves construction, transport and supplier companies.

2. **Value Propositions**

Reduce traffic congestion: reduce number of trips and also the lack of storage space which could produce more waste (money, kilometres, more emissions and less productivity)

Reduce fuel emissions: The transport optimisation will lead to a reduction of CO_2 and NO_x emissions from vehicles helping to fight against the Climate Change.

Avoid illegal landfills: promotion of circular economy and recycling points will improve the recovery of material and reduce the amount of wasted material.

Management of special permits with the City Hall: the CCC manages directly the special permits processes for the different sites, thus, streamlining the processes and reducing the issues due closed streets for the loading/unloading operations of materials of large dimensions.

Promote coordination between agents involved in urban mobility and transport.

Logistics cost reduction: Construction Companies outsources the logistics operations of some construction sites in the area served by the CCC. The cost reduction comes from the optimization of the operations due to a centralized management by a logistics expert.

Congestion reduction on site: The outsourcing of the logistics operations allows a better traffic management on site due to a centralized planning managed by a logistic expert.

Higher delivery reliability: The deliveries on the different sites are centralized and routed via the CCC which allows a better reliability and more flexibility in the deliveries and it will have a minor impact in traffic jam.

3. **Channels**

Personal Interviews: direct contact between the logistic operator and the main contractor offering the logistics services for the entire construction supply chain.

Mailing campaign: through Valencia City Council and construction and suppliers companies association will be contacted to explain benefits of CCC

Control reports (periodical evaluation): during the CCC operations, the logistics operator of the CCC reports to the main contractor the KPIs and benefits of its operations.

4. **Customer Relationships**

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Broker figure: the CCC takes action as a broker in order to be the link between the city, the suppliers and the construction companies.
Collaborative and dedicated personal assistance: the relationship between the city, contractors and the logistic operator of the CCC has to be very close and fluent. Both have to work closely in order to achieve the higher performance of the logistics operations and to reach the maximum potential benefits that can be produced in the construction process in the different sites.

5. Revenue Streams

Picking point: as centric location it will make possible to be a picking point for small, medium and large construction companies that pay to the CCC for their operations.

Storage point: as centric location it will make possible to be a picking point for small, medium and large construction companies that rent space in the CCC for their operations.

Recycling point: as centric location it will avoid illegal landfills and promote circular economy and re-usage materials when it would be possible.

6. Key Resources

Warehousing: Warehouse facility to perform the required logistics operations needed for the supply to the different construction sites served through the CCC. The facility has to be planed and sized according to the construction sites' requirements during the test life-cycle in order to evaluate results.

Handling equipment: in the same manner than the warehousing, the handling equipment needed for the logistics operations has to be sized according to the demand requirements.

Labour force: as it will be a third party managing the centre, it will be an internal cost for them.

Transport vehicles: the vehicles' fleet is essential for the transport operations. The fleet has to be optimized according to the transport needs and characteristics. However, the fleet can be composed by a mix of owned vehicles, rented vehicles and subcontracted vehicles that help to meet with the peaks of transport demand.

Optimization and management software: The optimization software for the route calculation and the materials consolidations is a key element for the operations of the CCC. This software allows the CCC to optimize the transport operations and achieve the required potential savings.

7. Key Activities

Route and Load factor optimization and Cargo consolidation: these are the key activities to be perform by the CCC operator because they can potentially

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optimise the total transport flows. The reduction of the total tonnes and cubic meters transported per kilometre produces the main revenue for the CCC operations. The CCC operator charges to the contractors (Construction Company) the transport cost from the suppliers' storages to the CCC and then from the CCC to the site. However, the reduction of the number of empty trips, the non-fully loaded vehicles, the achievement of higher load factor rates and the route optimization allows the CCC operator to save the total distance covered in tonnes or cubic meters per kilometre.

Coordination with the City, Suppliers and Construction Companies and the construction sites: the optimization of the logistics operations in the CCC and the transport flows requires a higher degree of coordination between the site managers and the CCC operator. This coordination is essential to match the demand of materials from the construction sites with the flow of materials from the suppliers. Especially if we look at municipality overview as it has to take care of mobility and avoid not required inconvenience.

Material planning and Inventory management: in the same manner than in the previous point, it is necessary to manage the materials' inventory of the CCC with the suppliers in order to meet with the demand from the construction sites.

8. Key Partnerships

Construction Company Suppliers: a fluent relationship between the CCC operator and the suppliers is needed to achieve a higher level of performance of the transport flows and inventory management.

Transport Companies: transport companies are important actors for the transport operations of the CCC due to the support that they provide to meet with peak demands in the transport flows.

Public Authorities: they support in terms of public land to the CCC and easy access, additional measures such as: transport legislation, closed streets and load/unload spots are key assets.

Construction Companies: its cooperation is a key element for the success of the CCC initiative. The relation between the construction companies and the CCC operator is a key element for the economic and operational feasibility of the CCC.

Software and equipment providers: a close relationship between the CCC operator and the software and equipment providers is important for the maximization of the efficiency in the CCC operations.

9. Cost Structure

Outsourcing Company managing CCC.

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Facility rental/acquisition: it will be provided by City Council in exchange for managing the CCC, it could be a fixed cost that must be optimized by correct sized of the facility during the project lifespan.

Communication campaign

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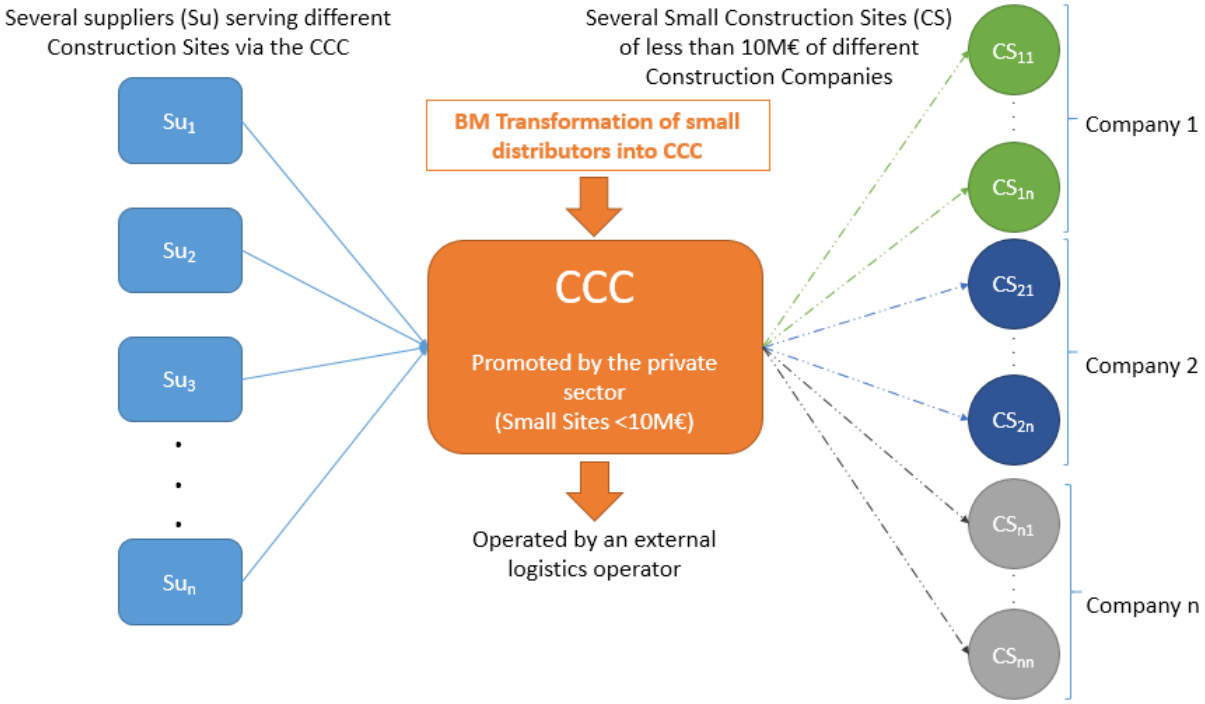
8.4.3.4 Scenario 4

Definition of the Scenario: *Business Model transformation of construction material distributors in Valencia.*

This scenarios depicts a possible solution of a specific problem of Valencia where a large number of distributors of basic construction material are located. The economic crisis has impacted heavily the construction market reducing the number of sites. Because of this, these basic material distributors (e.g. bricks, cement, plaster, etc.) that were focused in refurbishment projects and small and medium constructions sites have been struggling during the crisis.

The business model transformation of these construction material enterprises into CCC for small and medium construction projects could be an option to respond and overcome the crisis in the construction sector by providing new services and taking the lead into possible logistics regulations in urban environments that can be applied in the near future.



Main characteristics of the Scenario

1. One single facility: business model transformation of construction material distributors into small CCC to provide the logistics services.
2. One single CCC operated by an external 3rd company (construction material distribution company).

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3. Shared CCC with many construction companies, several sites and supplier companies (multi-site CCC) for small and medium size projects of less than 10M€.
4. The logistics operator is the owner of the material distribution warehouse that increases the services provided and is in charge of the management of the CCC and the logistics operations.
5. The business model of this scenario is going to be assessed from the point of view of the company that operates the CCC (old construction material distribution company)
6. The CCC do not organize the transport to the sites, it is charge of the construction company.
7. CCC Serving several constructions sites in one single city (Valencia)
8. Temporary basis (long time period and possibility to become permanent based on the results)
9. The use of the CCC be voluntary and it will have some advantages as it will be easy to organise transit and freight, improve situation and coordinate efforts between agents.
10. The CCC is operated as a centre, it will analyse direct and indirect costs and also continues with its old main activity: construction material sale.
11. Main Services offer by the CCC:
    - Loading and unloading operations: the CCC do not transport the materials to the site, it is in charge of the Construction Company. However, the CCC organizes the loading and unloading operations of the trucks.
    - In special cases the CCC can manage the transport to the constructions sites by outsourcing transport companies, however the transport is not the core business of its operations.
    - Logistics services in the CCC: storage, material handling, picking, crossdocking, work pack creation, pre-assembling, urgent deliveries, etc.
    - Reverse logistics and recycling services: CCC will be used as main storage point for reverse logistics and it also will be a recycling point and it will prevent illegal landfills and promote recycling selection process allowing the circular economy in some cases and reducing the quantity of wasted materials.
12. Voluntary use of the CCC: the CCC is optional for the construction companies that can take profit of the CCC location and the advantage of JIT deliveries.

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CANVAS Business Model

Key Partners 8

- Company Suppliers
- Transport Companies
- Construction companies
- Trade contractors and freelances

Key Activities 7

- Logistic optimization: load factor, coordination and consolidation.
- Coordination between agents
- Economies of scale for construction materials

Key Resources 6

- Warehousing
- Handling equipment
- Labour force
- Management Software

Value Propositions 2

- Basic construction material supply
- Security storage
- JIT deliveries
- Less Stock Management
- Congestion reduction on site
- Higher delivery reliability

Customer Relationships 4

- Face to face relationship

Channels 3

- Direct contact and meetings
- Mail and phone

Customer Segments 1

- Construction companies (small projects)
- Suppliers
- Trade contractors
- Freelances of the construction sector

Cost Structure 9

- Labour force
- Equipment rental/acquisition
- Software

Revenue Streams 5

- Material Storage services
- Security services
- Special picking services
- Construction material supply (basic and common materials)
- Urgent delivery services

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1. Customer Segments

The customer segment of the CCC is a Niche Market because it only serves suppliers and construction companies. Specifically for this scenario, the CCC serves to construction company with small construction sites in Valencia (less than 10M€).

Trade contractors and freelances of the construction industry that work in small or refurbishment projects and need basic and common construction materials.

2. Value Propositions

Basic construction material supply: The CCC sells basic construction materials and takes profit from the economies of scale.

Security storage: the CCC offers security services to avoid stole and damage materials on site.

Just in time deliveries: The CCC offers to the construction companies the possibility to prepare materials to be delivered in JIT basis.

Less stock management: the CCC reduce the land used to stack materials facilitating the materials and stock management on site to the construction company

Congestion reduction on site: The outsourcing of the logistics operations allows a better traffic management on site due to a centralized planning managed by a logistic expert.

Higher delivery reliability: The deliveries of the different sites are centralized and routed via the CCC which allows a better reliability and more flexibility in the deliveries.

3. Channels

Personal relation: direct contact between the logistic operator and the main contractor and suppliers offering the logistics services for the entire construction supply chain.

Mailing and telephone: continuous communication between the site manager and the CCC to organize and manage the delivers for the different construction sites.

4. Customer Relationships

Face to Face relationship: the relationship between the main contractor and the logistic operator of the CCC has to be very close and fluent. Both have to work closely in order to achieve the higher performance of the logistics operations and to reach the maximum potential benefits that can be produced in the construction process in the different sites.

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5. Revenue Streams

Material storage and security: the construction companies pay for the storage and security services provided by the CCC depending on the surface and time occupancy inside the facilities of the CCC.

Special picking services: work pack creation, pre-assembling and other value added services. The logistic operator of the CCC offers other added value services to the construction company that facilitate the construction process and improves the efficiency of the different construction sites.

Construction Material supply services: the company takes advantage of the economies of scale and continues selling basic construction materials such as cement, plaster, bricks, etc.

Urgent delivery services: urgent preparation of the construction materials (under request) including the possibility of transport services.

6. Key Resources

Warehousing: Warehouse facility to store the construction materials and perform the logistics operations needed for the different construction sites served through the CCC.

Handling equipment: in the same manner than the warehousing, the handling equipment needed for the logistics operations has to be sized according to the demand requirements.

Labour force: the labour force needed for the CCC operations has to be sized and optimized according to the demand. During working peaks the staff can be completed with personnel from temporary employment agencies.

Management software: management software for the storage activities.

7. Key Activities

Economies of scale for construction materials sales: the CCC operator buys large amounts of basic materials (e.g. cement, plaster, bricks, tiles, etc.) and then sells them in smaller sets taking profit for the economies of scale.

Load factor optimization and Cargo consolidation: these are the key activities to be perform by the CCC operator because they reduce the total transport flows.

Coordination with the Construction Company and the construction sites: the optimization of the logistics operations in the CCC and the transport flows requires a higher degree of coordination between the site managers and the CCC operator. This coordination is essential to match the demand of materials from the construction sites with the flow of materials from the suppliers.

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Material planning and Inventory management: in the same manner than in the previous point, it is necessary to manage the materials' stock of the CCC with the suppliers in order to meet with the demand from the construction sites.

8. Key Partnerships

Construction Company Suppliers: a fluent relationship between the CCC operator and the suppliers is needed to achieve a higher level of performance of the inventory management.

Transport Companies: transport companies are important actors for the transport operations of the CCC due to the support that they provide to meet with peak demands in the transport flows.

Construction Company: its cooperation is a key element for the success of the CCC initiative. The relation between the construction company and the CCC operator is a key element for the economic and operational feasibility of the CCC.

Trade contractors and freelances that need basic construction materials for their projects and can buy them in the same place

9. Cost Structure

Labour force: fixed cost for the permanent staff plus a variable cost for temporary workers during working peaks.

Equipment rental/acquisition and Software: fixed cost incurred during the implementation of the CCC plus a maintenance cost for the equipment and the software update.

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9 Summary and conclusions

The objective pursued in this deliverable D3.3 is to set a framework for the development and analysis of business models for Construction Consolidation Centres (CCC). Then, several business models have been developed considering the needs and characteristics of the different pilot cities evaluated in the SUCCESS project: Paris, Luxemburg, Verona and Valencia. The methodology proposed for the development of business models can be easily replied and adapted to any city wanting to assess the possible implementation of a Construction Consolidation Centre to improve its urban logistics.

First of all, it has been done a review and analysis of the business models of several experiences of CCC's implemented in the past in different cities around Europe. Then, the advantages and disadvantages of the Urban Consolidation Centres (UCC) and more precisely, of the Construction Consolidation Centre (CCC) were identified by the realization of their corresponding SWOT analyses. These analyses helped to determine the general features that can be improved due to the implementation of Consolidation Centres. Next, CANVAS Business Models was selected as a general methodology for the business model elaboration: CANVAS consists of a strategic management tool and methodology which describes and illustrates the essential components of a business in an easily understandable chart. Finally, following this methodology, each of the city pilots of the SUCCESS project defined the most suitable scenarios for the development of business models of a CCC to be implemented in the different cities, elaborating a CANVAS model in which is detailed the Business Model for each scenario.

In general, urban environments face the same common problems regarding the urban logistics, even though, the level of intensity of these problems and the peculiarities vary in each city. Thus, the possible Business Models for a CCC implementation also vary depending on the city in which it is going to be deployed. In particular, one of the most repeated business models proposed by the partners of the SUCCESS consortium is the Public-Private-Partnership (PPP) for a CCC implementation that is operated by an external and specialized logistic operator in a permanent basis. In this scenario, the CCC serves several sites of different construction companies and appears as a possibility that counts on the support of construction industry for their operations. In addition, another additional advantage of this scenario is that can reduce the transport externalities in urban environments (e.g. accidents, noise, congestion, pollution, etc.), being this an aspect to be taken into account by the local and public administrations. Besides, this possible solution introduces a new actor in the supply chain, and thus new business possibilities and potential of job creation in a sector that has been struggling in the recent years. Finally, this type of

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organisation can favour the increase of use of ICT tools and the degree automation in a sector reluctant to change.

Another common business model considered by the partners of the SUCCESS consortium is the implementation of a private CCC for one single construction company that wants to improve its logistics processes in a particular area with an important rate of activity, considering the CCC as a competitive advantage against its competitors (e.g. environmental benefits, optimization processes, etc.). In this particular case, the approach is different depending on the CCC management. On the one hand, the CCC is operated by the construction company itself and is considered as a cost centre that does not need to be profitable by its own. The profits will come from the optimization of the processes of the main core business which is the construction activity. In addition, the same scenario can also be managed by a third party logistic company that will be in charge of the CCC operations and will charge the construction company for its services (e.g. urgent deliveries, work pack creation, etc.). In both cases, the private initiative is the project promotor pursuing a process optimization, but this particular solution may have the support of the public authorities in future projects and tenders due to the benefits for the urban logistics.

Finally, some other scenarios of Business Models capable of solving specific problems in each of the cities of the SUCCESS project have been considered. Some examples of this particular business models are the business model transformation for construction material suppliers in Valencia into CCC for small construction projects or the temporary basis or the concealed CCC in Luxemburg for the development of a major project in the city centre following the example of the CCC implemented in Hammarby, Stockholm.

In conclusion, the selection of the most suitable business model for a CCC implementation will be based on different parameters that have been listed previously in this deliverable. These parameters have to be considered in advance by the different actors of the construction supply chain, taking also into account the degree of involvement of the local authorities in the urban logistics policies and the main city characteristics regarding the layout of the urban road network and the urban constrains.

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Bibliography

Anthony Harker, Wendy Allcorn and David Taylo (2007). Material Logistics Plan Good Practice Guidance. WRAP: www.wrap.org.uk

BESTFACT-Best Factory for Freight Transport (2013). Project deliverable 2.2: Best Practice Handbook. Available at http://www.bestfact.net/project-deliverables/

BESTUFS - Best Urban Freight Solutions II (2008). Quantification of Urban Freight Transport Effects II. Available at http://www.bestufs.net/bestufs2_results.html

Browne et al. (2005) Urban Freight, Consolidation Centres Final Report, Department for Transport, London.

Construction Logistics Handbook (2015). CROYDON

Construction Logistics Plan Guidance for Developers (2013). Transport for London

Construction Logistics Plan Guidance for Planners (2013). Transport for London

Department of Trade and Industry, BAA plc, Mace Ltd., Wilson James Ltd., Transport for London, Constructing Excellence and Stockholm Stad (2004) Construction Logistics Consolidation Centres: An examination of new supply chain techniques – managing and handling construction materials, Executive Summary Report, Constructing Excellence.

Department for Transport (2002) Heathrow Airport Retail Consolidation Centre: BAA plc, Good Practice Case Study 402, Energy Efficiency Best Practice Programme, DfT.

Eva Sunnerstedt, (2013). WEBINAR - Urban Consolidation Centres (UCCs), Experiences from Stockholm. CIVITAS

Freight transport, the Utrecht way. Paris Workshop 28.4.2011. Mark Degenkamp, City of Utrecht

Gary Cockram. Case Study: Freight consolidation in Bath. CIVITAS RENAISSANCE.

Greger Lundesjo, (2011). Using Construction Consolidation Centres to reduce construction waste and carbon emissions. www.wrap.org.uk/constructionlogistics

Gabriel T, Ricciardi N, Storchi G, (2009). Models for Evaluating and Planning City Logistics Systems.

Jesus Gonzalez Feliu, (2008). Models and methods for the City Logistics. Doctoral Thesis.

London Construction Consolidation Centre - Final Report (2008). Transport for London.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

Michael Browne, Allan Woodburn, Julian Allen (2007). Evaluating the potential for urban consolidation centres.

Osterwalder A, Pigneur Y, Tucci CL (2005). Clarifying business models: Origins, present, and future of the concept. Communications of the Association for Information Systems (AIS)

Osterwalder A, Pigneur Y, (2010). Business Model Generation – A Handbook for Visionaries, Game Changers and Challengers. John Wiley and Sons, Inc., Hoboken, New Jersey.

Paddeu Daniela, Fadda Paolo, Fancello Gianfranco, Parkhurst Graham, Ricci Miriam, (2014). Reduced urban traffic and emissions within urban consolidation centre schemes: The case of Bristol.

Peter Brett Associates (2007) Construction Consolidation Centres: An Assessment of the Potential for London-wide use, Final Report for Transport for London, TfL.

Quak et al. (2010), Evaluation of City Logistics Solutions with Business Model Analysis

Quak et al. (2012) Innovative solutions for city logistics demonstration and viability results, Associations for European Transport and Contributors.

Quak (2011) Urban freight transport: the challenge of sustainability. In Marcharis & Melo (Eds.) City distribution and Urban freight Transport –Multiple objectives, Edward Elgar Publishing.

Quak et al. (2014) Evaluation of City Logistics Solutions with Business Model Analysis, Procedia-Social and Behavioral Sciences.

Rethinking deliveries report. Transport for London

Ron van Duin (TUD), Hans Quak (TNO), Jesus Munuzuri (US). The Case The Hague

Scott Wilson Ltd, (2010). Freight Consolidation Centre Study - Final Report

START project (2008) Bristol Consolidation Scheme, START.

STRAIGHTSOL – Strategies and Measures for Smarter Urban Freight Solutions (2014). Deliverable D5.3 (Business models for innovative and sustainable urban-interurban transport). Available at http://www.straightsol.eu/deliverables.htm

The Directory of London Construction Consolidation Centres (2016). Transport for London

Tim Hapgood. Urban Freight Consolidation –The Bristol VIVALDI Project Experience. Transport Initiatives Group, Bristol City Council

TURBLOG – Transferability of Urban Logistics Concept and Practices from a Worldwide Perspective (2011). Deliverable 1: A worldwide overview on urban logistic interventions and data collection techniques.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 633338.

TURBLOG - Transferability of urban logistics concepts and practices from a worldwide perspective (2011). Deliverable 2: Business Concepts and models for urban logistics.

Urban Distribution Centres in Utrecht. Webinar 22 April 2013

Using a Construction Consolidation Centre to reduce deliveries and waste at One Hyde Park. Transport for London. www.wrap.org.uk/constructionlogistics

Wilson James Ltd. and Mace Ltd. (2004) Logistics Consolidation Centre Heathrow Airport: Outline Briefing Paper, Constructing Excellence.

Websites:

http://www.ibm.com/developerworks/rational/library/content/RationalEdge/aug04/5634.html

http://www.rose-hulman.edu/offices-and-services/office-of-innovation/innovation-canvas.aspx

http://web.stanford.edu/group/e145/cgi-bin/winter/drupal/upload/handouts/Four_Steps.pdf

https://leanstack.com/why-lean-canvas/

http://www.turblog.eu/

http://smile-urbanlogistics.eu/

http://cordis.europa.eu/publication/rcn/16579_en.html

http://www.wrap.org.uk/constructionlogistics

https://tfl.gov.uk/

http://www.bestfact.net/project-deliverables/

http://www.bestufs.net/bestufs2_results.html

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ANNEX 1: The nine building blocks of CANVAS Business Model:

1. Customer Segments

The **Customer Segments** BB defines the different groups of customers to reach and serve. Customers may be grouped into distinct segments with common needs, common behaviours, or other attributes. Customer groups represent separate segments if:

- Their needs require and justify a distinct offer
- They are reached through different Distribution Channels
- They require different types of relationships
- They have substantially different profitabilities
- They are willing to pay for different aspects of the offer

Besides, there are different types of Customer Segments:

- Mass Market
- Niche Market
- Segmented
- Diversified
- Multi-sided platforms or Multi-sided Markets

2. Value Propositions

The **Value Propositions** BB is the reason why customers turn to one company over another. This block describes the value that is delivered to a specific customer segment and which customer's problems are solved and satisfied with the bundles of products and services that the company is offering. Some Value Propositions may be innovative and represent a new or disruptive offer. Others may be similar to existing market offers, but with added features and attributes.

A Value Proposition creates value for a Customer Segment through a distinct mix of elements catering to that segment's needs. Values may be quantitative (e.g. price, speed of service) or qualitative (e.g. design, customer experience). The elements from the following non-exhaustive list can contribute to customer value creation.

- Newness: Some Value Propositions satisfy an entirely new set of needs that customers previously didn't perceive because there was no similar offering.
- Performance: Improving product or service performance has traditionally been a common way to create value.
- Customization: Tailoring products and services to the specific needs of individual customers or Customer Segments creates value.
- Design: Design is an important but difficult element to measure. A product may stand out because of superior design. In the fashion and

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consumer electronics industries, design can be a particularly important part of the Value Proposition.

- Brand/status: Customers may find value in the simple act of using and displaying a specific brand.
- Price: Offering similar value at a lower price is a common way to satisfy the needs of price-sensitive Customer Segments
- Others: Cost reduction, risk reduction, accessibility, convenience, etc.

3. Channels

The **Channels** BB describes how a company finds the right mix of channels to communicate and reaches its customers when delivering its Value Proposition. Channels are customer touch points that play an important role in the customer experience. Channels serve several functions, including:

- Raising awareness among customers about a company's products and services
- Helping customers evaluate a company's Value Proposition
- Allowing customers to purchase specific products and services
- Delivering a Value Proposition to customers
- Providing post-purchase customer support

Channels have five distinct phases. Each channel can cover some or all of these phases. We can distinguish between direct Channels and indirect ones, as well as between owned Channels and partner Channels.

Channel Types			Channel Phases				
Own	Direct	*Sales force*	**1. Awareness** How do we raise awareness about our company's products and services?	**2. Evaluation** How do we help customers evaluate our organization's Value Proposition?	**3. Purchase** How do we allow customers to purchase specific products and services?	**4. Delivery** How do we deliver a Value Proposition to customers?	**5. After sales** How do we provide post-purchase customer support?
		Web sales					
		Own stores					
Partner	Indirect	*Partner stores*					
		Wholesaler					

4. Customer Relationships

The **Customer Relationships** BB describes the kind of relationships a company establishes with specific Customer Segments. How a company interacts with its customers when proving their value and this relationships can range from personal to automated. Customer relationships may be driven by the following motivations:

- Customer acquisition
- Customer retention
- Boosting sales (upselling)

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We can distinguish between several categories of Customer Relationships, which may co-exist in a company's relationship with a particular Customer Segment:

- Personal assistance: This relationship is based on human interaction. The customer can communicate with a real customer representative to get help during the sales process or after the purchase is complete.
- Dedicated personal assistance: This relationship involves dedicating a customer representative specifically to an individual client. It represents the deepest and most intimate type of relationship and normally develops over a long period of time.
- Self-service: In this type of relationship, a company maintains no direct relationship with customers. It provides all the necessary means for customers to help themselves.
- Automated services: This type of relationship mixes a more sophisticated form of customer self-service with automated processes.
- Communities: Increasingly, companies are utilizing user communities to become more involved with customers/prospects and to facilitate connections between community members.
- Co-creation: More companies are going beyond the traditional customer-vendor relationship to co-create value with customers. For instance, YouTube.com solicit customers to create content for public consumption.

5. Revenue Streams

The **Revenue Streams** BB describes how are the customers going to pay the company and for what value. For instance, a telecom operator may charge customers for the number of minutes spent on the phone while a gym sells its members monthly or yearly subscriptions in exchange for access to its exercise facilities.

A business model can involve two different types of Revenue Streams:

- Transaction revenues resulting from one-time customer payments
- Recurring revenues resulting from ongoing payments to either deliver a Value Proposition to customers or provide post-purchase customer support.

There are several ways to generate Revenue Streams:

- Asset sale: The most widely understood Revenue Stream derives from selling ownership rights to a physical product.
- Usage fee: This Revenue Stream is generated by the use of a particular service. The more a service is used, the more the customer pays.
- Subscription fees: This Revenue Stream is generated by selling continuous access to a service. A gym sells its members

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- Lending/Renting/Leasing: This Revenue Stream is created by temporarily granting someone the exclusive right to use a particular asset for a fixed period in return for a fee. For the lender this provides the advantage of recurring revenues. Renters or lessees, on the other hand, enjoy the benefits of incurring expenses for only a limited time rather than bearing the full costs
- Licensing: This Revenue Stream is generated by giving customers permission to use protected intellectual property in exchange for licensing fees.
- Brokerage fees: This Revenue Stream derives from intermediation services performed on behalf of two or more parties.
- Advertising: This Revenue Stream results from fees for advertising a particular product, service, or brand.

Each Revenue Stream might have different pricing mechanisms. The type of pricing mechanism chosen can make a big difference in terms of revenues generated. There are two main types of pricing mechanism: fixed and dynamic pricing.

Pricing Mechanisms

Fixed Menu Pricing Predefined prices are based on static variables		**Dynamic Pricing** Prices change based on market conditions	
List price	Fixed prices for individual products, services, or other Value Propositions	*Negotiation (bargaining)*	Price negotiated between two or more partners depending on negotiation power and/or negotiation skills
Product feature dependent	Price depends on the number or quality of Value Proposition features	*Yield management*	Price depends on inventory and time of purchase (normally used for perishable resources such as hotel rooms or airline seats)
Customer segment dependent	Price depends on the type and characteristic of a Customer Segment	*Real-time-market*	Price is established dynamically based on supply and demand
Volume dependent	Price as a function of the quantity purchased	*Auctions*	Price determined by outcome of competitive bidding

6. Key Resources

The **Key Resources** BB describes the most important assets required to create and make a particular business model work. The Key resources can be owned or leased by the company or acquired from key partners. The key resources can be:

- Physical
- Financial
- Intellectual
- Human

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7. Key Activities

The **Key Activities** BB describes the most important things or actions a company must do to make its business model work and to operate successfully. For instance, for PC manufacturer Dell, Key Activities include supply chain management. For consultancy McKinsey, Key Activities include problem solving.

Key Activities can be categorized as follows:

- Production: These activities relate to designing, making, and delivering a product in substantial quantities and/or of superior quality. Production activity dominates the business models of manufacturing firms.
- Problem solving: Key Activities of this type relate to coming up with new solutions to individual customer problems.
- Platform/network: Business models designed with a platform as a Key Resource are dominated by platform or network related Key Activities. Networks, matchmaking platforms, software, and even brands can function as a platform.

8. Key Partnerships

The **Key Partnerships** BB describes the network of suppliers, partners and alliances that different companies make to optimize their business models, reduce risk, or acquire resources. Partnerships are becoming a cornerstone of many existing business models. It is possible to distinguish between four different types of partnerships:

- Strategic alliances between non-competitors
- Coopetition: strategic partnerships between competitors
- Joint ventures to develop new businesses
- Buyer-supplier relationships to assure reliable supplies

It can be useful to distinguish between three motivations for creating partnerships:

- Optimization and economy of scale: The most basic form of partnership or buyer-supplier relationship is designed to optimize the allocation of resources and activities. Optimization and economy of scale partnerships are usually formed to reduce costs, and often involve outsourcing or sharing infrastructure.
- Reduction of risk and uncertainty: Partnerships can help reduce risk in a competitive environment characterized by uncertainty
- Acquisition of particular resources and activities: Few companies own all the resources or perform all the activities described by their business

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models. Rather, they extend their own capabilities by relying on other firms to furnish particular resources or perform certain activities

9. Cost Structure

Cost Structure BB describes all the important costs incurred while operating under a particular business model. Creating and delivering value, maintaining Customer Relationships, and generating revenue all incur costs. Such costs can be calculated relatively easily after defining Key Resources, Key Activities, and Key Partnerships. Some business models are more cost-driven than others. So-called "no frills" airlines, for instance, have built business models entirely around low Cost Structures.

Naturally enough, costs should be minimized in every business model. But low Cost Structures are more important to some business models than to others. Therefore it can be useful to distinguish between two broad classes of business model Cost Structures, even though many business models fall in between these two extremes:

- Cost-driven: Cost-driven business models focus on minimizing costs wherever possible. This approach aims at creating and maintaining the leanest possible Cost Structure, using low price Value Propositions, maximum automation, and extensive outsourcing.
- Value-driven: Some companies are less concerned with the cost implications of a particular business model design, and instead focus on value creation.

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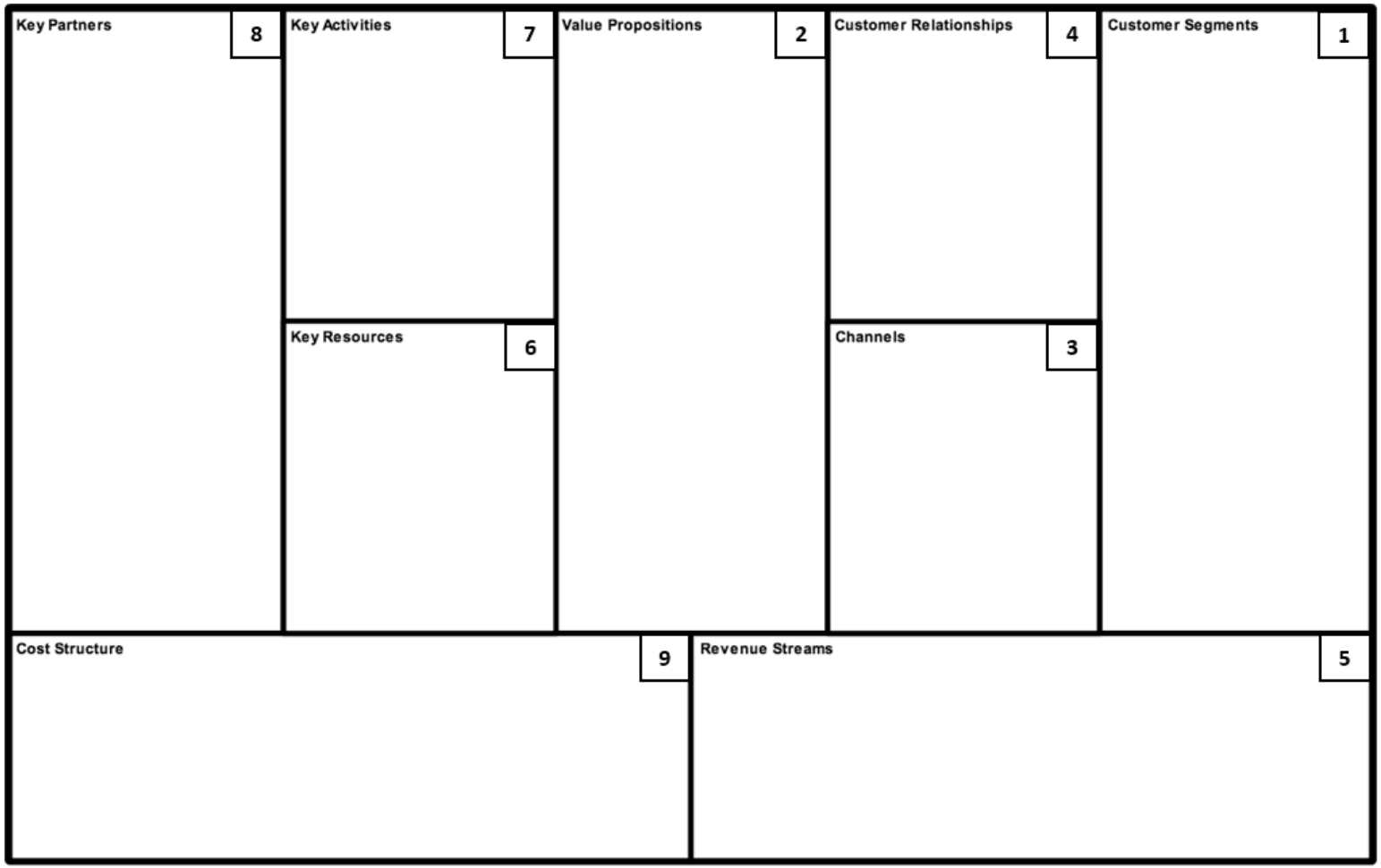
Annex 2: CANVAS Template



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