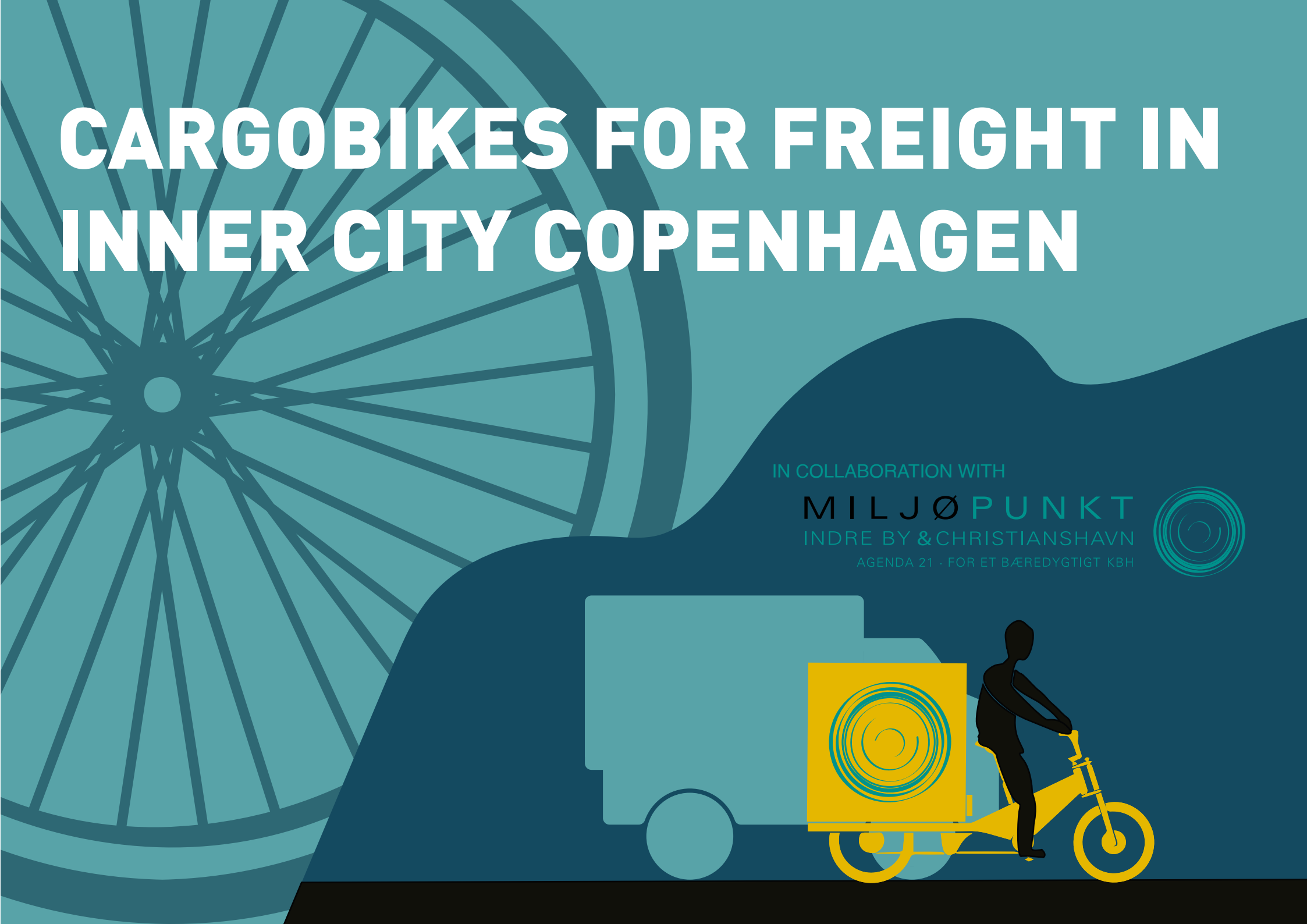
CARGOBIKES FOR FREIGHT IN INNER CITY COPENHAGEN

IN COLLABORATION WITH

MILJØPUNKT
INDRE BY & CHRISTIANSHAVN
AGENDA 21 · FOR ET BÆREDYGTIGT KBH



ABSTRACT

This project is a study of how cargo bikes can be the primary mean for freight delivery in the last link of the logistics chain: last-mile delivery. At present, the logistics conditions in inner Copenhagen are problematic, as there are far too many cars on the narrow roads, which creates traffic and long transport times. Package delivery has therefore become problematic and lengthy process for the current trucks and vans, for which there is no room in the cityscape.
To change the status quo, it is necessary to re-design the entire system in a way that does not have major consequences for the parties whose businesses depend on the system.
Initially, the current delivery system is examined to understand how it is structured. Secondly, the project group has done ethnographic research where data about the needs of the companies in Inner City, is collected. Moreover, the group has investigated the current actor-network to understand what currently stabilizes the regime.
Based on a literature review and the project group's data collection, three concepts are proposed that each consist of unique values and in different ways accommodates the needs of different companies. The most valuable concept, in the perspective of the project scope, was a consolidation center from which packages can be delivered by non-professional employees, or the company can deliver their packages themselves, with bicycles made available around Inner City.

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Cargo bikes for freight in Inner City Copenhagen

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SUPERVISOR

Andres Felipe Valderrama Pineda

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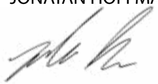

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In this project we have been collaborating with many different actors and want to give a special thanks to each of them.

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INTRODUCTION

Today's freight system has become unsustainable in its core. The freight system is extremely dependent on the infrastructure and motorized vehicles to operate. However, even though the fossil-fueled vehicles are a prominent part of the society, it is contributing to an unsustainable paradigm. To combat this, electric powered vehicles are becoming more popular, and multiple companies are branding themselves as sustainable, due to their use of electric vehicles. However, when moving the focus to small dense urban areas, the motorized vehicles contribute to multiple other problems. Traffic and congestion on the roads are not solved by electric vehicles.
We suggest that instead of leaning towards technological innovation, focus should be shifted towards a systemic redesign of the way we see freight today. In close collaboration with Miljøpunkt, this project investigate how freight could be re-invented by taking on a systemic and people-oriented approach.

The following research question has been made:

How can freight be delivered sustainably by cargo bikes in the Inner City of Copenhagen?

THEORY AND METHODS

THE MULTI-LEVEL PERSPECTIVE

The Multi-level perspective (MLP) attempts to understand how transitions come about and introduces a framework consisting of 3 overlapping levels: landscape, socio-technical regimes & technological niches. The landscape level consists of slow-changing external factors that provide a gradient for trajectories. The socio-technical regimes account for the stability of existing technological development, and the technological niches account for the development of radical innovations (Geels, 2001).

Looking at transitions through the 'glasses' of MLP, small innovations occur in both the socio-technical regime and the technological niches, whilst radical innovations only occur in the technological niches. Radical change happens when a radical innovation breaks out of the niche level. This can only happen when the ongoing processes of the regime and/or landscape creates what Geels refers to as a 'window of opportunities'(Geels, 2001).

STRATEGIC NICHE MANAGEMENT

This leads to the question of how to navigate and manage these niches to create desired sustainable changes in the socio-technical regime. An answer to this is the strategic niche management (SNM) approach.

"The SNM approach suggests that sustainable innovation journeys can be facilitated by creating technological niches, i.e. protected spaces that allow the experimentation with the co-evolution of technology, user practices, and regulatory structures. The assumption was that if such niches were constructed appropriately, they would act as building blocks for broader societal changes towards sustainable development." (Schot & Geels, 2008, p. 537).

When discussing SNM it is important to mention that the project group does not perceive it as a technology-push approach. This, as technological development is closely interrelated with societal change, meaning that technology cannot become a regime without societal changes occurring among the people that needs to adopt that technology.

Thereby, niche innovation cannot stand alone, and it needs to be considered how different actors can be interested in being a part of a change process. Government can participate in steering this, by providing enclosed spaces (could be subsidised) where the innovations can be nurtured without being pushed by market forces and the need for profit. This way, the government has a chance of realising future societal and environmental goals (Schot & Geels, 2008).

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SOCIO-TECHNICAL EXPERIMENTS

Socio-technical experiments constitute a partially protected environment, where radical innovations are tested and matured. This space facilitates an experimental environment where the challenges and opportunities of radical innovations can be identified, without market pressures from the external environment (Ceschin, 2014). These radical innovations may require a redefinition of current practices and thereby require a change in wants and meanings. Thereby, by having the socio-technical experiment in a partially protected environment, the innovation will both have space to be improved and defined, as well as interest people in the innovation and enrol them in the change. Two socio-technical experiments have been attempted throughout this project.

ACTOR-NETWORK THEORY

Throughout this project, the vocabulary of actor-network theory (ANT) has been adopted by the project group. This entails that the world is viewed as complex socio-technical heterogeneous networks, consisting of both human and non-human actors. In an ANT perspective, an actor is defined as something that 'acts' and its' position in the network is defined by the relations to other actors of the network (Callon, 1986).

ANT provides the opportunity to map and understand the relations between actors - and thereby understand the actors. Real-world socio-technical networks are dynamic entities that constantly evolve, so when mapping a network, it is important to realize that they are merely a static picture of a dynamic network.

Callon describes changes in a network as a translation process. The translation process consists of four different moments: problematization, interessement, enrolment and mobilization (Callon, 1986). The translation process becomes relevant as this project aims to make a change in the current network. In the following, each of the moments will be explained.

Problematization describes the process of getting actors to agree on a specific problematization. The problem must be negotiated with the actors for them to accept it.

Interessement describes the process where the actors become interested in the problem because they can relate to it and thereby benefit from it. To interest the different actors, the project group introduce interessement devices, that allow for circulation of knowledge and hereby knowledge production and reproduction.

Enrolment is the moment when the different actors accept their roles in the network and are taking part in the solution.

Mobilization is when the actors are working for the new network.

Through these translation processes, the project group intend to create a new network. This will be done by engaging different actors in a collaborative design process. This requires a recognition of which actors are necessary to transform before the new network can be mobilized. It is intended to interest the actors in the project by utilizing the methods of co-design.

CO-DESIGN

In this project, different actors have been involved in the design process. This is done to ensure a relevant solution that takes the different actors' concerns into account. This way of working is also what is described as collaborative design (co-design) (Brodersen & Lindegaard, 2016). It is the project groups' responsibility to navigate through the different concerns and problematization of the actors and to include relevant actors at the right time. The negotiation spaces framework (Pedersen, 2020) has been used to accomplish this.

In the framework, Pedersen states that the actor's problematizations and concerns can be negotiated in a co-design process. "Acknowledging that all individuals have the ability to be creative, co-design traditions such as participatory design view the designer not only as a creative expert designer who envisions products and solutions, but also as a facilitator who stages negotiations between actors with oftentimes contested and conflicting values and concerns" (Pedersen, 2020, s. 3).

The framework is useful in our project as it describes how interventions with actors should be staged, facilitated, and reframed (Pedersen, 2020).

INTERMEDIARY OBJECTS

T he project group used different inscribed materials to start a dialogue with actors. A design game is an example of this and the design game aim to: "engage diverse stakeholders in expressing, negotiating and generating a shared understanding of users, use contexts and technology in early concept design" (Vaajakallio & Mattelmäki, 2014, p. 65).
A design game can be used to negotiate different concerns with actors. According to Pedersen, these materials can function as intermediary objects. An intermediary object is an object that can circulate between different actors and produce knowledge in doing so. She explains how intermediary objects can represent, translate, and mediate between different actors.

The project group has used different intermediary objects through the design process.

CONCEPTS

Andreasen et al. defines a concept as:"… a design proposal that is detailed enough to justify if it is a good answer to the task and intention, and show a high probability of realization and success" (Andreasen et. al., 2015, p. 26). This entails that concepts are about processing ideas and making them feasible and understandable and opens the possibility of using the concepts in interventions with actors. Andreasen et. al. underlines this by stating:
"concepts have to be designed, drawn, and described so that others can understand and build on them" (Andreasen et al., 2015, s. 24).
The way the design group approach concepts is by using them as performative tools in interventions with different actors.

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DESIGN PROCESS

When doing design projects in a complex field, it can be useful to structure the design process. In this project, we have used the Double Diamond Model (Hutchby & Moran-Ellis, 2005). The Double Diamond model divides the design process into four phases. These phases are discover, define, develop and deliver.

The discover phase is the research phase where the project group collects empirical data and investigate different needs and problems. The define phase is where the project group narrow down all this newly acquired knowledge, to a research question, that is being solved in the following phases.

The develop phase is where the solution space is opened. At this point, the project group ideate and conceptualize. The last phase is the deliver phase, this is where a final solution is being determined. This solution is then discussed, and a possible implementation plan proposed. Even though this approach can seem linear, it should rather be seen as an iterative process where the project group jumps between the different phases continuously. At the end of the rapport, the group will reflect and show how the actual process of the project took place.

DOUBLE DIAMOND

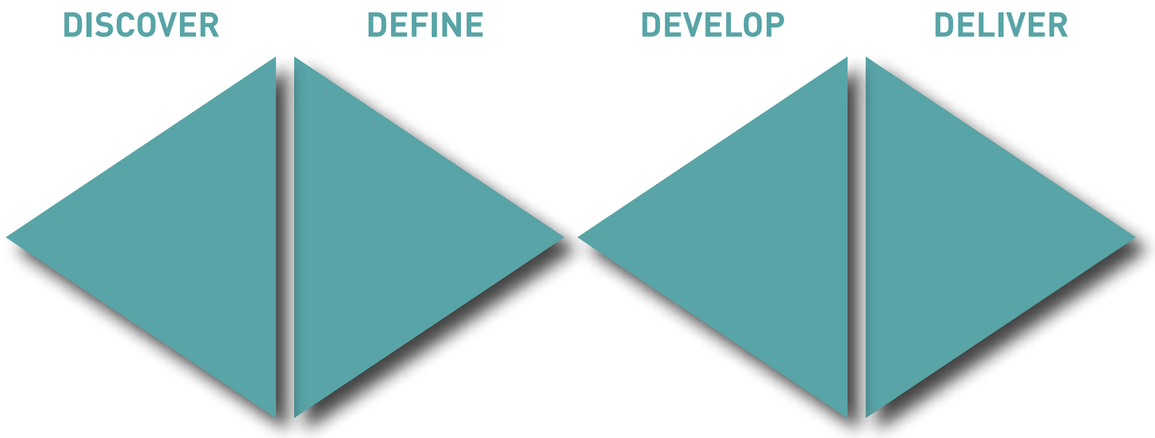

Figure 1: Double Diamond Model

READING GUIDE

This report is split into 4 main parts. The four parts are the phases of the double diamond. The project group has worked iteratively and visited each phase multiple times, but for the sake of understanding in the report, it has been chosen to split it into these four phases.

THE ENVIRONMENTAL ISSUES

The problematization of human activity regarding environmental issues and pressure on the ecological system can be framed by using Rockström et al. (2009) proposal of Planetary Boundaries (PBs). These describe indicators for a safe operating space for humanity and thus can be used for policymaking and governance when planning and developing for future mobility. The complexity of global infrastructure and the industry behind mobility of humans and services emphasize the importance of a systemic transition to tackle related issues of systemic processes at a planetary scale; Climate change, ocean acidification, ozone depletion – and aggregated processes on a local/ regional scale; Global P and N cycles, Atmospheric Aerosol Loading, Freshwater use, Biodiversity loss and chemical pollution (Rockström et al., 2009).

The critical processes that regulate the Earth systems are quantified to set thresholds, get feedback and map resilience but also to uncover uncertainties. To further develop this quantification, Steffen et al. (2015) introduced a two-tier approach for several boundaries to account for regional-level heterogeneity, updating the quantification of most of the PBs and identifying two core boundaries as well as proposing a regional level quantitative boundary for one of the two not quantified previously.

This project introduces these theories to frame the increasing interest of public and political realisation of how human activity affects Earth systems and consequently affect the capacity to persist in changing conditions. To measure these thresholds, the planetary boundaries can be quantified into units for the scientific community to be guided by and for lawmakers to rule by best practices for further development. As stated by the Stockholm Resilience Center (2012); planetary boundaries are valuable for policy making because they are proposals for adaptive governance at global, regional and local scales (Stockholm Resilience Center, 2012). Because of the cross-scale effects and entangled systems which affect each other inherently, it becomes extremely difficult to describe what, where and how changes need to occur.

GLOBAL AND EUROPEAN COLLABORATIONS

Building upon the planetary boundaries, two core boundaries (Steffen et al., 2015) were of concern at the Paris conference; Climate change and biosphere integrity, as these two on their own has the potential to drive the Earth system into a new state, if substantially and persistently transgressed.

The Paris agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. With the goal of keeping global warming well below 2 degrees Celsius, compared to pre-industrial levels (Delbeke et al., 2019), the race to

reduce impacts from the global society began.
An implementation of the agreement requires both economic and social transformation. With an overall aim of reducing Green House Gas emissions (GHGs), the parties commit to a set of targets in multiple sectors. The actions to reach these target needs to be massively increased, to achieve the goals of the Paris Agreement. Since the agreement entered into force, 196 parties have created low-carbon solutions and established new markets. More and more countries, regions, cities, and companies are aiming at carbon neutrality.
By 2030, Zero Carbon solutions could be competitive in sectors representing over 70% of global emissions (United Nations, 2021). Especially in the power and transport sector, there has been created many new business opportunities for early movers. According to the European Environment Agency, cities emit 69% of the EU's CO2 emissions and urban transport accounts for 70% of the pollutants and 40% of the GHG emissions from European road transport (EEA).

THE FREIGHT ISSUE

In Europe, it Is estimated that freight transport accounts for around 10-18% of urban road traffic, but the share of emissions of freight vehicles could vary between 20 to 30% of total urban traffic emissions depending on the situation (Ambrosino, Liberato, & Pettinelli, 2015). The new EU urban mobility framework roadmap (European Comission, 2021) sums up the results of the evaluation of the EU 2013 'urban mobility package' published in February 2021 which demonstrate that further EU action on urban mobility is needed to upgrade the 'EU sustainable urban mobility toolkit' to respond to growing challenges (CO2 and air pollutant emissions, congestion, road casualties, resilience of transport network). Further, The European Green Deal and Sustainable and Smart Mobility Strategy adopted in 2019 and 2020 respectively, provide a new EU framework for the overall direction of EU transport policy for the years to come and identify the importance of urban mobility in the context of the green and digital transitions (European Comission, 2021).
New EU climate ambitions: congestion, air quality, noise and road causalities require strengthened measures in urban mobility and in addition, the resilience of urban transport networks have been severely tested during the COVID-19 pandemic. The revision of the current policy framework, the EU 2013 'urban mobility package' is included in the Action Plan to the Sustainable and Smart Mobility Strategy, which also set the milestone that, by 2030, there will be at least 100 climate-neutral cities and the Court of Auditors pointed out the need for legislative action concerning the adoption of Sustainable Urban Mobility Plans (SUMPs) (European Comission, 2021).

Following the EU 2013 'urban mobility package' and SUMP specific focus are outlined in the 'Guidelines: Developing and Implementing a Sustainable Urban Logistics Plan (SULP)' (Ambrosino, Liberato & Pettinelli, 2015) where City Logistics is mentioned as a key element of the whole urban mobility governance with specific peculiarity as it is regulated and influenced by local authorities (municipal and regional) while organised and operated mostly by private actors/companies. Thereby, to achieve successful management of city logistics processes, it is essential to identify organisational and operational aspects in close connection with each other, in terms of both staff and infrastructure.
Generally, cities are very interested in future technologies that can allow easy management of the whole logistics cycle. However, integration of smart logistics policies in the overall Sustainable Urban Mobility Planning (SUMP) mitigates to some extent the need to use technological approaches. "Thus, the common approach 'buy technology and solve the problem', has become a trend in the transport and mobility context, can be reconsidered as a half-truth: technology surely helps transport and mobility management, but it cannot solve problems without an accurate revision of mobility/logistics urban planning" (Ambrosino, Liberato & Pettinelli, 2015, p.12).

Politically, the focus on all the issues related to the current city logistics of heavy vehicles has an exponential development. The individual municipalities can have a great influence on how the city logistics look, by introducing various initiatives that can make it more difficult to drive a car within the municipality. These initiatives may involve speed regulation, parking rules, time-limited access to city centres, vehicle requirements, etc. It draws a future where it is necessary to look at alternatives to the current traffic system (Gudmundsson & Krawack, 2021).

NATIONAL AND LOCAL INITIATIVES AND CONSIDERATIONS

In 2030, Denmark must reduce greenhouse gas emissions by 70% compared to the level in 1990. With the 70% target and the long-term target for climate neutrality by 2050 at the latest, it is the first time that Denmark sets goals for the total Danish emissions by law, and in this way, the goals represent a new direction for Danish climate policy (Klimarådet, 2020).

Copenhagen is part of the C40 network that is created and led by cities focusing on tackling climate change and driving urban action that reduces greenhouse gas emissions and climate risks while increasing the health, wellbeing, and economic opportunities of urban citizens. Working across multiple sectors and issues, C40 convenes networks that provide a range of services in support of cities' climate change efforts (C40 Cities, 2021). This work includes Green mobility where Copenhagen pledges to improve public transport and cycle infrastructure through partnerships and promotion, transitioning the transport sector to new fuels like hydrogen and biofuels, establishing intelligent traffic management, and influencing behaviour change. By 2025 75% of all trips in Copenhagen should be on foot, by bike or public transport – up from 66% today (C40 Cities, 2021).
In late May 2021, the Danish government put out a set of governance initiatives (Indenrigs- og Boligministeriet, 2021) to guide especially the Capital region towards greener cities; meaning cleaner air, gree-

ner car traffic (following a law passed in December regarding green transition of road transport) and more space for nature, further reading in ***political drivers***. In the initiatives concerning the Capital region developments towards liveability, healthy areas, activities and development planning are amongst the main focuses. These initiatives can play a crucial role in the conceptualisation and implementation of projects like this one and have further confirmed, the importance of regulatory measures to guide realisations of introducing cargo bikes, changing infrastructures and city logistics for a healthier and more sustainable city life.

THE LOCAL PERSPECTIVE OF INNER CITY

Within the medieval city of Copenhagen, vans- and heavy trucks account for just above 50% of the CO2 emissions (Gudmundsson & Krawack, 2021). Copenhagen has an ambition of becoming CO2-neutral by 2025 and being a healthy city to live in. The pollution from combustion vehicles results not only in Green House Gas emissions, but also particle pollution which contributes to bad air quality for people in the city.
The operations and manoeuvrings of vans, trucks and cars in the densely build and populated area of Inner City Copenhagen, has created crowded roads and spaces, congestions and noise pollutions. Year on year an increase in material flows through the city can be seen. The side-effect of this progress can be seen not only in the pressure it exerts on environmental parameters, but also in the conditions for people working, living and moving around actively in the Inner City, where an increasingly stressful and unhealthy environment affects people. The heavy means of transport are often also impractical because they are difficult to park in the city, resulting in the driver having to park some distance away from the destination. Likewise, there is often poor capacity utilization of vehicles because of the great diversity of recipients, senders, destinations and transport companies (Gudmundsson & Krawack, 2021).

In the context of small-medium historic towns (SMHT), urban mobility and logistics are even more complex due to aspects such as old road infrastructure, narrow streets, strict access regulations and the presence of valuable buildings, including heritage and historic assets. Moreover, SMHTs must tackle additional issues related to their specific territorial, social and economic characteristics (e.g., difficult mobility and freight distribution flow, higher impacts of environmental pollution on citizens and quality of life, etc.)(Ambrosino et al., 2015).
CO2 emissions are not the only problem with using heavy vehicles for goods delivery. This mean of transport adds to the congestion of roads in urban areas.
This results in stressed motorists which exacerbate the quality of the inhabitant's and driver's daily life and causes even more CO2 emission. The drivers that work for logistics companies are particularly exposed, as the roads and the regular traffic is their daily work environment (Gudmundsson & Krawack, 2021).

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HOW DO WE APPROACH SUSTAINABILITY?

The most common definition of sustainability is mentioned in the famous Brundtland report from 1987. It states that sustainability is: "Development that meets the need of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 15). Whilst this definition emphasizes almost purely the environmental aspect of sustainability, we argue that it is important to include multiple aspects of sustainability.
Barbier (1987) argues that sustainability consists of three aspects: environmental, social/societal and economic. However, this division has been heavily criticized mainly since it equals economic growth with economic sustainability. Purvis et. Al. (2018) argued that "capitalist economic growth of the Western world was fundamentally incompatible with ecological and social sustainability" (Purvis, Mao, & Robinson, 2019, p. 683).

Throughout this project, sustainability is seen and understood as something that encompasses both environmental and social/societal benefits. Furthermore, since the project group consist of sustainable design engineers, sustainability is seen as inherent, thereby being a core value rather than the last minute add on.

SUSTAINABLE TRANSITIONS

To tackle the many environmental problems, such as climate change, loss of biodiversity and resource depletion, Köhler et al. argue that these grand challenges "cannot be addressed by incremental improvement, but require shifts to new kinds of system, shifts which are called sustainable transitions" (Köhler et al., 2017, p. 5).

The current understanding of sustainability suggests that sustainability is to be seen as a system property and not a property of individual elements of the system. Ceschin & Gaziulusoy, therefore, argues that achieving sustainability requires a "process-based, multi-scale and systemic approach to planning for sustainability guided by a target/vision instead of traditional goal-based optimization approaches" (Ceschin & Gaziulusoy, 2016, p. 119).
Conclusively, to reach sustainability, a systemic, people-oriented sustainability approach needs to be adopted.

MILJØPUNKT

Miljøpunkt Indre By & Christianshavn is a self-owned fund, located in the capital of Denmark – Copenhagen. They aim to "create a better quality of life and a sustainable environment" (Miljøpunkt, 2021b).
Miljøpunkt advises on urban nature, environment and climate as well as supports and develops various projects with the local community. The foundation is financially supported by the City of Copenhagen, who provides support for various projects regarding the sustainable transition of the local area. Miljøpunkt submits an annual report to the municipality where they document which projects the financial support has contributed to.
The projects are often interdisciplinary projects where Miljøpunkt works to establish dialogue and development within the field of environment, culture and sustainability. Miljøpunkt work throughout a 2-year annual plan which focuses on the UN Sustainable Development Goals (SDGs). The annual plan contains exactly 9 of the 17 world goals that are incorporated in Miljøpunkt's objectives and efforts. In practice, this goal has led to four focus areas: Less noise, Green city, more recycling and clean air.
The fund consists of a board, a centre manager, and project managers. The centre manager of Miljøpunkt is Marianne Spang Bech who has many years of experience in technology, environment, sustainability, management and political service.
To accommodate the goals for Copenhagen municipality, Miljøpunkt has stated in their annual plan that they will initiate several projects in Inner City regarding 1) More recycling and sorting facilities, 2) A 'greener' city, climate adaption and sustainability, 3) cleaner air and less CO2 pollution and 4) less noise in the Inner City.
Paragraph 3.2.2 states that Miljøpunkt wants to "experiment with sharing schemes regarding zero-emission vehicles for business purposes" (Miljøpunkt, 2021a, p. 4), which is why they have initiated a project that aims to contribute with sustainable alternatives to the deliveries of goods and packages in the Inner City as a way of supporting a transition to sustainable mobility. The cargo bike is seen as a key element in this sustainable transition.
This is the project that the project group will take a part in.

PROJECT SCOPE

The scope of the project is to create a new delivery system using cargo bikes in Inner City. The focus on Inner City and Cargo Bikes is chosen because of the collaborator on the project, Miljøpunkt Indre by og Christianshavn.
Inner City consists of many small roads and shopping streets where a lot of SMBs are housed. Therefore, it makes sense to put the primary focus here, especially as they get smaller deliveries than e.g., Netto. This, as the lower capacity of deliveries couples well with the comparably low capacity of cargo bikes.
The focus in former projects has been on how to design such a delivery system for the distributers, whilst almost no emphasis has been put on those using the delivery system. This, combined with companies located within Inner City, has led the project scope to focus on

DISCOVER

INNER CITY PHYSICALLY

Inner City is the innermost district of Copenhagen. It covers an area of 8.98 m2 and has a population of 50 thousand citizens. The population density is set to be around 5,6 thousand citizens pr. m^2, which is approximately 28% more than the average population density of Copenhagen. This does, as shown in Figure 3 from the observatory field trip, lead to very crowded roads with a stressful atmosphere

Figure 2: shows where the Medieval City (red) is located within the Inner City (green)

Figure 3: Pictures of the obseratory trip to Inner City.

Located within the Inner City is the Medieval City, named so because of its old origin. Travelling by car in the Medieval City is usually difficult due to heavy traffic caused by narrow one-way streets (originally not built for cars), many pedestrians and bicyclist. Parking is difficult, and further initiatives to remove parking spaces has been initiated, see *political drivers*. The retail, bar and restaurant business are heavily represented (740 shops, 350 restaurants (Københavns Kommune, 2019)), and shoppers, consumers and tourists create revenue and a lively atmosphere, which contributes to making it a desired place to live.

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Approximately 15.000 vehicles drive through the Medieval City every day.
The type of cars is distributed as shown in figure 4: (Københavns Kommune, 2019). Inner City can be categorised as an SMHT. According to Ambresino et. Al. (2015), mobility governance of SMHTs should: “focus on three main axes: People, goods, parking. City Logistics and City administration, therefore, must be planned in terms of economic, environmental and social equity aspects” (Ambrosino et al., 2015, p. 8).

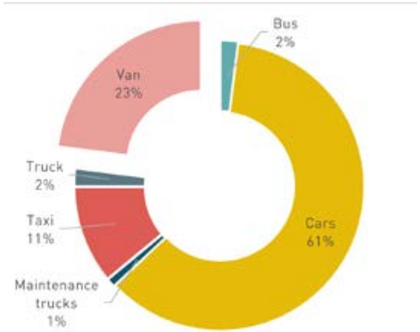

Figure 4: Types of vehicles entering the Medieval City.

POLITICAL DRIVERS

Several political initiatives have been launched in the process of making Inner City a car-free district. The following section will introduce and discuss some of these political initiatives.

RECOMMENDATIONS FROM CITY REPRESENTATION

The municipality of Copenhagen is currently focused on reducing car traffic in Copenhagen. In 2020 the city representation made a total of 9 recommendations to reduce car traffic in the Medieval City.
The goal was to involve businesses and private citizens to investigate the possibility of car reduction in the area (appendix 1).

The city representation recommended up to an 75 % car reduction in the Medieval City, by introducing trials with alternative transportation types such as cargo bikes.

Another recommendation was to reduce the number of parking lots by up to 75 %. The idea was to free up space in the city so space could be utilized for more sustainable purposes (We Do Democracy, 2019).
The 9th recommendation encourages trying out new models for the spaces of the Medieval city. Hence, the municipality has planned to perform seven different city trials, in some of which they close roads from traffic, opening for new ways to utilize these roads. These trials are set to be performed from June to September 2021

Figure 5: Map of the city trials.

ENVIRONMENTAL AND ZERO-EMISSION ZONES

Environmental zones in larger cities across the country have been introduced with stricter environmental requirements for both trucks, busses and vans. In the new set of governance initiatives released by the Danish government (Indenrigs- og Boligministeriet, 2021) it is suggested to let the municipalities have a greater influence on these zones (Initiative 1), deciding where to introduce them and to which degree. Further ambitions from 'the government's green transitions of road transport' are initiated to give the possibility of introducing zero-emission zones (Initiative 2), and hereby promote a shift to 'clean' and fossil-free vehicles.

As indicated in the initiative's name, these are zones where municipalities can set a restricted area boundary wherein vehicles that do not fulfil the specifications are forbidden. Another initiative (Initiative 5) mentions the need of removing barriers for the green mobility transition, by allowing local planning to create more space for car-sharing schemes and electric charging stations.

Moreover, changes to The Planning Act should enable the municipalities to plan more sustainably by providing a clear framework and opportunities. That shall pave the way for more green mobility, in particular electric cars and the necessary charging infrastructure for these.

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TRAFFIC ISLANDS

Traffic islands have been proposed as one of the solutions for limiting the number of cars entering and driving through the Inner City and more specifically the Medieval City.

Traffic islands do not indicate that the roads are closed for cars altogether, but that traffic is hindered, making it almost impossible to take shortcuts through the smaller roads. Traffic islands thereby ensure a safer environment for other types of transportation means as well as pedestrians. This has been proposed as one of the solutions for limiting the number of cars entering and driving through the Medieval City (Rådet for Grøn Omstilling, 2020).

The concepts introduced in this project should draw great advantage of these initiatives by seizing the opportunity to introduce infrastructure concepts that enhance the use of cargo bikes and support the electric elements of the logistics chains in cargo distribution. Even though specific areas are still to be decided, the initiatives give further possibility to changes in Inner City as political drivers to improving City Logistics, along with the recommendations from City representation.

CURRENT FREIGHT SYSTEM

Figure 6:
Simplyfied map of the current freight system.

CURRENT FREIGHT SYSTEM

To better understand the current freight delivery system, the project group decided to map the flows of the packages entering the Inner City. This is a simplified version of the current system, primarily made for the project group to have an overview of what is happening currently. Nonetheless, multiple variations of this system exist.
In the current system, the packages travel through several different steps before arriving at their destination. These are presented in figure 6.

THE FLOW OF PARCELS TO THE MEDIEVAL CITY

The delivery system currently has a maximum capacity of 34.500 m3 a day. This amount is based on observatory numbers from 2018 provided by Copenhagen municipality (Københavns Kommune, 2019). Here, it is stated that an average of 15.000 cars enters the Medieval City daily, whereof 23% are vans.
This amounts to 3450 vans every day. A quick search on the size of vans provided by different car companies shows that a general van has around 10 m3 load space (Mortensen, 2019) - thereby arriving at the result of the maximum capacity being 34.500 m3 a day. However, this number is only true when assuming that every van is filled to its maximum capacity. A more reasonable assessment would be that the capacity of the vans is utilized at 57 % (Greenfort, 2017).
This is based on rough estimates, as businesses usually keep this information to themselves (appendix 2). Using this 57% utilization as the general rule means that we arrive at 19665 m3 of packages entering the Medieval City a day.
Freight delivery is usually done by the big distribution companies such as Post Nord, DHL, Bring and GLS. The transportation mean, which is primarily used, is either vans or trucks. This is seen as preferable, because of the national infrastructure's emphasis on creating roads that make it more convenient to go by car, as well as the trucks capacity to carry a high number of packages pr. Load. However, this system is not without consequences. In a rapport by Concito from 2021, it is stated that 50 % of all CO_2 emission in the Medieval City is caused by either van or trucks (Gudmundsson & Krawack, 2021). Conclusively, the current freight delivery system is responsible for a large amount of the Medieval City's overall CO_2 emissions.
Another issue mentioned is the congestion. Due to the high population in Copenhagen, and the limited space, roads often are congested which is especially problematic during rush hours. According to Region Hovedstaden, trucks and vans are responsible for around 20 % of all the traffic in Copenhagen (Mortensen, 2019). This heavy traffic is making it difficult for the driver to arrive at their destination as scheduled, which is creating dangerous situations where drivers are forced to drive faster and more recklessly.

Furthermore, it is hard for the drivers to find spaces where they can park. This leads to the drivers often must either park illegal or park far away from the destination and walk the remaining distance with the packages (Mortensen, 2019).

CHARACTERISTICS OF CARGO BIKES

Cargo bikes come in many variations and designs and can even be customized for specific needs. In recent years, there has been an increase in the utilization of cargo bikes for commercial use, as cargo bikes are increasingly competitive in the freight market, especially so when they are made electric. The different cargo bikes can contain different capacities of load, freezers for food or be customized in almost every perceivable way.
This section aims to explain the characteristics of the cargo bike.

SPEED

The cargo bike speed is determined by the person driving it. An electric motor can only assist the cargo bike to a speed of 25km/h (Mortensen, 2019). The cargo bike becomes advantageous in dense urban areas, where the truck is affected by speed limits and traffic.

CAPACITY

A cargo bike has a lower capacity than trucks. Some of the large cargo bikes can carry up to 500 kg, or 2 m3 Compared to a van, this only makes up for one-fifth of the capacity. This automatically puts restrictions on both the weight and physical dimensions of the packages when being shipped with a cargo bike (Mortensen, 2019) (Nürnberg, 2019).

TAKING SHORT-CUTS

Within the Inner City, the cargo bike has clear logistical advantages compared to the truck. The well-developed bicycle infrastructure and traffic regulation enable the cargo bikes to drive almost everywhere, and it is easy to manoeuvre on the small one-way streets, closed roads etc. It also makes it easier to take direct routes to the destination, as there are often bicycle lanes across green areas where cars cannot drive.

PARKING

Parking is another advantage of cargo bikes, as they can be parked on the sidewalk right in front of the door. Trucks, on the other hand, often have to spend more time finding parking spaces, and typically have to park some distance away from the destination. A study has shown that while it takes an average truck 12 minutes per stop, it takes a driver with a cargo bike only 3-6 minutes per stop (Altenburg et al., 2018).

PRICE

If the price of the vehicles is compared isolated from other operating costs, the cargo bike has clear price advantages. An electric cargo bike costs about a quarter of a diesel-powered van, and about a tenth of a new electrical crafter. There are also lower maintenance costs for the cargo bike as the parts and reparations are cheaper.

However, the biggest expense related to freight is the wages of the drivers. Whether the cargo bike is cheaper in this regard is a question of how many bikes will be needed to deliver the same amount of cargo compared to delivery speeds in the Inner City of cargo bikes and trucks respectively (Mortensen, 2019).

SUSTAINABILITY

From an environmental perspective, the cargo bike has fewer disadvantages than the ordinary fossil fuel-powered truck. The trucks cause environmental damage such as air pollution and noise. Vans and trucks make up approximately 34% of the traffic's annual CO2 emissions in Copenhagen (Mortensen, 2019). Although electric trucks can aid in reducing CO2 emissions, it still adds to the problem of traffic and congestion of the roads. These are all factors that impact the quality of life of the residents in Inner City negatively.

VARIATIONS OF THE CARGO BIKE

As mentioned earlier, cargo bikes are available in many different variations and can be specially designed according to the company's needs. The following exemplifies some of the various value propositions that cargo bikes can provide.

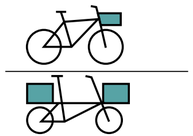
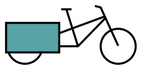
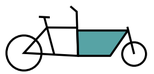
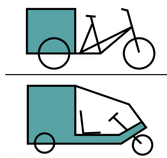
NAME	DISCRIPTION	CARGO SPACE LOCATION
POST BIKE	Post bikes are two-wheelers with frame geometry for a conventional two-wheeled bicycle. They usually have a cargo space in front of the steering wheel and / or behind the saddle. The maximum transport weight is usually 50 to 75 kg.	
LONGTAIL	Another variant of a two-wheeler equipped with an extended rear trunk, which is attached to each side of the rear triangle of the frame. At loads up to 50 kg, this construction can be operated in a similar way to a conventional bicycle	
FRONT LOADER	The cargo space is located in front of the cyclist, as low as possible. The frontloaders are mainly two-wheelers; their low center of gravity and the geometry of the frame allow for maneuvering even at higher transport weights.	
	Bike with cargo space in the front also available in multi-axle version, with two front axle wheels. This allows for excellent stability	
TRIKE	A multi-wheeler with the largest cargo space. Bicycles of this type are adapted to carry loads weighing up to 500 kg	

Figure 7: Different types of cargo bikes (Nürnberg, 2019).

CARGO BIKE REGULATIONS

The following describes the regulations of cargo bikes as an electric vehicle

•An electric motor may only deliver power when the bicycle's pedals or similar are operated at the same time (Koch, 2021).
•An electric motor must have a maximum power of 250 W (Koch, 2021).
•An electric motor may only deliver power at speeds of 25 km / h (Koch, 2021).
•The electric motor may deliver power at speeds of up to 6 km / h without simultaneously operating the bicycle's pedals or similar. However, this may only be done as long as the driver is manually acting on an electrical switch (Koch, 2021).
•The total length of the bicycle and trailer must not exceed 3.5 meters, and the width not more than 1 meter (Rådet for sikker trafik, 2021).

LITERATURE REVIEW

The project group has performed research to create an overview of the literature on the implementation of cargo bikes for freight, and to gain valuable insights and building blocks for future concepts.

In this chapter, some cases and their conclusions about the positives and negatives surrounding the implementation of cargo bikes for freight will be presented.
Firstly, the findings from chosen cases will be presented, these findings are divided into partnerships, costs and benefits & barriers. Secondly, the former cases are plotted into DFS evolutionary framework, to analyse the focus of the cases.

PARTNERSHIPS

Business cases like sustainable city logistics (Wrighton & Reiter, 2016) showcases the implementation of an edge-of-city depot centre, for prescheduled collections and deliveries (70% of total), as well as a partnership for last-mile-delivery and first-mile delivery where items are delivered and collected by cargo bikes for larger courier companies. These partnerships have shown great potential for the larger courier companies currently delivering with trucks/vans, as they currently suffer from congestion and highly trafficked roads leading in and out of the city (Schliwa, Armitage, Aziz, Evans, & Rhoades, 2015).
Similar projects were carried out in Leeds, where Last mile Leeds was founded based on understanding the problems of inefficient and expensive current modes of last-mile deliveries, which could be made cheaper, more efficient, and sustainable by utilizing cargo bikes. Here, they were able to offer competitive prices to carry out city

centre deliveries for DHL as a sub-contractor, utilizing the company's pre-existing infrastructure and logistics centres (Schliwa et al., 2015).

COSTS AND BENEFITS

For the companies working within delivery and distribution, the literature points to the cargo bike as a viable option for replacing the current truck-heavy delivery system. In the example of Gnewt (Lenz & Riehle, 2013), a distribution company in London, the high cost of implementing two separate storage depots within the city was outweighed by the low need for maintenance of the cargo bikes and the employment of people on flexible working contracts.

Cargo bikes have economic, environmental, and societal benefits; lower initial cost, lower running cost, less need of parking, comparative high reliability as journey times is less affected by variable traffic conditions, less need of special training and licenses for employees, and low environmental impact and associated PR benefits for the company (Lenz & Riehle, 2013). The cost of implementing cargo bikes in urban areas as a mean of deliveries has been further investigated in other reports (Wrighton & Reiter, 2016)(Sheth, Butrina, Goodchild, & McCormack, 2019). A cost simulation made by Wrighton et al. estimated a possible cost reduction of up to 45%. The case study of Amstel et al. found that owning a cargo bike can be of value to a business in various ways and mentions both increases in efficiency, a distinctive image and happier employees.

Furthermore, experiments show that adjustability in the design of the cargo bike could contribute to its implementation. In the example of Cyclespark (Balm & van Amstel, 2017). it is shown that a specially developed cargo bike was made to fulfil the specific needs of a company. Electrical components were added to the bikes to make them able to have a cooling system, ensuring 'safe' delivery of fresh goods. Furthermore, a trailer was developed to enable the cargo bike to carry a load of up to 500 kg. This shows that cargo bikes can increasingly carry more and more of the different streams of goods.

BARRIERS

Though numerous advantages are pointed out in areas such as economy, flexibility, speed and sustainability, the cases also show barriers to implementing cargo bikes. It was described how the use of cargo bikes for freight relies heavily on the acceptance of customers. Hence, the service providers are faced with the large challenge of proving to the customer that it is possible to transport freight with cycles. As for operators, the shift is not unproblematic either. Drivers of cargo bikes are more exposed to accidents which can raise concerns.
Additionally, there might be issues with driver fatigues. The limited range and load of cargo bikes mean more trips are to be made, to supply the same amount of cargo (Lenz & Riehle, 2013), thereby, it can quickly become less profitable if the distances the cargo bikes need to drive to deliver becomes longer, as the cargo bike does not have the same speed as other means of delivery.

CASE OVERVIEW

To ensure that this project contributes to a new line of research, that incorporate sustainability as a core value, former cases were plotted into the DFS evolutionary framework.
The scope, content and results from the cases were identified and then placed accordingly to whether the focus of the cases was on technology or people, and whether the projects had an insular or systemic approach.

As shown in figure 8 the former cases are primarily placed within the two first innovation levels: product level & product-service system level. The cases placed within the product level focused primarily on optimization of the bike, or how a technological improvement could support the implementation of cargo bikes, whilst the cases placed in the product-service system-level dealt with how the cargo bike could substitute the van in the last mile of the deliveries.

A description of the cases can be seen in appendix 3.

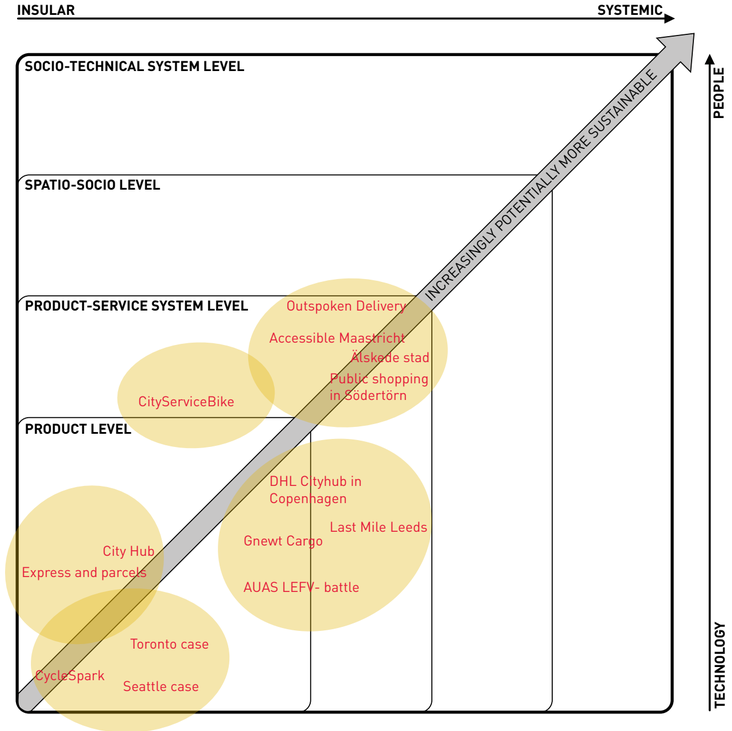


Figure 8: Former cases, plotted in to the DFS framework. (adapted from Ceschin & Gaziulusoy, 2016).

ETHNOGRAPHICAL RESEARCH

The following section will introduce which key actors the project group found relevant to investigate and interest, in the part-taking of making concepts for a change process in the inner city. The section will furthermore present data and the key takeaways from the ethnographical work.
The SMBs are considered a key actor since this project revolves around engaging SMBs in a sustainable transition. The project group also identified a lack of knowledge in the literature on which needs and values the SMBs had regarding their delivery system.
The Copenhagen municipality has been identified as a key actor because they have the power to create the setting in which the distribution companies can act. This also means they possess the ability to apply regulations, like zero-emissions zones, which would give the freight companies the initiative to change. The Strategic Niche Management (SNM) approach also emphasised the importance of including regulatory actors when facilitating sustainable innovation journeys (Schot & Geels, 2008).The distribution companies that use cargo bikes have been identified as a key actor because they hold knowledge regarding how freight delivery is done today and how they are positioned in the current freight network. By including these actors, the group can gain valuable insight into the limitations and obstacles these companies face.
The project group will continuously work with these actors to understand and negotiate their different concerns throughout the entire project.

MEETING WITH CAPITAL REGION & COPENHAGEN MUNICIPALITY

To interest municipal actors, the project group organised a meeting with Tanja Maria from Copenhagen Municipality and Kia Madsen from Capital Region.
During the meeting, Tanja Maria pointed out that the municipality is very interested in green initiatives within Inner City. This is also the reason behind city trials. One of the primary aspects of the city trials mentioned in ***political drivers*** is that parking spaces are going to be removed and used for something else. Tanja Maria suggested that some of the freed-up space could be used for the parking of bikes.
One of the issues of implementation is getting the businesses to engage in the change. A way of enabling this is to increase the possibility for companies to brand themselves through the change and strengthen their identity as responsible business owners.
Tanja and Kia's experiences with analysing for implementation of cargo bikes has led to them assessing scalability as an important aspect. However, this opens a dilemma: what happens when a lot of businesses make use of cargo bikes? Can the bicycle lanes of Copenhagen handle the increased capacity, and how will it interact with the mobility and safety of citizens? Therefore, the timeframe of when the cargo bikes would be moving around is of importance – by avoiding rush hours on the bicycle lane, congestion could be avoided, limiting the negative effects of introducing many cargo bikes to the lanes.

Kia pointed towards the importance of having a broad variety of cargo bikes on the bicycle lane and not solely having the ones with the largest capacity. This to make sure that the bike does not use more space on the bicycling lanes than necessary, and another bike can be chosen when only a limited number of packages needs to be delivered.
Notes from the meeting can be found in appendix 2.

MEETING WITH BYUDVIKLINGSGRUPPEN

Byudviklingsgruppen (the city development group) is a sub-department of Inner City local committee. The local committee is in charge of allocating a fund to different projects in the area and engage citizens in the development of the city. Moreover, they act as the connection between the citizens and borgerrepræsentationen (which consists of elected politicians) (Borgerrepræsentationen, 2011). Byudviklingsgruppen more specifically investigates infrastructural aspects of the development of the city.
The project group saw it as important to engage Byudviklingsgruppen in the project to get their insights and interest them in the project so that they would be willing to help support a future concept with cargo bikes. Therefore, they participated in their meeting on the 27th of March, 2021.
At the meeting, Byudviklingsgruppen mentioned that it was important to take other bicyclists into account before flooding the bike lanes with cargo bikes. Furthermore, they let the group know of different local producers of cargo bikes that might be able to help with the development of a cargo bike that could fit into the current cityscape.
Notes from the meeting can be found in appendix 2.

SOCIO-TECHNICAL EXPERIMENTS WITH SMBs

The project group conducted two socio-technical experiments in which cargo bikes were implemented in two companies to deliver their packages.
The socio-technical experiments were supposed to be conducted with a cargo bike as a radical innovation. It is not the cargo bike itself that become radical, but rather the purpose of the cargo bike – experimentation of the bike as a mean for deliveries. It is radical because of the technological, regulative and institutional changes it brings to the company. The experiments took place in a real-life setting, ensuring that a broad variety of actors was involved in the experiments e.g., operators of the bike, Miljøpunkt who provided the cargo bike, the customers, the shop owners etc. However, it was conducted in a partially protected space, where money and profitability were not considered, but the scene was still playing out the current physical environment.
The two companies that were to be a part of the socio-technical experiments were selected according to:
1) The company size, as the project scope is targeting SMBs
2) The company's location, both because of the project scope targeting Inner City, but also because stores that are densely located provide a better opportunity for testing a system where several companies share a cargo bike for goods delivery.
3) The interest in taking part in the experiments.
The following will detail the conduction of the socio-technical experiments with two different companies.

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APAIR

The first experiment was conducted with the shoe store Apair. The agreement was a two-month trial in which Apair borrowed a cargo bike to deliver their products in the local area.

Through the trial, Apair was supposed to be responsible for planning and structuring the cargo bike delivery, for example by planning what time of the day the delivery should take place, and how often the deliveries should take place. During the trial, they should every second week fill in feedback forms to contribute with relevant data for the project group, which later would be discussed at physical meetings with Apair. The trial started and the cargo bike was handed over to Apair.

Unfortunately, the trial ended rather abruptly, as Apair experienced complaints about the parking of the bike in their backyard and were informed that they had to remove the cargo bike. As a result, the group had to end the trial.

TANTE - T

The second experiment was to take place at Tante-T, a tea shop located in Torvehallerne. The shops in Torvehallerne were obvious candidates for the experiment as Torvehallerne consists of small shops located close to each other.

Furthermore, they have a lot of free space outside the market halls that belongs to the organisation – thereby the project group supposed that parking of the bike would not be an issue. Tante-T had previously used cargo bikes for package delivery with success and was interested in participating in the experiment. Shortly before the bikes had to be handed over to Tante-T, the shop announced that they, unfortunately, did not get permission to park the bikes in the area outside Torvehallerne.

Resultingly, the cargo bike was never lent to them.
Even though both experiments were not successful in the sense that the bikes never got to be tested, the attempt to experiment highlights the importance of creating parking opportunities in Inner City.
It could be argued that the socio-technical experiments failed because they were not protected enough from the mainstream selection environment. However, this is a clear trade-off, as a more protected space might have led to less valuable insights.

SMB - SURVEY

To gain quantitative insights on the needs and values of the SMBs, a survey was conducted.
The survey took shape of an online questionnaire, which could be accessed via a QR code on a flyer. The flyer was handed out to 170 stores in Inner City, selected on the size of the business, and the size of the stores' products, as they had to be compatible with the loading capacity of a cargo bike. As the flyers were delivered, the project team had the opportunity to interact briefly with the staff and store owners and got their immediate response on cargo bikes as a mean for package delivery.
By handing out the flyer in person, the group could already interest businesses in participating in the project. This information was streamlined with the results from the survey.

The results from the survey, can be viewed in appendix 4.

Figure 9: The flyer distributed in Inner City.

RESULTS FROM SURVEY

The survey was split into two parts: one to investigate the current delivery methods in Inner City, one to investigate the initial impression on shifting to cargo bikes.
Most businesses indicated that they were satisfied with their current delivery system, even if most had deliveries by vans and trucks. Some did indicate though, that the vans would sometimes be a nuisance to customers when blocking entrances to different stores. Furthermore, most of them got deliveries from +30 km away and only send very few packages locally.
SMBs consider delivery speed and punctuality to be the most important qualities of a delivery system. The low CO2 footprint is considered a medium important quality along with flexibility and personal relationship with suppliers

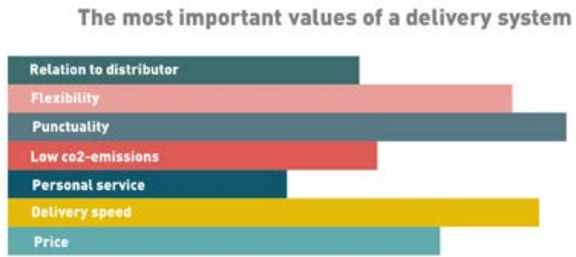

Figure 10: The most important values of a delivery system

Figure 11: percentage of respondants introduced to cargo bike delivery

Regarding the transition to cargo bikes, the companies considered positive aspects of the implementation to be a possibility for sustainable branding, flexible delivery, and new business opportunities, as bikes can act as a mobile sales desk from which they can sell.

Perceived concerns that companies had of the transition were price, inadequacies in capacity, slow delivery and coordination issues, such as how cargo bikes are booked if the bikes are shared with other companies and where to park the bikes.

Furthermore, it became apparent that most companies had never been introduced to cargo bike delivery as an option.

FIELD OBSERVATIONS AND CONVERSATIONS WITH SMBS

During the project, the project group has been into Inner City multiple times. During these excursions, they have observed the conditions of the city as well as talking with the SMBs.
Generally, a lot of SMBs expressed problems regarding the current deliveries. One SMB mentioned how their ordered packages were just thrown off outside the store, and they then had to quickly get everything inside. Furthermore, it was expressed how there was a hectic atmosphere when the packages were delivered, as the truck was blocking the road for other cars when it was being unloaded. Another SMB mentioned how they had switched to a delivery company with smaller trucks, as previously they have had issues with the truck not being able to navigate around the narrow corners close to their shop.
When the project group talked with the SMBs they often reacted very positively when explained the purpose of the project. As described by one of the SMBs: “you want to get rid of the murder trucks? That is a great idea!”.
By observing the traffic in Inner City obvious issues were seen. Pallets with packages were blocking the sidewalks, forcing pedestrians and bicycles onto the road where passing cars honked at them in frustration.
Pictures of the trips to the Inner city can be seen in appendix 5.

Furthermore, in the process of getting in contact with actors in the Inner City, the project group got in contact with Christian from Frederiksberg Erhverv. He explained that they were very interested in the project as they were looking into creating a socioeconomic centre with cargo bike deliveries. However, the project group decided not to include them further in the project, as Miljøpunkt financially could not support initiatives in another municipality.

MEETING WITH BY-EXPRESSEN

It was relevant to engage with actors who already had experiences in using cargo bikes for delivery in Copenhagen. The project group contacted By-Expressen and arranged a meeting with Sebastian, who is one of the employees that daily mounts and drives the cargo bikes. By-Expressen is a small delivery company that is experienced in using cargo bikes. It was established in 2012 and have since then created a business branded on cargo bikes. They offer the service of collecting and distributing packages to a wide number of different businesses in Copenhagen. They provide both express delivery and day to day distribution.
The first part of the meeting aimed at getting a better understanding of how By-Expressen was able to compete with other distribution companies. Specifically range and capacity were of great interest.

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According to Sebastian, the bikes are limited in the range they can cover. By-Expressen is currently able to cover most of Copenhagen and some areas outside Copenhagen. Sebastian emphasized that the greater the distance, the harder it is to compete with the vans and trucks.
The capacity was not seen as a problem for By-Expressen. This was mainly because many of their customers were sending smaller packages. However, By-Expressen also had a small trailer they could attach to the cargo bike, or they could send more than one bike if the customer needed a larger delivery. According to Sebastian, this was often where the price would increase, which also meant that they could not compete with other distribution companies if the shipment was too large.

The second part of the meeting was staged as a small prioritization game. The project group had identified different problems that were connected when transporting packages on a cargo bike compared to vans and trucks. These were:

- Capacity limitation
- Distance
- Parking of cargo bikes
- Congestion on bike lanes
- Transportation safety of the products

To better discuss these, different images were brought and functioned as intermediary objects, which made it possible to mediate knowledge between Sebastian and the project group. One picture was discussed at a time.
Sebastian’s main points to the different problem areas are described in the following.

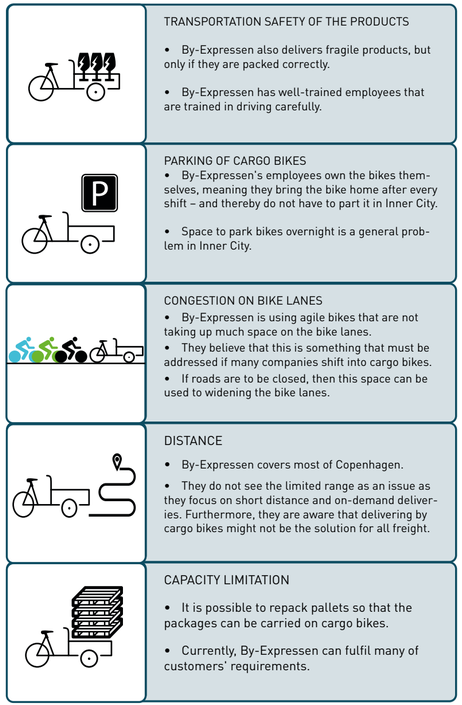

Figure 12: Mainpoints from By-expressen

Based on this conversation the project group wanted Sebastian to prioritize the different problems. This was a complicated task for Sebastian because he had not experienced a lot of the problems. The only thing that Sebastian saw as problematic was the parking of cargo bikes. This was a problem that had to be solved before more cargo bikes could be implemented in Copenhagen.
However, this was a recurring problem that the project group had identified before.
Notes from the meeting can be found in appendix 2.

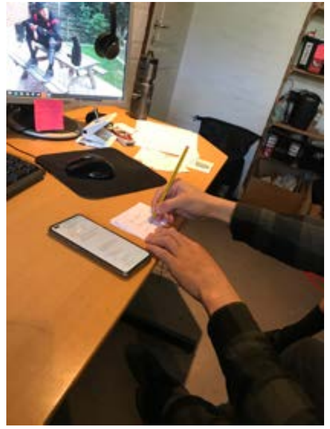

Figure 13 & 14: Priotizing game with Sebastion

INTERVIEW WITH BRING

To further understand the obstacles of using cargo bikes for freight, as well as the business model, Henrik Skyum, coordinator of the cargo bike drivers in Bring Courier and Express, was contacted.
Bring is a freight company servicing selected countries primarily in the northern part of Europe. The biggest part of their business is delivering and distributing by trucks and vans, but they also have a department for deliveries on cargo bikes for the last mile.
Notes from the meeting can be found in appendix 2.

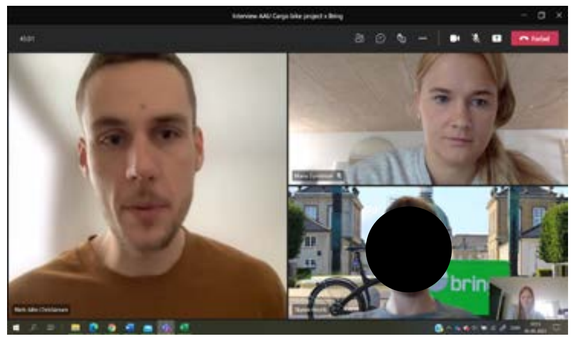

Figure 15: Meeting with Henrik

KEY INSIGHTS

They primarily do on-demand deliveries, such as flower deliveries and one-hour groceries ordered online. In general, they do not have agreements with specific companies, and they usually just provide "one-time" deliveries. They have a user platform where the shops can choose how they want to have their goods delivered and one of the options is the cargo bike. There is an added service, where the businesses get a notification when the package has been picked up and when it is arriving at the business. On the platform, the business receives its receipt as well.
They usually handle more distribution than deliveries to the companies, e.g., flower delivery, and internally between different parts of companies. They are working on a better synergy with Bring Parcels, so they can provide more delivery services.

"Delivering with cargo bike makes sense until the trucks pass them", thereby it does not make sense to deliver in areas where the density is very low. This is why their primary focus is to deliver by cargo bike inside Cityring 2.
Henrik mentioned that they would be interested in a location inside the city where they can rent a space for the company to park their cargo bikes, as currently, their offices are a bit outside of the city.
Henrik estimates that 75% of the flow of packages can be delivered by cargo bikes.
An issue is that companies tend to pack in "standard boxes", which

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results in a lot of air being transported. This can be an issue when they must be transported by cargo bikes, which have a limited capacity.

The municipality puts a focus on clearing roads for cars before concentrating on making the bicycling lanes safe in the winter. That can cause dangerous situations for the cargo bike drivers, who always drives on demand during the day.

Bring puts a lot of effort into ensuring that their workers have good working conditions. Therefore, they would not be able to lower the price to what it currently costs to have delivered by truck.
They do not have any problems with parking their bikes when delivering, as they are not away from it for long. Sometimes they just ask a nearby person to look after the bike while they deliver the package.

INTERVIEW WITH CHAINGE

The group established a meeting with Chainge, whose business model mainly consists of providing cargo bike deliveries of food boxes. The meeting was established in their storage facility in Copenhagen, in a room filled to the brim with their characteristic cargo bikes with a large container on the back.
The meeting consisted of the project group, armed with questions and wonderings, and the co-owner at Chainge, Torben Damgaard Nielsen.

Standing in the storage facility the group got a quick view into the daily happening of the company. They were checking and repairing bikes and making everything ready for the delivery of the food boxes. Generally, Chainge is very engaged in the green transition, and are trying to prove that using cargo bikes for deliveries in Copenhagen is realistic.
Notes from the meeting can be found in appendix 2.

KEY POINTS FROM THE MEETING

The good thing about delivering subscription goods is that they have recurrent customers and recurrent delivery routes. The deliveries are therefore highly predictable and make Chainge able to plan the schedule of employees accordingly. Thereby, they do not risk having drivers standing still at the facility not having anything to deliver. In general, for cargo bike delivery to be efficient, they need to know how much is going to be delivered to their facility, at what specific time and what size the packages are. If they do not know this, it quickly becomes inefficient and non-profitable.

They can transport up to 200 kg a time, however, they do not have a long-range. Therefore, they generally only deliver within 'cityring 2' in Copenhagen. It becomes too expensive to deliver when the distances are greater than cityring 2.
It is difficult to get storage facilities in the Inner City. Chainge has been trying for the past year to find something, but rent is often unreasonable.

To meet the demand for green transition and sustainable logistics in Copenhagen, the municipality becomes an important collaboration partner. In this sense, by creating for example an public-private innovation partnership between the municipality and a change ready sustainable logistics operator, sustainable logistics could be tested on a larger scale.

Chainge actively participates in the debate on new city projects. They have been in contact with “jernbane byen”, a new city district being built, to create big areas where cars are not welcome. They have been in contact with “jernbane byen”, a new city district being built, to create big areas where cars are not welcome. This way, they will have infrastructure that fits the bike instead of the car.

The drivers of the Chainge cargo bikes do not experience issues with congestion on the bicycle roads if they are not driving at peak times. However, should there be more space on the bike lanes in Copenhagen, Chainge would evaluate the design of the bikes, possibly investing in bikes with a bigger capacity.

The bikes need to be maintained on a running basis as cargo bikes are yet a fully developed technology. Transition to as green as possible logistics in general, can only happen, when road transport operators change their ways or are forced to do so. In the meanwhile the cities will drive the green transition from the bike path and out of town.

SHARING OF IDEAS

Torben furthermore provided the project group with a few ideas of how to make a sustainable transition to cargo bikes. He mentioned that making use of the current infrastructure such as train rails would be beneficial and remove traffic within the city.

Additionally, there are multiple stations within the inner city, whereas you could distribute the packages from the centre and out, instead of the other way around which is currently happening because of the prices of facilities in the Inner City. The train/metro connects to important areas where cargo enters currently, such as Nordhavn and Kastrup.

DEFINE

ACTOR NETWORK

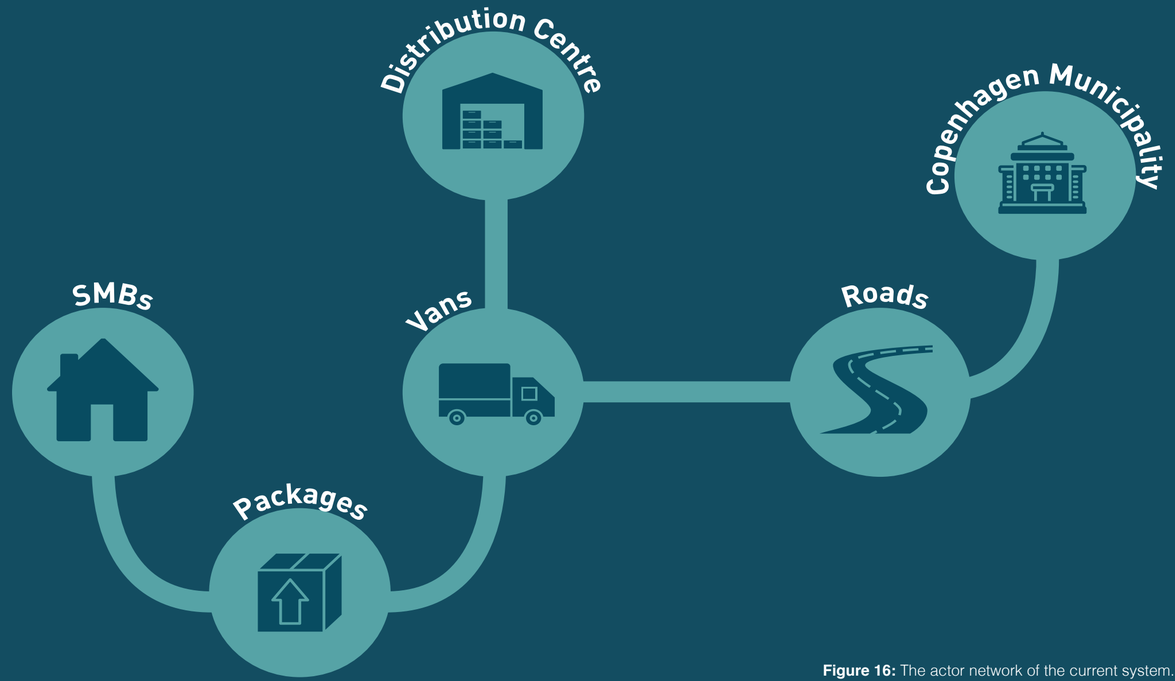

Figure 16: The actor network of the current system.

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ACTOR NETWORK

Based on the information gathered in the previous research, the project group mapped the different actors and their relations in a network. The focus of the network is to show how and why the network is stabilized around vans and trucks.

The following relations have been identified as important.

THE RELATION BETWEEN VANS/TRUCKS AND ROADS IN INNER CITY

The infrastructure in Copenhagen is currently supporting private cars, vans and trucks as the primary way of transporting goods. Speed limits, roads and traffic lights are all designed to make it easier for automobile vehicles to get around as fast as possible. Resultingly, this has reinforced the perception of vans as the ultimate solution for freight. However, as the roads are still rather small within the inner city, and not originally designed for cars, the increase in vans and trucks results in congested and chaotic roads.

The roads of Inner City are already highly pressured as they must accommodate all types of traffic as well as provide parking spaces for people living in the area. Hence, small roads are made even smaller when parking spaces are added on the sides of them. The utilization of public parking spaces in the Medieval City is 107% (Københavns Kommune, 2019), meaning that there is always cars parked illegally. This results in trucks and vans having to park illegally and block the roads when delivering to the shops, as they have no other place to park (Gudmundsson & Krawack, 2021).

THE RELATION BETWEEN PACKAGES AND THE VANS/TRUCKS

The relation between the packages and the transport vehicle is essential for the delivery system. The vehicle's physical dimensions limit the size of the packages accordingly.
The trucks and the standard for transporting goods (e.g., on EUR pallets) has co-evolved to fit perfectly with each other. This results in the companies being able to order large quantities at once, which would not easily fit into other types of freight vehicles – thereby limiting the possibilities of other types of freight vehicles entering the market.

RELATION BETWEEN SMB AND PACKAGES

The very existence of SMBs depends upon the ability to sell their products. Thereby, it is a need for survival that they can have packages delivered to their shops. As of now, an SMB can order any given product, and have it delivered to them by using a freight company. Often, they do not have to handle the transportation themselves but

only order and await its arrival. When they send products from their store they have a stronger relation to the packages, as they are responsible for the package arriving at the agreed time and in the agreed condition.
Often products are packed in an over-dimensioned cardboard box. This is because weight is usually the parameters that impact the price most. Since cardboard boxes and the filling is limited in weight, the price is almost the same, no matter what size of the cardboard box the companies are using - and usually, it is cheaper to buy a lot of standard boxes, even if they do not perfectly match the dimension of the product to be sent. Currently, there is a lack of incitements to pack products more efficiently - especially so as vans and trucks, in general, have a high capacity and wasting space is therefore not an issue.

RELATION BETWEEN COPENHAGEN MUNICIPALITY AND THE ROADS IN INNER CITY

Copenhagen municipality is responsible for establishing new roads and repair old ones within the Inner city. They are the ones that make decisions about the development of the city, as they have power over the roads and can decide what changes should be made.
Thereby, they can decide to implement restrictions on what vehicles are allowed inside the inner city as well as facilitate this change. Currently, the municipality has decided to make some changes to the structure of Inner City, based on recommendations of a group of selected citizens.

These recommendations include city trials, zero-emission zones and removal of parking spaces. Overall, this could imply that the municipality is ready to start the transition to a new freight system in Inner City.

RELATION BETWEEN THE DISTRIBUTION CENTRE AND THE VANS/TRUCKS

Because of the diversity of distribution companies, many different distribution centres already exist as each distribution company has their own. This increases the number of freight vehicles in Inner City as one company might get packages delivered by different distribution companies, even if those packages could easily fit into just one vehicle. Thereby, the amount of traffic in the city is increased. This has resulted in quite expensive last-mile delivery for the distribution companies, as the traffic and congestion result in a lot of work hours being spent waiting in queues.

Furthermore, when local customers orders packages from SMBs inside Inner City, the packages are first transported to the distribution centre located outside Inner City, just to be transported to the customer in Inner City. Whilst this makes sense from a mega-logistic point of view, it is not resource-efficient when delivering locally.

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This way of viewing the network highlights several elements that must be considered when wanting to change the status quo. Firstly, the stabilization of trucks and van as a mean for delivery has resulted in the entire network establishing their relations accordingly, thereby fitting their processes to the use of trucks and vans. It is not possible to just substitute the trucks and vans with a cargo bike since the cargo bike does not meet the current requirements of the actors.
If the network is to be stabilized around the cargo bike as a mean for delivery, the network must be destabilized, by introducing new actors to the network and by making existing actors willing to change.

SUM UP OF GAINED KNOWLEDGE

To collect all the gained knowledge and align the members of the project group, it was decided to make a session where points from actors and literature were collected. This way, it could be ensured that all group members had the same standpoint in terms of starting the conceptualisation phase of the project.

One group member was standing at the whiteboard, while the others were ready with the different documents and worksheets that had been created until then. They then brought forth points, which were discussed among the group members. Some points were contradictory, allowing the group members to discuss why they were so.

The points were written down according to the actor they were about and can be further investigated in appendix 6.

CREATION OF PERSONAS

Personas can be used to represent different actors' point of views. Lene Nielsen describes personas as: "a persona is a description of a fictitious user. A user who does not exist as a specific person but is described in a way that makes the reader believe that the person could be real. A persona is based on relevant information from potential and real users and thus pieced together from knowledge about real people." (Nielsen, 2019)

The project group realised that a lot of the SMBs had different and contractionary concerns regarding the transition to cargo bikes and different needs for deliveries. Therefore, the SMBs characteristics were divided based on the survey as well as the oral feedback received by the project group during talks with SMBs in Inner City.
The divisions were transformed into four different personas that represent the values and needs of different companies.

The information that the personas are based on can be seen in appendix 7.

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DEMANDING DOROTHY

Key points:
- In need of flexible delivery
- Shifting requirements
- Deliveries on demand

About Demanding Dorothy

Dorothy likes to be creative and produce a lot of stuff for her shop herself. She wants her shop to be the biggest producer of customized products in Copenhagen, resulting in her having requirements for many different materials, to be able to produce something for everyone.

It is important to her that the shop can keep up a great speed, as they can then offer their customers faster repairs etc. She has never heard of using cargo bikes as a means for delivery.

The shop is selling new items, as well as repairing these items for customers. It is important for the shop to be able to quickly repair the product that their customers bring back, as it is one of the selling points. They never know what a customer is going to require of them, resulting in them having to order and having things delivered on demand. However, their packages are always very different, as they in the shop produce various items, both big and small. Furthermore, they receive and send packages to people all over Denmark and have a need for someone to pick up their packages every day.

BUSY BUSINESS BENNY

Key points:
- Customer experience
- See delivery as external
- Predictable delivery

About Busy Business Benny

Benny is busy man. Recently they just expanded the products categories they were selling. For Benny reliability is the most important thing when he chooses delivery company. When he orders products, he needs to know exactly that the products will be there on time. Furthermore, he prefers not to be involved in the delivery process. He likes to spend his energy in the shop and scheduled the deliveries the same time every week.

Recently Benny heard about cargo bikes for delivery, he believes that this is a stupid idea, so he has not investigated it – how could they ever live up to his requirements?

Bennys shop is very season depended. This also means that they shift their products quite often. They have 10 employees in the shop and many customers are present in the shop throughout the day. Therefore, employees always have to be present to ensure the customers a good experience.

Figure 17 & 18: Personas

SOFT SALLY

Key points:
- Likes to engage with outbound delivery company
- Local community
- Small deliveries

About Soft Sally

Sally believes the personal interaction with people is very important. This is also the case with her delivery solutions. For this reason, she has sticked to the same delivery company for the past 5 years. She has established a very good connection with them, they know what she requires and they always live up to her expectations.

Sally has also been a part of creating a network between different companies, where they can make initiatives to help the local communities. She is very engaged in this network. Recently Sally has been thinking about getting a cargo bike, so that they could use this for some of the deliveries. The problem is that they currently have no place to keep a cargo bike.

The shop is selling different local produced goods. They have a contract with a small delivery company that deliver to them twice a week. The deliveries are done with vans, where they receive a high number of goods pr time. Since they do not sell that many products through their web shop, they just do it through the post office.

GREEN GERALD

Key points:
- Sustainability
- Individual responsibility
- Very small deliveries

About Green Gerald

Green Gerald is engaged in sustainbility – to a great extent. He always tries to apply this value to his business, as it is important for him to advertise for sustainable solutions. He is open to trying things out if he can see that they will add to the sustainability branding of the company – and if he sees that it has sustainability potentiality.

In his business they typically promote the most sustainable products. They have relatively few deliveries and do not have agreements with distributer companies. The company consist of 2 employees, who all burn for creating sustainable change. They usually collect the goods at the post office by themselves and bring it to the store, even if this often takes up time that could be used on other things.

Figure 19 & 20: Personas

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PROBLEM DEFINITION

The project group wants to investigate how cargo bikes can be implemented by assessing what and who is necessary to consider for a systemic change to happen in Inner City.

To do this, Copenhagen Municipality will be considered as an outer skirt boundary for distribution operators, and global and national supply chains will not be considered. On behalf of this research, the project group aims to develop concepts, that can illustrate and explain key points in resolving the issues of pollution and undesirable conditions for residents, visitors and business owners. It is an overall criterion for the concepts, that they can be seen as solutions in long-lasting practices (stable network of freight) and that they can create value to involved actors. In the search for a long-lasting sustainable change, the project group seeks to create a new freight system and mobilizes relevant actors.

For this reason, the research question is as follows:

How can freight be delivered sustainably by cargo bikes in the Inner City of Copenhagen?

REQUIREMENTS AND CRITERIA

To structure the process of generating concepts for the new system, the project group made a design specification. A design specification mentions the specific requirements that the design must live up to, as well as the criteria that it would be nice for the concept to encompass (Cross, 2008). Making the design specification helped the project group align and decide upon what a concept should be capable of and define the solution space.

Once a design specification has been defined, concepts can be developed following the project scope. The design specification is also used to develop the assessment parameters on which the concept proposals are assessed. This makes it possible to later distinguish the different concepts from each other and assess their strengths and weaknesses.

The different requirements and criteria were selected based on empirical data from literature and the engagement with the different actors.

Requirement ID	Requirements:
R1	Must reduce the car traffic in Inner City
R2	Must be constructed as a systemic delivery system
R3	Must reduce the amount of co2 emitted in the Inner City
R4	Must be able to handle the capacity of the category: small-medium packages
R5	Must include cargo bikes as last-mile delivery

Figure 21: Requirements.

The requirements were selected according to the scope of the project. The project aimed to reduce the amount of car traffic and CO2 emissions, by introducing a systemic freight delivery system based on cargo bikes. These were separated and formulated as requirements.
R4 was made to ensure that the solution, as a minimum, could handle packages of a certain size. The capacity is crucial for the efficiency of a concept, but also how economically viable the concept becomes. Efficiency and economy are two factors that in a freight delivery system influence each other. To compensate for the limited capacity in a cargo bike, the project group narrowed the focus to small and medium packages only.
The criteria made is the following:

Criteria ID	*To what extend:*
C1	It reduces the car traffic in Inner City
C2	It includes multiple aspects of sustainbility
C3	It matches the personas
C4	It can carry the same capacity of cargo as current system
C5	It is feasible to implement
C6	It is radical compared to the current system
C7	It can be scaled to replace more of the current regime
C8	It is fast to implement (relative to 2025 target)

Figure 22: Criteria.

See appendix 8 for an explanation of the criteria origin.
The individual criteria were then discussed internally in the group where their relevance as compared to the scope of the project. See appendix for an explanation of the criteria origin.

The individual criteria were then discussed internally in the group compared to the scope of the project.

RANKING OF CRITERIA

The following explains why the criteria received their rank. The ranking was done from 1-5, with 5 being the most relevant and 1 the less relevant.

C1: IT REDUCES THE CAR TRAFFIC IN INNER CITY

The current freight delivery system is dominated by vans and trucks. One of the main issues with the current freight delivery system is the negative effect this has on congestion and emissions in the cityscape; therefore, it is essential that a concept can reduce car traffic in Inner City. The project group decided to rank it 5.

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C2: IT INCLUDES MULTIPLE ASPECTS OF SUSTAINABLITY

This criterion is rooted in the semester theme, which is about sustainable transition. The project group wants the concepts to not only consider environmental sustainability but also social sustainability. Both environmental and social sustainability are important when creating a concept that is sustainable from its core. Because of this, the project group decided to include this criterion and gave it a rating of 4.

C3: IT MATCHES THE PERSONAS

A key element in the project scope was the focus on the different SMBs in Inner City. The project group spent much time understanding the different needs of the specific actors. It was relevant for the concepts to accommodate these needs before it would be a good solution. The project group also decided to rank this criterion 5.

C4: IT CAN CARRY THE SAME CAPACITY OF CAR GO AS THE CURRENT SYSTEM

Because this semester theme is about system transition, the project group identified this as a very relevant criterion. Before a change in the freight delivery system is possible, it is important that the new system can handle the same number of packages as the old one. This criterion got a rating of 4.

C5: IT IS FEASIBLE TO IMPLEMENT

Feasibility measures the degree to which the implementation of a concept is problematic for various actors. Involvement of actors requires that actors can see the benefits of getting involved in a concept. If an implementation process is complicated and cumbersome then it is less feasible to implement. The project group identified feasibility as key criteria because it was important before a change could happen. The project group gave it the ranking 5.

C6:IT IS RADICAL COMPARED TO THE CURRENT SYSTEM

Since the semester project was about sustainable transition, the project group decided to have the criteria that the concept should be radical. Radicalism in this context is considered to the extent it changes or derails the current delivery system drastically. It is considered valuable, as there is a need for an alternative way of perceiving the delivery system. A radical concept creates novelty value in suggesting – sometimes quirky - considerations and new ways of thinking. However, the project group also identified that a radical solution not necessarily was a good solution, therefore it got the ranking 3.

C7: IT CAN BE SCALED TO REPLACE MORE OF THE CURRENT REGIME

Concepts that can be scaled up to a larger or different area would have the potential to further reduce car traffic, thereby resulting in greater CO2 savings. Since this semester was about creating systemic changes, the project group decided to include this criterion. As literature has shown, different locations require different implementation solutions, as there is no “one model fits all” which can make scalability problematic (Ambrosino, Liberato, & Pettinelli, 2015) and because of the project scope of targeting SMBs in Inner City, the criterion got the ranking 2.

C8: IT IS FAST TO IMPLEMENT (RELATIVE TO THE 2025 TARGET)

The project group identified that the implementation time was a relevant criterion. Since the world is constantly changing, the concept must be implementable in a near future, else the reality where it should be implemented will no longer fit, and the concept will no longer be the ideal solution.
The project group gave it the raking 4.

The result of the criteria rating can be seen in the table below.

Criteria ID	*To what extend:*	Weight from requirement
C1	It reduces the car traffic in Inner City	5
C2	It includes multiple aspects of sustainbility	4
C3	It matches the personas	5
C4	It can carry the same capacity of cargo as current system	4
C5	It is feasible to implement	5
C6	It is radical compared to the current system	3
C7	It can be scaled to replace more of the current regime	2
C8	It is fast to implement (relative to 2025 target)	4

Figure 23: Weighted criteria.

DEVELOP

CONCEPTUALIZATION

The project group wanted to create various concepts that could be used to investigate different ways of implementing cargo bikes in Inner City. Through literature research, the concepts were built upon previously suggested or performed concepts and further inspired from the interactions with the different actors. Instead of creating full systemic concepts key elements that the concepts should consist of were discussed. This process was a creative iterative process where different elements were discussed.
As shown in figure 24 drawing was used in explaining these elements. Each of the different elements proposed was discussed in the group. This ended up with the project group agreeing on 6 different ideas.

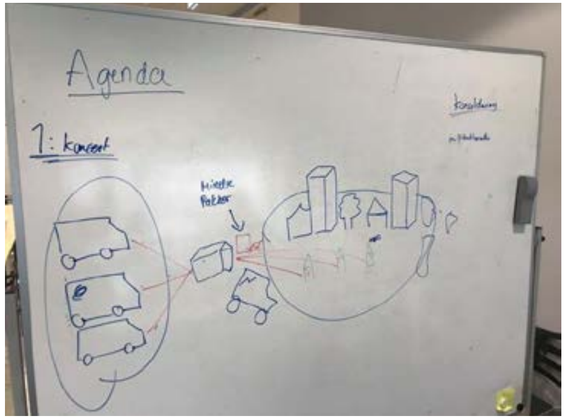

Figure 24: The project group exlaining ideas on the whiteboard.

CONCEPT IDEAS

In the following section, six conceptual suggestions to implement cargo bikes will be explained, as well as where the inspiration for the concepts originates from.

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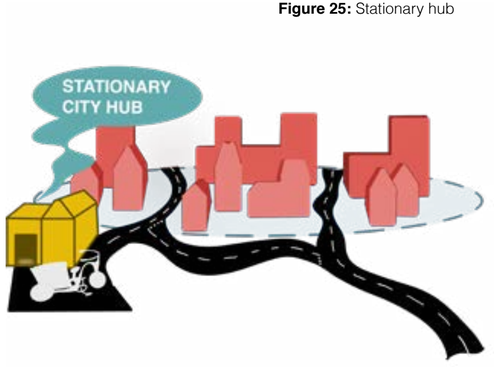
STATIONARY CITY HUB

Figure 25: Stationary hub

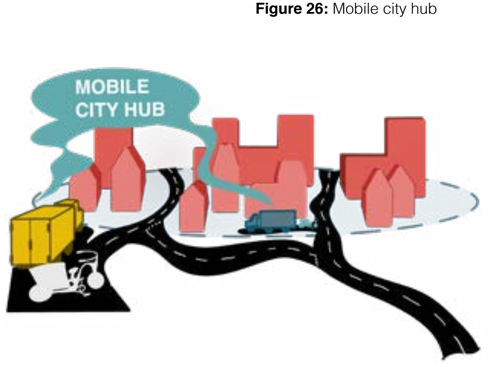


As a part of the freight system, multiple previous projects and research papers pointed towards the stationary city hub as an important element (Gudmundsson & Krawack, 2021)(Schliwa et. al., 2015) (Lenz & Riehle, 2013). A stationary city hub functions as a storage facility within the dense part of the city, where packages are delivered to and picked up for last-mile delivery.

The use of stationary city hubs has several advantages. Firstly, it does not require a timewise synchronization between the delivery to the city hub, and the pickup from the hub, since the packages can be stored safely. Secondly, this way of storing packages allows for a swap in vehicles e.g., from a van to a cargo bike.

MOBILE CITY HUB

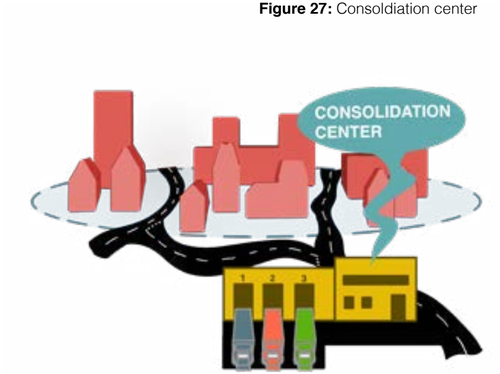
Figure 26: Mobile city hub



The mobile city hub has proved feasible in dense city areas where no physical storage facility was available (Gudmundsson & Krawack, 2021) (Schliwa et al., 2015). The mobile city hub can be a big truck or van, driving around in a scheduled route or it can be smaller containers that are moved around the city to key areas. From here, smaller vehicles can meet the mobile city hub at several meeting points, to reload the packages from the mobile city hub onto their vehicle.

CONSOLIDATION CENTER

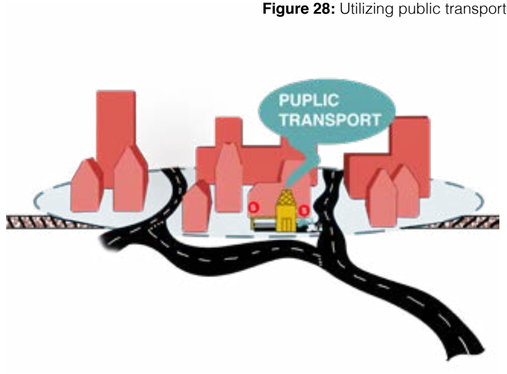
Figure 27: Consoldiation center



At the consolidation centre, multiple distributors deliver packages that can be consolidated for effective delivery into city areas and an optimal route for delivery is decided. Former reports highlight the importance of the consolidation centre when implementing last-mile delivery systems (Schliwa et al., 2015)(Gudmundsson & Krawack, 2021).

UTILIZING PUBLIC TRANSPORT SYSTEMS

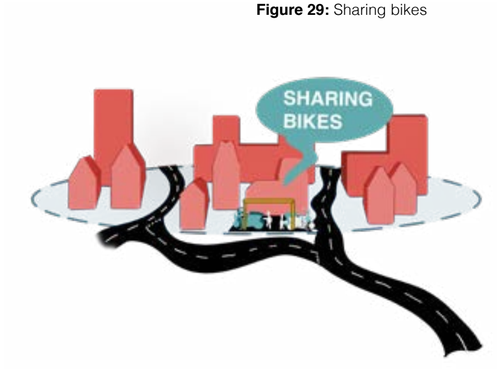
Figure 28: Utilizing public transport



Former projects and research have investigated the possibility to utilize public transportation as a means for transporting packages into densely populated areas (Simonsen et. al., 2018) see ***Interview with Chainge – sharing of ideas***. The suburban trains in Copenhagen operate almost every hour of the day and are only fully utilized in peak times, which mean that there is a great potential in utilizing trains for transporting packages in the off-peak hours.

SHARING BIKES

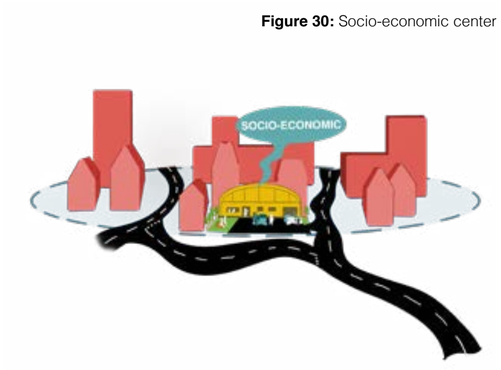
Figure 29: Sharing bikes



The idea of sharing schemes is becoming more and more popular, and the concept of sharing schemes is seen as an integrated part of circular economy. This concept idea is created with inspiration from Miljøpunkts effort to introduce sharing of cargo bikes between the business' in Inner City. Sharing a bike can make sure that the bike is used more often, and thereby provides the most value.

SOCIO-ECONOMIC CENTER

Figure 30: Socio-economic center



Since cargo bikes as a mean for last-mile delivery do not require any license or former education, it opens the possibility to hire non-professionals. This idea of hiring non-professionals has been discussed by Frederiksberg Erhverv as a way of dealing with freight and create jobs.

COMBINATION OF CONCEPTS

To create fully systemic concepts, as required by R2 - Must be constructed as a systemic delivery system, some of the concept ideas could be further developed - or even combined.

To overcome the complexity of an entire delivery system, the system was divided into “Inner City system” and “outer city system”. When combining the concept ideas, the project group would first assess the outer city system, and then the Inner City system.

In further ideation and conceptualisation, no fossil fuel vehicles should have permission to enter Inner City. It was necessary to consider how the links in the outer city could prevent fossil-fuelled vehicles to enter Inner City.

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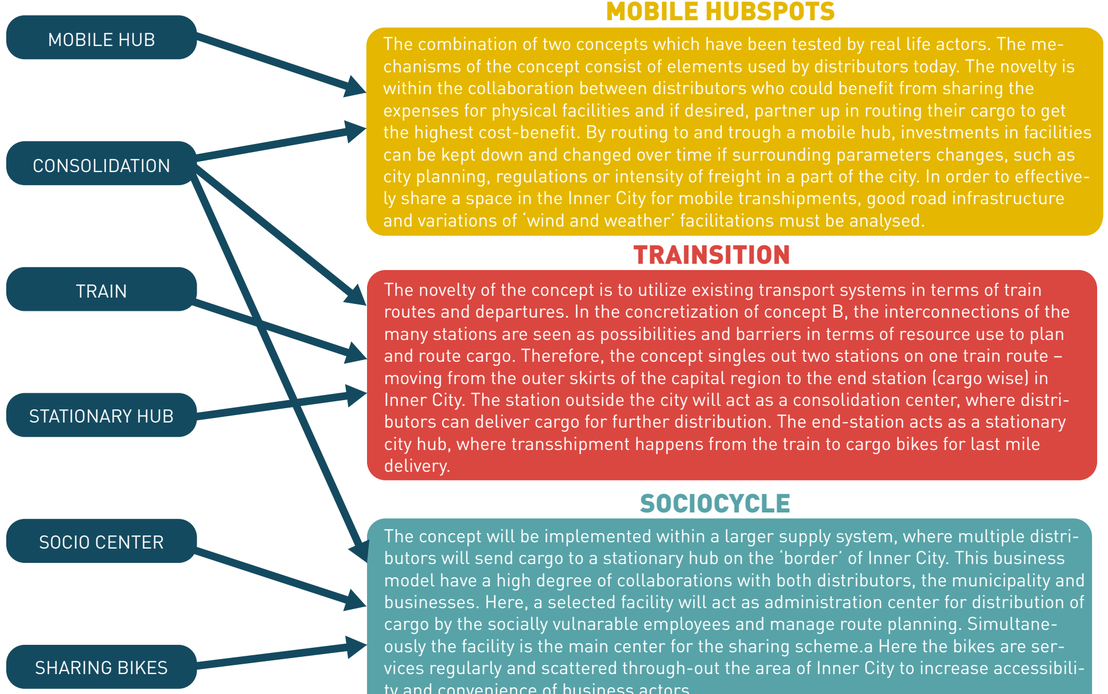


Figure 31: Combination of concept ideas.

PRESENTING THE COMBINED CONCEPTS

After formalising three concepts, it was relevant to describe the flow of the packages. The creation of storytelling can help actors understand the steps in which they could potentially be involved. The idea was to create something that allowed for dialogue with the actors in the following process.

Three worksheets of 'storytelling' were developed, and they can be viewed in the following section.

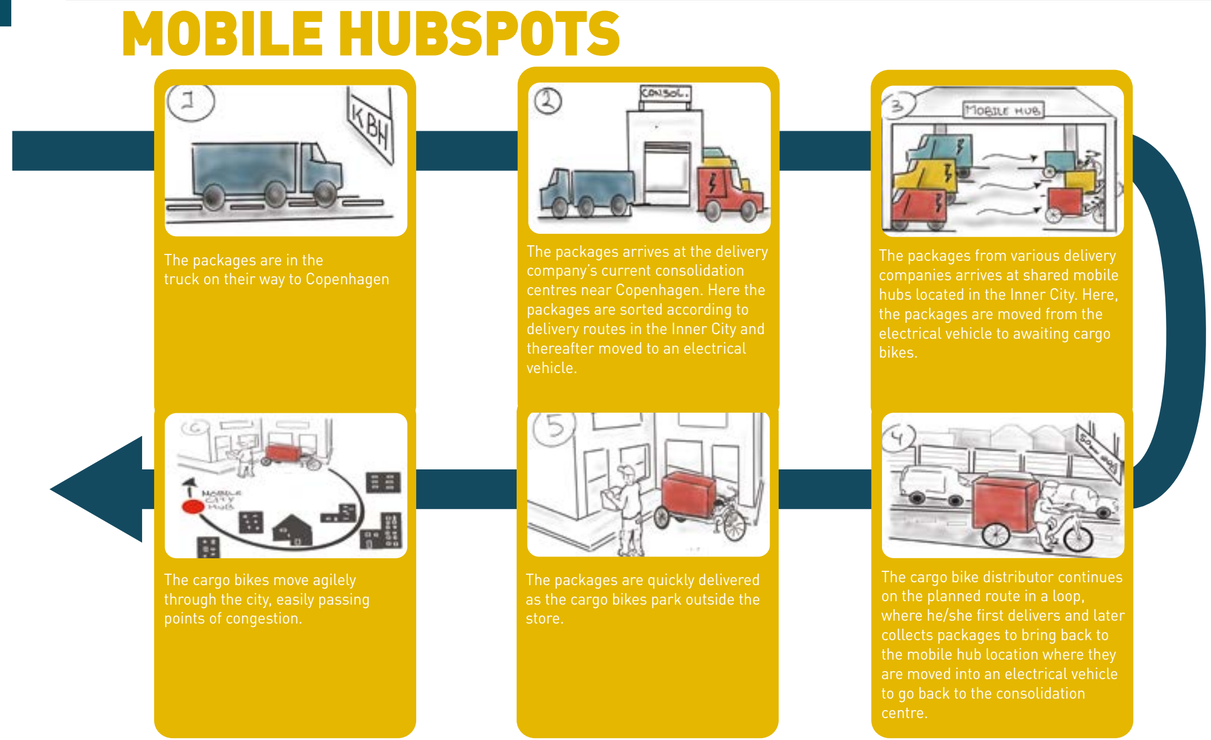


Figure 32: Storytelling Mobile hubspots

TRAINSITION

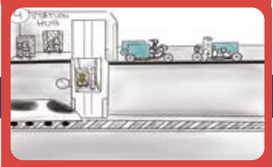
The packages arrive at a shared consolidation centre located at a train or metro station. This consolidation centre is owned by an external company, who also owns a city hub at a station in the inner city.

The incoming packages get scanned in the consolidations centre by the chauffeur and separated into boxes depending on city quarters and possible delivery routes. The packages are now the responsibility of the external company.

An employee of the consolidation centre takes the boxes down to the train. They are put in a dedicated section of the train and the train leaves the station.

Back at the city hub the collected packages are scanned and put in boxes depending on if they need to be delivered in the Inner City or if it is going on a longer journey.

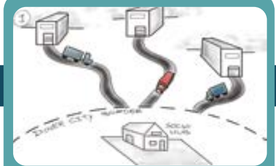
The distributor rides on a planned route, where he/she first delivers and then collects packages to bring back to the city hub.



The train arrives at the Inner City station. An employee of the station takes the boxes out and puts them in the city hub, ready to be picked up. The commercial cargo bike distributor arrives, gets off his bike and takes the box belonging to his route.

Figure 33: Storytelling Trainsition

SOCIOCYCLE



The packages in the truck is on its way to consolidation centres outside of Copenhagen. Here the packages are sorted according to destination - and which needs to go into the inner city. The consolidation centres are owned by the distribution companies.

From different parking spaces in inner Copenhagen, the SMBs can rent and pick up cargo bikes to use in their business. Among other things they can use it for collecting and deliering packages at/to the consolidation center

The packages are transported with a sustainable vehicle to a consolidation centre in Inner City, functioning as a socio-economic centre. Here they are sorted according to routes inside the city, and whether the packages should be distributed or picked up.

From the consolidation centre, socially vulnerable people will deliver the packages to the SMBs in loops and drive back to the centre. Packages to be send from the customers are picked up as well.

The SMBs can choose to book socially vulnerable people that deliver the packages (from the centre) for them, or they can choose to deliver the packages by themselves, by renting/burrowing a cargo bike at the consolidation centre.

Figure 34: Storytelling SocioCycle

DECIDING ON A CONCEPT

Throughout any design process, ideations and selections can produce multiple suggestions for solutions. When producing in groups, different or conflicting viewpoints can result in various perceptions of what the concept is and does. To review the construction and implications of the concepts, the project group initiated a score-weighting method.
Through discussions representing own and fictional personas upon field research, the project groups refined the concepts. This provided more detailed concepts to discuss with key actors.

The following consists of two sections. The first section explains the rating process of each concept and the arguments for their ratings alongside a rating from the personas as spokespersons for the SMBs. The second section introduces a series of interviews and meetings conducted with different actors and their feedback on the different concepts. It was based on these two sections that the project group could decide which concept they wanted to continue with.

INTERNAL RANKING OF THE CONCEPTS

In the following chapter, the rating of the concepts according to their fit with the criteria will be presented. Firstly, the rating based on personas will be introduced, which corresponds to C3 - It matches the personas. Secondly, the rating according to the rest of the criteria will be presented and finally, the result will be presented.

RATING BY PERSONAS

It was important for the project group to include the different SMBs in the ranking of the different concepts. For this purpose, they used the personas, as these were representing the different SMBs in Inner City. The answers being presented are fictive and constructed by the group but constructed by considering the archetype of the persona.

The statements can be viewed in the next pages.

SOCIOCYCLE

"I don't know, it doesn't seem as professional. If the employees don't know what they're doing, it might mess with the time of arrival and that's a 'no go' for me. Do these people even know how to handle my important cargo correctly? But I do like the freedom in having a choice of having it delivered or picking it up. In that way I could decide when I wanted to get or pick something up, and not depend on somebody external. I like flexible offers as they can offer alternatives to my demands. I wouldn't know which bike to choose though, could I get help with that?

TRAINSITION

"It doesn't seem as flexible, I'm concerned there is not enough distributors I can chose from. I always hear things about train delays. What about my 'on demand' deliveries, it would be depending on the schedule of the train. I guess traffic is pretty unpredictable as well, the trains would be able to move around traffic congestions, which I could see value in. The trains could properly carry some of my larger/heavier deliveries, but are there other constraints in getting in and out train stations? I get so annoyed whenever I have to move around all these people in there. But maybe you could find another entrance for the cargo. The train doesn't seem as flexible in its tracks and there are more steps in the system. Potentially this could make the process of getting my cargo more difficult, and who do I talk to if I want to complain?"

MOBILE HUBSPOTS

"If the mobile hubs could make sure that the packages are quickly getting distributed by not leaving them in a storage facility, I could see value in that. I hate when they are left overnight in a storage close to me. What if the van and bike are not present at the same time? I need to know that they can do pick up when I need it, I don't want to wait. But if many companies are part of the system, it would be easier to find a company that covers my demands. If the companies are circulating in the city all day, it could create a better timeframe for me to arrange pick-ups and receive important materials. I like professional solutions, there should be a good digital platform where I can follow their planned routes. I assume they work efficiently, but you never know. Also, I have some freight with larger/heavier items, where I would need a larger electrical vehicle to drive it straight to me. Could they do that?"

DEMANDING DOROTHY

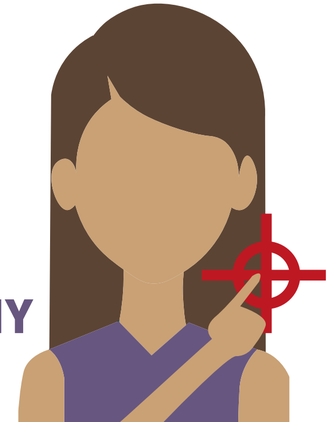


Figure 35: Interview with Demanding Dorothy.

SOCIOCYCLE

"This one I like too. I would both use the socio-distributors and the bike rental. I like to get around the city myself, but sometimes I don't have the time. So if I can both get a service that is emission free and social sustainable I would be all in! I would properly rent the bikes to do material pick-ups and maybe even go out and sell from them. Maybe I would need different types a bicycles for these things. In any case, we are all about pedal-power!"

MOBILE HUBSPOTS

"I think there is a lot of good aspects here. The vans are all electric and drive mostly on the big roads. We should really strive to move around in our living areas by foot or bicycle, or some other way that doesn't create stressful noise and bad emissions. The mobile HUB is pretty cool, we could make extra green areas with space for loading and unloading, and the workers would be outside when they do their job, which would be super nice for them. "

TRAINSITION

"Cool! Public transport is really good, we should all share the same systems to get around. Much less investments and resource use. The idea of using the train stations would leave extra space in the city to do urban re-wilding project.
Cars are really not good you know, so much production for so little usage time. I would definitely use this way of shipping, it is so much more sustainable."

GREEN GERALD

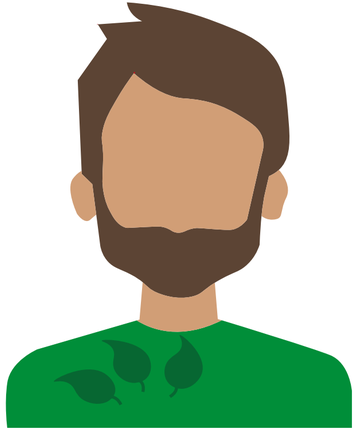


Figure 36: Interview with Green Gerald.

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SOCIOCYCLE

"This one I really like! Seems like I could talk with so many interesting people. And there are people struggling in our community you know. I think they would love to bicycle around the city. I know I would! I always dreamed of having a cargo bike. Cruising around with wind in my hair, smiling and waving to everybody I meet on my way. And I don't have much space in my little shop, so it's perfect that I can just go and get it when I need it"

MOBILE HUBSPOTS

"Okay, that could work, it's like a meeting place right? I always go to these flee-markets and it is so nice to go around and talk with everybody. If all these companies meet and shift packages, would that mean I wouldn't have the same courier every time? I really like the one I have now, she comes in and small talk whenever she have time. The different companies properly wouldn't have time for that. And they wouldn't get to know me and my needs, just throw in the package and off they go to meet the van. Actually, where would they meet? There is so many nice and peaceful spots in the city, and I wouldn't want them to mess up that. "

TRAINSITION

"Actually, a lot of my deliveries are local, mouth to mouth reputation you know. But I get some pretty rare stuff in from all over the world sometimes, so that might as well be with train right? I like public transport, you always meet so many people. Maybe it could be a good way to create more sustainable cargo freight, but it shouldn't take away space from passengers"

SOFT SALLY

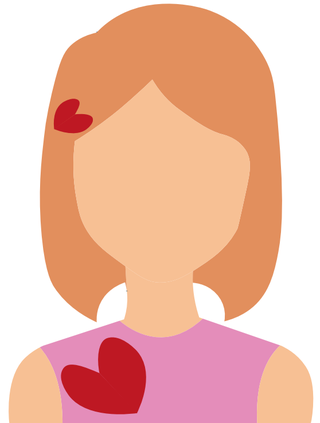

Figure 37: Interview with Soft Sally.

SOCIOCYCLE

"I don't know, shouldn't people stick to what they are good at? I make my business in giving people what they want. I'm like that myself, I don't really need all the add-on. I just want what I need, nothing more. I could give it a shot. Maybe make some business case out of using the sharing bikes to make extra sales. But if the distributors act unprofessional around my business, I would never use them again. I would probably need some recommendations from some of my other business partners before I would give it a go."

MOBILE HUBSPOTS

"I really need my deliveries to be predictable, would it be possible for the companies to plan and be precise as to at what time they are at my business? If many companies are part of the system, they need to talk together so they can give me the best solutions without wasting my time. It should be easier to cover all my freight needs, if so, I could save some time talking with different ones, and time is money! If they could co-operate on their online platforms, I could do all the planning from my office computer or on my phone between meetings. I'm still concerned about the mobile loading and unloading, my business needs change all the time and I need precision."

TRAINSITION

"I can see the business case in this one. The distributors have more accuracy in planning, as they run of the train schedules. I think that could be very precise on delivering at the agreed time. Also, they would be moving around car congestions both on the train AND on the bicycles. There is money to be made in that. I guess it all depends on how many trains that would be operating and how well the train stations are modified and managed. Management with many touch point are hard, I know, I do it every day"

BUSY BUSINESS BENNY

Figure 38: Interview with Busy Business Benny.

Based on these viewpoints from the personas, the project group ranked the different concepts in Figure 39. Further arguments for ranking can be seen in Appendix 9. These results are not giving a perfect picture of the reality but are used as a reference which makes it possible to discuss the different concepts according to different SMBs needs and wants in Inner City.
Because some of the personas were more prevalent in Inner City, it was decided that some of the personas should have a bigger say than others in the ranking. Therefore, the project group estimated the prevalence of these personas based on interviews in Inner City and the survey.
This ended up with two different results as seen in figure 39.

Representation of Personas	20%	50%	10%	20%	SUM
Personas	DD	BBB	SS	GG	
Concepts					
Mobile HUBspots	4	2	3	3	12
Trainsition	2	3	4	4	13
SocioCycle	4	1	5	5	15
%persona on Mobile HUBspots	0,8	1	0,3	0,6	2,7
%persona Trainsition	0,4	1,5	0,4	0,8	3,1
%persona SocioCycle	0,8	0,5	0,5	1	2,8

Figure 39: The concepts are listed and related to the estimated extend of a value proposition for each persona. At the bottom, a percentage of the estimated percentage-wise representation in the segment are added.

As seen in Figure 39 Sociocycle is the concept that is scored highest. Followed by Trainsition and lastly Mobile HUBspots which scored the lowest. These are the scores without the percentage ranking. If this is considered, then Trainsition is ranked highest, following SocioCycle and in the end Mobile HubSpot's, primarily due to the heavy influence of Busy Business Benny.
Both scores will be included in the final rating of the different concepts.

THE RATING ACCORDING TO OTHER CRITERIA

The rating of each of the concepts was done by the project group. In this process, the group chronologically went through each of the criteria, and the concepts were discussed accordingly.
These arguments can be seen in Figure 40.

Criteria ID	Criteria rating	Concept rating		
		Mobile HUBspots	Trainsition	SocioCycle
C1	The main task of the project is to create more space in inner city by reducing the cars in the cityscape, therefore it is essential that a potential concept can reduce car traffic in the inner city.	Depending on the amount of HUBspots trafic could become more intense in areas, but still reduce compared to status quo	The concept would greatly reduce car trafic, as "only" trains are entering the city (relative to category capacity)	Depending on the amount of Socio-HUBs trafic could become more intense in areas, but still reduce compared to status quo
C2	Involving multiple aspects of sustainability, will contribute to conceptualizations that are sustainable in its core. The more aspects of sustainability that are included in a concept, the more actors can be mobilized, as the concept embraces a broader network of actors. It is important for the success of the implementation of a concept to mobilize different actors.	Investment in electric trucks are incremential improvements in the system. Many HUBspots can create nuisance in inner city environment	Builds upon current infrastructure, save ressources and optimize the payload of running trains with few passengers.	Adds more social sustainability and introduced circular economy in the sharing scheme.
C3	As the project has been able to identify different needs of companies which are the actors the concept aims to implement a cargo bike delivery system for, it is a key criterion that a potential concept meets these needs.	See table xx	See table xx	See table xx
C4	Because this semester theme is about system transition, the project group identified this as a very relevant criterion. Before a change in the freight delivery system is possible, it is important that the new system can handle the same number of packages as the old one. This criterion got a rating of 4.	It has the possibility to increase the amount of electric vans and Mobile HUBspots to cover demand.	There could be constraints in the schedule of the train, as in how much cargo that can go in and out before departure	Increase of truck and inclusion of multiple operators for incomning cargo could meet demands. Possible bottle neck in non-proffesionals
C5	Feasibility measures the degree to which the implementation of a concept is problematic for various actors. Involvement of actors requires that actors can see the benefits of getting involved in a concept. If an implementation process is complicated and cumbersome and does not contribute with anything significant for the actors involved, they will not be able to be mobilized in concepts.	Carried out by proffessional operators and to some extend in function today showing payoffs in economy and service	High need of mobilisation of actors and supporters. Investments in modifications need to be secured early.	Could recieve support from mulitple actors. More administrative barriers.
C6	It is good if it can create some disruption and get people to talk and break up the current unsustainable regime. Radicalism in this context is considered to the extent it changes or derails the current delivery system. It is considered valuable, as there is a need for an alternative way of perceiving the delivery system. A radical concept creates novelty value in suggesting –sometimes quirky - considerations and new ways of thinking, and it is the radical solutions that create radical change.	Aspects of the concepts are currently used. Considered incremential improvals to current system.	Breaks from current system perception of moving cargo around in cities by trains.	Has novel elements in relations to cargo distribution by non-proffessionals and value propersition in sharing cargo bikes between businesses.
C7	It is not as important as the things surrounding the inner city is more important in this particular project. It would be nice, but if it happens at the expense of e.g. more traffic in inner city, it is not a good thing. Concepts that can be scaled up to a larger or different area would have the potential to further reduce car traffic, and greater CO2 savings.	Going out in more rural areas, mobile hubs could be great in keeping costs down on facilities and still be able to offer sustainable cargo bike services.	As train infrastructe cover large parts of Denmark, it could be rolled out. More actors would have to be invovled and the complexity of route planning and modifying stations would increase	The concept need supporters both from public and private sectors. Critical mass in costumers could exclude some areas.
C8	The world changes constantly, if it take too long to implement it might not be a good solution at the future point in time. Future technology changes the conditions for what is profitable for companies to use the delivery system. However, it should not damage a concept that it takes e.g. 1 month more to implement than another (we are speaking years difference).	Fast to implement and possible to incorporate near future technologies as to vehicles and on/off-loading technologies to better the concept	Modifying current trains could time costly possible become obsolete or a bad investment, if trains are replaces.	networks and partnerships between pubplic and private actors could take time to estblish. Could become a very opinionated concept to roll out in the city.

Figure 40: Full overview of the concept ratings

ADVISEMENT ON CONCEPTS

The project group established contact with the different actors to get feedback on the concepts. The meetings were staged in different ways, based on what was possible for the different actors. In all the concepts the storytelling was used as an intermediary object, which was circulated between the different actors.

The following section will explain how each meeting was facilitated. The key points from the meetings can be found in the tables presented to each meeting.

See all notes from the meetings in Appendix 11.

MEETING WITH MILJØPUNKT

Since Marianne was the main collaboration partner in the project, it was important to get her feedback on the different concepts. The meeting was staged in an online setting where the storyline from each concept was explained. Throughout the meeting, Marianne gave feedback on different elements in each concept and pinpointed problem areas.

Marianne liked SocioCycle the most.

MEETING WITH COPENHAGEN MUNICIPALITY AND MILJØPUNKT

The focus of this meeting was to present the three concepts to Tanja Maria and negotiate the municipality´s role in them. The meeting took place in an online setting, where both Tanja Maria and Marianne discussed and gave feedback on each concept.

Actor	Feedback	Action points (based on ideation)
Copenhagen Municipality	Prior experiences in dialogue with large distributors indicates that collaborations are difficult	- Analyse for pressure and relief points - Workshop with matters of concern
	Brand & identity factors amongst distributors are important and there is resistance to do cross-overs	- Re-branding possibilities, tell the story of sharing - Resource management and environmental responsibilities
	Concerns about insurance in transhipments between actors has been raised before	- Involve industry and insurance companies
	Parking of cargo bikes is still an issue	- Miljøpunkt & KK are in dialoque to create a parking spot – initiate visibility project
	HUB's should not be placed where "peaceful zones" are placed, but must still be close to critical infrastructure (main roads etc.)	- Close contact in ideation and implementation with city planning departments.

Figure 41: Feedback from Copenhagen Municipality.

MEETING WITH BYUDVIKLINGSGRUPPEN

Marianne arranged a meeting with Byudviklingsgruppen, that previously had been involved in the project. The meeting took place in an online setting, where each concept was explained in detail. Several members of Byudviklingsgruppen gave feedback on the concepts.

Actor	Feedback	Action points (based on ideation)
Byudviklings-gruppen	Make these cargo bike strategies more visible for, and acknowledged by, business owners	- Network meetings , Campaigns - Interressment devices (cargo bike pop-up events
	Parking houses which do not run at full capacity and could be utilized for cargo transhipment	- Analyse for accessibility in spaces like parking houses.
	Get the industry involved from the beginning. Initiatives which are being forced upon them results in resistance in acceptance.	- Stakeholder network meetings - Partnerships

Figure 42: Feedback from Byudviklingsgruppen.

FEEDBACK FROM BRING

It was not possible for Henrik from Bring to participate in a meeting. Therefore, the project group made it possible for Henrik to give written feedback on the different concept in an email. Henrik mailed back with feedback on difficulties and opportunities in each concept.

Actor	Feedback	Action points (based on ideation)
Bring Courier & Express	The idea of using train logistics in the city are fine, and could open back up collaboration with DSB to send express parcels	- Involve DSB and other relevant actors from train logistics
	Sorting cargo in the early morning hours could interfere with rush hour train passengers	- Research to what degree sorting can happen during the day and night - Look into facility operations – physical limitations
	Trains and stations are not designed and organised to handle cargo	- Develop the concept toward meeting these criteria in low impact solutions
	Ensure that cargo meant for distribution in Inner Copenhagen are kept within Copenhagen (current issues of driving cargo out to drive it back in)	- Create partnership with local actors to communicate and mange distributions

Figure 43: Feedback from Bring

MEETING WITH CHAINGE

This meeting took place at Chainge´s facility in Copenhagen. The project group presented the storyline of each concept to Torben and received feedback throughout the meeting. Torben stated that he was ready to take part in SocioCycle, with help from the municipality.

Actor	Feedback	Action points (based on ideation)
Chainge	To avoid centralising traffic around HUB's, scattering them into smaller HUBs around the city could be an option	- Analyse for cargo streams and city planning
	It will be hard to coordinate the timing of vans and cargo bikes transshipments in the mobile HUB's. Costly if they are wait for each other	- Plan & prepare for delays - Utilise hours where traffic is light - Estimate with expert knowledge
	Usually, it is hard to find facilities in Copenhagen. More free spaces due to Corona	Seize the opportunity, act now!
	Utilising public transport for cargo would make sense. Stations could be adapted but things like elevators (underground stations) could be difficult.	- Pre-pack cargo boxes that are closed and fit directly on a bike - High attention to security and safety.
	The only thing that can carry the capacity of a heavy truck, is a train	- Activate new train business models
	Societal elements could create administrative difficulties in terms of efficiency. Possible reduction in margin.	- Emphasis on good managers - Support from municipality is crucial
	Electric Bicycles should be parked inside overnight (Theft and thermal conditions)	Ensure locations for inside parking or ensure that batteries can be removed and kept inside.
	Economics in sharing schemes can be difficult. Service and maintenance are high, must be rented out a high percentage of the day	- Design for durability - Research a network-sharing partnership - Broaden the costumer segment to SMB's and
	Rentals and sharing products often have a shorter lifetime expectancy, as they are treated bad.	- Take pictures of the bike before and after use (in app)
	It could be undesirable for business, if they have to spent too much time and getting and returning the bike.	- Place as many bikes around the city as the business case allows
	In which cases would it be better to use a shared cargo bike, rather than a shared electric car?	- Create awareness around positive side effects of bicycling and resource consumption - City developments might change this perception
	When planning for the use of electric vans, in any case, that needs to go in and out of the city day-out-day-in, range ang charging times becomes a key factor	- Develop and collaborate in business models of battery or vans shift in between loading/unloading

Figure 44: Feedback from Chainge

INTERVIEW WITH LET'S GO

The interview with Christian from Let's Go was conducted by telephone. This meeting aimed to get feedback on the sharing part of SocioCycle since Let's Go had experience within this area.

Actor	Feedback	Action points (based on ideation)
Let's Go	We provide different types of cars, to accommodate different user needs	- Introduce multiple types of bikes in the sharing scheme
	We have set a target of having maximum 150 m between our cars to meet requirements of convenience.	- Ensure same measurements when creating a cargo bike sharing scheme in areas with high usage
	There should be a cluster of sharing vehicles within a radius of 500 m to accommodate convenience of costumers	- Ensure same measurements when creating a cargo bike sharing scheme in areas with high usage

Figure 45: Feedback from Let´s Go

UTILISING FEEDBACK ON THE THREE CONCEPTS

Since the actors had given relevant feedback to all the different concepts, it was decided to spend time refining each of the different concepts before choosing a final concept.

This is explained in the following chapter.

REFINING MOBILE HUBSPOTS

The concept can be implemented and be operated with a short timeframe due to the aspect of mobile transshipment between vehicles. The physical requirements depend largely on the ability to locate suitable “spots” around Copenhagen, but in specific Inner City. Easy access, yet exclusion from peaceful areas is crucial, along with sheltering features surrounding the loading/unloading process. The concept is to some extend tested and used by distributors today (i.e., Bring couriers & express)
The following points were the main takeaway from the feedback:

- Ensure dry transshipment spots.
- Requires close collaboration between the private and public sector, when determining the location of the transshipments.
- Multiple spots for mobile transshipment to diversify risk and opportunities.
- Back-up storage facility for unforeseen circumstances.
- Ensure desirable proximity to the main road network and city access areas.
- The planning and packing of cargo should be designed to be as quick as possible to be transshipped between vehicles.
- New specialized loading/unloading systems could increase efficiency.
- Strong partnerships must be ensured from the beginning. A business model where individual operators retain value and brand their identities are crucial.

REFINING TRAINSITION

The concept is more radical in its profile and demands higher attention towards developing and adapting physical parameters and operator behaviours. The concept offers a different value to the “green transition of road transport” by offering the possibility to re-invent the use of trains for freight and reducing traffic. Consequently, this means that the concept to some extend draws focus away from cargo bikes. The following points were the main takeaway from the feedback from the actors:

- Mobilisation of actors within the private distribution segment should consolidate to meet with actors from the municipality and region. Additional support could be gained through POGI, which is a partnership for public ‘green’ procurements with ambitions of driving the market towards low impact solutions (Forum for Bæredygtige Indkøb, 2021).
- Transform train stations and trains with low impact solutions on

physical changes.

- Standardization of small containers, which can be operated through train stations, on and off the trains and placed on bikes.
- Identify stations where current facilities allow to move pallets through.
- Identify areas with the highest flow of cargo to improve the return of investment. Trains can carry high capacities and replace trucks going in and out of the city.

train stations, on and off the trains and placed on bikes.
- Identify stations where current facilities allow to move pallets through.
- Identify areas with the highest flow of cargo to improve the return of investment. Trains can carry high capacities and replace trucks going in and out of the city.

REFINING SOCIOCYCLE

The concepts are in line with multiple public initiatives such as active healthy living, reducing noise and increasing interactions in communities as well align with Miljøpunkt’s environmental agenda in 2021, effort 3.2.2: “Do experiments with sharing schemes for emission-free transport vehicles for businesses” (Miljøpunkt, 2021, p. 4). This is, of course, not decisive for a sustainable transition of deliveries, but an important aspect of the project at hand, and the scope of the project.

- High level of municipal participation.
- Socially vulnerable employees are often in public programs.
- Ensuring spaces throughout the city for parking bikes
- The cargo bike portfolio should consist of various types to meet user requirements.
- Batteries are maybe less necessary in the sharing scheme, as users are not likely to bike all day every day.
- Where batteries are needed, they should be collected at night to avoid theft and thermal shifting conditions.
- Include a responsibility aspect in the sharing scheme. Returning in the same conditions and liability can reduce service and maintenance cost.

CHOICE OF CONCEPT

The following section will elaborate upon which concept the project group will continue their detailing of.

Since the main collaborator of this project is Miljøpunkt, their opinion of the final concept was crucial to include in the selection process. Of the actors contacted, their weighting of the concepts did not show a clear favourite. Thereby, when combining both the feedback from Miljøpunkt, the feedback from other actors and the internal scoring of the concepts, SocioCycle stands as the “winning” concept. This concept will therefore be refined further in the following chapter.

DELIVER

DETAILING SOCIOCYCLE

The following chapter contains a detailed description of the SocioCycle.
Firstly, the project group will show and discuss how the SocioCycle is also creating a new network, where new relations are explained. Secondly, it will be discussed to what degree SocioCycle can handle the same capacity as the former system. Thirdly, some of the implications of the concept will be discussed and practical solutions are proposed. At last, an action plan for realising SocioCycle is presented.

NEW ACTOR NETWORK

Figure 46: New actor network

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NEW ACTOR NETWORK

The project group described earlier how the network is stabilized around vans and trucks as the mean for freight delivery. However, for this project, the interesting part is not just mapping the current system but assessing what relations will need to change when implementing the new system with cargo bikes. Therefore, in the new network, the cargo bike is positioned as the primary means of delivery within the Inner City. The main takeaway is that before SocioCycle will be functional and dominant, multiple relations will have to be changed and/or established, with the inclusion of new actors that should be enrolled and mobilized.

THE RELATION BETWEEN PACKAGES, CARGO BIKES AND SMBS

The cargo bike does not have the same capacity as vans, which means that the packages in the new network must accommodate this change. Hence, it should be ensured that packages are packed according to the dimensions of the cargo bike. Since the shipment of packages become smaller, the SMBs will need to adjust accordingly and will have to receive smaller, but more frequent deliveries.

In the first network, it was shown how packages currently are packed in cardboard boxes that were much larger than the product itself. Since the space is limited when using cargo bikes, this problem is becoming more of an issue in the new network compared to the old one. It is acknowledged by the project group that this specific issue can become problematic if not solved in the new network.

THE RELATION BETWEEN THE SMBS AND THE CARGO BIKE

The SMBs that want to take part in delivering their packages, will establish a new and closer relation to the cargo bike. Since the SMBs will be operating on the cargo bike, they will need to gain knowledge within the operation of them.
Furthermore, they will need to adopt a new way of delivering and planning distribution, so that it fits the specifications of the cargo bike. However, in return, they will receive the benefits of the cargo bike such as a possibility for green branding, on-demand delivery, and more autonomy in terms of how their packages are delivered.

RELATION BETWEEN CARGO BIKES, PARKING SPACES AND THE MUNICIPALITY

As discussed in the previously presented network, parking lots in Inner City are always occupied, resulting in even more traffic and illegal parking of delivery vans. In the new network, parking lots for cargo bikes will be strategically located in the Inner City, so that SMBs will be able to easily access a cargo bike close to their location, and the number of cars allowed in the Inner City will be limited (We Do Democracy, 2019). However, these parking spaces will take up much less space than parking spaces for cars, allowing for more space to be provided to the other users of the city. The Copenhagen Municipality will have to create these parking lots for the cargo bikes.

RELATION BETWEEN BICYCLE LANES, CARGO BIKES, THE MUNICIPALITY AND OTHER BICYCLISTS

Shifting all small and medium-sized deliveries in Inner City to cargo bikes will result in an added pressure on the bicycle lanes of Inner City. Eventually, this could result in the emergence of negative relations with other users of the bicycle lanes, as these would have the possibility of becoming too busy and congested. Therefore, the project group also identified other bicyclists as a relevant actor in the network. It would therefore be needed that the Copenhagen Municipality engages, as they have the power over the bike lanes.

RELATION BETWEEN THE CARGO BIKE, THE SOCIOCENTER AND THE WORKERS THERE

As a newly introduced actor, the socio-Center will take on the role of the consolidation Center. The Center will have the responsibility of logistically sorting the packages so that they are packed accordingly to where in Inner City they are to be delivered. For the socio-Center to consolidate according to locations, they must have clear communication about how much each cargo bike can hold so routes can be adjusted to bike capacity. The socio-Center has a relation to the workers as the Center should be inclusive of more social groups. Thereby, it will be important that e.g., flex-workers and other people finding it difficult on the job market can be included.

In the network, it has been identified what should change before this new network can be stabilised around the cargo bike as a mean for delivery. It is identified how many of the previous negative effects (such as pollution and chaotic atmosphere due to congested roads) have been diminished. However, possible problematic elements have also been identified in the new network. These are necessary to solve before the new network can be mobilised. It is important to remember that this network is yet not mobilised. The project group will later present an action plan, for which actions should happen before the new network can be stabilised.

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CALCULATING THE

To investigate to what degree the new system can live up to current expectations regarding the capacity of deliveries, the project group has calculated how many cargo bikes will be needed to fulfil this need.
As mentioned, the maximum capacity of the current system, based on the number of vans currently going into the Medieval City, is 34.500 m3. However, as has been discussed, this amount is only realistic in the case where the capacity of the vans is fully utilized. Multiple sources have assessed that the vans are rarely operated at full capacity (Greenfort, 2017)(Gudmundsson & Krawack, 2021). Therefore, it does not make sense to estimate the number of cargo bikes needed based on the maximum capacity only, as this most likely is not the real capacity of packages being delivered. To deal with this, the project group has calculated the total capacity of the system needed based on different percentages of utilized capacity, as seen in Figure 47.

These calculations are based on multiple assumptions – such as average trip length, type of cargo bike and number of hours the bike is active during a day. These are all assumptions that could drastically change the number of cargo bikes needed.

Taking the 57% utilization noted by Dansk Erhverv, using the cargo bikes currently used by Chainge (with the capacity of 1 m3) being utilized completely and with a daily running time of 12 hours a day, assuming one trip takes 45 min, the number of bikes needed for fulfilling the need is 1078. Furthermore, it should be noted that this number assumes that the cargo bikes will handle 100% of the current delivered capacity of vans, without thinking about the size of the packages. According to Wrighton & Reiter (2016) 50% of the current deliveries could be transported by cargo bike. If this number is applied in the calculation the result will be 614 cargo bikes.

Utilized capacity	90%	75%	57%	50%	40%	25%	10%
m3 a day	31050	25875	19665	17250	13800	8625	3450

Figure 47: Calculation of total m3 per utilized capacity

SOCIOCYCLE FINAL DESCRIPTION

This would seem like a rather high number of bikes, especially as even more bikes will be needed to provide the second service of SocioCycle (renting cargo bikes). It could thereby be discussed what could potentially happen to current regulations for this to be more feasible.

Currently, the bikes are not allowed to exceed 3.5 meters in length. This has been mentioned by actors as rather short compared to what is possible to drive. Therefore, if this regulation was to change, and an extra trailer could be put on the back of the cargo bikes, each bike would be able to carry up to 2 m3. Consequently, the number of bikes needed to reach the current capacity would be halved.
See the full calculation in appendix 10.

In the following section, the project group will present the concept 'SocioCycle' in more detail. The process of implementation is described in ***process of implementation***. In the process of implementation, Miljøpunkt Indre By & Christianshavn are mentioned as change agent.
The project group considers Miljøpunkt as an entity of expertise in driving a 'green' transition in Inner City and a key actor in mobilising relevant actors and partners. The concept can be considered a 'hybrid' in its business model approach as it has many different offers to various customers and partners. It will enter a market where few big actors share a large portion of the market (Finans, 2019). Small, new actors have entered to take care of what, by the bigger distributors, is considered 'unwanted' distribution categories, like subscription-based fresh food and other direct deliveries. These categories include multiple stops on routes, sometimes consisting of low value (distribution charge) packages, which makes the Last-Mile Delivery (LMD) uninteresting from an economical perspective for the big distributor companies.

The project group see SocioCycle as a suitable business model to implement in Inner City, as it consists of elements that could bring value to both businesses, people and the environment - while placing itself to take care of distribution within Inner City which is usually not a profitable business for bigger distributors.

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The SocioCycle Centres are to be placed in the outer area of Inner City, from where consolidation and distributions are managed. Furthermore, this will be the 'headquarter' of a sharing scheme for the rental of cargo bikes, both for companies and private. Both segments are included to ensure maximum usage of bikes and secure profitability.

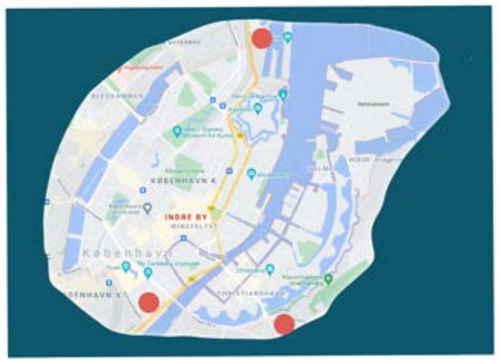

Figure 48: The red dot represents possible locations for the SocioCycle Center. These are placed close to large roads and away from peaceful areas, where the stream of transportation with larger electric vehicles are less likely to cause interference with vulnerable road users.

Figure 49: The blue 'beaming' dots represent possible locations for 'bike sharing'-stations. These should be placed conveniently close to businesses and public infrastructure.

SYSTEM VIEW

The system perspective in the following concept considers the SocioCycle Center as a sub-contractor. This concept offers both pick-up and delivery services and as a sub-contractor, it manages the LMD to businesses in Inner City. The last part (of larger distances) of the logistics service is often costly for the distributor due to the time consumption relative to earnings per stop and go. In some cases, it can represent most (53-75%) of the distribution costs (Xiao et. al., 2017).This as the service of the companies is often to provide the entire logistics chain from point A to B, and the alst part of the route often takes longer time, thereby resulting in more lost driver-time.

Each distribution company need individual systems in the part of the logistics chain that is defined as LMD, which results in several distribution Centers in the Capital Region, that provide the same service. The low degree of consolidation between the distributors in LMD makes this link a costly process in terms of salary as well as more problematic logistics. Hereby the concept is considered a possible cost-out solution for distribution companies, where the last link is handled for them at a competitive price while maintaining customer channels. It is considered not only as an economic advantage for distributors but also as an opportunity for them re-consider their vehicle fleets and future market advancements, while also having the opportunity to brand themselves on the contribution to a “car-free city”. By sub-contracting, responsibilities and insurances of the cargo (CMR – carriage of goods by road) can be pre-determined, which can otherwise be a barrier in having larger distribution companies’ hand-over their shipments between actors or in consolidation Centers (Appendix 11).

BOOKING SHARING BIKES

As companies can decide whether their packages should be handled by themselves or by non-professional socio-distributors, the decision will probably be determined by 1) the company’s available human resources, and 2) the price difference between the two options (See Figure 50 for calculation examples).

The cargo bikes that are located around Inner City can be booked as an annual subscription. An annual subscription is supposed to make sharing bikes attractive to companies for the use of package delivery, while private use is paid by the hour. With an annual subscription, the bikes can be booked a year in advance. With this feature a company can book the bikes for a regular day in weekly deliveries, ensuring availability of preferred bikes and security in relying on the system. Another way of ensuring the bikes accessibility to companies could be to reserve a number of the bikes exclusively for customers with annual subscriptions.

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Cargo bikes without electricity motors could be offered at a cheaper price than the ones with motors. This will make the incentive to use mechanical cargo bikes more attractive, and the company will actively consider whether it is a necessity that the bike is electrically powered, depending on the distance and the purpose of renting the bike. Purchasing mechanical cargo bikes will be cheaper for the SocioCycle Center than electrically powered bikes and make start-up costs lower. This consideration might also contribute to reducing unnecessary resource consumption, as not all trips or purposes for renting cargo bikes depends on the electrical motor. In the perimeter of Inner City fx the purpose of the renting bike could be to move larger items over short distances or creating new business models (selling from a still-standing bike etc.).

In addition, mechanical cargo bikes can contribute to other aspects of user needs. There may for example be personal incentives to choose a mechanical bike over an electric one. For the environmentally-conscious customer, the choice can be justified by the fact that the battery of an electric bike is partly built of critical materials. Furthermore, for active, health-conscious customer, mechanical bikes can provide purposeful exercise.

SHARING SCHEME

As different cargo bikes can accommodate different user needs, it must be considered which bikes are available at the bike-sharing stations. A business with smaller quantities of packages, such as Soft Sally’s business, might not need to have packages delivered in large and technical advanced cargo bikes, which can cause barriers in user adaption and contributing to crowded bicycle lanes.
For archetypes like Soft Sally and Green Gerald, smaller cargo bikes should be available, whereas companies with larger quantities of packages need larger cargo bikes with high payloads, to be available. The need for electric cargo bikes being a possibility at the bike-sharing stations could be present, as mechanical bikes can make delivery less efficient, and too cumbersome for companies. To mobilize companies to use the system, it must not be too difficult to use (appendix 11). The availability of electric bicycles will require further administration from the sociocentre, as the batteries on the bikes will have to be replaced with charged ones if the bikes cannot be charged directly at the bike-sharing station.

Likewise, the electric bikes should be parked in a temperate room to avoid excessive maintenance costs of damaged batteries (appendix 11). To further avoid maintenance costs, the cargo bikes for the bike stations could be specially designed for durability, as they will be exposed to wear and tear by users with no ownership-relations as well as by different weather conditions.

To mitigate the risk of customers being careless with the bicycles, a requirement of taking pictures before and after the lending period could be required.
This will make customers more aware of whether they are damaging the bike during use. If controlled by a mobile app, this could include an unlocking and locking feature with Bluetooth to avoid handling of physical materials (Freetrailer, GoMore, LetsGo etc.).
The location of bike stations must be at convenient distances from business (See figure 49). For this reason, Let's Go has a goal of having their cars placed 150 m between each or a cluster of cars within a radius of 500 m (appendix 11) It is important that the bikes have fixed stations where they can be parked, so companies always know where the bikes can be found and from where they can be unlocked and locked again.

To locate these stations, it is advantageous to involve various public and private actors who can be helpful in identify room for the stations in inner Copenhagen. The municipality of Copenhagen is a key actor, as they have the power and overview to create the space, as well as the interest in making a change in inner Copenhagen happen. Private actors can contribute with unused space where the bicycles can be parked, such as parking garages, department stores, etc. It should be considered which actors would be able to contribute with an alternative suggestion to bike-sharing- stations

LOCAL PERSPECTIVES

As personal relationships with distributors were considered valuable by some of the SMBs in Inner City, it would be beneficial to strive for the individual employees to have fixed routes and deliver to the same customers.
This would contribute to a sense of community for SMBs. This sense of community is also supported when the businesses handle their packages and can strengthen the business relationship with customers, and thus act as an effective marketing strategy, as well as promoting cargo bike delivery.

SOCIOCYCLE CENTER

The socio-center could be owned by a professional distribution operator and establish strategic partnerships with a business- and trade organization (potentially Copenhagen Commerce & Culture, KCC). The advantage of such a partner would be, that the centre could mobilize an already existing network of businesses to gather critical mass in the customer portfolio.

It is essential, that the SocioCycle Center can create a turnover that makes the business plan profitable, as the previous project with public funding in City Logistic projects has shown to be hard to manage after public funding or involvement has been terminated: "A large number of the specific city logistics projects have been initiated or

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supported of public bodies in different countries and cities, and many of these have had the character of pilots or trials. However, a large proportion of these projects have ceased to exist when the public support has ended" (Gudmundsson & Krawack, 2021, p. 14).
Furthermore, the operator of the centre must have the fundamental experience and competencies in operating distribution and employees, while having the capacity to support socially vulnerable employees. The unprofessional employees at the centre should have certain training by professional distribution managers. The ones with needed considerations toward their physical or mental state should have professional guidance available from social workers. Chainge has shown interest in a trial of facilitating such a centre, in a possible collaboration with the municipality of Copenhagen (appendix 11). The cargo bikes used by the employees at the SocioCycle centre would probably mainly consist of bikes with electric motors and high payloads as the staff would drive with larger quantities at a time, to several companies, in loops. The bikes will be parked indoors to accommodate theft and temperature issues that could damage the batteries on the bikes.

There is a certain requirement for the size of the socio-centre as it must be able to accommodate all small and medium-sized packages to the inner city. Realistically, it may be necessary to have multiple centres located in areas close to optimal infrastructure.

SOCIO-ELEMENTS

The employees at the socio-centre involve a combination of socially disadvantaged, students, unemployment benefit recipients, and flex workers. In addition, there will be professional administration for route planning, package sorting, etc.

For the socio-centre to be financially viable, professional employees must be also involved, as the centre cannot be handled by inexperienced and unskilled professional groups exclusively.

To compensate for the inconveniences caused by unprofessional employees, there should be financial support from the municipality.

SMB COST OF DELIVERY

The final concept proposal of the project, SocioCycle, has two approaches to deliver value on different parameters for the SMBs. The selection between sticking to current distributors who could provide similar services (pick-up and delivering of packages) and the SocioCycle services are dependent on cost along with the perceived value in comparison. To obtain insight into what a cost structure might look like, the project group performed a simple calculation, with high uncertainty, as to what the SocioCycle might be able to charge customers as well as the internal cost of switching the operation of pick-up/ delivery to own employees. The further economy in establishing and running the SocioCycle Center and sharing scheme is not calculated.

POSTNORD (PN) CURRENT DELIVERY IN VAN

To compare solution and prices, the project group selected the 'PostNord packages'- service and price list according to weight (Postnord, 2021).

The LMD cost is set upon literature review and estimates. Many cases focus on capacity and categories along with CO2 reduction. Hence, the possible savings for larger distribution companies switching to cargo bikes for LMD are less described. Xiao et al., 2017 suggest savings in the interval 53-75% (in China) and Wrigthon & Riele (2016) refers to The City Log project where inner-city consolidation centre has demonstrated that 20% of the process cost and more than 80% of motorised courier trips could be replaced by cargo bikes (p.956).

PN Current delivery in van

Item cat.	Weight (kg)	Price (DKK)
Package 1	0,5	34
Package 2	1	35
Package 3	2	40
Package 4	5	45
Package 5	10	55
Package 6	15	68
Package 7	20	85
Package 8	25	95
Package 9	30	110
Package 10	35	120
10 PCS.	143,5	687

(DKK) Total cost		687
LMD cost	55%	377,85

Socio distribution

Item cat.	Weight (kg)	Price (DKK)	Post
Package 1	0,5	125	Adm. cost relative to delivery trip
Package 2	1		
Package 3	2		
Package 4	5	110	Pay pr. hour socio-distributor
Package 5	10		
Package 6	15		
Package 7	20		
Package 8	25		
Package 9	30		
Package 10	35		
		(1 hour)	
10 PCS.	143,5	235	

(DKK) Cost PN (45% of their total)	309,15
(DKK) cost socio del.	235
(DKK) total system delivery Cost	544,15

Sharing scheme

Item cat.	Weight (kg)	Trips made (same day)	Anual subscribtion (DKK)(1 day/week)	Employee cost (DKK/hour)
Package 1	0,5	1	5000	125
Package 2	1			
Package 3	2			
Package 4	5			
Package 5	10			
Package 6	15			
Package 7	20			
Package 8	25			
Package 9	30	1		
Package 10	35			
			(52 weeks)	(1,5 hour)
10 PCS.	143,5	2	96,15384615	187,5

(DKK) Cost PN (45% of their total)	309,15
(DKK) Total cost of renting and transporting cargo	283,6538462
(DKK) total system delivery Cost	592,8038462

Figure 50: Calculation of expected cost of using the system for SMBs, compared to the cost of current options.

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SOCIO DISTRIBUTION

The pricing for the SocioCycle distribution service is set upon having administrative cost related to making each trip possible; rent, energy bills, service and maintenance, sorting and route planning, in-house personal and more.

Further, an hourly rate of the employee on the bike is set. In the simple estimate calculation, it is expected that the remaining 45% cost from PostNord is added to the service cost, to give an estimate of the whole distribution service from order- to receiving the packages.

SHARING SCHEME

In the sharing scheme, it is framed that a shop would like to collect their packages at the SocioCycle centre. The shop has an annual subscription of using a cargo bike 1 day a week. This bike has potentially less capacity than one of the distributors. Therefore, 2 trips to collect the packages are estimated, along with time used exclusively on the route.
The remaining hours of the day, that the bike is rented, could be used for other purposes, and increase the economic profitability of the annual subscription.

As introduced, the economic estimates of cost for the SMBs are highly uncertain, and mainly serves the purpose of highlighting aspects of considerations to managing and selecting options of cargo transport methods for the SMBs. The LMD cost that the professional large distributors would save by sub-contracting with SocioCycle, could become the potential earning percentage of the SocioCycle Center. The cost of running the Center and providing new value propositions to the SMBs in renting schemes are determined by the structure of the business models.

ACTION PLAN

The project group decided to create an action plan, that describes relevant actions to be executed to realize the SocioCycle. Following the action plan is considering the next steps in terms of what, how and who is involved in each step.
The first couple of steps will be initiated by the project group. However, eventually Miljøpunkt would take over the project to facilitate the project as the change agents.

After the location of SocioCycle Center has been settled, and internal structures of the Center is established, initiatives to investigate how the concept can be scaled, would be ideal. Once the scalability of the concept is documented, other municipalities should be introduced to SocioCycle. However, SocioCycle should be tested and iterated upon for a few years, before trying to actively interest other municipalities.

The scalability should not be driven by SMBs alone, but to a high degree be incentivized by the different municipalities. A possibility could be for Copenhagen Municipality to invite other municipalities into different workshops, relaying their experiences with the concept to them, thereby interesting other municipalities in the change process.
The full action plan is seen in Figure 51,

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		WHAT SHOULD BE DONE?	HOW SHOULD IT BE DONE?	BY WHO?
TO IMPLEMENT THE CONCEPT	1	Investigate how to execute the sociocentre	Establish a negotiation space with relevant actors.	Miljøpunkt, Distributor, KCC, KK, Group 7 AAU
	2	Decide on a placement of sociocentre	Look into what is possible with the current infrastructure and where it should be placed to be most effective	KK, city planners, Distributors
	3	Find out who should run the sociocentre	Investigate and identify potential business that could be interested.	Miljøpunkt, KK, Distributor
	4	Decide on parking spaces for sharing scheme	Look into possibilities in connection with city trials, private partners, other corelating projects, governmental initiatives etc.	KK, Miljøpunkt, Private partners
	5	Establish what bikes to buy for the sharing scheme and the sociocentre	Investigate the needs among SMBs to ensure that the bikes cover these. Maybe a variaty of bikes will be needed to fulfill different tasks.	Distributor, producers of bikes, networks through Kia (Region CPH), SMBs
	6	Find out who should work there	Discuss the possibilities for including people that otherwise would not have a job.	Professional managers, Social workers, KCC, KK, Miljøpunkt, distributors
	7	Interest SMBs and distributors in making use of the centre and/or the sharing scheme	Discuss what should be done; should there be regulatory changes? Could economic incentives be created?	KK, Region CPH, Borgersamligen, Byudviklingsgruppen, City planning, KCC
TO SCALE THE CONCEPT	8	Proof of concept and ensure partnerships and critical mass in customer segements	Through trials and customer driven marketing	
	9	Interest other municipalities in the concept and investage for implementability in the new contexts	Allign the concept through regulatory measurements and governmental initatives	

SCALABILITY

The first step will be initiated by the project group. However, it is the wish that Miljøpunkt carries on the project and becomes the facilitator. It would thereby be their responsibility to create awereness around the project and enroll necessary actors.

When the SocioCycle Center is up and running and a work breakdown structure has been established, it would be time to investigate how the concept can be scaled. Amstel et al. (2018) touch upon this regarding sustainable City Logistics, by describing relevant areas of the Business Model design according to the scalability of the Business Model with checklist for the assessment, prediction and improvements. The checklist are as follows (Amstel et al., 2018, p. 84-85):

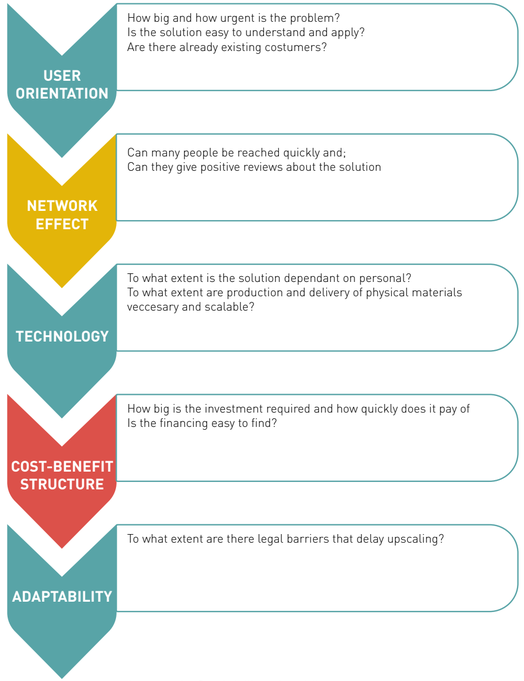

Figure 52: Scalability checklist

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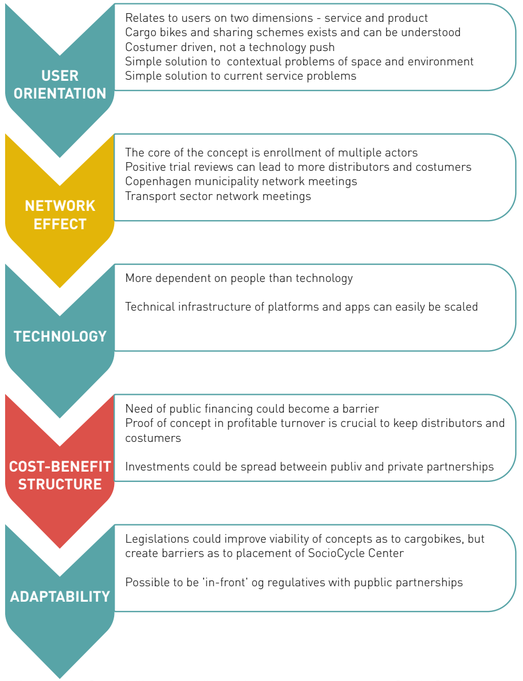

Figure 53: Scalability checklist with relevent answers to SocioCycle

The areas of the checklist are listed with relevant answers to SocioCycle in the figure 53.

Once the scalability of the concept is documented, other municipalities should be introduced to the concept. Of course, the concept should be tested and iterated upon for a few years, before trying to actively interest other municipalities.

However, the scalability should not be driven by SMBs alone, but to a high degree be incentivized by the different municipalities.
A possibility could be for Copenhagen Municipality to invite other municipalities into different workshops, relaying their experiences with the concept to them, thereby interesting other municipalities in the change process.

PROJECT PROCESS

Following the projects development structure; Discover, Define, Develop and Deliver, the project group analysed the key areas, which led to the final concept proposal. The Discover, Define and Develop phases resulted in multiple smaller divergent and convergent processes linking to each other's outcome. The design processes were characterised by collecting knowledge and reference points in the Discover phase, which were moved into the Define and Develop phases with small iterative processes, sometimes with the need of visiting the Discover phase again. This entanglement of moving back and forward of obtaining knowledge and utilising it can be chaotic to illustrate, and the process model, therefore, represent an overview of the process development with key areas plotted. In the figure 54 the timeline is represented moving from the left to the right, and the process phases from the top to the bottom.

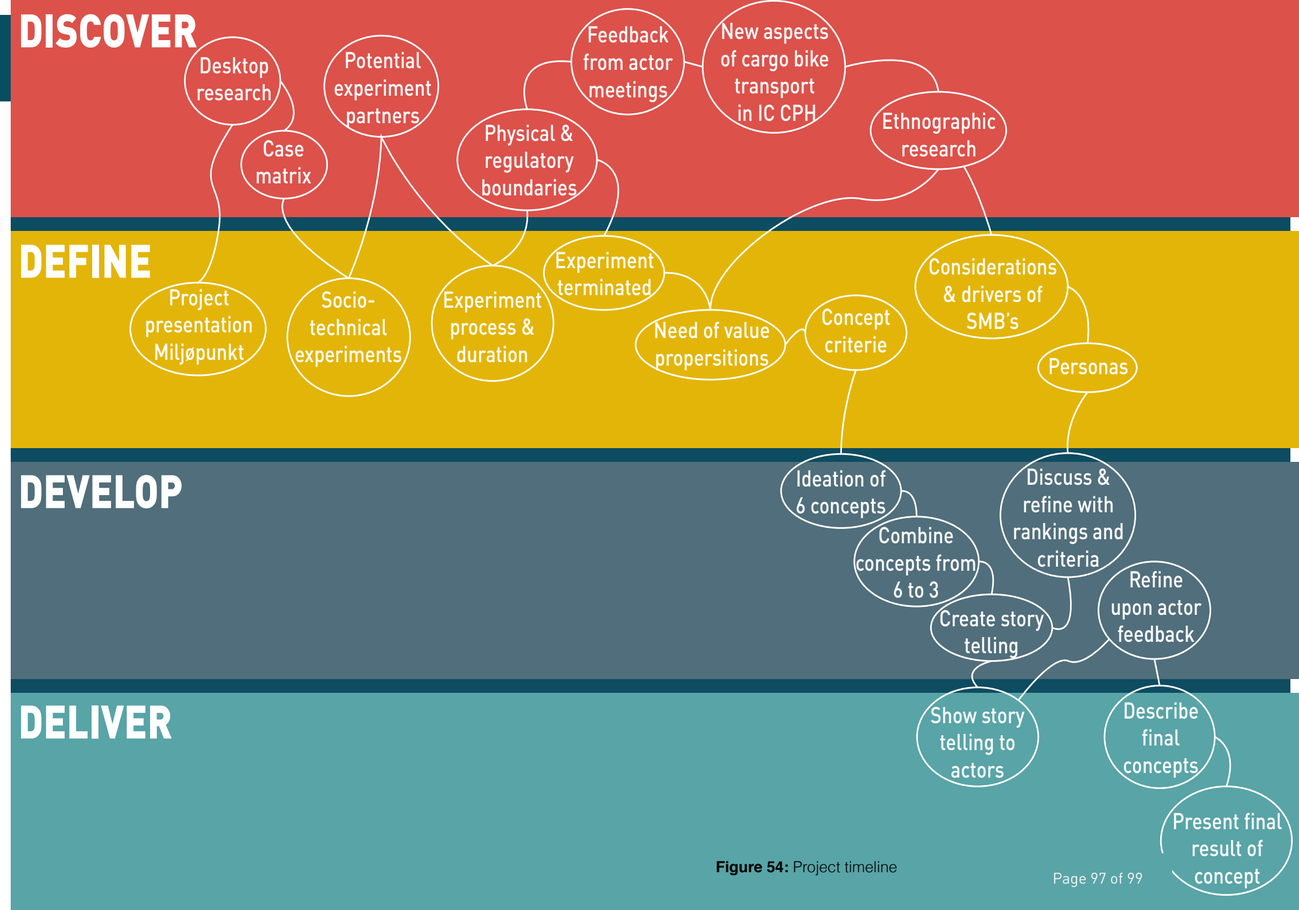

Figure 54: Project timeline

DISCUSSION

LACK OF INFORMATION

Throughout the project, the group experienced several times, that the SMBs were unaware of the capabilities of cargo bikes. This could indicate that there is a lack of information about what a cargo bike can contribute.
Based on this, initiatives to inform business' about the opportunities and benefits of cargo bikes, and how they can be adapted to the specific company's business model, should be conducted. This can be considered as an effective method to interest actors and facilitate a process of change. In this context, KCC and SMV Danmark are possible channels to pass information along to SMBs, as they already have networks through which information can be disseminated. This can take place through workshops, newsletters, offers of trial schemes, etc.

SYSTEMIC CHANGES

To create sustainable transitions requires radical replacement of an entire established system, that is unsustainable at its core.

The final concept defines a new freight system where incrementally improved bicycles are used for freight delivery. New actors are mobilized to take on new roles in the logistics system.
The concept should be perceived as a kickstarter to create changes on a larger scale. It is recognised that an increasing number of cargo bikes would put pressure on the current infrastructure and that this will need to be dealt with. It will thereby put pressure on the government to rethink the current infrastructure. In addition, initiatives that make it more difficult to be a motorist in Inner City, and reduce the number of cars in the inner city, would open up the possibilities of incorporating wider cycle paths or individual cargo bike paths.

DESIGN FOR SUSTAINABLE TRANSITIONS

The project of Sustainable Transitions and the use of the direction and evolution of Design for Sustainability (DfS), helps us to understand the desired progression from insular- to systemic innovations where the progression is in context to incremental- and radical innovations (Ceschin & Gaziulusoy, 2019). Earlier in the report, the project group identified how most of the recently done cargo bikes cases, were placed within the two first innovation levels: Product level and product-service system level. Instead, we wanted to create systemic changes that were on a Spatio-Socio or Socio-technical system level. According to Ceschin et al, changes at the sociotechnical system level requires an intermixed set of different innovations and the engagement of many different socio-economic actors (Ceschin & Gaziulusoy, 2016).
To achieve a Systemic Design, we adopted the ideology of having relationships between the persons, the community and the local context at the core of the project. These relationships are connections between various socio-economic actors in Inner City. While this has been beneficial to get insights into the flow of cargo, it lacks perspective on information and communication between these actors.

It would have been valuable in the process to create interventions where the different actors could have been gathered, and concerns of the different actors could have been negotiated. This could have created consensus or even collaboration between the actors and made a Systemic Transition more likely to be accepted by multiple parties.

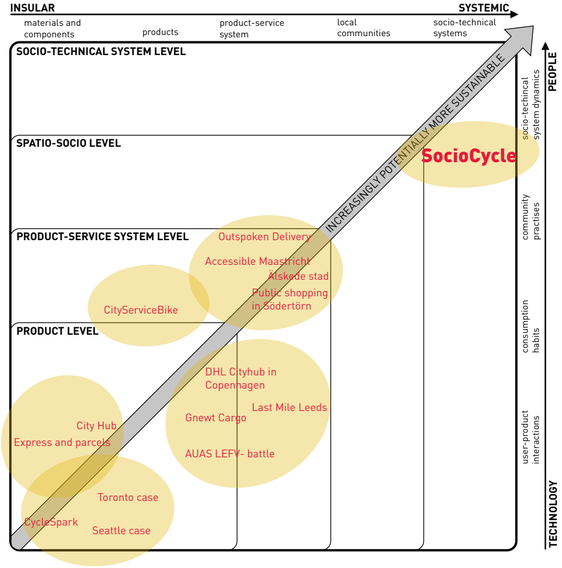

Figure 55: SocioCyle plotted into DFS framework (adapted from Ceschin & Gaziulusoy 2019).

The concept lacks the necessary focus on creating radical innovation within new technology advancements to replace the entire socio-technical regime in transport and distribution. Instead, the radicalness is related to introducing a new aspect of socio-economy to the transportation sector.

A general shift in the design approach for DfS, and as an outcome Sustainable transitions, from technocentric to humancentric are ideal for long-lasting system changes. “Design for Sustainable Behaviours (DFsB) Seeks to influence human behaviour and habits by intervening in physical and digital artefacts or policies” (Ceschin, Gaziulusoy, 2019, p.153). The outcome of the project did possess many aspects of human behaviour because a system shift and acceptance of the new system will require changes in behaviours and practices from both distributors and SMBs. Meanwhile, the regulatory bodies from the municipalities should offer supportive structures to these changes.

The result should be improved liveability for citizens in Inner City, and a general shift in the perception of cargo freight by campaigning the positive environmental effects of being more conscious about freight; ordering and sending packages.

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CONCLUSION

The project has investigated and conceptualised solutions for sustainable freight of Cargo in Inner City, Copenhagen. A final concept has been proposed, as an answer to an unsustainable system of cargo freight, creating negative externalities on the environmental and societal settings.
A need for change in practices of distribution companies and SMBs handling of shipments have been analysed and described, along with a needed change process of the perception of cargo bikes as a suitable solution for cargo freight. To this aspect, a particular focus has been on the actors of local SMBs, distributors and public bodies. While actors of retail need to change their practices in packing of cargo according to dimensions, instead of weight, and distributors need to change practices in their logistic chains, initiatives from the government and municipality can enhance or inhibit the potential of switching vehicle type on last-mile delivery from vans and trucks to cargo bikes.

The design suggestions for the system- and transition innovations has been developed towards encouraging long-term visions for new systems and the linkage between strategic decisions from the municipality and private actors.

Hereby the project has offered insight into the products and services of distributors, new business models for distributors, SMBs and new operators within distribution as well as system integration in the envisioned future system involving all actors of the project.
A human-centric approach has resulted in a concept, SocioCycle, with added value to the business and process of cargo freight and the mobilisation and enrolment of existing and new actors into a vision of sustainable cargo freight.

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