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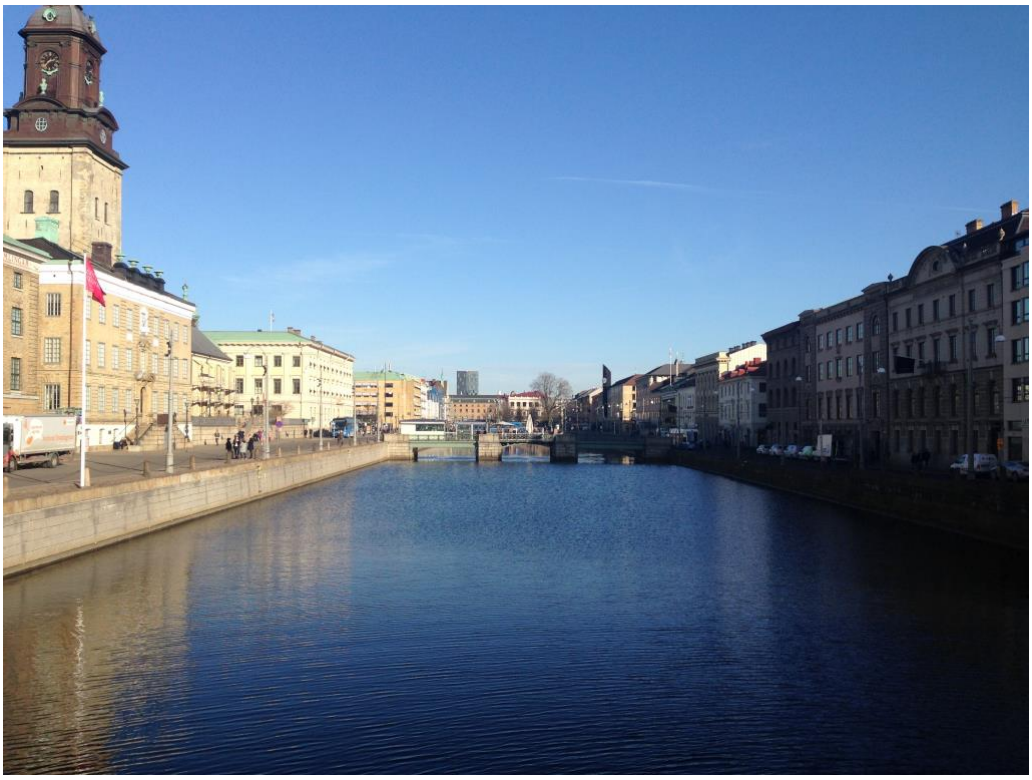

Urban Water Truck : Sustainable Urban Logistics

Waste(d) Waterways – Future of Urban Transportation?

Master's Thesis in the Master's Programme
MSc. Maritime Management

CHANDRAPRABHA JHA
FREDRIK HALLSTRÖM

Department of Technology Management and Economics
Division of Innovation and R&D Management
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Chandraprabha Jha
Fredrik Hallström

Tutor, Chalmers:	Carl Sjöberger
Tutor, Company:	Björn Södahl & Robert Rylander

Department of Technology Management and Economics
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Department of Technology Management and Economics
Division of Innovation and R&D Management
Chalmers University of Technology
SE-412 96 Gothenburg, Sweden
Telephone: + 46 (0)31-772 1000

Cover:
[Picture credentials: Chandraprabha Jha]

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Abstract

Around 10 million people live in Sweden, out of which 86% of its population resides in urban areas. The urban population keeps on increasing, which poses significant challenges for Sweden. Overall, there is an increasing pressure on the livelihood of urban areas, relating to factors such as congestion, air pollution, noise pollution, among others. In this study we focus on Gothenburg, which is the second largest city in Sweden in terms of population. An innovative solution to consider in addressing these challenges in Gothenburg is the Urban Water Truck. The city of Gothenburg is characterized with its beautiful canals, which were historically an important mode of transportation and city infrastructure. Under the influence of modernization, the canals became a mere purpose of tourist attraction rather than urban mobility. The Urban Water Truck concept advocates for repurposing and efficient sustainable use of the canals. Through deploying qualitative research methods, we investigated how this innovation can be utilized for urban mobility of goods and waste and embedded within the current mobility system of the city. Several in-depth interviews were carried out with relevant stakeholders such as municipal departments, real estate companies, hotels, restaurants and experts on waste and logistics in the city , each holding a unique perspective, which allowed us to investigate this from various angles. To guide our inquiry and analyse our results we operationalized theory from the Stakeholder Power-Interest Matrix and Grounded Theory. The results revealed that the stakeholders perceive congestion as a key challenge for the City of Gothenburg and that the use of the waterways, the canals, may be a viable way of reducing this. Further, the flow of goods and waste of the inner city of Gothenburg were difficult to map however it was found that mapping of goods were relatively complex to document. For waste it was clear that the flow was systematic and very few actors operated in the city. However, due to the lack and confidentiality on the data related to the movement of waste in the city, flow was not mapped. Therefore, Urban Water Truck should start initially with the transportation of wastes. With regard to the stakeholders, the Power-Interest Matrix analysis demonstrates that key stakeholders in the context of this innovation yield different levels of power and interest, and each need to be addressed appropriately in order to make the solution viable. The results indicate that the Urban Water Truck has most likely a window of opportunity by seeking close collaboration with Stadsleveransen for integration in the current logistics system of Gothenburg.

Keywords: Urban Water Truck, Innovation, Gothenburg, Inner City, Stadsleveransen, Urban Mobility

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Chandraprabha Jha & Fredrik Hallström

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1.Introduction

More than 10 million people live in Sweden, out of which 86% of its population dwell in cities (Statistics Sweden, 2019). The Swedish urban population is gradually increasing (World Bank, 2018), which will eventually bring more congestion to the cities. Gothenburg is the second most populated city in Sweden (Statistics Sweden, 2019). With multitude of developments taking place, Gothenburg is bound to attract more inhabitants. Stadsutveckling Göteborg (2019) confirms that the city is currently undergoing its most comprehensive city development in modern time, with developments like Västlänken, a new bridge and a new tunnel crossing Göta älv. The expansion will require increased transportations of goods and waste in and out of the city, which most certainly will lead to a heavier burden on the existing infrastructure. Gothenburg is also home of Scandinavia's largest port and large volumes of goods is delivered to and from the port every day. The goods is not only distributed in the area around Gothenburg, but also to other parts of the country (The Port of Gothenburg, 2019).

The congestion in Gothenburg can be clearly felt on having a ride within the city and the condition worsens during office hours. The topography of Gothenburg creates almost the perfect conditions for inversion during winter time, which creates a lid above the city that captures the pollution in the air (Göteborgs Stad, 2019). This situation calls for reduction of congestions on road to facilitate seamless mobility, thereby preventing accidents, reducing pollution and saving time for the commuters. According to Trafikkontoret (2012) the emissions from traffic has to decrease with 80% until 2030, in order to limit the climate effect. Additionally, they state that Gothenburg could benefit globally by being an early adjuster, so that the industry sector and universities gains knowledge that could be exported to an international market, when the demand increases.

In 2016, the Swedish Government appointed the Swedish Maritime Administration to investigate how transport flows could be moved from road to inland waterways. The report pointed out that the waterways are highly underutilized with regards to the existing waterways and infrastructure (Garberg, 2016). The urban waterways are currently mostly used for touristic purpose during a small period of time (usually during summer). Therefore, the connectivity is less, and stakeholders have urban mobility solutions through other means of transport. Cities like Paris, Amsterdam and Utrecht have been utilising their urban waterways in various commercial ways such as Mokum Mariteam in Amsterdam carries wastes and Beer Boat in

Utrecht delivering beer (Jandl, 2016). Thus, the urban waterways could be used for transportation of goods and waste in order to reduce congestion in a highly dense area. There have been multiple projects on urban mobility, for example Urban Water Truck (UWT) and the DenCity 1, 2, and 3 etc (SSPA, 2019). These initiatives have potential to enhance sustainable urban mobility, using waterways. Given this aforementioned, this thesis investigates how the waterways could be integrated into the current logistic solution for Gothenburg. To this end the following research questions were composed to guide our inquiry:

1.1 Research question

1. How could the urban waterways in Gothenburg be integrated into the current logistic system, in the inner city?
2. What requirements will different stakeholders have on such a solution?

1.2 Objectives

The objectives of the thesis are to:

- Investigate the flow of goods and wastes in the inner city (the areas around the canal, see Figure 1 for a map of the inner city).
- Map the stakeholders that has interest and power to influence the use of waterways with the help of Urban Water Truck.
- Find out the barriers and requirements in its implementation.
- Investigate if there are any leverage points that could facilitate a system where the waterways are included and can be used as a means for urban mobility.

1.3 Demarcations

This thesis will focus on urban waterways in the city of Gothenburg and more specifically the urban waterways in the city centre / inner city as shown in figure 1 below. The thesis will not explore the technical requirements that a vessel would need in order to operate in those waters. This thesis does not provide any technical solutions to improve the present urban mobility.

Figure 1. *Map of the inner city (Inom Vallgraven). Source: Google Maps.*

2.Theoretical Background

This section will provide the relevant background to the Urban Water Truck and the theory that guided the study's scientific inquiry. Additionally, to the Urban Water Truck, Stadsleveransen is discussed in this section as they form a crucial part of the city's logistics stakeholder network. The theory presented here draws upon stakeholder analysis and innovation theory. Specifically, the Stakeholder Power-Interest Matrix, importance of collaboration in an Innovative project, and Leverage Points were deployed as theoretical lens for guidance of the interviews and interpretation of the results, which can be found discussed in further details in the upcoming sections.

2.1. Urban Water Truck

A collaboration of RISE Viktoria ICT, KTH Centre for Naval Architecture, Gothenburg University and Södahl & Partners AB has been focused on exploring the options for use of waterways for transportation of goods and waste. The main objective is to exploit the potential of Urban waterways for transportation in order to reduce growing congestion, noise-levels, emissions and traffic accidents. The collaboration resulted in the concept of Urban Water Truck.

Urban Water Truck has been envisioned as a standardized and modularized waterborne transportation concept with technology from the automotive industry, such as electric or hybrid powertrain. The concept should also be able to do automatic mooring and possibly even be autonomous, and the goal is to have a finished concept ready the 5th of June 2021 (Södahl, 2017). Appendix 1 can be retrieved for visualizations of Urban Water Truck.

2.2. Stadsleveransen

Stadsleveransen is an initiative by Innerstaden (a company owned jointly by the business owners, real estate owners and the city of Gothenburg) with an intention to enhance collaboration among the stakeholders to develop the inner city into more attractive commercial and tourist destination (Innerstaden, 2019). Stadsleveransen facilitates a common goods reception for businesses in the inner city. They consolidate goods and perform the last mile delivery, using electric vehicles (see Appendix I). Stadsleveranses only handles small packages currently, and it is operated by Paketlogistik (Coldrey, M. 2016). The main objective behind

this initiative is to enhance collaboration among the stakeholders to develop the inner city into a more attractive commercial and tourist destination (Innerstaden, 2019.).

This Trafikkontoret department of the City of Gothenburg has been awarded the Swedish price Quality innovation Award, 2017 for its work with Stadsleveransen on smart and environmentally friendly transports to shops and offices in Gothenburg city. The committeé that handed out the award stated the following, *"The innovation shows the possibilities to create an increased value for both the customer and the environment. It leads the way to a more sustainable development of the society, both ecologic as well as societal and financial. Given the urban development in all parts of the world, Stadsleveransen provides a good example on how future sustainable transport solutions could look in an urban environment"* (Göteborgs Stad, 2017).

2.3. Stakeholder Power-Interest Matrix

The Business Dictionary (2019), defines a stakeholder as "*A person, group or organization that has interest or concern in an organization. Stakeholders can affect or be affected by an organization's actions, objectives and policies.*" Hence, stakeholders are individuals or groups which are interdependent on an organisation and vice versa (Mitchell et al., 1997). Complex problems and projects usually involve a number of stakeholders. The collaboration among these diverse actors plays a crucial role in the success of such projects. Therefore, from a strategic point of view it is important to map these stakeholders to understand their position and motivation for a project. Mapping stakeholders helps to identify individual stakeholder's expectations and influence in a project. Which in turn helps in explaining their political priorities (Johnson et al., 2011) of these stakeholders. The Power-Interest Matrix model is one of the tools that is used to map stakeholders.

Johnson et at., (2011) and Enserink et al., (2010) further elaborates on the significance of power and interest of a stakeholder. For instance, Johnson et at. (2011) points out that power can be seen as a mechanism to "*persuade, induce or coerce others into following certain courses of action*" (p. 186). Furthermore, Enserink et al. (2010) indicates that, power is also possession of critical resources which has an ability to drive change. Interest on the other hand, as elucidated by Enserink et al. (2010), refers to an actor's degree of dedication and motivation towards a project or an issue. Both papers further suggest the kind of relationship an organisation or

individual should maintain with their stakeholders. Figure 2 displays the matrix consisting of four quadrants each depicting the suggested relationship with the stakeholders.

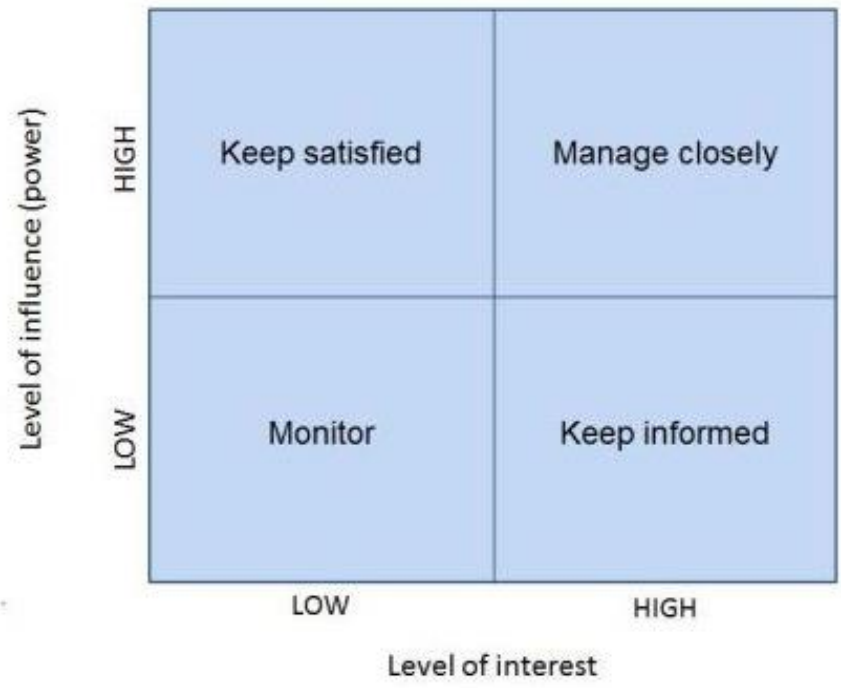

Figure 2. *Power- Interest Matrix model. Adapted from (Johnson et al., 2011, p.182)*

According to the matrix there are four kinds of stakeholders:

1. **Stakeholders with Low Interest and Low Power** - They are the least important stakeholder, because they have a low level of interest and possess very little power to have significant influence. Hence, Enserink et al. (2010) referred to them as *"the crowd"*. The issue usually has a very little impact in their daily routine of these stakeholders. Hence, these stakeholders demand minimum effort from the organisation. They just need to be monitored. All that is required form such stakeholders is feedback, cooperation and some assistance when necessary (Lin et al., 2018).
2. **Stakeholder with Low Interest but High Power** - They are an important group of stakeholders because any change in their degree of interest has huge influence on the project at hand. Hence, they are *"the context setters"* (Enserink et al., 2010). With an increase in their increase they can transform to key players. Usually institutions fall under this category of stakeholders (Johnson et al., 2011). Therefore, it is necessary that

these stakeholders are satisfied. (Lin et al. (2018) suggest that, these stakeholders can be helpful by sharing their resources and collaborating with other stakeholders. It is in the best interest of the project that if this group of stakeholders can be persuaded to develop more interest in the project. It is the job of project members to motivate such persuasion in these stakeholders.

3. **Stakeholder with High Interest but Low Power** - These stakeholders need to be kept in loop by keeping them informed. They can prove to be powerful allies in influencing other powerful stakeholder (Johnson et al., 2011) like "key players" and "the context setters". Enserink et al. (2010) refers to them as *"the subjects"* and usually, community groups constitute this group of stakeholders (Johnson et al., 2011). Therefore, their cooperation, network and alignment with the project have potential to drive the project in the desired direction (Lin et al. (2018).
4. **Stakeholders with High Interest and High power** - They are the most important stakeholder with high level of interest as well and high power, hence, they are referred to as *"the key players"* (Enserink et al., 2010). These stakeholders should drive the change through taking the lead position and coordinating various other stakeholders (Lin et al. (2018). This requires that these stakeholders are managed very closely.

The power-interest matrix model perfectly fits into the research question and objective(s). From this model we adopt the perspective that the different stakeholders involved will have different power and interest. To this end, we interviewed its potential clients (hotels and restaurants), government organisation (City/municipality), waste management experts, community association etc. The model will therefore be operationalized as the lens through which the result and conclusions will be guided and obtained.

2.4. Innovation in the context of Gothenburg

Innovation has been taking place ever since humanity has existed, however, the importance of understanding the innovation was not recognized until 1930s when Joseph Schumpeter's work was published (Goffin and Mitchell, 2016). Innovations have been defined in multiple ways by multiple people. For instance, Michael Porter defined innovation as *"(...) both improvement in technology and better methods or ways of doing things. Innovation can be manifested in new product design, a new production process, a new marketing approach or a new way of conducting training "* (Porter, 1990, p. 74). Whereas, Organisation for Economic Co-operation

and Development (OECD, 2010), defines innovation as *"the implementation of a new or significantly improved product (goods or service), or a process, a new marketing method, a new organisational method in business practices, workplace organisation or external relations"* (p. 19). There are many more definitions by various scholars and innovators, however there is one similarity in all of them - that innovation had various dimensions and it is the introduction of something new that adds value for the user.

Innovation is contextual: a solution that is already present in another industry or geography might be considered as innovation in another industry and geography where it is currently lacking. Similarly, Urban Water Truck is an innovative solution in the context of Gothenburg for urban mobility. Similar solutions exist in cities, including Amsterdam, Paris, Utrecht and London (Jandl. 2016), but since this urban mobility solution of Urban Water Truck is new concept in Gothenburg, offers implications for sustainability and it will add value for its customers, it can be considered as an innovative solution in the context of Gothenburg. Urban Water Truck is planned to be more technically advanced than other similar existing solutions.

Complex innovative projects such as Urban Water Truck require collaboration. Collaboration is necessary because there are a number of actors whose activities, decisions, power and interest will influence the viability and feasibility of its implementation. Collaboration will help the initiators to better understand the demands and expectations of the stakeholders, which leads to clear objectives and ultimately to successful implementation of Urban Water Truck. These actors comprise of both private and public entities because urban mobility concerns everyone within a city. Cankar & Petkovsev (2013), emphasize on the importance of cross-collaboration between public and private actors. They advocate that, such collaboration facilitates the exchange of knowledge, experience and know-how between the stakeholders. At the same time, the public sector gets access to a new set of skills, agility, innovative thinking and creativity from private organisations whereas the private sector gets access to new financial resources and business capital (Cankar and Petkovsev, 2013).

2.5 Leverage Points

Another objective of this study is to investigate possible leverage points for Urban Water Truck. To this end, a literature search was conducted to find out a suitable theoretical framework. One potential model is the leverage points model of Meadows (1999). Meadows (1999), defines

leverage points as: *"These are places within a complex system (a corporation, an economy, a living body, a city, an ecosystem) where a small shift in one thing can produce big changes in everything"*. Meadows (1999) has also pointed out 12 places within a system where an intervention can be made. However, during the in-depth interviews it was found that the empirical data does not allow to use of leverage points as described in Meadows (1990). Henceforward, for the purpose of this study, a more suitable understanding was developed, tailored to this study's specific context. The following definition was developed:

> *"A leverage point is a factor or any activity within the context of urban mobility of goods and waste in the city of Gothenburg, which creates a window of opportunity for Urban Water Truck to become implemented and adopted within the current urban mobility system".*

Through this definition we operationalized what a leverage point means and how this can be identified in the empirical material.

3. Methodology

Given the research questions and objectives, a qualitative methodology was considered the most suitable. The rationale behind choosing this methodology are: (1) This study involves collecting perspectives of stakeholders, and (2) since the study is focused on Urban Water Truck (which is not operational in Gothenburg), the current state of knowledge is immature. This study is therefore exploratory in nature where the intention is to collect perspectives on opportunities and challenges. The following subsections discuss the sampling, data collection, data analysis and the ethical considerations within this research.

3.1. Sampling

The respondents were recruited through a combination of convenience and purposive sampling (Patton, 1990; Gray, 2014). A convenience sampling is a kind of sampling where the sample is selected on the basis of easy accessibility and availability (Etikan, et.al., 2016) whereas purposive sampling is deliberated because of the qualities possessed by the participants (Etikan, et.al., 2016). The selection criteria for the respondents was based upon the fact that the respondents were directly connected (stakeholder) to the logistic flow (goods and wastes) in the areas near the canal (inner city).

The recruitment was carried out through email, telephone, and face-to-face conversations. The respondent sample consisted of diverse actors, including hotels, restaurants, real estate companies, experts on waste industry, representative of waste management company, a shopping centre, municipality organisations and an innovation consultant. Further details can be obtained in the forthcoming sections.

3.2. Data Collection

Both primary and secondary data forms the basis of our study. The primary data was collected predominantly through semi-structured interviews, conversations and observations. The secondary data was collected mostly through desk search.

3.2.1 Semi-Structured in-depth interviews

Semi-structured in-depth interviews were the main source of data for this study. The interviews were conducted both in Swedish and English, depending on the comfortability of the

respondents. Nine interviews were face-to-face interviews and two interviews were carried out telephonic due to unavailability for physical meetings for the respondents. The interviews usually took around 35 minutes on an average. The main themes of the questionnaire were - mapping the flow, sustainability, perspective on use of waterways as a means of logistic solution and ideal logistic solution according to them. The semi-structured questionnaire was adapted each time according to the interviewee because of the heterogeneity of the sample (Appendix II).

Table 1. *Characteristics of the study respondents.*

Respondents	Designation	Organisation	Type of Organisation
Respondent 1	CEO	Restaurant	Eatery/Restaurant
Respondent 2	Representative	Centre Management Organization	Collaborative platform for stakeholders of inner city
Respondent 3	Manager	Hotel	Hotel and restaurant
Respondent 4	Former employee	Waste Management Company	Collects waste and recycling
Respondent 5	Project Leader in Urban Mobility	Municipal organisation	Deals with the urban mobility
Respondent 6	Region Manager Göteborg	Real Estate Company	Owns property in the inner city
Respondent 7	Consultant	Innovation consultant company	Consultancy for logistic system in the city
Respondent 8	Sustainability Manager	Community Association	Shopping centre
Respondent 9	Strategy Consultant	Municipal organisation	Deals with sustainable waste (management) and water
Respondent 10	Business Development manager	Waste Management company	Collects waste and recycling
Respondent 11	Sustainability Manager	Real Estate Company	Owns property in the inner city

3.2.2 Desk Search

The secondary data was mostly collected through desk search. The data was collected from various websites, reports, scientific articles.

3.3. Data Analysis

The transcripts were text-analysed by applying Grounded Theory, as introduced in 1967 by Glaser and Strauss (2017). For this purpose, the transcripts were coded according to the three-stage coding process (Corbin and Strauss, 1990), and Code Scheme was developed (Appendix III). Bohm (2004). defines coding as *"coding may be described as the deciphering or interpretation of data and includes the naming of concepts and also explaining and discussing them in more detail"* (p.270). Each code identified a named concept, then codes are grouped into themes and differentiated. According to Corbin and Strauss (1990), the coding process is done in three stages: open coding, axial coding and selective coding.

In open coding, the data form the transcript is analysed in depth with focus on each and every sentence. This allows to pay attention to details such as events, actions and interactions which are extracted from the sentences and labelled as concepts based upon their similarities and differences (Corbin and Strauss, 1990). The prerequisite of this this stage is that one has to have a good background knowledge about the research subject. These concepts are then grouped into various categories and subcategories. The next stage of coding is axial coding. During this stage these categories are further refined and grouped into concepts (Corbin and Strauss, 1990). These concepts are again grouped into various themes. In this stage the frequency of the concepts was noted down, which gives an indication about who important a particular concept is. The most important outcome of this stage of coding is the visibility of the relationship between concepts and themes. Now, since there is an established relationship between concepts and themes the above process is re-iterated by reading the transcript again and refining the concepts and themes in the selective coding stage (Corbin and Strauss, 1990). An important aspect of this stage of coding is that here that further descriptive details are added to the code scheme like adding quotes from the respondents to support the concepts and themes.

The coding scheme can be found in Appendix III. The development of the code scheme is based on **inter-code agreement** between the authors**.** The coding process was carried out by both the authors independently and then compared for consistency. The differences were discussed until an agreement was reached. This was important for validity and reliability of the results.

3.3.1 Stakeholder Analysis

The in-depth interviews were triangulated with a stakeholder analysis. The stakeholders were analysed on the basis of the power-interest matrix model as discussed in the theoretical background. The position of the stakeholder in the matrix is decided by various indicators pointed out by Rustinsyah (2018). Factors like authority, capability, capacity, credibility and networking determine the power of a stakeholder whereas hope, aspiration and potential benefits of a stakeholder indicates the level of interest the stakeholder has on a project (Rustinsyah, 2018). These factors help in establishing the position of stakeholder in the power-interest matrix.

3.4. Ethical Consideration

All the interviews were conducted following the routines of the informed consent procedure. Consent was gathered verbally form the interviewees. The consent form was dictated by the authors before the interview which constituted the purpose of this study, the manner of data collection, anonymity of their identity and how data will be used and treated. The interviews were entirely voluntary, and the interviewee had full freedom to withdraw from the interview at any moment. The interviewees were also briefed that in case they have any complain they can contact the author or the university anytime. Nine out of eleven respondents agreed to be non-anonymous, however, for the consistency of our research the respondents are kept anonymous for our study. Also, it is the belief of the authors that if those stakeholders are identified it is possible to trace the rest of the stakeholders who wanted to remain anonymous.

4. Results

This section presents the study's findings and is structured along the lines of the following topic that relate to the formulated research questions and objectives, namely: (1) stakeholder mapping, (2) mapping the flows, (3) current challenges, (4) solutions, (5) waterways, (6) ideal logistic solution, and (7) sustainability. In each of the sections draw upon the theory that has been operationalized and triangulated with the in-depth interviews that were carried out with the identified stakeholders in the Urban Water Truck arena. This section will first commence with the integration of the results within the framework of the Power-Interest Matrix.

4.1 Stakeholder mapping

The initial hypothesis that different stakeholders will yield different levels of interest and power can be confirmed when the respondents are mapped onto the Power-Interest Matrix, see Figure 3 below.

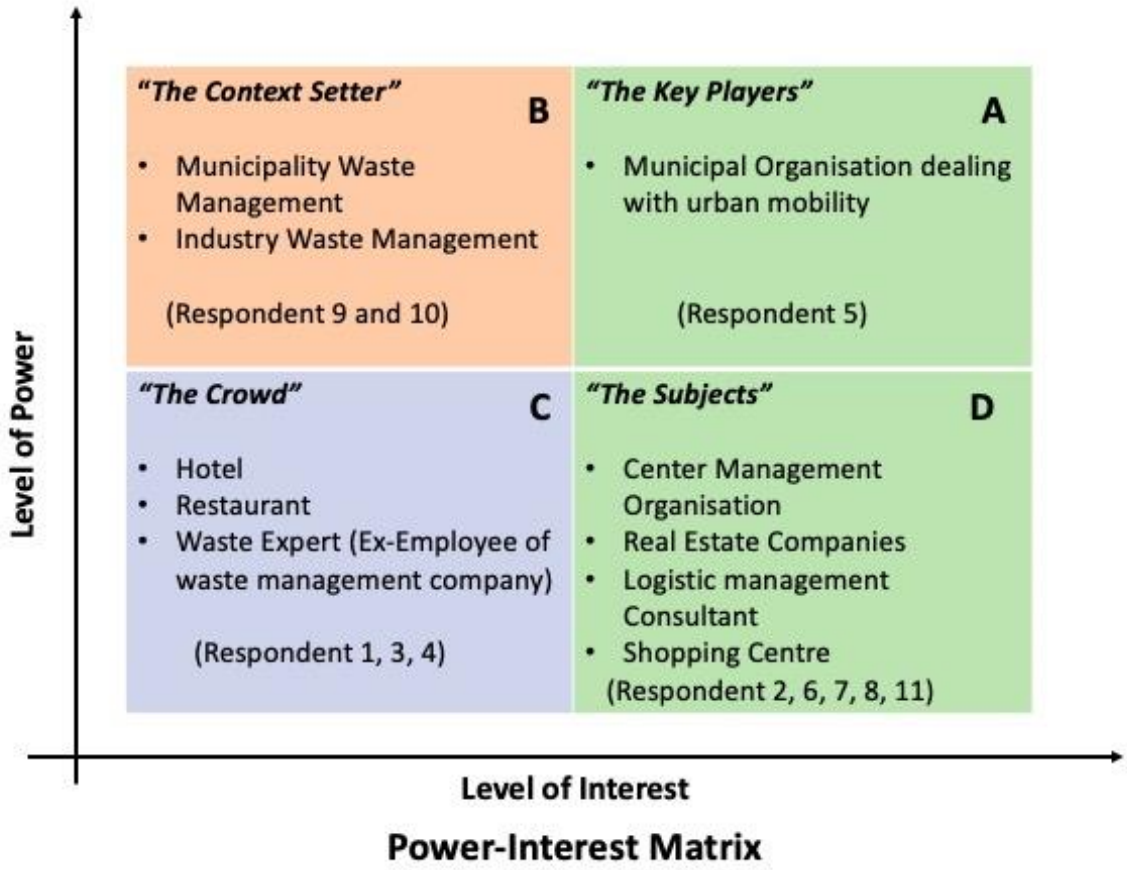

Figure 3. *Stakeholder Power-Interest Matrix* (adapted from *Johnson et al. (2011), p.182*)

Block A - As ***"key player"*** one stakeholder group was identified: the municipal organisation that holds responsibility for urban mobility. In addition, this stakeholder also bears responsibility in developing the city's regulations and policies. Therefore, they have a high level of power. From the in-depth interviews it could be noted that these stakeholders are enthusiastic about the solutions, since it offers potential in reducing the city's congestion and pollution. It is found that this group has a high level of interest. Further, since they have a high level of power, they can be very influential in making Urban Water Truck a successful urban mobility solution. They can integrate this innovation within their current system of regulations and policies. Following the theory behind this framework, this stakeholder group has to be closely managed and close collaboration is necessary for viability and implementation success.

Block B - Stakeholders here are the ***"context setters"***. This group consists of the stakeholders who deal with the waste management in the inner city. Although they have enough power, they lack interest in the Urban Water Truck project for various reasons, which will be further illustrated. They have to be kept satisfied so that they might not have any conflict of interest. The proponent Urban Water Truck has to make sure that the level of interest in them should be increased gradually. That is, with an increase in interest they have a potential to become "key stakeholders", which is favourable towards the system-wide adoption of the innovation.

Block C - This block consists of diverse stakeholders; including a restaurant, a hotel and a former employee of a Waste Management Company. Although they face challenges with the current system their level of interest and power remains low, since they harbour constraints in their opportunity and ability to bring about change and mostly focus in their day-to-day business, hence referred to as the ***"crowd"***. These stakeholders have to be continuously monitored. Their support and willingness to use Urban Water Truck will play a crucial role in its successful commercialisation, because they represent the innovation's end users.

Block D - Stakeholders like real estate owners, associations and logistics consultants constitute block D. They have shown immense interest in Urban Water Truck during the in-depth interviews. However, they do not possess enough power to contribute in successfully implement it, hence they are referred ***"the subjects"***. They have to be kept informed.

4.2 Investigating the flows

In order to find out how stakeholders could use the waterways in addition to their current logistics solution, it is key to first understand the current flow and its limitations, and the existing challenges that stakeholders face in transportation of goods and waste to the inner city. It is also necessary to understand possible solutions to the current challenges; if there are any current solutions that could be facilitated on the current challenges, or if there are any planned solutions as well as possible solutions that the stakeholders have thought of.

Initially, our inquiry commenced by seeking interaction with hotels and restaurants to test our hypothesis that they control the flow of goods and wastes. However, after interacting with some hotels it was found that they are not in control of their logistics. For waste it is the real estate owners together with waste management companies who determine its flow, and for the supplies it is the distributors who are in charge. This early and instant feedback from restaurants and hotels facilitates the expansion of the scope of this study to include other stakeholders. Therefore, it was decided to interview various stakeholders who can possibly affect the flow of logistics in the areas around the canal.

Clearly, mapping the flow of transports in Gothenburg has proven being a difficult endeavour. However, we were able to find out that the transports to businesses in the inner city can be divided in two different segments. The first segment is **"*transport of goods*"** into the city and the other is **"*transports of waste*"** from the city. The flow of goods is the most difficult segment to map, since the distributors are usually in charge of these transports. They are not systematic, since it depends on the distributor and the amount of goods ordered. Hotels and restaurants usually have several distributors depending on supplies and the orders are not always systematic either. Therefore, the amount of goods transported, dependent on numerous factors, and the number of vehicles transporting it, likewise. There are however, a few larger actors in the distributing market that are working with consolidation of goods. For example, Menigo and Martin & Servera, consolidate goods from multiple smaller suppliers and distribute the goods to the customers, these transports are more systematic and instead of several small vehicles going to the same restaurant, it can be delivered in one larger vehicle, for example.

The transportation of waste in the inner city is more systematic and the number of actors is much more reduced compared to the goods segment. Waste is divided into two categories, it is

household or household-like waste and industrial waste. The household waste is the regulated in Gothenburg and it is the responsibility of Kretslopp och Vatten. They currently have two companies contracted to collect and process the waste. The two companies are Nordisk återvinning, a privately-owned company and Renova, a company combinedly owned by ten municipalities in the region around Gothenburg. The two companies are responsible for different parts of the city, varying in area, but equal in the amount of waste collected. Renova has 250 heavy vehicles operating in Gothenburg and they collect 550 000 tons of waste per year, and they are also responsible company in the inner city.

The flow of the wastes is closely monitored by the waste management company and the municipality. The waste management company in the city uses sophisticated software to optimize their route planning for collecting the waste. Due to the confidential nature of this data about the flow, the company did not disclose their information with us. Therefore, mapping the exact flow of the vehicles for waste and goods in the city was not possible due to lack of data for the waste, and due to the complexity and unsystematic flow for goods.

The industrial waste is not regulated and therefore allowed open market. It is usually the Real-estate owners that are in charge of purchasing the service with one of the private actors' companies acting on this market. To be able to act on this market the company needs to have a contract with FTI (Förpacknings och Tidningsinsamlingen), that are in charge of all recycling stations in Sweden.

4.3 Current challenges

This section will describe the current challenges identified by various stakeholders that the logistics system in the inner city is facing today.

Congestion is the biggest challenge identified by most of the stakeholders.

> *"We have to reduce the amount of trucks in the city, we want to make the city for the people not for the trucks"* (Respondent 6, real estate company).

In spite of regulations in the inner city, where vehicles heavier than 3.5 tons are prohibited to enter into certain areas to inner city, the overall traffic has increased. According to a Project

leader in Urban Mobility Project from the municipality, there has been a "rebound effect" of these regulations. This respondent further commented, that since now heavy vehicles are restricted, as a replacement more small vehicles are entering the inner city leading to more traffic than before. A representative of Central Management Organisation in the inner city also emphasised on the same issue concerning the small distribution vehicles. A logistic consultant in the city observes that, these regulations have been misinterpreted and states that: *"The goal was to decrease the movements within city to get a better quality of life in the streets of the city. But they didn't understand that. They thought it was something else, I don't know how, but still. So they switched from large trucks to smaller trucks and a lot of more smaller trucks. So we have a lot more trucks moving around instead."* (Respondent 7). This finding shows that in spite of regulations to limit traffic increase, the actual implications can harbor different (side) effects.

Inefficient waste management was another challenge quoted by multiple stakeholders, including the CEO of restaurant, a Hotel manager, a Municipality waste management consultant and a sustainability manager from a real estate company. They believe that the waste can be handled in a much more efficient manner. Furthermore, these respondents and a logistic consultant also expressed their discontent with the current logistics management in the city. According to the CEO of a restaurant in the inner city: *"(...) I would say I understand why there are many trucks, but I feel like it's too many trucks to get into the same spot" (Respondent 1).* At the same time the respondent feels that there is very little control to influence the situation, since it is mostly the distributors of supplies that has control.

Lack of data was another problem that was identified by three respondents (Municipality Urban Mobility, Logistics consultant, Real estate). They asserted that the lack of data has created hindrances in making strategies and solutions. The data regarding the flow of goods is very difficult to obtain owing to its heterogeneity and complexity. However, when it comes to waste flow, it is relatively easy as mentioned by the waste management experts. Furthermore, the same experts believe that ambiguity in the type of waste also poses challenges to them. There has been constant discussion regarding what is household waste and what is industrial waste. This ambiguity in the categorisation and the accountability for handling different kinds of waste has created complications.

Misunderstanding of transport companies. The logistic consultant and the sustainability manager from a shopping center both mentioned that transporting companies confuse the meaning of the concepts "Just in Time" and "Just Now". To illustrate, the logistic Consultant mentioned that *" (...) PostNord, DHL and everyone is talking about fast delivery and the customer request delivery faster and faster and faster, and I don't really believe that. I think we are satisfied if we know when (...)".* The other respondent advocated for the same point of view. Both of them suggested that the transporting companies' decision should be based upon facts, figures, and demands of the customers. In contrast to the views of these transporting companies, both the respondents are of an impression that the customers are only concerned in knowing when exactly their goods will arrive rather than getting it immediately "now".

The economy was also cited as one of the key challenges. They main argument behind economy as a challenge is the cost and profit. The stakeholders believe that current economic state does not leave them with many options and they have difficulty in attaining economic sustainability with more sustainable alternatives. One of the real estate company representatives mentioned that they want to make the buildings more sustainable, but the cost associated with such construction are still very high.

Lastly, **Infrastructure** related to the waterways was also a challenge identified by stakeholders. Specific references were made to the conditions of quays, level of water in the canal from the quay, height of the bridges and etc. Stakeholders also mentioned that the current infrastructure is built in such a way that it facilitates only land transportation system within the city. An overview of the challenges can be retrieved for summary below in Table 2.

Table 2: *List of challenges. For simplicity reasons, the respondent numbers can be matched with Table 1 for more details on the respondents.*

Challenges	**Mentioned by**
Congestion	Respondent 1, 2, 3, 4, 5, 6, 7, 8 and 9
Inefficient waste management	Respondent 1, 3, 9 and 11
Inefficient logistic management	Respondent 1, 3, 6 and 7
Lack of data	Respondent 5, 7, 11
Ambiguity in the category of waste	Respondent 4 and 9

Misunderstanding of transport companies	Respondent 7 and 8
Economy (cost and price)	Respondent 10 and 11
Infrastructure	Respondent 4 and 11
Other Challenges mentioned were: Monopoly, Inefficient city planning, Noise, Technology immaturity, Business model, Misunderstanding of regulations, Resistance to change, Lack of awareness by people and Capitalistic system	

4.4 Solutions

The following subsections will describe solutions to the current challenges. First, current solutions that have been implemented and could ease the current situation will be presented. Second, the planned solutions that stakeholders are intending to implement, and third what possible solutions that stakeholders believe could be implemented in order to overcome the aforementioned challenges. Exploring these is important in obtaining a thorough picture of the current planned and desired solutions, such that a possible window of opportunity can be explored for Urban Water Truck.

4.4.1 Current solutions

Since the challenges described are present, there are obviously no current solutions in place to eliminate those. There are, however, solutions in Gothenburg that could be implemented to these challenges that are brought up and discussed by several respondents, namely (1) Lindholmsleveransen, and (2) optimization software.

4.4.1.1 Lindholmsleveransen

Lindholmsleveransen is the concept that is similar to Stadsleveransen. It delivers goods to offices and businesses located in Lindholmen through a collaboration between the businesses and the different real-estate owners. The recipients in Lindholmen utilize a c/o address, where all the packages and goods are distributed to and Lindholmsleveransen consolidate these goods and perform the last mile delivery. The main difference between Stadsleveransen and Lindholmsleveransen is that the latter also collects waste from the businesses and transports this to the consolidation centre, where it is collected by a waste management company. The waste stands for 80% of the transports performed. This decreases the amount of vehicles operating in the area. The waste is also the part that Lindholmsleveransen earns money from,

since the real-estate owners compensates for the waste collected. If Stadleveransen would implement the same concept as Lindholmsleveransen, where waste is also collected from the businesses, it could have an impact on the congestion.

4.4.1.2 Optimization software

The waste management companies use different software in order to plan their voyages in the city. The software can decide which route are shortest in order to decrease the distances travelled. The software are being optimized and at least one waste management company is now able to monitor the amount of waste in the different waste bins, which means that the bins will only be emptied when necessary. The effect of this is that the trucks can optimize their routes and the degree of filling in the trucks can be higher. If this type of software was implemented in a broader scale, it could possibly yield less trucks on the road.

4.4.2 Planned solutions

There are planned solutions from the stakeholders to cope with the current challenges. The solutions are in many ways connected to the challenge of congestion in the city and therefore many of the planned solutions are demonstrating ways to decrease congestion. These can be grouped into (1) expanding Stadsleveransen, (2) expanding regulations on heavy trucks, (3) floating recycling centrals, and (4) electric powered trucks.

There are plans to expand **Stadsleveransen**, in order to be able to distribute more goods so that the need of heavy trucks in the inner city decreases. Stadsleveransen is planning to expand in terms of distribution area and in type of goods. Currently. Stadsleveransen only delivers small packages, but there are investigations in the possibility to do, like Lindholmsleveransen and collect waste from the businesses. The main issue in the inner city is that there are more real estate owners, and they possess individual contracts with waste management companies, which complicates this type of solution.

There are also plans to **expand the regulations** regarding heavy trucks in the inner city. Currently, the regulations regarding heavy traffic in the inner city is within the area Östra-, Västra- and Södra Hamngatan down to the canal in the south, excluding Saluhallen. The regulation is in force between 11:00 to 05:00 and all trucks heavier than 3,5 tons are prohibited to enter the area within this time span. Plans are to extend both the area and the time-limitation to include all of the area within Vallgraven between 10:00 and 05:00. However, these plans are

at a very early stage and when and how to implement them is not decided. Important within this solution is to consider the adaptation of stakeholders to such regulations, which can potentially result in unanticipated effects, such as increased traffic of smaller modes of transportation.

Another plan for the city is to start with **floating recycling centrals** on Göta älv. These recycling centrals will be based onboard a barge and will be moored in different locations, such as Eriksberg, Lindholmen and Klippan. The aim with these centrals will be to reduce the need for people to use a car when recycling their waste. The city will start implementing these during the upcoming fall of 2019. The use of the waterways is also something that the city is exploring even further. However, there are no concrete plans on how the waterways could be used more extensively and efficiently. However, it is mentioned in the traffic strategy of the city that they will attempt to leverage the waterways for more extensive purpose.

Kretslopp och Vatten, that are in charge of the household waste in the city, have already made demands to the two companies in charge of collecting that waste. That is, they demand **electric powered trucks**. There are a number of heavy waste trucks that are powered by electricity in the city today and there are plans to expand the fleet with hydrogen powered trucks. These solutions are examples on how the city is aiming at reducing pollution in densely populated areas. Further, there is work going on in the mall of Nordstan, to reduce the amount of trucks going in and out of the building. For instance, an investigation in Nordstan identified that 80% of the amount of goods that arrives to Nordstan each day, is transported by only 20% of the trucks entering. This means that 80% of the trucks are only responsible for 20% of the amount of goods, and this is something that Nordstan is planning to change. Therefore, they have been working on implementing a consolidation centre in the outskirts of the city, where all the goods are consolidated, and the last mile delivery is performed only by the amount of trucks needed. For this solution to work, all businesses in Nordstan would have to use a c/o address, so that their shipments are delivered to the consolidation centre. The solution is expected to reduce the amount of trucks entering Nordstan heavily, but the ability to receive goods directly to Nordstan without the consolidation process will still be possible.

4.4.3 Possible solutions

When it comes to possible solutions the responses varied. The solutions are to a large extent based on the fact that most respondents see congestion as one of the main challenges that the

inner city has (when it comes to transportation of goods and waste), and that the transports should decrease and become more sustainable.

Stadsleveransen is a solution that has been mentioned both as a planned solution but also as a possible solution. The reason for this is that some respondents are not responsible for Stadsleveransen and perhaps does not possess knowledge about the plans. However, five respondents mentioned that a possible solution to reduce congestion and pollution in the inner city could be by expanding the use of Stadsleveransen. How to expand Stadsleveransen varied, from delivering large packages to also collecting waste. The possibility of expanding Stadsleveransen as a solution, was mentioned several times together with the possibility to implement a system with urban consolidation centres. The urban consolidation centres would receive all the goods bound for the businesses in the inner city in order to consolidate the different shipments and deliver it to the inner city with one transportation unit. This would increase the degree of filling in the trucks instead of having a larger number of smaller trucks transporting in the city. A possibility is that Nordstan would act as such a centre, where goods are collected and distributed to businesses in the inner city because of its well-developed loading/unloading area underneath the mall.

Lastly, different kinds of **regulations** were mentioned as possible solutions for the challenges. Types of restrictions mentioned were, for example, car free zones - in order to cope with the congestion in the city. One respondent mentioned emission free zones as an alternative to car free zones, in order to enhance better understanding of such regulations. *"There is a need for a behavioural change",* was one respondent' solution for the current challenges. This means that people would have to change their perception about, for example, waste, and start to view waste as a resource.

4.5 Waterways

The current state of transportation is important to identify and understand what barriers are currently in place when it comes to implementing waterways as a means of urban transportation. It is however no silver bullet as several factors will have to be anticipated simultaneously. For example, the waterways have its technical limitations, defined by the way that they are currently built and the infrastructure surrounding the waterways. This thesis has merely focused on the opinions and ideas from different stakeholders in the city, and therefore not focused on the

technical issues of using waterways, such as draft in the canals and height underneath the bridges crossing the canals. The idea and intention behind this thesis was to focus on exploring a business model for Urban Water Truck. Before Urban Water Truck was concretely discussed in the interviews, a discussion about the use of waterways was held, where the respondents were to give their opinions about challenges and advantages with using waterways. These can be found presented in the sections below.

4.5.1 Challenges

In order to discover how the waterways could be integrated into the current logistics system and what requirements there would be on such a solution, it is important to understand what types of challenges it could face.

The quays. One of the main challenges with the waterways in Gothenburg today are the quays that surround the water. The status of the quays is questionable, and this is something that the city has planned to investigate and map. The load that each quay can take and how the landslide affects the quays are two things that needs to be investigated. Respondents also see the height of the quay from the water level up to street level as a challenge, for transporting goods and waste. There is a need for a solution where the height from the water will not harbour issues. That is, a new transport system needs to be accessible to the users in order to be successful.

Infrastructure. The general lack of infrastructure in order to make it operational is something that some respondents also mention as a great challenge to using the waterways. With infrastructure they mean, for example, in terms of waste handling a "receiving structure" for waste that is transported on the waterways.

Waste transportation. Also issues such as how the waste should be transported on waterways arose, including: should it be in bins or should it be transported in bulk? If the waste was to be transported in waste bins onboard a vessel on the waterways, there is a need for a system where the bins are exchanged. If instead the waste is transported in bulk, there are potential issues on how to ensure no waste is being dropped or spilled into the water.

Waste transfer. Several respondents (respondent 1, 4 and 9) also highlighted that the waste transfer from the existing waste rooms to the canals could be an issue. There are different types of obstacles between the water and most of the hotels and restaurants located in the inner city,

such as roads, tramways and pedestrian streets. If an electric powered vessel should operate the canals, there has to be one or several charging stations installed along the water. Charging stations along the canals in Gothenburg could be an issue, because of the landslide. Thus, further research is needed on how these charging stations should be designed.

Risk bearer. For a new transport system to be implemented into the current system there is a need for someone to bare the risk of implementation. Who should be the risk owner is one challenge that needs to be solved in order for a successful integration of waterways in the logistic system.

4.5.2 Requirements

There are a number of requirements that a logistic solution on the waterways needs to fulfil in order to become successful. Many of the requirements below were mentioned by stakeholders involved in the current transportation flow, regarding knowledge about transportation of waste, etc. If waste were to be transported on the water, there has to be a system for loading and unloading of waste to the vessels. It would have to consider weather conditions and the current infrastructure of businesses in the inner city - in how they handle their waste on site. The system also has to take into account how the treatment facility is handling incoming waste. For example, if the waste bins were to be exchanged so that the vessel loads waste in the current bins, then there has to be a system were the bins are exchanged so that the business is not left without bins for the time that the waste is transported to the treatment facility and back. If the waste is discharged from the bins onto the vessel, then it needs to be able to unload the waste at the treatment facility.

In Gothenburg the treatment facility for household waste is located in Sävenäs just next to Säveån, which is a river floating out in Göta älv in Gothenburg. To be able to transport household waste it has to be able to go to Sävenäs, where it should be unloaded. According to one respondent (Respondent 10) this is not possible, because of the small river and because of that the facility cannot receive waste from the water at this location. According to another respondent (Respondent 9) it is possible to go to Sävenäs with a barge, but there are challenges to unload the barge at the facility. To be able to collect and transport household waste, it is required that the receiving facility is adjusted to received waste from a waterborne vessel.

4.5.3 Possibilities

One of the main benefits with using the waterways to a greater extent is that it will reduce congestion. If heavy trucks in the inner city were changed to some kind of vessel on the waterways, the city will become more attractive, as one respondent argued (Respondent 11). Connected to the reduction of congestion, pollution would likely reduce if more sustainable means of transportation was used. That is, on the water instead. In turn, this would increase the city's reputation and also improve the health and livelihood for people located in the area. Similarly, a decrease of noise from trucks would also improve the environment and create a more dynamic urban life.

There are several possibilities in how the waterways could be integrated into the current system. If the city would implement a so-called Urban Consolidation Centres (UCC), where goods for the inner city is consolidated, then there would be a possibility to also have an External Consolidation Center (ECC). The ECC would be located outside the city, with advantage based near a current logistics hub, where communication is good for large transport units. Two respondents mentioned (Logistic consultant and CEO of a restaurant) that an ECC should be located in the Bäckebol industry area, where several other logistic hubs, such as Schenker and DHL are based. Goods for the inner city would be consolidated in this ECC and then feedered into an UCC, from where it would be distributed to the different businesses. The idea of Bäckebol for the ECC, is that it is also located near Göta älv. Therefore, an idea is that the feedering from the ECC to the UCC could be done by a vessel on the water.

4.5.4 Urban Water Truck

The respondents were introduced to Urban Water Truck, during the interviews in connections to the discussion about the waterways. Therefore, challenges, advantages, requirements and possibilities for Urban Water Truck are basically the same as for the waterways in general. However, this section will focus on describing the respondent's attitude and perceptions towards the Urban Water Truck.

One respondent mentioned that Urban Water Truck could be responsible for the floating recycling centrals that will be implemented in the fall of 2019 (Strategy Consultant at the Municipal Organisation). The plan now is that there will be a standard diesel driven tug boat in charge of transporting the centrals from one place to another, and also up river to a discharge

station where the waste will be transported to a recycling facility. If the Urban Water Truck, with electric powered engines could do this work instead, it would minimize emissions of greenhouse gases, making the whole operation of recycling centrals more sustainable.

Nine out of eleven respondents were positive towards Urban Water Truck and the possibilities that Urban Water Truck could bring into the current system. Urban Water Truck could ease the system by moving transports from land to the water, decreasing congestion and emissions, from the current system. These respondents had a very similar perception that waste would be easier to transport on the waterways, as a first step of integration. Waste would be easier because of the time sensitivity that is usually connected transportation of goods. However, as one respondent mentioned "*There has been a misconception of the meaning "delivery just on time" and "delivery right now"* (Respondent 7). which means that there is a perception that goods need to be delivered as fast as possible, when people really just want to know when it is being delivered.

Two respondents, from the municipality waste management and a waste management company, were however more sceptical towards Urban Water Truck as a possible city intervention, not Urban Water Truck in particular as a project or company. The respondents were sceptical in how transports could be moved from land to water. Additionally, issues regarding a massive need for investments in order to change the current infrastructure, to integrate transports on water were also mentioned. They also highlighted that road transports are becoming more sustainable and efficient (electric vehicles), which could ease the current challenges from within.

4.6 Ideal logistic solution

The respondents were asked to describe their ideal logistic solution in every interview, and they were enabled to interpret this freely. This section will describe some connections between the different respondents and providing examples of their solutions.

Not one single type of transport or transportation unit stood out as an ideal solution, to the contrary seven respondents mentioned some kind of multimodal solution, where a variety of different transport modes are used in order to provide a better service but also to provide a better environment in the city. Collaboration between the different transportation types was one factor

that was mentioned, in order to improve the quality. Amongst the different types of transports that was mentioned, there was a strong focus on transportation units with low emissions, such as bicycles, electric or hydrogen trucks, electric powered vessels and so on. The variety of different modes would complement each other and provide an advantage to the city and its inhabitants.

"(...) one truck, one barge or one of anything that could be able to deliver everything, so it would be like a depot, in like Bäckebol or somewhere." (Respondent 1, Restaurant CEO)

In the ideal logistic solutions, consolidation centres were mentioned by four respondents (typically the "subjects", see Figure 3), where all goods from different suppliers would be collected and from there distributed to the recipients, with the most suitable type of transport. These consolidation centres should not only be for the inner city but could work for the whole city with consolidation centres spread out through the city geographically.

4.7 Sustainability

During the interviews time was devoted to discussing how the different stakeholders work with sustainability and if sustainability was important for their image and reputation. All respondents mentioned that sustainability is important for them but in what way it was important varied. Two respondents mentioned that sustainability should be viewed as an opportunity and something that could provide competitive advantage for their business. For instance, one real estate company representative mentioned that if the company does not invest in sustainability the cost in the future will be much greater:

"If we do business as usual, we will in the future have so much more costs and if we do like this, we will gain in the future" (Respondent 11, Real estate company representative).

One respondent did however mention that they do not work to become sustainability certified in anyway, but that they are trying to find more sustainable ways to work in their day to day work. For example, they reported being in discussions with the real estate owner to get the possibility to sort their waste.

5. Discussion and Conclusion

This study was able to answer the main research questions: "How could the urban waterways in Gothenburg be integrated into the current logistic system, in the inner city? And what requirements will different stakeholders have on such a solution?"

The main findings of this study were as following. With regard to mapping of transportation flows it was found out that mapping of goods is challenging since many actors are involved and there is a lack of symmetry in its flow. Transportation of waste, on the other hand, is more symmetric with only a small number of active players. The in-depth interviews revealed that the majority of the stakeholders were very interested in the use of waterways for transportation of goods and wastes. Urban Water Truck was considered one of the possible solutions for mobility through waterways. However, two stakeholders, both related to waste management in the city hold scepticism about the idea and its feasibility. Further, it was identified that transportation of wastes would be easiest through waterways and Urban Water Truck should therefore start with the transportation of waste. The biggest challenge discovered pertaining to the use of waterways was the accessibility of business (for transferring goods and wastes) to the waterways. Also, some leverage points were found that could assist an integration of waterways and Urban Water Truck into the current logistics flow. The section ends with recommendations for the implementation of Urban Water Truck and suggestions for further research. These results will be further discussed in this section in detail.

5.1 Transportation flows

From the results aforementioned, it is straightforward to conclude that waste would be the easiest to transport on the waterways, compared to transportation of goods. This is probably because of the complexity involved with transportation of goods. There are much more stakeholders in the “goods industry” in Gothenburg, with different and unknown number of suppliers, as well as several different transporting companies delivering various amounts of different types of cargo. Therefore, mapping the transportation flow, of this kind, is proven very difficult since the transports are not systematic. A qualitative method poses significant limitations to the ability to map these flows. A resolution would have been the collection of quantitative data, which felt outside the scope of possibilities for this specific study. However, the qualitative method provides good insights in how and why transports are made in a certain

way. The result provides information about the waste industry that is very valuable for this thesis. Transportation of waste is seemingly much more systematic, with only a few stakeholders acting on the market. The household waste and the household-like waste are taken care of by two different companies appointed by the municipality, since this type of waste is regulated. The other type of waste is not regulated at all, which means that it is contracted on the free market, where there are several actors involved in Gothenburg. It is usually the real estate, or property owner that has a contract with them, which means that this type of waste is probably easier for a new operator on the market to get a part of. However, these types of contracts are most likely very price focused, which means that to get a competitive advantage, a new actor needs to compete either on price or on quality.

5.2 Managing stakeholders

The stakeholder mapping according to the power-interest model also provided very useful insights. It gave an indication of what to expect and how to manage each stakeholder. As depicted in Figure 3 in the Results section it can be seen which stakeholders are formulating the "crowd", "the subjects", "the context setters" and the "key players". The stakeholders in "the crowd" category involve the hotels and restaurants and they could be end users of the Urban Water Truck. Therefore, it is important to keep these stakeholders informed about the happening and make them enthusiastic about the benefits of Urban Water Truck so that they can plan and strategize accordingly. The stakeholders in "the subject" category yield high interest but lack power to make the Urban Water Truck Project successful on their own initiative. They consist of the association in the inner city, real estate companies and logistics consultants. They find the Urban Water Truck Project very interesting, because they believe that it is going to make the inner city more attractive as a destination for business as well as for the visitors. Additionally, the Urban Water Truck has a potential to reduce the congestion, decrease pollution and enhance the quality of life in the inner city. Therefore, it is important for the proponent of Urban Water Truck that they keep a very good relations with them to maintain their interest in the project. These stakeholders typically can typically be good allies while negotiation and lobbying with the key stakeholders and other powerful actors (Johnson et al., 2011). So far, these were the two types of stakeholders that have low power in the context of Urban Water Truck.

There are two more stakeholders "the context setters" and the "key players", who have enough power to influence the success of Urban Water Truck. The only difference between them is that the former lacks interest and the latter is interested in Urban Water Truck. The "context setters" consists of one stakeholder from the municipality and one from the industry. However, their similarity is quite striking as both of them deal with the waste management in the city of Gothenburg. The former owns the latter, together with other municipalities. This is considered as an interesting finding, because these two respondents were the only sceptical ones towards Urban Water Truck as a means of transportation of waste and goods through waterways. Of course, they possess more knowledge about the operational difficulties that are involved in managing waste, but one factor could also be the large recent investments in electric and hydrogen powered trucks, in order to decrease emissions from the fleet of trucks. Therefore, they either see Urban Water Truck as something that is redundant in the system or they might also see Urban Water Truck as their competitor in the market. In case waterway solutions will be prioritized and vehicles will be further eliminated from the city, then these amounts invested can become sunk cost for them.

The only stakeholder that was found to possess high power and high interest in the Urban Water Truck was the department of the municipality dealing with the urban mobility. Since, their main objective is to make the city as sustainable as possible, they are interested in innovative projects such as Urban Water Truck. They have enough power to make regulations than can either make Urban Water Truck very attractive among the other stakeholders or it can make it very unattractive. For instance, if the municipality would make a regulation to ban all the trucks in the inner city, then businesses have to resort to other modes of transportation. Being surrounded by the canal, water ways can be a good alternative for the transportation of goods and wastes. Here, Urban Water Truck can have an advantage of being a service provider to the businesses in the inner city. Therefore, these stakeholders have to be managed closely and in close collaboration with them systematic planning should be made, stakeholder meeting should be organised, and use of various resources should be discussed. It appears that innovative projects like Urban Water Truck always have to depend on the stakeholders to make a ground-breaking impression. The main objective of the proponent of Urban Waterways should be to involve many key stakeholders as possible.

The use of waterways needs to be pushed by the city, since the city is the key player in providing infrastructure for the waterways to become (further) utilized. It is stated in the traffic strategy

for the city, that they should explore the possibility for use of waterways, and a valid starting point would be to investigate the status of quays around the urban waterways. Urban Water Truck has a good chance to successfully integrate into the system when there is great collaboration with other stakeholders in Gothenburg. It appears that this innovation has the right specifications for the requested type of transportation unit in the inner city. It could provide a low emission and low noise type of transport unit, that would operate in the inner city without contributing to the congestion. For Urban Water Truck to integrate successfully within the current system it has however some challenges to overcome.

5.3 Challenges

One of the main challenges for the use of waterways in transportation of waste, is how the waste transfer would be carried out from the hotel, restaurant or other type of business to a vessel in the canal. If a collaboration between Urban Water Truck and Stadsleveransen was set up - where Stadsleveransen would collect the waste from the business and discharge it to an Urban Water Truck - then this could be a solution to that challenge. Also, with innovative projects, usually a dilemma arises among the stakeholders whether to invest resources in something that they have not witnessed before. At the same time, providing evidence in support to such projects in order to convince stakeholders becomes difficult. In the present situation, the stakeholders might be sceptical to invest in innovative projects like Urban Water Truck, because first of all they do not have enough evidence for the usefulness of Urban Water Truck, and second, they compare a system which is working good currently with a system that does not exist yet. This calls for dialogue and collaboration.

5.4 Collaboration

Most respondents would like to to see an expansion of Stadsleveransen and this is probably because it is something they see is working, and something that is working with an expansion in other parts of the city. As mentioned, before it is for a stakeholder easier to invest in something that they have witnessed before, thus, an expansion of Stadsleveransen is most likely going to happen. However, it is difficult to forecast if it is going to expand by also collecting waste or if it is only going to expand by delivering more types of goods in a bigger area. From the stakeholder's point of view an expansion where waste is also collected seems to be the most desirable option. Stadsleveransen would in that case have to collaborate with the real estate owners, in order for them to let Stadsleveransen handle the type of waste that is not regulated.

This would decrease traffic in the city, and since Stadsleveransen is operating in the inner city each day, it could collect waste every day, which means that the waste rooms could be smaller, opening more space for owners to earn money from. One issue with Stadsleveransen would in this case be that it is quite small and the waste with paper, plastic, and so on requires space. This means that the small truck has to go several times to the drop off area for waste, and discharge, in order to go back and collect more waste. As the consolidation centre today is based in Gullbergsvass (outside the innercity), this would probably demand much time spent from travelling from the inner city out to Gullbergsvass. If Nordstan instead would act as the consolidation centre for Stadsleveransen where goods are consolidated, and waste taken care of, this would shorten the distances between the businesses and the pick-up/drop-off area.

5.5 Leverage points

Leverage points were identified in the context of Urban Water Truck in accordance to the empirical data. To create a point of leverage, Urban Water Truck should start operating with the transportation of waste initially. This project need collaboration, and it is only the close collaboration with the stakeholders that is going to guarantee the success of Urban Water Truck. It is also advisable that Urban Water Truck should operate in synchronisation with Stadsleveransen. Stadsleveransen is already showing promising results as mentioned by stakeholder and there are multiple stakeholders that are working together in making it successful. This network of stakeholders should be leveraged to push the Urban Water Truck project in the desired direction. Another actor very interested in Urban Water Truck is Nordstan, the shopping centre in the inner city who is willing to transform the shopping center as a consolidation hub as well. Therefore, Urban Water Truck should collaborate with Stadsleveransen and the shopping centre, since these two actors have the interest of the Stakeholders in the city. Waste that is collected from the businesses in the inner city by Stadsleveransen could be transported out of the city on an Urban Water Truck. If the Urban Water Truck also is in charge of moving the recycling centrals in the river, it will have a good infrastructure to discharge the waste at a location created for this. In a long-term perspective, a collaboration with Stadsleveransen together with shopping centre could provide a logistic solution where Nordstan would act as an Urban Consolidation Centre (UCC), for Stadsleveransen and an External Consolidation Centre (ECC) would be located out in the industrial area of Bäckebol. The transportation from the ECC to the UCC could be done by

Urban Water Truck which would decrease congestion in the city, which would lead to a decrease of emissions to the air and create a more desirable inner city.

5.6 Suggestions for further research

For further research it is recommended to investigate how to have an efficient accessibility to the waterways from businesses in the vicinity of the waterways. Specifically relating to this innovation, it would be interesting to find a way on how Urban Water Truck, Stadsleveransen and Nordstan could collaborate in order to have an innovative and effective solution for Gothenburg's urban logistics. Also, formulating a business model around this system would be recommended. Since this study was not able to fully map the flows of goods and waste, further research could be conducted on doing a full investigation on how the flows are moving, and preferably this should be carried out with stakeholders that are able to share the relevant data. For instance, it would be advisable to discuss the topic with the larger distributors, such as Menigo and Martin & Servera, in order to see how their flows are moving and also to do a quantitative study where movements are traced and reported.

5.7 Conclusion

In conclusion, congestion is perceived as a key challenge for the City of Gothenburg and the use of waterways in the city can be a viable way to reduce this congestion. Urban Water Truck has great potential to be an alternative to the current urban mobility solution for goods and wastes. However, it should initiate with integrating into current system first before it can be offered as an alternative to the current solution, if desirable. There are several challenges related to its use mostly due to the infrastructure and accessibility of and to the waterways. Given the aforementioned, Urban Water Truck should start initially with the transportation of wastes. The results also indicate that Urban Water Truck has most likely a window of opportunity through seeking close collaboration with Stadsleveransen for integration in the current logistics system of Gothenburg.

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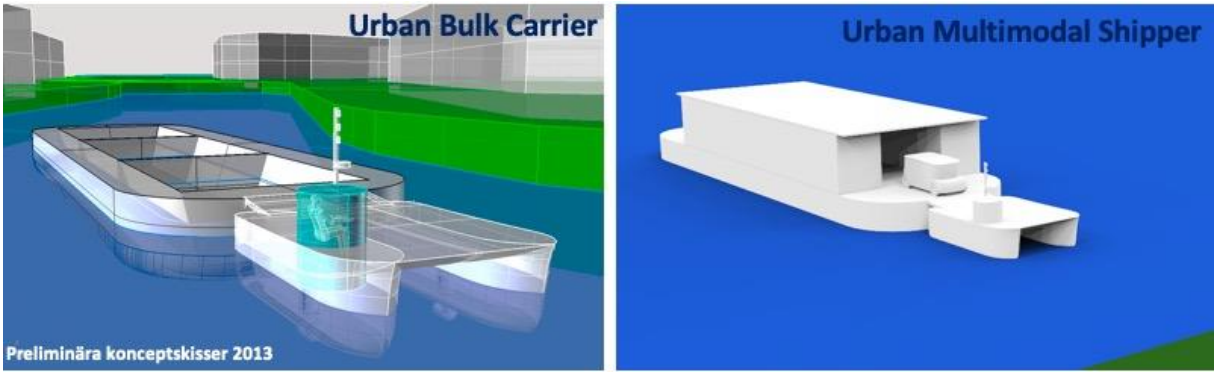
Appendix I

Urban Water Truck. Source: Södahl(2017)



Urban Bulk Carrier, Urban Multimodal Shipper. Source: Södahl(2017)

Stadsleveransen Source: Göteborgs Stad (2019)

Appendix II

Interview guide

{first start with the verbal informed consent procedure}

Introduction

- Could you describe me your responsibilities as {designation}?
- How do you/does your company currently transport supply and waste? *(probe: who? how? names?)*
- Who makes the decisions regarding the transport of supplies and wates? *(is it at operational level or an executive decision?) (if it is the suppliers, do you have the possibility to influence their decisions?)*
- Are there any challenges in the current logistics solutions? Have you thought of a solution?

Sustainability

- How important is sustainability for your restaurant/hotel? Does this has any effect on the image/reputation of your restaurant/hotel? How does your company work with sustainability?

  What does your company mean when you say sustainability?
- In which aspect can you think you can be more sustainable in the day-to-day operations, pertaining the transport of supplies and waste?

UWT Specific

- What are your thoughts about using the waterways?
- Have you heard of Urban Water Truck? *(if not; briefly explain)*
- According to you, what aspect of the Urban Water Truck seems most attractive to you?

In London and also other parts of the world, there are taxes for heavy vehicles. Also, at some places it is even banned during certain parts of the day. This is done to reduce the congestion in the city and to reduce the pollution (including noise).

- If similar measures are taken in Gothenburg how would you adapt to it? How will this affect your business? Your current logistic solution?

We have also heard that Roselundsbron is getting closed

- How will this affect your business? How will you respond to it?

If we have a solution like UWT, which intends to provide a sustainable logistics solution, reduce congestion as well as pollution,

- Would you opt for it? What would be the company's benefits? And its challenges? Do you think the benefits outweigh the challenges?

Closing

- Just the last question, according to you what should be an ideal logistic solution?
- Is there anything else that you would like to tell us that you think is important and has not been discussed?

Appendix III

Code Scheme

Themes	Concepts and subconcepts	Frequency	Remarks
Current Challenges			
	Inefficient waste management	1, 3, 9, 11	
	Congestion	1, 2, 3, 4, 5, 6, 7, 8, 9	
	Inefficient logistics management	1, 3, 6, 7	
	Monopoly	1	
	Inefficient city planning	3	
	Ambiguity (waste)	4, 9	
	Noise	4	
	Technology maturity	5	
	Lack of data (mapping the flow)	5, 7, 11	
	Business model	7	
	Misunderstanding of regulations	7	
	Misunderstanding of transport. comp.	7, 8	"Just in time vs. Right now,"
	Resistance to change	8	
	Lack of awareness by people	8	
	Economy (cost and price)	10, 11	
	Infrastructure	4, 11	
	Capitalistic system	11	
Solutions			
	Current		
	No solutions	1	
	Solutions	2, 5, 7	

	Lindholmsleveransen	7, 9	
	Optimizing software	10	
	Planned		
	Restrictions	1, 2, 5	
	Positive consequences	1, 3	
	Negative consequences	1, 3, 5	
	Expand Stadsleveransen	2, 5 , 6 , 7	
	Use Waterways (by city)	5	
	Floating recycling central	9	
	Waste traffic management	9	
	Hydrogen/electric trucks	9	
	Possible		
	Car free zones	5, 6	
	Emission free zones	5	
	Urban consolidation centres	5, 6, 7, 8 , 9	
	Regulations	5, 6, 7	
	Behavioural change	6	
	Stadsleveransen	2 , 5 , 7 , 8 , 9	
	C/O address	8	
	Minimize waste	11	
	One waste management contract	11	
	Cost calculation	11	"ecological cost, environmental cost"
	Awareness	11	
	Circular economy	11	
Waterways			
	Challenges		
	Quay	2, 5, 6	
	Waste transfer	1, 4	
	Infrastructure	10, 11	
	Solutions		
	Leadership	5	

	Risk owner	5	
	Advantages		
	Reducing congestion	1, 2, 3, 8	
	Reducing pollution	1, 2, 3	
	Health	5	
	City reputation	8	
	Dynamic urban life	11	
	Possibilities	2, 3	
UWT			
	Positive	1, 2, 3, 4, 5, 6, 7, 8, 11	
	Sceptical	9, 10	
	Uses	4	
	Challenges		
	Bridges	4	
	Accessibility	4, 9	
	Quays	4, 5 , 8	
	Risk owner	5	
	Charging stations	5, 8	
	Infrastructure	10	
	Requirements		
	Efficiency	5	
	Zero loss	5	
	Win win	5	
	Possible to go to Sävenäs	9	
	Loading and unloading (bins)	10, 11	
	Possibilities		
	Feeder to UCC	7, 8	

	Taking care of floating recycling centrals	9	
	Innovate	9	?
Leverage points (lowest hanging fruit)			
	Waste	1, 3, 5, 6, 7, 8, 9, 11	
	Collaboration	1, 2, 4, 5, 6, 8, 11	
	Goods	3	
	Waste as resource	4, 6, 11	
	Importance of awareness	5	
	Data	5	
	Stadsleveransen / Innerstaden	2, 3, 4, 5, 6, 7, 8	
	Nordstan - Distribution Hub	6, 7, 8	
	Pushed by the city	10	
Mapping the flows (control)			
Goods	Distributor	1, 3	
Waste	Waste management companies	1, 3	
Sustainability			
	Pro	1, 2, 3, 4, 5, 6, 7, 8, 9,10,11	
	Opportunity	1, 11	
Innovation			
	Pro - Innovation	1, 2, 4, 7, 8, 9	
Ideal logistic solution			
	Multimodal	1, 2, 3, 5, 6, 7, 8	
	Consolidation centres	5, 6, 7, 8	